WASTEWATER IRRIGATION MANAGEMENT PLAN

The Local Meat Co Pty Ltd

CLAUDE ROAD ABATTOIR, 1178 CLAUDE ROAD, CLAUDE ROAD

DECEMBER 2024

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1 Introduction

1.1 Background

The Claude Road Abattoir is located at 1178 Claude Road, Claude Road, approximately twelve kilometres (km) southwest of Sheffield in northern Tasmania (Figure 1). The abattoir is situated on approximately 13.1 hectares (ha) on a property that is under a lease to buy contract by The Local Meat Co Pty Ltd (the proponent). The Claude Road Abattoir falls under the *Kentish Interim Planning Scheme 2013,* zoning "rural resource".

The proposed capacity increase at the abattoir will mean it is considered a level 2 activity under section 24 of the *Environmental Management and Pollution Control Act (1994)* (EMPC Act) as annual production will be more than 100 tonnes per annum. The maximum production limit will be 500 tonnes per annum, although it is anticipated that production will usually be around 400 tonnes per annum. The Claude Road Abattoir will be required to be assessed by the Kentish Council after instruction from the EPA.

Wastewater generated from the abattoir (including washdown water from the abattoir yards and kill floor) is coarse screened before being collected in a sump where it flows to the two lined wastewater storage ponds to the northwest of the abattoir. Treated wastewater is irrigated onto pasture to the north and northeast of the abattoir. Wastewater ponds are used as contingency storage if irrigation cannot occur (e.g. saturated soils due to rainfall). The annual volumes that will be generated from the abattoir are estimated to be small, totalling approximately 250kL/year for wastewater. Further background information on the operation and management of the Claude Road Abattoir is provided in the Environmental Effects Report (subsection) (Pinion Advisory, 2024).

Given the low production numbers for the Claude Road abattoir, a sustainable waste disposal plan for onsite disposal has been investigated. As a result, the abattoir proposes to irrigate wastewater from the abattoir yard and kill floor to land.

As per the Environmental Effects Report Guidelines: The Local Meat Co Pty Ltd, Claude Road Abattoir Capacity Increase, Claude Road TAS 7306 (EPA 2023), the proponent is required to submit an Irrigation Management Plan to the EPA for approval.

Pinion Advisory was commissioned by the proponent to develop a Wastewater Irrigation Management Plan (WIMP) for the proposed property, located at 1178 Claude Road, where the abattoir is located. The WIMP has been developed to provide the EPA with the necessary information regarding the irrigation of wastewater at the site. The plan will also assist the Claude Road Abattoir to manage the wastewater irrigation in an effective and sustainable manner.

1.2 Property

The property to be used for irrigation is the property where the abattoir is located. The property covers an area of 13.1ha (32 acres). Property and land tenure details are provided in Table 1.

Table 1. Property and land tenure details.

Name	Details
Claude Road Abattoir	
Property Address	1178 Claude Road, Claude Road TAS
Area	13.1 ha
Property ID	3183535
Title Reference	136376/1
Tenure	Landowner: Margaret Ellen Kelly. Lease to purchase contract in place with The Local Meat Co Pty Ltd
Zoning	Rural resource (*Kentish Interim Planning Scheme 2013*)

1.3 Objectives of the Wastewater Irrigation Management Plan

The objectives of this WIMP are to:

- Meet the requirements of the Environmental Effects Report Guidelines for the Claude Road Abattoir issued by the Environment Protection Authority (EPA) in March 2023.
- Outline management practices required to ensure safe and sustainable wastewater irrigation at the site.
- Detail an appropriate and site-specific environmental monitoring program to monitor the impact of wastewater irrigation.

This WIMP has been developed to ensure the irrigation has long term environmental sustainability, appropriately manages public health considerations and provides benefit to the Claude Road property.

Rather than a linear disposal-driven reuse scheme, this WIMP outlines an option which is consistent with the waste management hierarchy, based on the beneficial reuse of wastewater to agricultural land.

1.4 Regulatory requirements and guidelines

Some guidance and advice on best practice environmental management is provided in the *Wastewater Management Guidelines for Meat Premises and Pet Food Works* (DPIWE 2001).

While abattoir waste does not strictly meet the definition of recycled water, the *Environmental Guidelines for the Use of Recycled Water in Tasmania, 2002*, referred to hereon as the Tasmanian Recycled Water Guidelines (TRWG) it has been consulted in the development of this plan.

The foreword of TRWG note the TRWG are intended to provide a framework to allow the sustainable reuse and recycling of wastewater in a manner which is practical and safe for agriculture, the environment and the public. Whilst it is acknowledged that water quality from the abattoir does not meet the TWRG requirements due to coliform levels, this document provides guidance on various aspects of recycled water management, and encourages a performance based, site specific approach to management consistent with industry standards and best practice environmental management.

1.5 Supporting documentation review

Documents consulted and reviewed in the development of this WIMP include:

- Australian Guidelines for Water Recycling: Managing Health and Environmental Risks, 2006
- Environmental Effects Report Guidelines: The Local Meat Co Pty Ltd, Claude Road Abattoir Capacity Increase, Claude Road TAS 7306 (EPA 2023).
- Environmental Effects Report (subsection), Pinion Advisory, 2024.
- Environmental Guidelines – Use of effluent by irrigation. NSW DEC, 2003.
- Tasmanian Recycled Water Guidelines: Environmental Guidelines for the Use of Recycled Water in Tasmania, DPIPWE 2002.
- Wastewater Management Guidelines for Meat Premises and Pet Food Works, DPIPWE 2001.

