NEW ZEALAND WINE
PURE DISCOVERY

NEW ZEALAND WINEGROWERS
Code of Practice for Winery Waste Management
MAY 2010

This document is intended to provide practical guidance on strategies for managing solid and liquid wastes as at 1 April 2010, based on legislative texts, guidance material and discussions with regulators and industry members. All due care and attention has been exercised in the preparation of the information contained in this document. However, regulations will change over time, and interpretations may differ. We will endeavour to provide regular updates as they come to hand. Nevertheless, this document is not intended to be the definitive source on legal matters relating to winery waste.

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1. INTRODUCTION

1.1 BACKGROUND

This Code of Practice (CoP) was commissioned by New Zealand Winegrowers (NZW) and Sustainable Winegrowing New Zealand (SWNZ) to replace the previous Management of Waste By-Products Code of Practice for Wineries 2000.

MWH has previously carried out a Literature Review of Winery Waste Management (2008). The CoP incorporates the findings of this review and is intended to be a SWNZ quality improvement tool which assists wineries in achieving "sustainable certification". The key focus is the process to be followed to improve environmental performance.

1.2 PURPOSE

The purpose of this CoP is to provide practical guidance to winery management and staff on strategies for managing solid and liquid wastes generated by wineries. The overall goal is to promote cleaner production and sound environmental practices in the New Zealand wine industry.

The CoP sets out practices to avoid, remedy or mitigate potential environmental effects of solid and liquid wastes generated by wineries, such as:

- loss of downstream surface water or groundwater quality due to nutrient enrichment or salinisation
- degradation of soil structure or contamination
- odours from waste facilities

1.3 STRUCTURE OF THE DOCUMENT

This CoP recommends practices for:

- Treatment and disposal of wastewater and solid wastes from wineries
- Cleaner production for wineries
- Potential for beneficial reuse of winery wastewater and solid wastes from wineries

The document is structured as follows:

Section 1	Introduces the background, purpose and structure of the CoP
Section 2	Defines the process to be followed for wineries to achieve sustainable environmental practices
Sections 3-9	Provide details of each step of the process for achieving sustainable environmental practices, including practical advice for winery staff and management
Section 10	Details the reference documents used in the preparation of the CoP
Section 11	Provides a glossary of terms and abbreviations used throughout the CoP
Section 12	Includes additional data in the form of Appendices

2. WINERY WASTE MANAGEMENT CODE OF PRACTICE

2.1 WASTE MANAGEMENT PROCESS

The process which wineries are recommended to follow in order to make choices regarding the sustainable management of their solid and liquid wastes includes seven key steps (Figure 1).

1. **Legislative Requirements:** Knowledge of the legislative requirements within New Zealand is a key factor with regard to waste management in wineries. This includes existing national legislation and policies, regional and district rules and potential legislative changes being promoted by Government.

2. **Receiving Environment:** The requirements for reuse, treatment and/or disposal are dependent on the nature of the receiving environment. This will also determine contaminants that must be avoided.

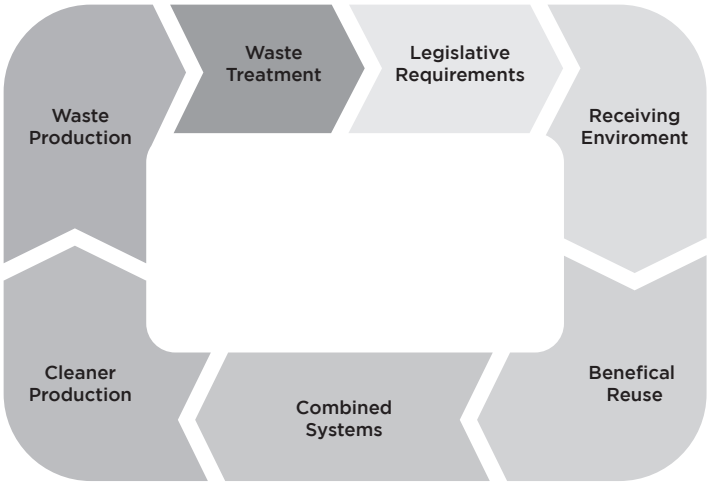

FIGURE 1: The Winery Waste Management Cycle

3. **Beneficial Reuse:** The potential for beneficial reuse of winery wastes streams should be considered as a key priority and it likely to reduce the consumption of precious resources such as water as well as the limiting the generation of wastes for subsequent disposal.

4. **Combined Effluent Systems:** The decision as to whether to combine winery wastewater with domestic wastewater and/or stormwater generated within the winery will have a number of implications in terms of the treatment and disposal options for the waste streams. Stormwater generated during the vintage period may be dealt with differently than outside the vintage period.

5. **Cleaner Production:** The adoption of cleaner production techniques such as preventing or minimising the generation of waste at source, efficient utilisation of resources and minimising contamination of waste streams will ensure sustainable practices and decrease adverse effects on the environment.

6. **Waste Production:** When assessing the quantity and quality of waste generated in a winery it is critical to identify the source of the waste and any potential contaminants as this will assist in managing the impact of such wastes on the environment.

7. **Waste Treatment:** The final step in the waste management process for wineries is to determine the most appropriate methods for treatment and disposal of the residual waste streams. Consideration should be given to the potential impacts of the treatment processes themselves as well as any potential by-products generated.

2.2 EXCLUSIONS

This CoP contains explanatory information, the processes outlined do not represent the only acceptable means of good environmental practice and winery waste systems should be investigated, designed and reviewed by experienced and qualified engineers.

This CoP excludes:

- Human effluent treatment and disposal, guidance for these practices is available from other sources.
- Disposal to municipal treatment facilities.
- Distilleries, as only a few New Zealand wineries have distilleries.
- Effects on carbon emissions as this is being addressed elsewhere.
- Social and cultural effects as being covered in other reports by SWNZ.
- Packaging or solids wastes other than winery processing wastes.

3. LEGISLATIVE & OTHER REQUIREMENTS

Legislative requirements in relation to winery wastes encompass both national legislation as well as the rules defined in Regional and District Plans. Other requirements to be aware of include those set out in national programmes and strategies, any new National Environmental Standards likely to be introduced and voluntary best practice guidelines and standards designed to assist in improving environmental performance.

