Brewery Operations Summary

The main plant & equipment needed for our brewing operations are listed below:

- Two Vessel, Electric Heated 500L Brewing Kit
- 5 x 500L Conical Based Stainless Steel Fermenting Vessels
- 1 x 1000L Hot Liquor Tank (electric heated)
- 1 x 800L Cold Liquor Tank
- 1 x Semi-Auto, 1 Head Keg Washer
- Single vessel CIP system
- Glycol Chilling System (for temperature control of fermentation and cold liquor tanks)

The beer production cycle takes between three and four weeks, from being brewed to finished beer ready for packaging.

With a limited available footprint, the maximum amount of fermentation capacity is restricted to 5 fermenters. This calculation is shown in cell J9 of supporting document "Brewing Capacity Calculator". This small brewery size means that the system has a maximum output of three brews per fortnight. The brewing process itself will be conducted on weekdays, between 8am and 4pm.

This results in a maximum production capacity of approximately 2,500L per month or 30,000L per year. Initially we anticipate production volume to be 1,200L per month based on forecasted sales volumes. This will slowly increase up to our production capacity as demand for our product grows.

With the available high volume of keg sales in the Hotel, and consideration to the limited footprint available for the brewery, our focus will be on draft beer sales. As a result, there is no bottling or canning equipment planned for installation.

Brewery - Wastewater Management Plan

Overview:
Wastewater from the brewing process may contain significant levels of organic material from the raw materials used and a degree of acidity/alkalinity from the cleaning solutions (CIP). The brewing process can also produce wastewater of high temperature.

The organic and inorganic contaminants can have effects on the environment, thus requiring the wastewater to be treated prior to discharge to sewer. In order to do this, the brewery will have an independent floor waste system, that captures all liquid waste in a collection tank for treatment prior to discharge to sewer.

The system has been developed to meet the requirements of the Richmond Valley Council Policy #15.8, "Discharge of Liquid Trade Waste to the Sewerage System".

Waste Stream Volume Estimations (Theoretical Maximums):

Annual Beer Production (Initial) = 15kl
Annual Beer Production (Max Capacity) = 30kl

Industry Standard for 500l Craft Brewery = 6:1 Waste to Production ratio
Annual Waste (Max Capacity @ 90% Efficiency) = (6 x 30) / 0.9 = 200kl

Average Daily Discharge = 200kl / 365 days = 550 litres per day
Peak Daily Discharge = 200kl / 50 weeks / 4 days = 1000 litres per day

Summary of key data:

Annual Beer Production	30 kL
Annual Waste	200 kL
Peak Daily Discharge	1 kL

Relevant Effluent Characteristics:
The following wastewater specifications are relevant to the brewing process. The planned trade waste system is expected to meet these requirements.

PARAMETER	**Richmond Valley Council SPECIFICATION**
pH	Between 7 and 9
Temperature	< 38 Degrees Celsius
Suspended Solids	600 mg/L
BOD	600 mg/L (or higher at small mass loads)
COD	1,800 mg/L (3 x BOD)
TDS	1,800 mg/L (3 x BOD)
Nitrogen	100 mg/l
Phosphorus	20 mg/l

Containment:
The system will ensure all brewery wastewater is captured within a closed drainage network. This will be ensured by using bunding walls around the fringe areas of the wet area, with central drain points installed where liquid waste will be produced.

All high BOD / COD waste streams will be removed independently of this trade waste system. Further detail covering the management of these streams, is provided in the Environmental Management Plan "Solid Wastes" section.

System Design:
The system will consist of:

- Floor drains:
    - 2mm screens on square drains.
    - Sediment trap downstream of the strip drains.
    - Catchment sump with pump, piped to balance tank, activated by a float switch.
- Balancing Tank:
    - Approx 4,000L in volume, capable of storing one week waste.
    - Installed at rear of building in service area.
    - Vented at roof height.

The wastewater will be brought within the discharge specifications by way of the following treatments:

- Suspended Solids
    - Balance tank will have a conical bottom to assist in collection of sediment.
    - Discharge will be from centre of tank, rising vertically to mitigate risk of discharging settled solids.
    - Settled solids will be collected from the bottom of balance tank by an authorised liquid waste removal contractor.
    - Removal of solids will be recorded on trade waste system logs.
- pH
    - Manual adjustment of pH will be achieved in the tank using NaOH or HCl to meet Richmond Valley Council requirements (7-9 pH).
    - Small recirculating pump (flow rate of 1L/s) to equalise pH and ensure even distribution of neutralisation additions.
    - Initial and final pH will be recorded on trade waste system logs.
- Temperature
    - Only a small percentage of waste water is expected to be above 38 degrees.
    - The tank is expected to consistently be below discharge temperature threshold.
    - Manual temperature adjustment to less than 38°C (if required), by adding additional ground water, if discharge is required when temperature is out of specification.
    - Confirmation of current temperature to be recorded on trade waste system logs.

Once the balance tank has been confirmed within specification:

- Discharge line will be opened allowing the tank to gravity feed to the sewerage.
- Discharge will be via a magnetic flowmeter to calculate the total volume discharged.
- Discharge line will be closed prior to any additional brewing operations that may introduce additional liquid waste to the system.
- Volume discharged will be recorded on trade waste system logs.