1.6 Existing environment

The property is predominantly situated on existing agricultural farmland. The majority of the site and surrounding area are classified as agricultural land (FAG) according to TASVEG 4.0. An area of *Eucalyptus viminalis* grassy forest and woodland (DVG) exists to the northeastern end of the property. Wastewater reuse on the property will continue to occur in previously cleared agricultural paddocks and therefore no significant natural and cultural features are likely to be impacted.

The topography of the region consists of valleys within gentle to steep vegetated ranges. The Dasher River is located more than 50m outside the northern and northwestern boundaries of the property, while a small ephemeral watercourse occurs through the north and northeastern section of the site and flows across the property in a northerly direction into the Dasher River. A 50m buffer is naturally in place between the property and Dasher River, and buffers of at least 35m are applied to dams and the ephemeral waterway on the property to manage runoff and spray drift. The buffers are to manage spray drift and will remain as currently vegetated, either pasture or pasture with a native tree canopy. Soils in the area are classified as Ferrosols and are developed on Cenozoic quartz sandstone and conglomerate talus derived from Owen Group correlates. The agricultural areas are located on the flat to gentle slope between altitudes of 240m and 250m. A search of the LIST map identified no acid sulphate soil sites on or near the property, although the Inland Acid Sulfate Soils mapping showed there is a low probability of acid sulfate soils occurring on the northwestern section of the property, outside of the planned irrigation area. There are several residences within 1000m of the site.

Rainfall occurs throughout the year; with a median annual rainfall of 1059.6mm. Median rainfall is highest in July (193.6mm) and lowest in January and February (55.8mm and 44.2mm) (Claude Road (Cemmelot) Station 091361, BOM 2024).

The closest representative wind data is from the Sheffield School Farm (Station Number 91107), located 10km northeast of the site. Data shows strong south easterly, north westerly, and westerly winds in the morning while the afternoons are dominated by northerly, north westerly and westerly winds.

2 Wastewater reuse activities

2.1 Wastewater quantity and quality

Wastewater generated from the abattoir is coarse screened at the drainage points, with the solid waste fraction collected and transported to a licenced waste facility. The remaining wastewater is collected in a sump and directed to the two lined wastewater ponds. Wastewater is stored in the wastewater ponds before irrigation onto pasture to the north and northeast of the abattoir occurs.

The volume of wastewater to be produced by the abattoir is estimated to be 0.25ML/year, based on a production of 500 tonnes/year.

Wastewater from the first wastewater pond (northern pond) was tested to determine wastewater quality. Wastewater quality is presented in Table 2 and Appendix A. Further discussion of wastewater quality data and application rates are discussed in Section 2.6.1.

Table 2. Wastewater quality for Claude Road abattoir.

Parameter	Unit	Abattoir wastewater*		Average mass per ML (kg)	Application per annum# (kg/ha)
		Nov 23	Nov 24		
pH	pH unit	7.87	8.44		
EC	µS/cm	2700	2080		
TSS	mg/L	520	514		
TDS	mg/L	940	1590		
Nitrogen, Total	mg/L	299	277	299	98.7
Phosphorus, Total	mg/L	21.9	23.8	21.9	7.2
Potassium	mg/L	113	97	113	37.3
Sodium	mg/L	106	103	106	35.0
Biological Oxygen Demand	mg/L	316	356		

* sampled from wastewater storages on 01/11/2023

based on irrigating 250kL over 0.74ha

2.2 Wastewater irrigation infrastructure and application method

Wastewater is pumped out of the storage ponds and applied to the identified paddocks (Figure 1) via a travelling slinger irrigator. Irrigation will only occur when moisture is deficit in the soil, this is usually between November and February. The irrigation of wastewater at the property will be managed by The Local Meat Co with all personnel involved in irrigation activities trained in the appropriate use of the infrastructure.

The red ferrosol soils present at the site are free draining and generally forgiving in terms of soil saturation, however there is still the potential for saturation to occur, typically over the winter months. During this period (and after significant rain events) soil moisture levels will be monitored via

spade tests. This simple and low-tech system will be installed in a representative location within the property to provide an indication of soil moisture levels (shown on the device with several yellow dots).

If soil moisture conditions are determined to be too wet, wastewater will be stored in the 0.40ML and 0.55ML storage ponds until a soil deficient occurs. If the ponds fill and conditions are still unsuited to irrigation, wastewater would be tankered offsite to a TasWater sewage treatment plant. Wastewater would be transported by a waste transporter under Regulation 10 of the *Environmental Management and Pollution Control (Controlled Waste Tracking) Regulation 2010* (Controlled waste transporter registration number: CWTEMP266TA).

Irrigation requirements will be assessed regularly to inform irrigation activities and optimise wastewater irrigation. If required, additional irrigation equipment will be determined in consultation with The Local Meat Co Pty Ltd and an appropriately experienced external advisor. Additional irrigation equipment should only be required if there is a failure with the existing infrastructure. Solids screening and settling ponds should ensure that solids are settled out and the irrigator is designed to allow for some solids, hence the wastewater should not significantly block irrigation infrastructure. Periodic maintenance may be required and should be completed using appropriate PPE.