3.1 NATIONAL REQUIREMENTS

The key national requirements relating to treatment and disposal of winery wastes are summarised in Table 1.

TABLE 1 – KEY NATIONAL REQUIREMENTS RELEVANT TO WINERY WASTES

	INSTRUMENT	KEY REQUIREMENTS
NATIONAL LEGISLATION	**RESOURCE MANAGEMENT ACT 1991 (RMA)**	• Provides the primary framework for resource utilisation within New Zealand. The overriding purpose "is to promote the sustainable management of natural and physical resources". • Sets out a duties and restrictions in relation to the use of land, coastal marine areas, river and lakes beds, water, discharges, noise and adverse effects on the environment. • Any activity can either be authorised by a rule, either in a regional plan or district plan, or through a resource consent or a designation.
	HAZARDOUS SUBSTANCES AND NEW ORGANISMS ACT 1996	• Aims to protect the environment, and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms. • Imposes a duty to avoid, remedy or mitigate adverse effects associated with importing, possession, or use of a hazardous substance or new organism. • Established standards, known as 'group standards', for groups of materials with similar hazards. These standards were introduced to ensure the safe disposal of hazardous waste, and to provide data on hazardous waste generation and disposal.
	ENERGY EFFICIENCY & CONSERVATION ACT 2000	• Promotes energy efficiency, energy conservation, and use of renewable sources of energy.
	WASTE MINIMISATION ACT 2008	• Encourages a reduction in the amount of waste we generate and dispose of in New Zealand and aims to lessen the environmental harm of waste. • Provides a framework for product stewardship to reduce waste from products and take responsibility for the environmental effects of products – from 'cradle-to-grave'. • You must adhere to any waste-related bylaws made by your territorial authority under the Act.

TABLE 1 Continued

	INSTRUMENT	KEY REQUIREMENTS
OTHER NATIONAL REQUIREMENTS	**RESOURCE MANAGEMENT (National Environmental Standards for Sources of Human Drinking Water) REGULATIONS 2007**	• To reduce the risk of contamination of drinking-water sources by requiring regional councils to consider effects of certain activities on drinking-water sources when granting water permits or discharge permits including or amending rules in regional plans in relation to permitted activities. • Requires regional councils and territorial authorities to impose a notification requirement on certain resource consents in the circumstances where an event occurs that may have a significant adverse effect on a drinking-water source.
	PROPOSED NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT	• The purpose is to help guide decision-making on freshwater management under the Resource Management Act 1991 (RMA) at national, regional and district levels. • Outlines objectives and policies for the management of fresh water, helping to inform immediate decisions as well as longer-term thinking and planning.
	NEW ZEALAND WASTE STRATEGY 2002	• Recognises the benefits that can be achieved by using our natural resources more efficiently and supports the 'waste hierarchy' – the '5Rs' of reduction, reuse, recycling, recovery, and management of residual waste. • Three core goals; to lower the costs and risks of waste to society, to reduce environmental damage from the generation and disposal of waste, to increase economic benefit by using material resources efficiently. • Recognises that waste management and minimisation in NZ are everyone's responsibility
	GOOD PRACTICE GUIDE FOR ASSESSING AND MANAGING ODOUR IN NEW ZEALAND	• Suggests a national approach to assessing and managing offensive odours. • Contains advice on: o How to assess the effects of odour, including how to determine what "no objectionable or offensive odour" means. o How to monitor the effects of odour through community surveys, odour diaries and council investigations. o Case law developed under the RMA relating to odour management in New Zealand. o When to use dispersion modelling. o Managing odour emissions, including basic information on suitable mitigation options.

3.2 LOCAL REQUIREMENTS

The key local requirements which relate to the treatment and disposal of winery wastes are summarised in Table 2.

TABLE 2 – KEY LOCAL REQUIREMENTS RELEVANT TO WINERY WASTES

	INSTRUMENT	KEY REQUIREMENTS
REGIONAL COUNCILS	REGIONAL POLICY STATEMENTS	• The Resource Management Act 1991 requires all regional councils to produce a regional policy statement for their region and then review it every 10 years. • A statutory document that identifies the major resource management issues for the region, and sets out objectives, policies and methods for tackling these issues.
	REGIONAL PLAN: WATER	• Applies to all fresh water in the region, including water in rivers, lakes, streams, ponds, aquifers and artificial water courses, but excludes freshwater in the coastal marine area. It also applies to all land in river & lake beds. • Identifies issues to be addressed so that fresh water resources can be sustainably managed.. Objectives, policies, methods and rules are documented to address these issues.
	REGIONAL PLAN: LAND	• Applies to discharges of contaminants to land, whether or not the discharge enters water. • Identifies issues to be addressed so that the receiving environment for discharges to land can be sustainably managed. Objectives, policies, methods and rules are documented to address these issues.
	REGIONAL PLAN: AIR	• Applies to discharges to air in the whole of the region. • Identifies issues to be addressed so that the receiving environment for discharges to air can be sustainably managed. Objectives, policies, methods and rules are documented to address these issues.
	REGIONAL PLAN: WASTE	• The purpose of a Waste Plan is to provide an integrated approach to waste issues with the aim of reducing the adverse effects associated with the region's waste stream. • To achieve this, the Waste Plan will have policies and methods (including rules) to address the relevant waste issues.
	DISCHARGE CONSENT	• Discharge Consent to discharge water and contaminants to land or water

TABLE 2 Continued

	INSTRUMENT	KEY REQUIREMENTS
DISTRICT COUNCILS [1]	DISTRICT PLAN	• Councils are required to prepare a District Plan under the Resource Management Act 1991. • Primary document that manages land use and development within the district. • Contains rules that may affect you if you are making a development or land use proposal.
	LAND USE CONSENT	• Land use consent to undertake the activity if not a permitted activity under the District Plan.
	TRADE WASTE BYLAWS	• The purpose is to control trade waste discharges into the wastewater system to protect: o Sewers, pumping stations, storage tanks, wastewater treatment plants and other related wastewater system structures o Workers operating in or with the wastewater system o The environment by ensuring the necessary Resource consents are met. • The bylaws may also provides a basis for charging persons who use the wastewater system and a basis for the introduction and implementation of the New Zealand Waste Strategy.