Brewery - Environment Management Plan

The key areas for categorising potential health and environment impact from the brewing process can be split into the following key categories:

1. Wastewater
2. Solid Wastes
3. Air Emissions & Odour
4. Noise
5. Energy Consumption

The purpose of this Environmental Management Plan is to describe the principles behind, and procedures to be implemented, for the management of waste and environmental factors generated by installation of the brewery.

Rod N Reel has developed this plan to ensure that all wastes are reduced, reused and recycled wherever possible. This Waste Management Plan outlines measures to manage and mitigate waste generation and resource consumption during brewing operations.

The plan demonstrates that the installation of the brewery will have minimal environmental impact on the local area.

Solid Wastes:

I. Spent Grain/Hops/Trub: These materials will be collected prior to discharge to drain. Solids will be stored in sealed bins and taken off site for animal feedstock or for composting.
II. Yeasts/Tank Sludge: The yeast solids will be disposed of together with the spent grain, the liquid wastewater to the sewer.
III. Hazardous waste: Minimal hazardous waste will be produced. Each of these will be managed as followed:
    - Carbon Dioxide. Fermentation from a 500l system is minimal and will have no measurable impact on the
    - Chemical Waste. Containers used for storage of acid and alkaline chemicals will be rinsed within the brewery trade waste system. Any impact on pH from this process will be balanced as per the standard pH adjustment process.
IV. All general solid waste will be collected and removed by contractors, via the existing general rubbish and recycling bins in use by the tavern.

Air Emissions & Odour:

Air emissions include carbon dioxide generated from fermentation and water vapour from the brew kettle during the boiling process. Given the small footprint of the brewery, these are not expected to have any measurable environmental impact.

The potential for odour emission will be primarily from the brew kettle. Odour will be generated during wort boiling together with a small quantity of steam. Quantities of steam per batch will be in the order of 25 Litres (500 Litres x 5% Evaporation = 25 Litres of water). As part of the brewery design and management of emissions during this process, the brewing kettle will have a vapour condenser installed to liquify the steam to water. The working principle being that no odour is

emitted as a result of the steam vapour volatiles condensing and being captured within the brewery wastewater system.

The location for the brewery is within a large, well-ventilated area. Carbon dioxide production from fermentation on a 500L system will have no measurable impact on the carbon dioxide levels within this area.

No external penetrations to the environment from the brewing area are planned.

Noise:

Noise from brewery operations will occur from the following pieces of equipment.

- Pumps
- Motors
- Refrigeration System

External noise to the property boundaries will not be increased, with consideration of the following points.

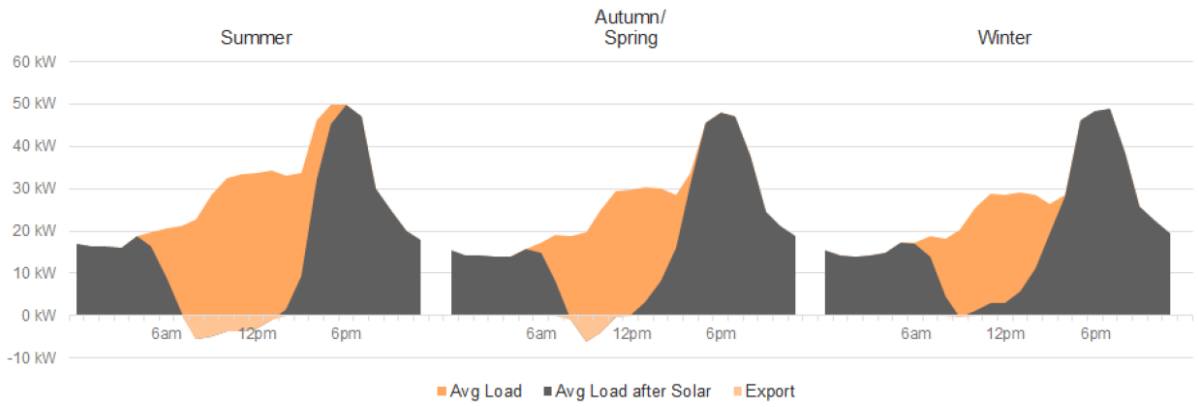
- Pumps and Motors, operating internally within business hours.
- Refrigeration plant, this is smaller and more efficient than the existing refrigeration plant in use for cool rooms and the beer system.

Energy Consumption:

Energy consumption is dependent on production and is predominantly electrical power. Energy is an excellent candidate for efficiency improvements as saving reduces production costs as well as greenhouse gas emission to the environment.

A solar array is installed on the premise. This is currently producing excess electricity during daylight hours. The highest demand for energy from the brewing process occurs during wort boiling. The planned schedule will have this process falling between 10 and 2pm on brew days (3 times per fortnight). This aligns well with current excess energy available from the solar system, as can be seen in below graph from the venues solar report.

This will significantly offset the energy consumption, thus reducing greenhouse emissions.



Other energy conservation measures include:

- Recovery of heat from boiling kettle via vapor condensor.
- Cooling of wort with incoming brew water (liquor) using heat exchanger, that stores recovered heat as hot water that is then used for other brewing operations.