2.3 Soils

A site visit and soil survey were undertaken by Pinion Advisory on 1 November 2023. Topsoil (0 - 10cm) and subsoil (25 – 55cm) samples were collected from two different test pit locations.

Samples were collected from the following areas at the site:

- TP 1: one sampling test pit located approximately 50m to the north of the abattoir site.
- TP 2: one sampling test pit located approximately 160m to the north of the abattoir site.

Sampling locations are presented in Figure 3 (Section 7.3). Soil samples were sent for analysis to Incitec Pivot Nutrient Advantage Laboratory, Werribee Victoria (a NATA accredited laboratory).

Soil results are summarised in Table 3 and Table 3, with raw data provided in Appendix A.

The results show that the soils have a:

- pH slightly low in TP1 to the north of the abattoir site.
- low electrical conductivity.
- low chloride level.
- low exchangeable sodium percentage/non-sodic soil (indicating sodicity will less likely be an issue for wastewater irrigation at the site, under normal irrigation management practices)
- low nitrate-nitrogen, phosphorus (Colwell), potassium (Colwell) and sulphur.

The soil analysis shows that the area would benefit greatly from application of the nutrient rich wastewater. Ongoing soil monitoring of the irrigation area will provide information on potential nutrient accumulation or nutrient deficiencies.

Table 3. Baseline soil nutrient data.

Site	pH (1:5 $CaCl_2$)	EC (1:5 water) dS/m	Chloride mg/kg	ESP %	Nutrients NO_3-N mg/kg	NH_4-N mg/kg	P mg/kg	K mg/kg	S mg/kg
TP1 0 – 10cm	4.7	0.04	<10	2.30	12	4.6	19	120	1
TP1 25-55 cm	4.4	0.03	<10	3.40	7.5	3.0	9	71	3
TP2 0 -10 cm	5.1	0.03	12	1.20	0.6	13.0	10	86	3
TP2 25 – 55cm	5.2	0.02	<10	2.30	0.7	4.2	9	39	5

Table 4. Baseline soil nutrient and metals data.

Site	Ca mg/kg	Mg mg/kg	Na mg/kg	Cu mg/kg	Zn mg/kg	Mn mg/kg	Fe mg/kg	B mg/kg
TP1 0 – 10cm	800	168	34.5	0.44	0.83	4.4	120.0	0.4
TP1 25-55 cm	80	36	25.3	0.31	0.04	0.1	83.0	0.4
TP2 0 -10 cm	1260	96	20.7	0.75	0.30	3.3	100.0	0.4
TP2 25 – 55cm	460	36	16.1	0.41	0.09	0.9	97.0	0.3

2.4 Animal health controls

Recommended stock grazing withholding periods, in areas that are irrigated with wastewater, are dependent upon water quality. Advice on livestock withholding has been sought from the Chief Veterinary Officer. Due to the risks associated with *Taenia sp.* (tapeworm), pigs and cattle should be excluded for 42 days from sites irrigated with wastewater. Any fodder removed from wastewater irrigation areas should not be removed until the 42-day withholding period is complete. The risk of *Taenia sp*. in abattoir wastewater is low providing human waste is not included.

A minimum five-day withholding period for other grazing stock (e.g. sheep, horses, etc.) is required. The property manager will manage grazing and livestock access with internal fencing.

2.5 Irrigation demand

Irrigation area requirements have been determined based on:

- Total wastewater production of 0.25 ML/yr (4,808 L/wk).
- Rainfall and evaporation data for Claude Road from the Queensland Government's SILO (Australian climate data from 1889 to yesterday).

Basic climate data is provided in Appendix B.

Water balance calculations were conducted for the mean and 90th percentile rainfall years (Table 5), with full water balances included in Appendix B.

In a mean rainfall year local irrigation demand is forecast at 1.99ML/ha. In a 90th percentile rainfall year, this decreases to 0.7ML/ha.

Table 5. Water balance table – mean and 90th percentile rainfall year.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual Demand
Mean year irrigation demand (ML/ha)	0.0	0.0	0.0	0.0	0.25	0.58	0.55	0.41	0.19	0.0	0.0	0.0	1.99
90th %ile year irrigation demand (ML/ha)	0.0	0.0	0.0	0.0	0.11	0.21	0.17	0.2	0.0	0.0	0.0	0.0	0.70

Table 6 summarises the water balance irrigation area requirements at the forecast wastewater volume.

Table 6. Water balance irrigation requirements at the forecasted wastewater volume.

	Mean rainfall year	90th %ile rainfall year
Irrigation demand (ML/ha)	1.99	0.70
Land area required for 0.25ML/yr of wastewater (ha)	0.074	0.33

An initial potential irrigation area of 1.3ha is identified in Figure 1. Irrigation demand of these areas is summarised in Table 7.

Table 7. Irrigation demand.

Name	Area available (ha)	Mean rainfall year irrigation demand (at 1.99ML/ha)	90th %ile rainfall year irrigation demand (at 0.7ML/ha)
Area 1	1.3	1.55	0.55

Table 8 indicates that annual irrigation demand across the potential irrigation areas exceeds the available wastewater volume of 0.25ML by more than double. Water balance calculations indicate that approximately 0.074ha of pasture would be sufficient for wastewater reuse in a mean rainfall year and 0.33ha in a 90th percentile rainfall year (refer to water balance in Appendix B).