NOTES: 1. *In the following areas the functions of the Regional and District Councils are combined into one Unitary Authority - Chatham Islands, Gisborne, Marlborough, Nelson, Tasman and the new Auckland Council post November 2010.*

3.3 PRACTICAL ADVICE

RECOMMENDATIONS

1. Identify the legislative and other requirements which are relevant to your winery and the waste streams generated, including national and local, mandatory and voluntary, using Table 1 and Table 2 as a reference guide.

2. Get up-to-date copies of the relevant legislative and other requirements.

3. Undertake a comprehensive audit of process operations, inputs and outputs of raw products and energy, human resource management and fate of waste products to determine how the relevant requirements impact on the design and operation of your winery.

4. Establish and maintain the necessary systems and procedures to ensure compliance with the relevant legislative and other requirements.

5. Undertake regular reviews to ensure that any changes to existing legislative and other requirements are identified.

6. Train all staff in environmental best practice

USEFUL REFERENCES

- www.legislation.org.nz
- www.lgnz.co.nz
- Regional & District Councils – websites, Regional Plans, District Plans www.lgnz.co.nz/lg-sector/maps/
- Winery Industry Publications e.g. NZ WineGrower Magazine www.nzwinegrower.co.nz
- www.nzwine.com (members section) and SWNZ www.nzwine.com/swnz
- www.mfe.govt.nz/issues/waste/waste-minimisation.html

4. RECEIVING ENVIRONMENT

The type and nature of the receiving environment will determine the relevant legislative requirements and will also impose limitations on the range of options for reuse, treatment and/or disposal of winery wastes. The four possible receiving environments for winery waste discharges are:

1. Land	3. Local authority wastewater treatment system
2. Water	4. Air

4.1 LAND

Discharge to land is the most common method of treatment and disposal for winery wastewater. This method of disposal requires suitable soil and plants to uplift the surplus water and nutrients applied with sufficient surface area to provide re-aeration of the soil before repeat applications of winery wastewater.

Discharge to land is also an option for solid waste. Solid wastes have the potential to generate high strength leachates and to clog the soil. Land disposal of solid waste can also be achieved by dumping to landfill. This is not recommended due to the high cost involved and potential for waste minimisation by other methods. Where disposal to landfill is being considered it is necessary to review the moisture and chemical content of the solid waste and compare them with the landfill acceptability criteria (LAC).

The effects on groundwater are vitally important when considering land-based treatment. Much of Hawkes Bay, Marlborough, Canterbury and Central Otago are supplied with potable drinking water that is untreated, pristine in quality and very old.

Table 3 provides details of the issues which should be taken into account when considering land-based discharge of winery wastewater or solid waste over confined or unconfined aquifers.

TABLE 3 – SUMMARY OF ISSUES TO CONSIDER WHEN DISCHARGING WINERY WASTEWATER OR SOLID WASTES TO LAND

ISSUES	WASTEWATER DISCHARGES	SOLID WASTE DISCHARGES
AQUIFER	• Confined • Unconfined • Depth to groundwater	• Confined • Unconfined • Depth to groundwater
TOPOGRAPHY	• Slope • Vegetation • Surrounding land uses • Average rainfall • Humidity • Soil temperature	• Slope • Vegetation • Surrounding land uses • Average rainfall • Humidity • Soil temperature

TABLE 3 Continued

ISSUES	Wastewater Discharges	Solid Waste Discharges
CLIMATE	• Average rainfall • Evapotranspiration rates • Humidity	• Average rainfall • Humidity • Soil temperature
BUFFER ZONE REQUIREMENTS	• From surface water or coastal water • From discharge to neighbours and buildings	• From surface water or coastal • From discharge to neighbours and buildings
MONITORING	• Air • Dust • Water • Odour • Soil chemistry (control and changes over time)	• Air • Dust • Water • Odour • Soil chemistry
SOIL TYPE	• Dominant soil type – clay, silt or sandy gravels • Average water holding capacity • Porosity • Soil chemistry and physical structure	• Dominant soil type – clay, silt or sandy gravels • Average water holding capacity • Porosity • Soil chemistry and physical structure
GROUNDWATER	• Depth from surface • Flow direction • Nearby abstractors e.g. drinking water	• Depth from surface • Flow direction • Nearby abstractors e.g. drinking water
SODIUM and POTASSIUM CONCENTRATIONS (WW) % MOISTURE (SW)	• In receiving environment • In wastewater discharge	• In solid waste • In receiving environment
APPLICATION	• Applicator type • Application rate (<120kg BOD/ha/day) • N loading rate in receiving environment (<200kg N/ha/yr) • Resting periods for soil	• Application method • Application rate (<120kg BOD/ha/day) • N loading rate in receiving environment (<200kg N/ha/yr), C:N ratio • Resting periods for soil
STOCKPILING	• Not applicable	• Not recommended • Sealed pad • Prevention of leachate

4.2 WATER

Disposal of winery wastewater to surface or ground water is an option where the topography, soil, groundwater or climate are unsuitable for irrigation to land. In accordance with the RMA, wineries discharging to water will need to obtain a resource consent through a process which requires detailed consideration of options and effects on the receiving waters. Table 4 provides an indication of the issues which should be taken into account when considering discharge of winery wastewater to surface or ground water.

TABLE 4 – SUMMARY OF ISSUES TO CONSIDER WHEN DISCHARGING WINERY WASTEWATER TO WATER OR LOCAL AUTHORITY SEWAGE SYSTEM

ISSUES	SURFACE WATER	LOCAL AUTHORITY SEWAGE SCHEME
LEGISLATIVE	• Resource consent required • Likely to contain stringent conditions	• Trade waste consent required • Future changes to trade waste consents
TREATMENT	• High level of treatment required • Consent will include stringent monitoring requirements	• Pre-treatment to required standard e.g. screening, flow equalisation, pH, suspended solids and BOD treatment limits • Consent will include stringent monitoring requirements
CAPACITY	• Limited by resource consent	• Availability of reticulation • Availability of treatment capacity
GENERAL	• Cultural issues	• Levy to council • Contingency in case capacity fails

4.3 LOCAL AUTHORITY SEWAGE SCHEME

The discharge of winery wastewater to a local authority sewage system is an attractive and simple option where available and where the sewage scheme has sufficient capacity. Such discharges will generally require a trade waste consent or permit under a local authority Trade Waste Bylaw.