2.5.1 Irrigation contingencies

Wastewater would be applied to areas identified in Figure 1. The whole 1.2ha is suitable for irrigation. The two lined wastewater ponds with a combined storage capacity of 0.95ML will store wastewater over the winter period. The water balance calculations show that a storage of 100kL would be required to store wastewater during the whole storage period (generally April to October in a mean year and March to October in a 90th percentile year), however due to the low rates of wastewater produced, it is likely that there will be enough of a soil deficient during this period to irrigate. Irrigation should only occur when a moisture deficit exists within the soil. Irrigation onto saturated soils may lead to offsite transfer of nutrients or harm to the soil structure and hence must be avoided. The management and monitoring of soil moisture is discussed in Section 2.2.

If conditions are not suitable for irrigation (i.e. saturated soils due to heavy or extended rain periods), wastewater will be stored in the wastewater ponds until such time as irrigation is possible. If the ponds fill before this occurs, wastewater will be transported to a TasWater sewage treatment plant for treatment, under Regulation 10 of the *Environmental Management and Pollution Control (Controlled Waste Tracking) Regulation 2010* (Controlled Waste Transporter: CWTEMP266TA).

The disparity between wastewater available and site irrigation water requirements (during the irrigation period, e.g. spring to autumn) allows the Claude Road Abattoir greater flexibility to rotate between irrigation areas annually and reduce any risk to soil and groundwater values from the irrigation of wastewater.

2.6 Nutrient balance

2.6.1 Wastewater quality data

While water balance calculations indicate that 0.33ha would be sufficient to irrigation the annual wastewater volume (in a 90th percentile year), it is recommended that the application of nutrients (kg/yr) targets the annual nutrient removal rate of pasture.

The mass of nutrients per megalitre (ML) of wastewater (based on a single sample of abattoir wastewater) and the approximate annual nutrient removal rates for best practice pasture management is summarised in Table 8.

Summary of assumptions used in the wastewater nutrient analysis include:

- Average potassium (K) concentration of the wastewater 113 mg/L.
- This equates to 113kg of K per ML of wastewater.
- 0.25 ML/yr of wastewater produced equals 28.25kg/yr of K.
- The annual potassium requirement of pasture is 50kg/K/yr.
- To match the nutrient requirement of pasture, 28.25kg/yr of K has been divided by the K requirement (50kg/K/yr).
- Based on this annual K requirement, 0.25ML/yr of wastewater should be irrigated over 0.57ha.

- Therefore, the optimal application rate equals 0.33ML/ha/yr (or 330,000L/ha/yr).

The nutrient balance shows that both phosphorus and nitrogen are significantly lower and present a deficit situation, where additional fertiliser is likely to be required. Application rates for potassium have been matched to remain below the 50kg/ha annual removal rate for pasture. Given the potential to increase the irrigation area in the future (providing the capacity to rest irrigated areas), the risk associated with excess potassium application is low. There is sufficient area available to allow for wastewater irrigation to rotate across different paddocks, allowing soil potassium to be managed.

Theoretically, irrigation can continue year on year on the same 0.57ha, however annual soil monitoring is recommended to ensure nutrients do not accumulate. An alternate option is to spread the wastewater over a larger area as a fertiliser alternative. Approximately 0.74ha is currently used for wastewater irrigation, which will be expanded to a single travelling slinger run covering 1.3ha.

Table 8. Wastewater nutrient analysis and nutrient removal rates.

	Supply in wastewater		
	N	P	K
Wastewater quality* (mg/L)	299	21.9	113
Nutrient supplied per ML of wastewater (kg)	299	21.9	113
Nutrient supplied in wastewater per ha/annum# (kg/ha)	62.8	4.6	23.7
Annual nutrient removal rates for best practice pasture mgt (kg/ha)	150	30	60
Nutrient balance (kg/ha)	-87.2	-25.4	-36.3

* sampled from wastewater ponds 01/11/2023

Wastewater available for irrigation 0.25ML/0.74ha=0.21ML/ha/yr

Annual soil testing within the irrigation sites must be undertaken to monitor the soil fertility levels (as described in Section 7.3). Adjustments to the application of nutrients, based on trends over time, may be required. This could be achieved by dilution (i.e. shandying with fresh water) and/or expanding the irrigation footprint.

2.7 Salinity risk

A study by MLA (2017) found that salinity levels (measured as electrical conductivity) in the wastewater one of the largest abattoirs in Australia abattoir ranged from 3040µS/cm to 3530µS/cm, with an average of 3370µS/cm (Jensen et al., 2017). Wastewater quality testing shows that the wastewater at the Claude Road abattoir is 2700µS/cm, which is indicative of irrigation water salinity class 4 (2300-5500µS/cm) as defined by the TRWG.

Perennial ryegrass is quite tolerant of saline soils and considered to be tolerant of irrigation water with conductivity of up to 4,600µS/cm. Other pasture species present, such as clover, are not as tolerant and can be impacted at conductivity of 1,300µS/cm (NSW DPI 2017).