Wineries need to consider the requirements of the trade waste consent and discuss pre-treatment to meet Council standards (Table 4). The design of the pre-treatment system also needs to be considered so that it can be used for future treatment with an aeration and clarification step if trade waste charges become expensive or if the Council places stringent conditions on the consent. Many Councils are reapplying for consents due to expire on wastewater schemes and consequently trade waste consent conditions and charges can be expected to become more stringent.

4.4 AIR

Any discharge from wastewater treatment plants, composting facilities or discharge of wastewater to land will be required to conform to the requirements of the Regional Air Plan or Land Use Consent conditions for that activity.
Typically these require no objectionable or offensive odour at the boundary of the site to prevent a nuisance for neighbours.

Also odour levels should comply with the acceptable exposure levels for personnel as recommended by the OSH/Ministry of Health and as defined in Manual for Wastewater Odour Management-NZWWA. The ventilation and extraction system shall collect odour and protect staff operating the wastewater treatment plant. In addition, hydrogen sulphide levels shall be within safe operating levels and recommended levels by the equipment manufacturers in all areas where electrical or electronic equipment is present.

4.5 PRACTICAL ADVICE

RECOMMENDATIONS

1. Identify all the solid, liquid and gaseous discharges from your winery processes (Section 8). nclude vintage, non-vintage, continuous, intermittent and emergency discharges.

2. Determine the quantity and quality of each of the discharges from your winery processes.

3. Identify the potential receiving environments for each of the discharges from your winery processes

4. Undertake an assessment of the most appropriate receiving environment for different waste streams by considering the issues detailed in Table 3 and Table 4.

5. Obtain the necessary permits and consents to ensure compliance with the relevant legislative and other requirements for your winery (Section 3).

5. BENEFICIAL REUSE

5.1 WASTEWATER

Winery wastewater can be utilised for a range of purposes dependent on constraints such as the quality required, distance form the source, infrastructure required, land capability and environmental impacts. A significant benefit of reusing wastewater is that it can reduce the volumes of water required.

The most obvious location for reuse is in the winery itself where the following issues must be taken into account:

- Pre-treatment requirements
- Compliance with food standards requirements
- Storage – type, capacity, lining to prevent seepage.

Winery wastewater can also be utilised for irrigation of land. Potential options include:

- Vineyard – provided the treatment wastewater is low in salts, reuse through the vineyard is feasible.
- Fertigation – wastewater can be used as a fertigation source of nutrients. It may be necessary to store the wastewater to control the timing and irrigation of vines.
- Woodlot – Olives, nuts, eucalyptus. Woodlots are widely used in Australia.
- Pasture – Dependent on whether the treatment water is low in salts.
- Landscape area – Landscaped areas around the vineyard or winery are an obvious use of wastewater where the volumes are small.

Table 5 identifies potential issues associated with the reuse of winery wastewater.

TABLE 5 – SUMMARY OF ISSUES TO CONSIDER WHEN UTILISING WINERY WASTEWATER FOR IRRIGATION PURPOSES

ISSUES	WASTEWATER IRRIGATION
BASELINE	• Existing groundwater and surface water quality levels • Local groundwater and surface water abstractors
FACTORS LIMITING REUSE	• Volume—total annual and peak vintage • Salts • Excess of sodium relative to calcium plus magnesium (sodicity) • Nutrient loading: carbon, nitrogen, phosphorus, potassium, etc. • Acidity • Variability

TABLE 5 Continued

ISSUES	WASTEWATER IRRIGATION
WHERE	• Soil type and structure • Topography • Groundwater depth • Climate
HOW	• Application method • Application rate (<120kg BOD/ha/day) • N loading rate in receiving environment (<200kg N/ha/yr), C:N ratio • Resting periods for soil • Does not exceed soil water holding capacity
MONITORING	• Air • Dust • Water • Odour • Soil chemistry
STORAGE	• Pre-treatment required • Storage area lined to prevent seepage • Wastewater irrigation quality requirements – if wastewater is to be reused to irrigate vines it will be required from October to March. Winery wastewater produced from February to May will need to be treated to a point where it can be stored over winter without odour nuisance and be available for the next irrigation season. To store water, biological treatment is required to reduce BOD to <30mg/L.
IRRIGATION RATES	• Current agricultural land use • Land capability – soil types, slope, hydrology and landforms • Irrigation loading rates – these may vary regionally according to volumes specified in District Plans.

5.2 SOLID WASTE

There are several options for the beneficial reuse of solid waste such as marc (sludge waste treatment is further addressed in Section 9.3). These include:

- Incorporation into vineyard & pasture soils
- Composting organic production waste for reuse in vineyards, etc.
- Stock feed - Cattle, deer and pigs
- Potential by-products – including grapeseed oil and vitamins.
- Distillery – although commonly used in Australia and USA this is not commonly used in NZ.

Table 6 identifies potential issues associated with the reuse of solid wastes generated in the winery.

TABLE 6 – SUMMARY OF ISSUES TO CONSIDER IN THE BENEFICIAL REUSE OF WINERY SOLID WASTES

VINEYARD & PASTURE	COMPOST	STOCK FEED
METHODOLOGY • Spread thinly on field immediately after pressing - aerobic & less likely to cause odour or leachate problem. BASELINE • Topography • Climate • Soil type and structure BUFFER • From neighbours • From surface water & groundwater bores SOLID WASTE QUALITY • % moisture content of solid waste • Chemical content MONITORING • air • dust • water • odour • soil chemistry HOW? • Application method • Application rate (<120kg BOD/ha/day) • N loading rate in receiving environment (<200kg N/ha/yr), C:N ratio • Resting periods for soil • Does not exceed soil water holding capacity ACCESSIBILITY • Of receiving site	MIXING MATERIAL ORIGIN • Safety • Quality SOLID WASTE QUALITY • Chemical status • Nutrient status • Volumes of mixing material available STORAGE • Leachate control – collection, treatment & bunding • Sealed • Temperature control • Moisture control • Air flow LEGAL REQUIREMENTS • Controls are required to seal base area & collect leachate for treatment	METHODOLOGY • It is recommended that chemical residue testing is undertaken on marc before it is fed to stock or check spray dairies from contributing vineyards and check for hydraulic oil contamination • Spread marc for stock feed or stock fed on sealed pad if in one location STORAGE • Speed of application vs storage • Toxic leachate management - sealed BUFFER • From neighbours • From surface water & groundwater bores MONITORING • air • dust • water • odour • soil chemistry SOIL TYPE / STRUCTURE

5.3 PRACTICAL ADVICE

RECOMMENDATIONS

1. Identify the discharges from your winery processes (see Section 8 for further details). Include vintage, non-vintage, continuous, intermittent and emergency discharges.