Rainfall in the Claude Road area is equivalent to approximately 12.24ML per hectare per year in mean rainfall year, increasing to 15.09ML per hectare per year in a 90th percentile year, while it is recommended that only 0.33ML (330kL) of wastewater will be applied per hectare per year due to potassium concentrations. At this ratio of rainfall to wastewater, salts are unlikely to accumulate in the soil due to significant flushing by rainfall.

Any unlikely salinity issues could also be managed by increasing the irrigation area. Alternatively, wastewater irrigation could be applied on a new paddock with a similar area of application. There is sufficient land available to allow for wastewater irrigation to rotate across different paddocks. Ongoing wastewater and soil monitoring will inform future management. If rising salinity was observed, an application of a freshwater leaching fraction may be a recommended contingency.

2.8 Sodicity risk

Irrigation with saline water can lead to increasing soil sodicity.

Soil sodicity relates to the amount of sodium present in the soil, and at high levels causes negative changes to the soil structure with the clay particles excessively swelling. Soils that are sodic, with exchangeable sodium levels (ESP) above 6%, may have impaired soil drainage and infiltration rates, and this can result in poor pasture growth, pugging and the potential for surface water run-off.

Sodicity in the topsoil ranged from 1.20% to 2.30%, which is considered very low. At the proposed application rates the risk of sodicity increase is very low. Soil sodicity will be reviewed during the annual soil monitoring program.

3 Wastewater management practices

3.1 Permitted and non-permitted uses

Wastewater from the Claude Road Abattoir is suitable for the following purposes:

- Irrigating pasture and fodder crops for consumption by livestock, in adherence to the withholding periods stated in Section 2.5.
- Irrigating industrial processing crops where the produce is industrially processed prior to consumption such as poppies or canola oil crops.
- Irrigating industrial non-edible crops such as trees.

Wastewater from the Claude Road Abattoir **cannot** be used for the following purposes:

- Human drinking water.
- Stock drinking water.
- Irrigating crops where the produce is consumed directly by humans.
- Irrigating pasture or fodder crops to be grazed by poultry.

3.2 Withholding periods

The following withholding periods apply to the use of wastewater for irrigation:

- A minimum five-day withholding period for any grazing by livestock.
- The withholding period for pigs and cattle extends to a minimum of 42 days.
- 42-day withholding period between irrigation and harvesting of fodder crops.
- Four (4) hours or until dry between irrigation and harvest of industrial processing or non-edible crops.
- Irrigation will not occur during or immediately after periods of prolonged rainfall.

3.3 Buffer zones

To manage the risk of spray drift beyond the property boundaries and sensitive areas, the following buffer distances are to be implemented:

- 50m buffer distance from the road.
- 35m buffer distance from the farm dams.
- 35m buffer distance from the nearest watercourse.
- 100m buffer distance from the boundary of properties containing a residence.

Wastewater irrigation buffer zones are shown in Figure 1.

Residences to the north and northeast boundary will only by likely affected during south to southwest winds. This wind direction is rare and only occurs approximately 5% of the time. These impacts will be mitigated through restricting only irrigating between 10am and 2pm on days when the winds are NOT blowing from the south to southwest.

In addition, irrigation will not occur when wind conditions are more than 10km/hour such that there is a risk of spray drift leaving the property boundaries or entering a sensitive area (e.g. nearest residence or road). The buffers are to manage spray drift and will remain as currently vegetated, either pasture or pasture with a native tree canopy.

Figure 1 Wastewater irrigation areas, buffers and soil pits.

3.4 Signage

Signs will be installed to warn people that wastewater water is being used on the property, with appropriate signs installed at the following locations:

- Entry gate to the property where wastewater is being applied.
- Boundary fences of the irrigation area.

Examples of a warning sign is shown in Figure 2.

Agricultural fence signage

Figure 2 Examples of a wastewater warning sign.

3.5 Fencing

The property has an external boundary fence to prevent unauthorised access to the site. All irrigation areas are to be fenced to exclude access from the public and livestock.

3.6 Preventing contact with wastewater

Contact with wastewater will be avoided by implementing the following practices:

- Access to irrigation areas is to be restricted when irrigation with wastewater is in operation.
- To prevent inhalation of wastewater particles, maintenance of irrigation infrastructure will not be conducted when the irrigation system is pressurised.
- Before conducting maintenance on irrigation infrastructure, the relevant equipment will be flushed with fresh water.
- Where there is risk of direct contact of wastewater, appropriate personal protective equipment will be worn (e.g. breathing mask and/or waterproof gloves).

After handling irrigation equipment or wastewater infrastructure, hands should be washed with soapy water or antimicrobial solution.

4 Management of abattoir waste

It is proposed that the abattoir waste (paunch, offal, hides, bones and other solids) will be removed in the kill room and sent down a chute outside and directly into a sealed skip bin and taken off site to a licenced facility.

The solid waste will be transported to the licenced waste facility for disposal, under Regulation 10 of the *Environmental Management and Pollution Control (Controlled Waste Tracking) Regulation 2010*. Waste will be transported by a waste transporter, who is a registered waste transporter. The Controlled Waste Transporter registration number is: CWTEMP266TA - Wells Plant Hire Excavations and Construction.

5 Monitoring programs

Best practice dictates that appropriate monitoring is included in the Wastewater Irrigation Management Plan and undertaken on the areas where wastewater is applied.

5.1 Irrigation record keeping

Records of wastewater applications will also be maintained to enable results from the monitoring program to be linked to management practices. This will include weekly recording of the volume and location of wastewater applied to the property.

Site personnel will record the date and volume of wastewater taken to the property for irrigation. Example record sheets for wastewater applications are provided in Appendix D.

5.2 Wastewater monitoring

Wastewater samples are obtained from the abattoir/process floor wastewater storage ponds. Wastewater monitoring will be conducted biannually (autumn and spring) to advise the nutrient budgeting, fertiliser requirements and to allow for the wastewater application rates to be adjusted annually. Wastewater analysis shall include the analytes in Table 9.

Table 9. Recommended wastewater sampling analytes and frequency.

Parameter	Unit	Frequency
Total Suspended Solids (TSS)	mg/L	Biannual
Electrical Conductivity (EC)	µS/cm	Biannual
pH	pH units	Biannual
Biochemical Oxygen Demand (BOD)	mg/L	Biannual
Calcium	mg/L	Biannual
Magnesium	mg/L	Biannual
Sodium	mg/L	Biannual
Potassium	mg/L	Biannual
Bicarbonate	mg/L	Biannual
Sulphate	mg/L	Biannual
Sodium Absorption Ratio (SAR)	mg/L	Biannual
Ammonia Nitrogen	mg/L	Biannual
Nitrate Nitrogen	mg/L	Biannual
Nitrite Nitrogen	mg/L	Biannual
Total Nitrogen	mg/L	Biannual
Dissolved Reactive Phosphorus	mg/L	Biannual
Total Phosphorus	mg/L	Biannual
Thermotolerant Coliforms	cfu/100ml	Biannual
Alkalinity – Hydroxide	mg/L	Biannual
Alkalinity – Carbonate	mg/L	Biannual
Alkalinity – Bicarbonate	mg/L	Biannual

5.3 Soil monitoring

Soil sampling of the irrigation area will be completed annually to inform irrigation scheduling and nutrient budgeting. It is recommended soil monitoring be undertaken in September of each year to allow for laboratory analysis and fertiliser recommendations by an agronomist leading into to the next irrigation season.

One sampling transect will be sufficient for the wastewater irrigation reuse area, a 100m transect line will be used for sample collection. For the transect, cores of the topsoil (0-10 cm) of the soil profile are to be taken from 10 random points along the transect. The cores are to be bulked together in clean buckets and separated into 500g sub-samples of topsoil for the transect. Soil samples will be collected and kept in cool conditions until submitted to a NATA accredited laboratory for testing.

Every second year, subsoil (25-55cm) sampling should be included and follow the same methods as topsoil sampling.

The recommended analysis suite is shown in Table 10. The list of parameters tested should be reviewed after three years of data collection, and potentially rationalised, should some parameters be determined as not relevant to the program. Soil sampling locations are presented in Figure 3.

Table 10. Recommended soil monitoring analytes and frequency.

Parameter	Unit	Frequency
pH	pH units	Annual
Electrical conductivity (ECse)	dS/cm	Annual
Exchangeable calcium (Ca)	meq/100g	Annual
Exchangeable magnesium (Mg)	meq/100g	Annual
Exchangeable potassium (K)	meq/100g	Annual
Exchangeable sodium (Na)	meq/100g	Annual
Cation exchange capacity (CEC)	meq/100g	Annual
Calcium/Magnesium Ratio		Annual
Phosphorus (Colwell or Olsen)	mg/kg	Annual
Potassium (Colwell)	mg/kg	Annual
Sulfur (KCl)	mg/kg	Annual
Chloride (Cl)	mg/kg	Annual
Calcium (Ca)	mg/kg	Annual
Magnesium (Mg)	mg/kg	Annual
Sodium (Na)	mg/kg	Annual
Exchangeable Aluminium (Al)	meq/100g	Annual
Aluminium	mg/kg	Annual
Copper (Cu)	mg/kg	Annual
Iron (Fe)	mg/kg	Annual
Boron (B)	mg/kg	Annual
Manganese (Mn)	mg/kg	Annual
Zinc (Zn)	mg/kg	Annual
Nitrate as N	mg/kg	Annual
Ammonium as N	mg/kg	Annual
Total kjeldahl nitrogen as N	mg/kg	Annual
Organic carbon (walkley and black)	%	Annual
Phosphorus buffer index		Annual
Exchangeable Sodium Percentage (ESP)	%	Annual

Figure 3 Location of soil sampling transect.

5.4 Monitoring schedule

A summary of the annual monitoring program schedule for wastewater and soil is presented in Table 11.

Table 11. Annual monitoring program schedule.

Monitoring program activities	J	F	M	A	M	J	J	A	S	O	N	D
Wastewater sampling (Biannually)			**X*** (After summer)						**X*** (Before irrigation)			
Soil sampling (Annually)									**X**			

6 References

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New South Wales Department of Primary Industries (NSW DPI) (2017). Salinity tolerance in irrigated crops. Primefact 1345 Second Edition. Agriculture NSW Water Unit. Accessed online (12/05/2020) at: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/523643/Salinity-tolerance-in-irrigated-crops.pdf.