2. Determine the quantity and quality of each of the discharges from your winery processes.

3. Identify potential options for reuse of each of the discharges to different receiving environments.

4. If discharging wastewater to land for irrigation read
   www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/irrigation/irrigation-best-management/httoc.htm

5. Undertake an assessment of the most appropriate reuse options for different waste streams by considering the issues detailed in Table 5 and Table 6.

6. Identify and obtain the necessary permits and consents to ensure compliance with the relevant legislative and other requirements for your winery (Section 3).

7. Educate staff in requirements of winery waste processes at least three months prior to vintage and train new staff as they come on board.

6. COMBINED EFFLUENT SYSTEMS

The decision as to whether to combine winery wastewater with domestic wastewater and/or stormwater generated within the winery will have a number of implications in terms of the treatment and disposal options for the waste streams. These issues are summarised in Table 7.

TABLE 7 – SUMMARY OF ISSUES TO CONSIDER IN RELATION TO COMBINED WINERY EFFLUENT SYSTEMS

ISSUES	COMBINED SEWAGE AND WINERY WASTEWATER	COMBINED STORMWATER AND WINERY WASTEWATER
COMBINED	• Balanced food supply for biological treatment • Restricts options for disposal to land due public health risk • System malfunction could lead to shut-down of winery operations	• Recommended during vintage • Extensive wash-downs during vintage give higher contaminant loadings. • Unmanaged stormwater flow can substantially increase risk of overloading the wastewater storage & treatment system.
SEPARATE	• Lower capital & operational costs • Flexibility • No public health implications	• Recommended during non-vintage • Non-contaminated stormwater is a valuable resource • Options: 1. Dispose to land 2. Re-use for cooling, irrigation or washdown 3. Local stormwater system

6.1 SEWAGE SYSTEM

The quantities of domestic wastewater generated at a winery are likely to be small compared with the volumes of winery wastewater. It is good practice to avoid a combined sewage-winery wastewater system to protect public health of people in potential contact with wastewater.

6.2 STORMWATER SYSTEM

Wineries across New Zealand have open areas, buildings and machinery that collect stormwater potentially containing contaminants of concern due to their typical occurrence in stormwater runoff and wastewater overflows, as well as those specific to the wine-making process.
It is recommended that a separate stormwater system be used during non-vintage as contaminant loadings will be lower. However, during vintage times it may be beneficial to combine the two systems, providing a greater level of treatment for the stormwater due to higher contaminant loadings. Provision should always be made to allow a predetermined amount of "first flush" stormwater to enter the wastewater system, to remove dust, oils, leaves, etc. before diverting to the stormwater system.

6.3 PRACTICAL ADVICE

RECOMMENDATIONS

1. Determine the quantity and quality of winery wastewater, domestic wastewater and stormwater (see Section 8).

2. Identify potential options for combining winery wastewater with domestic wastewater or stormwater.

3. Determine whether combined systems are likely to be appropriate based on the issues outlined in Table 7.

7. CLEANER PRODUCTION

The concept of Cleaner Production is an important process in demonstrating economic solutions to waste management with the objectives of reducing waste volume and impacts on the environment and community.

The hierarchy to be used when considering the most appropriate cleaner production strategies is given in Figure 2.

A commitment to responsible environmental management and the implementation of cleaner production strategies will minimise consumption of resources such as chemicals and water. Other motivating factors for the implementation of cleaner production include:

FIGURE 2: Hierarchy of cleaner production strategies (source: Winery Wastewater Handbook)

- Financial benefits due to reduced waste disposal and raw material costs (including energy and water)
- Improved environmental image
- Green consumer pressure especially for exporters to Europe
- Regulatory pressures e.g. MfE and RMA requirements
- Increased production.

7.1 CLEANER PRODUCTION STRATEGIES

Typical examples of cleaner production strategies are outlined in Table 8.

TABLE 8 – TYPICAL CLEANER PRODUCTION STRATEGIES FOR WINERIES

ISSUES	CLEANER PRODUCTION STRATEGIES
CHEMICALS Toxic substances are not generally used by wineries	• Caution winery personnel not to dump herbicide, pesticide residuals or spent forklift crank case oil in outside waste drains.
WASTE MINIMISATION Using resources efficiently and minimizing waste streams	• Cleaner production focuses on identifying and changing processes & housekeeping to minimise waste volumes.
REDUCING WATER POLLUTION Changes in certain common practices, procedures or policies can improve wastewater quality	• Phase out all products containing sodium, having a direct beneficial effect on SAR (Sodium Absorption Ratio). • Reducing the COD (Chemical Oxygen Demand) of wastewater through screening out solids larger than 0.5-1.0mm with basket screens. • Collect and treat lees and caustic wash water separately. BOD of lees can exceed 120,000g/m3 and overload treatment system.
SALT REDUCTION Eliminating the use of salts (K, Ca, Na, Mg) in wineries to reduce COD of wastewater	• Some applicable salt reduction options are quite costly. • Replace disinfectants and cleaning agents with ozone. • Use only environmentally friendly chemical products.
REDUCING WATER CONSUMPTION Reducing water usage to the absolute minimum to reduce wastewater volumes	• Leaking taps. • Hose connections. • Retrofitting washdown hoses with pistol grip nozzles to prevent hoses running needlessly in drains. • Monitoring tank cleaning cycles to see if the rinse cycles are over or under done. • Exploring use of cold water, pressure augmented, low volume cleaning systems for troublesome tartaric accumulations of residues on marc conveyors and press machinery. • Isolate stormwater from the open crushing pad area during non-vintage periods and diverting this into the stormwater system (i.e. install a diversion valve on collection point of crush slab). • Use low cost waste heat from refrigeration systems to produce hot water to improve cleaning & sterilising efficiency. • Re-using rinse water for other purposes where purity is not crucial. • Use brooms or mops for rinsing floors instead of a water hose. • Continuous digital record of wastewater produced with calibrated flow meter. • Estimate flows and loads from winery unit processes.