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7 Appendices

Appendix A – Laboratory results

CERTIFICATE OF ANALYSIS

Work Order	: **EM2319612**	Page	: 1 of 5
Client	: **The Trustee for Pinion Advisory Unit Trust**	Laboratory	: Environmental Division Melbourne
Contact	: Ryan Francis	Contact	: Hannah White
Address	: (Tech 4, Unit 2, 30-38 Innovation Drive, Dowsing Point) 112 Wright Street East Devonport 7310	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: TLMC	Date Samples Received	: 02-Nov-2023 11:25
Order number	: ----	Date Analysis Commenced	: 02-Nov-2023
C-O-C number	: ----	Issue Date	: 10-Nov-2023 16:29
Sampler	: Wade Bone		
Site	: ----		
Quote number	: EM23PINION0001		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EG005-T : EM2319542 #4 Poor matrix spike recovery for total copper due to sample matrix. Confirmed by re-digestion and re-analysis.
- EG005-T : EM2319612 #3 have been diluted prior to Cadmium analysis due to sample matrix. LOR values have been adjusted accordingly.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium, sodium and ammonia for sample #1.
- EK057G: EM2319612 #1, a dilution was required prior to analysis due to sample matrix. LOR has been raised accordingly.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP1	TP2	----	----	----
				Sampling date / time	01-Nov-2023 00:00	01-Nov-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2319612-002	EM2319612-003	--------	--------	--------
					Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		26.2	20.9	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	<5	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<5	----	----	----
Chromium	7440-47-3	2	mg/kg		8	53	----	----	----
Copper	7440-50-8	5	mg/kg		15	15	----	----	----
Lead	7439-92-1	5	mg/kg		12	19	----	----	----
Nickel	7440-02-0	2	mg/kg		3	7	----	----	----
Zinc	7440-66-6	5	mg/kg		<5	9	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	TLMC	----	----	----	----
				Sampling date / time	01-Nov-2023 12:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2319612-001	--------	--------	--------	--------	
				Result	---	---	---	---	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	**7.87**	----	----	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	**2700**	----	----	----	----	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	**940**	----	----	----	----	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	**520**	----	----	----	----	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**1120**	----	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	**1120**	----	----	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**6**	----	----	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	**152**	----	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	**19**	----	----	----	----	
Magnesium	7439-95-4	1	mg/L	**8**	----	----	----	----	
Sodium	7440-23-5	1	mg/L	**106**	----	----	----	----	
Potassium	7440-09-7	1	mg/L	**113**	----	----	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	----	----	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	**212**	----	----	----	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.05	----	----	----	----	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.05	----	----	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	**0.01**	----	----	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**299**	----	----	----	----	

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	TLMC	----	----	----	----
				Sampling date / time	01-Nov-2023 12:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2319612-001	--------	--------	--------	--------
					Result	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**299**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**21.9**	----	----	----	----
EK071FG: Dissolved Reactive Phosphorus as P by DA									
Dissolved Reactive Phosphorus as P	----	0.01	mg/L		**14.8**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**26.8**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**24.2**	----	----	----	----
ø Ionic Balance	----	0.01	%		**5.02**	----	----	----	----
EP020: Oil and Grease (O&G)									
Oil & Grease	----	5	mg/L		**7**	----	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		**316**	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EP020: Oil and Grease (O&G)

CERTIFICATE OF ANALYSIS

Work Order	: **EM2418247**	Page	: 1 of 4
Client	: **The Trustee for Pinion Advisory Unit Trust**	Laboratory	: Environmental Division Melbourne
Contact	: Ryan Francis	Contact	: Hannah White
Address	: (Tech 4, Unit 2, 30-38 Innovation Drive, Dowsing Point) 112 Wright Street East Devonport 7310	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 24THELO_CONS	Date Samples Received	: 22-Oct-2024 11:15
Order number	: 24THELO_CONS	Date Analysis Commenced	: 23-Oct-2024
C-O-C number	: ----	Issue Date	: 30-Oct-2024 10:18
Sampler	: ----		
Site	: ----		
Quote number	: EM23PINION0001		
No. of samples received	: 1		
No. of samples analysed	: 1		

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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Ionic Balance out of acceptable limits for sample #1 due to analytes not quantified in this report.
- Ionic balances were calculated using: major anions - chloride, alkalinity, sulfate and major cations - calcium, magnesium, potassium, sodium and ammonia for #1
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Wastewater pond	----	----	----	----
				Sampling date / time	21-Oct-2024 15:30	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2418247-001	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**8.44**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**2080**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**1590**	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		**514**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**886**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**886**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**6**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**158**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**16**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**6**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**103**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**97**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**139**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		**0.01**	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Wastewater pond	----	----	----	----
				Sampling date / time	21-Oct-2024 15:30	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2418247-001	--------	--------	--------	--------
					Result	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser - Continued									
Nitrate as N	14797-55-8	0.01	mg/L		**0.01**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**277**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**277**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**23.8**	----	----	----	----
EK071FG: Dissolved Reactive Phosphorus as P by DA									
Dissolved Reactive Phosphorus as P	----	0.01	mg/L		**11.9**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**22.3**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**18.2**	----	----	----	----
ø Ionic Balance	----	0.01	%		**10.2**	----	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		**356**	----	----	----	----