7.2 WASTEWATER MINIMISATION

Table 9 provides an overview of the various cleaner production techniques available for minimising wastewater in winery operations.

TABLE 9 – OVERVIEW OF CLEANER PRODUCTION TECHNIQUES FOR MINIMISING WASTEWATER IN WINERY OPERATIONS (CHAPMAN, 1996).

CLEANER PRODUCTION PRINCIPLE	AREA OF WINERY OPERATION	
	PROCESS CONTROL	PROCESS MODIFICATION
WASTE AVOIDANCE	• Use brooms or squeeze-mops to clean floors rather than wash down	• Phase out wet discharge filters in favour of dry discharge filters • Use nozzles which turn off when the grip is released • Separate stormwater
WASTE MINIMIZATION	• Reduce frequency of washing • Use no more water than needed for the job • Cellar: change placement of valves to eliminate total flushing of lines when bleeding • Check for leaks in equipment, event the size of a pin-head	• Use low volume, high efficiency cleaning systems • Design and place equipment to minimise transfer distances and make cleaning easy • Use foam pigs to create an oxygen barrier when transferring juice and wine
REUSE	• Reuse stormwater for cleaning floors etc	• Modify pumps on vacuum drum filters to enable recirculation of water • Recirculate water used to keep seals of centrifuges and other equipment moist
RECYCLE OR RECLAIM	• Maximize recycling of caustic/citric cleaning waters	
TREAT	• Treat water for reuse in the winery or for irrigation • Separate recycled caustic and ion exchange wastes, lees and treat separately	
DISPOSE	• Minimise effluent requiring disposal	

7.3 MONITORING

Environmental monitoring is an effective tool to assist wineries to:

- Determine the load and effects of winery wastes on the environment
- Supervise, maintain or improve the performance of winery waste management systems
- Analyse the environmental management performance of the winery

A more intensive monitoring program is required during one or two years to verify estimated volumes and chemical characteristics of the wastewater, and to establish starting conditions of the discharge environment and initial response to the management system.

After the initial monitoring period a less intensive program is required to check for changes in established wastewater volumes and chemical loading, and that current management practices are not impacting the environment beyond predictions.

At present no industry-wide environmental monitoring standards have been established in New Zealand. In Australia the SA EPA (South Australia Environmental Protection Authority) has determined that wineries must develop procedures to sample and monitor influent water, wastewater, soil, groundwater and receiving environments. Table 10 is based on the SA EPA monitoring requirements.

TABLE 10 – OVERVIEW OF WINERY MONITORING REQUIREMENTS

ISSUES	MONITORING REQUIREMENTS
WASTEWATER FLOWS	• Measure and record waste water flow and volume frequently. Ideally a continuous digital record of waste water produced with a calibrated flow meter. • Flow measurements must be synchronised with wastewater quality monitoring to enable accurate pollutant load calculations.
WASTEWATER QUALITY	• Sampling must reflect wastewater quality during the production period. • A schematic diagram must be submitted indicating the sequence of wastewater treatment processes employed and the suitability of the monitoring point.
SOIL	• As a guide, wineries that irrigate with wastewater at a rate greater than 100mm (1 ML/ha) per year should include annual soil chemistry monitoring in their monitoring programme to detect any changes in soil properties. • Best practice maintains that soil moisture and water budget calculations should be kept and made available for inspection where required. • Establish a control site which receives no winery wastewater irrigation • Sample two composite soil samples across the disposal site to allow for different soils • Sample annually after vintage irrigation for soil chemistry parameters as outlined in Table 12. For more detail refer SA EPA (2004)
GROUNDWATER	• As a guide, wineries that irrigate with wastewater at a rate greater than 100mm (1 ML/ha) per year should monitor groundwater in the irrigation site if there is a confined or unconfined aquifer less than 15 metres below the surface.
SURFACE WATER	• Where wastewater management system components such as land irrigation are located within 50 metres of a watercourse, the quality of the water in the watercourse during periods of flow should be monitored at locations and frequencies agreed to with the Regional Council.
SOLID WASTE	• Wineries must maintain and record solid wastes produced each year. • If sludge or marc is applied to the land, wineries must monitor, at least annually, the heavy metal content of the sludge and the soil to which it is applied.
STAFF TRAINING	• Education of employees forms an essential component in the planning and implementation of cleaner production for winery waste management.

APPENDIX 1 provides a Winery Waste Management Checklist based on the South Australia EPA for monitoring in Australian wineries, modified for New Zealand conditions.

7.4 PRACTICAL ADVICE

RECOMMENDATIONS

1. Read and implement "Winery Wastewater Handbook" by Jeanette Chapman published by Winetitles.

2. Utilise the checklist in Table 9 to identify potential cleaner production strategies for your winery.

3. Encourage and incentivise winery staff to identify cleaner production options.

4. Use the hierarchy given in Figure 2 to determine which Cleaner Production Strategies to focus on initially.

5. Before making any substantial changes to the current system it is necessary to weigh up the relative benefits to be gained from implementing 'cleaner production' strategies in the winery, upgrading or replacing wastewater treatment equipment and/or modifying aspects of the wastewater disposal-reuse strategy.

6. Identify the key parameters to be monitored for your winery discharges and implement a routine monitoring programme for vintage and non-vintage activities.

7. For irrigation of land read section titled "Monitoring the effects of wastewater disposal" **www.epa.sa.gov.au/xstd_files/Industry/Guideline/guide_wineries.pdf**

8. Establish your contingency plan for dealing with system failures, rapid harvest due to weather conditions or unexpected harvest quantities-can your system cope with unplanned risks?