Appendix B – Water balance tables

Assumptions	Mean rainfall year
Rainfall data obtained from	Claude Road
Evaporation data obtained from	Claude Road

Average Wastewater flow of 0.25 ML/year based on projected weekly water use

		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	**A**	mm	157.27419	121.79032	97.822581	55.532258	32.212903	21.403226	25.709677	38.129032	58.4	88.696774	114.6	147.07667	959
Effective Lagoon Evaporation	**B**	mm	125.8	97.4	78.3	44.4	25.8	17.1	20.6	30.5	46.7	71.0	91.7	117.7	767
Rainfall	**C**	mm	78.606452	62.535484	70.483871	86.193548	106.37097	125.11613	167.79677	155.47742	131.41613	97.609677	78.28	64.133333	1224
Effective Rainfall	**D**	mm	55.0	43.8	49.3	60.3	74.5	87.6	117.5	108.8	92.0	68.3	54.8	44.9	857
Direct Crop Coefficient	**E**		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
Evapotranspiration (A x E)	**F**	mm	110.1	85.3	68.5	38.9	22.5	15.0	18.0	26.7	40.9	62.1	80.2	103.0	
Irrigation Requirement (F - D)	**G**	mm	55	41	19	0	0	0	0	0	0	0	25	58	199
Net Lagoon Evaporation	**H**	kL	28	21	5	0	0	0	0	0	0	0	8	32	93
Wastewater Flow	**I**	kL	20.37	20.37	19.71	20.37	19.71	20.37	20.37	18.40	20.37	19.71	20.37	19.71	240
Net Lagoon Inflow (I + H)	**J**	kL	-7	0	15	20	20	20	20	18	20	20	12	-12	147
Water Used in Irrigation (G x Irrigation Area)	**K**	kL	41	31	14	0	0	0	0	0	0	0	19	43	147
Average Daily Irrigation Rate	**L**	kL/d	1	1	0	0	0	0	0	0	0	0	1	1	
Cumulative Storage (Storage in Previous Month + J - K)	**M**	kL	30	-1	0	20	40	60	81	99	120	139	133	78	
Lagoon Depth	**N**	m	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	

Lagoon (reuse dam) Area		ha	0.059
Assume Effective Rainfall Factor			0.70
Irrigation Area Required		ha	**0.074**
Lagoon Volume Required		ML	**0.1**
Lagoon Depth		m	**0.2**

Notes:
Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA
Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.
Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario

pinion ADVISORY

Assumptions	90th percentile rainfall (wet year)
Rainfall data obtained from	Claude Road
Evaporation data obtained from	Claude Road

Average Wastewater flow of 0.25 ML/year based on projected weekly water use

		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	**A**	mm	149.6067	107.30338	89.188607	51.467261	27.385271	18.754116	22.696742	35.696754	56.795135	84.819751	107.1542	133.93209	885
Effective Lagoon Evaporation	**B**	mm	119.7	85.8	71.4	41.2	21.9	15.0	18.2	28.6	45.4	67.9	85.7	107.1	708
Rainfall	**C**	mm	124.7668	79.081622	89.707764	98.309878	131.63404	147.17567	181.87327	181.80099	155.48864	124.98366	90.972781	103.30489	1509
Effective Rainfall	**D**	mm	87.3	55.4	62.8	68.8	92.1	103.0	127.3	127.3	108.8	87.5	63.7	72.3	1056
Direct Crop Coefficient	**E**		0.70	0.70	0.70	0.60	0.50	0.45	0.40	0.45	0.55	0.65	0.70	0.70	
Evapotranspiration (A x E)	**F**	mm	104.7	75.1	62.4	30.9	13.7	8.4	9.1	16.1	31.2	55.1	75.0	93.8	
Irrigation Requirement (F - D)	**G**	mm	17	20	0	0	0	0	0	0	0	0	11	21	70
Net Lagoon Evaporation	**H**	kL	0	4	0	0	0	0	0	0	0	0	0	2	6
Wastewater Flow	**I**	kL	20.37	20.37	19.71	20.37	19.71	20.37	20.37	18.40	20.37	19.71	20.37	19.71	239.86
Net Lagoon Inflow (I + H)	**J**	kL	20	16	20	20	20	20	20	18	20	20	20	17	234
Water Used in Irrigation (G x Irrigation Area)	**K**	kL	58	66	0	0	0	0	0	0	0	0	38	72	234
Average Daily Irrigation Rate	**L**	kL/d	2	2	0	0	0	0	0	0	0	0	1	2	
Cumulative Storage (Storage in Previous Month + J - K)	**M**	kL	30	0	0	20	40	60	81	99	120	139	122	68	
Lagoon Depth	**N**	m	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	

Lagoon (reuse dam) Area		ha	0.059
Assume Effective Rainfall Factor			0.70
Irrigation Area Required		ha	**0.33**
Lagoon Volume Required		ML	**0.1**
Lagoon Depth		m	**0.2**

Notes:
Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA
Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.
Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario

pinion ADVISORY

Appendix C – Wastewater irrigation application record sheets

Wastewater irrigation application record					
Date	**Location/Area**	**Target Application Rate (kL/ha)**	**Actual Application Rate (kL/ha)**	**Area Irrigated (ha)**	**Quantity (kL)**

Appendix D – Soil investigation pits

Figure 4 TP1

Figure 5 TP2