9. Undertake "warrant of fitness" checks pre-harvest of all electrical- mechanical plant associated with the water and solids waste streams

8. WASTE PRODUCTION

8.1 WINEMAKING PROCESS

The wine making process includes the following steps and is summarised in Figure 3:

- Destemming of grapes
- Crushing of grapes
- Pressing of must (before fermentation for white wine)
- Fermentation (post pressing for red wine)
- Racking
- Filtering
- Maturing
- Bottling

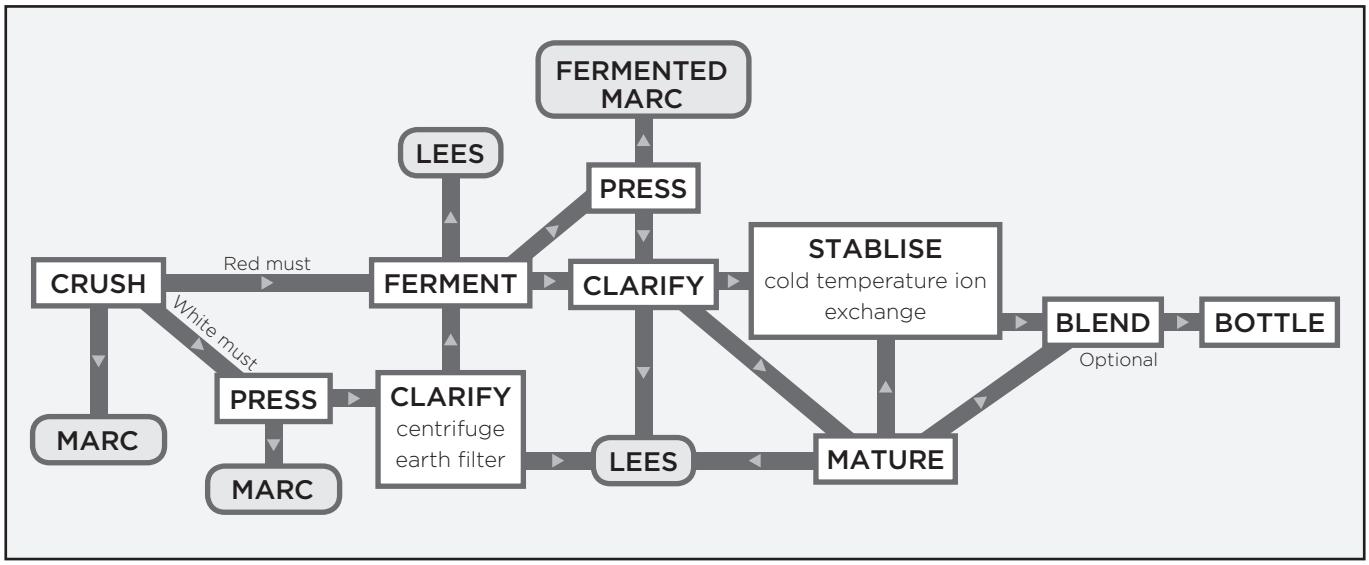

FIGURE 3: Steps in the manufacture of table red and white wines (Source: Winery Wastewater Handbook)

Sparkling wines made by traditional methods include extra steps of fermentation in the bottle, disgorging of the sediment and topping up with wine. Much of the waste is produced during the vintage period of grape harvesting. The major categories of winery waste are solid and liquid wastes.

TABLE 11 – SUMMARY OF WINERY WASTE PRODUCTION SOURCES

WASTE OUTPUTS	SOLID WASTE	WINERY WASTEWATER
WASTE TYPES	• Marc • Suspended solids from screenings • Lees • Bentonite & diatomaceous earth • Sludge from settlement tanks	Cleaning water from: • From rinsing bottles • From washing floors & equipment • Washing from fermentation • Vessels, hoses & barrels
QUANTITIES	• Typically 1-1.5 tonnes marc : 10 tonnes grapes pressed	• Target 1.5m^3 : 1 tonne grapes
ISSUES	• Lees and Sludge high in BOD • Different treatments required for sludge & marc	• High BOD/N/P ratio • Seasonal variations in concentrations

8.2 SOLID WASTES

Solid waste is associated with production of grapes and wine arises from consumable and capital items which might be hazardous/prescribed substances, recyclable or general waste. Winery process solid wastes mainly compromise:

- Marc consisting of stalks, seeds and skins from pressing of grapes
- Suspended solids from screenings of wastewater
- Lees sediments containing pulp, tartrates and yeasts from fermentation
- Bentonite and diatomaceous earth sludges from clarification processes
- Solids from emptying settlement tanks
- Hazardous chemical waste (e.g. poisons, laboratory chemicals, oil, etc.)
- Dry cake perlite cellulose powder
- Sump or lagoon sludges

One tonne of marc with 50% moisture content contains 9 kg of nitrogen and 9 kg of potash as potassium carbonate and 2.3 kg of phosphoric. In New Zealand typically 1-1.5 tonne of marc is produced per 10 tonnes of grapes crushed. It is important to note that the lees, sludge and solids produced are very high in BOD and should be separated from wastewater to reduce treatment costs.

8.3 WINERY WASTEWATER

Wastewater generated by processing and cleaning operations at wineries is normally the most significant environmental management issue at wineries. An understanding of the sources and destination of winery wastewater and the impacts of variations in quality and quantity is an important step towards sustainable management.

Winery wastewater consists mainly of cleaning water from:

- Rinsing bottles
- Washing floors and equipment
- Washing fermentation vessels, hoses and barrels

New Zealand currently produces on average 3 cubic metres of wastewater to every 1 tonne of grapes per annum, with a 1:1 ratio during the vintage period. It is considered that a ratio of 1.5 m^3 of wastewater per tonne of grapes is a feasible target for New Zealand wineries.

Typical contaminants contained in winery wastewater are detailed in Table 12.

TABLE 12 – SUMMARY OF WINERY WASTEWATER CONTAMINANTS

CONTAMINANT	TYPICAL MONITORING PARAMETERS	
CARBON NITROGEN PHOSPHORUS	• Biological Oxygen Demand (BOD) • Total Organic Carbon (TOC) • Chemical Oxygen Demand (COD)	• Total Kjeldahl nitrogen • Total phosphorus
SALINITY & SODICITY	• Sodium (Na+) • Potassium (K+) • Calcium (Ca2+) • Magnesium (Mg2+) • Electrical Conductivity (EC)	• Sodium Adsorption Ratio (SAR) • Chloride (Cl-) • Sulphate (SO42-) • Carbonate (CO32-) • Bicarbonate (HCO3-)
ACIDITY	• pH	

Winery wastewater is mainly cleaning waste. Sodium hydroxide is the most commonly used caustic cleaning agent, which requires neutralisation using citric/tartaric acid solution and rinsewater. Regeneration of earth drum filters and ion exchange columns also generate wastewater, as does the use of evaporative cooling towers.

Table 13 provides a generalised profile of daily wastewater flow originating from winery operations in South Australia.

TABLE 13 - WASTEWATER FLOW FROM WINERY OPERATIONS (SA EPA, 2003)

WINERY OPERATION		CONTRIBUTION TO TOTAL WASTEWATER QUANTITY	CONTRIBUTION TO WASTEWATER QUALITY	EFFECT ON LEGAL WASTEWATER QUALITY PARAMETERS
CLEANING WATER	Alkali Washing (removal of K-bitartrate) and Neutralisation	Up to 33%	Increase in Na, K, COD & pH Decrease in pH	Increase in EC, SAR, COD Variation in pH
	Rinse Water (tanks, floors, transfer lines, bottles, barrels)	Up to 43%	Increase in Na, P, Cl, COD	Increase in EC, SAR, COD Variation in pH
PROCESS WATER	Filtration with Filter Aid	Up to 15%	Various contaminants	Increase in COD & EC
	Acidification and Stabilisation of Wine	Up to 3%	H_2SO_4 or NaCl	Increase in COD & EC Decrease in pH
	Cooling Tower Waste	Up to 6%	Various salts	Increase in COD & EC
OTHER SOURCES	Laboratory Practices	Up to 5-10%	Various salts, variation in pH, etc.	Increase in COD & EC

8.4 STORMWATER

Stormwater is rain and other forms of precipitation that falls on hard impervious surfaces such as roofs and paved areas, and which is collected and drained away quickly from a site to avoid localised flooding. Due to the different levels of surface cleanliness which stormwater comes in contact with, the quality of stormwater can range from very clean to very polluted. Therefore, stormwater at wineries can be a valuable resource or a source of pollution requiring careful management.

The quantities of stormwater generated depend on the size of the impervious areas within the winery and on the quantities of rainfall. Stormwater produced during the vintage period may be contaminated by run-off from winery operations.

8.5 PRACTICAL ADVICE

RECOMMENDATIONS

1. Identify who is responsible for winery wastes three months prior to vintage

2. Consolidate the information on systems, backup and equipment in an Operations and Maintenance Manual

3. List all unit process operations used in your winery (include cooling towers as they generate waste).

4. Prepare a flow chart that shows the flow of product between the processes (grapes, must, wine etc). These will include one-way flows, loops, or both to account for variations between different wine types.

5. Prepare a second flow chart that identifies all input materials other than product, and any output of materials used elsewhere in the winery.

6. Assess the nature of wastewater, stormwater and solid waste generated from the winery processes and associated operations.

7. Determine the quantities of different types of waste produced. Information may be available from existing collection and disposal records.

8. Focus on minimising production of waste and providing adequate onsite collection of different categories of solid waste.

9. Operators are responsible for ensuring that waste is adequately disposed of, whether by appropriately licensed collectors and depots, or on site.

WINERY WASTEWATER

10. Calculate the quantity of wastewater generate by each unit process (such as washing of; barrels, press, grape, bins, floor, filters, etc) by weeks 1-52 of the year.

11. Estimate frequency per week for each unit process, such as number of barrels washed

12. Measure the water used for each unit process by filling a known volume with stopwatch or flowmeter

13. Records results and assumptions on a spreadsheet

14. Compare to recorded wastewater flow meter records to estimated water usage above to check reality

15. Test high strength wastewaters such as lees and caustic soda wash water and separate from normal wastewater treatment process

16. Use cleaning agents that do not require a subsequent water rinse

9. WINERY WASTE TREATMENT OPTIONS

9.1 WASTEWATER

9.1.1 Pre-treatment

Good screening systems to remove solids prior to settlement tanks significantly reduce the strength of wastewater. Key requirements are:

- Must remove most of the skins, seeds and stems.
- Constructed of materials resistant to corrosion by winery waste.
- Easily cleanable.
- Located downwind of the prevailing wind direction so that odours do not cause a nuisance for restaurants, or wine tasting areas.
- It may also be advisable to include a settling basin to collect diatomaceous earth from the waste water before discharging into the settlement tank.

9.1.2 Wastewater Treatment

There are a range of different biological treatment options to be considered with regard to winery waste treatment. It is beyond the scope of this CoP to discuss in detail the types of wastewater treatment, please refer to Metcalf & Eddy, 2003. Types of treatment systems include:

1. Suspended Growth Systems
   a. Activated Sludge
   b. Lagoons

2. Fixed Growth Systems

3. Membrane Bioreactors (MBR) - Relatively new technology in the wastewater treatment field. A combination of a biological reactor and a filtration step on porous membranes, MBR's separate biomass and treated water in place of a settler used in conventional activated sludge systems. There are 3 types of membranes used; tube, plate, ceramic - these are currently being developed. They cost more but have better flow rates and longer lives.

4. Anaerobic Treatment

5. Chemical Methods - Vaughn & Marsh (Metcalf & Eddy 1980) described lime treatment to raise the wastewater pH to 11. This causes the suspended solids and colloidal material to settle as a sludge. This treatment precipitates the tartrates as calcium tartrate, reduces the BOD of the waste by 50% and produces a clear straw coloured liquid that easily seeps into soil of intermittent irrigation plots.

6. Wetlands - Treatment wetlands are constructed wastewater systems that rely on physical, chemical, and biological processes typically found in natural wetlands to treat wastewater. As discussed by O'Brien et al. (2002), a treatment wetland replicates the processes occurring in natural wetlands, but uses wastewater or stormwater as the water source.

The advantages and disadvantages of the different options are detailed in Table 14.

TABLE 14 – WINERY WASTEWATER TREATMENT OPTIONS

TREATMENT		ADVANTAGES	DISADVANTAGES
SUSPENDED GROWTH SYSTEMS	ACTIVATED SLUDGE	• Compact & sometimes lower in initial cost than other systems	• High operating (energy) costs and therefore high whole-of-life costs • Large volumes of sludge are produced • Systems vulnerable to shock &variable loading - common in wine production • High BOD & sugar content necessitates extended aeration periods & may result in sludge bulking • Close operational control and pH adjustment appear to be required (Bolzonella, 2006)
	LAGOONS	• Relatively simple & dependable wastewater treatment options • Tofflemire (1970) documented the performance of a dual power lagoon system. He found for two ponds in series with detention times of 35 and 115 days respectively: o BOD reduction was 98% o No pH adjustment was required o No nutrient addition was required o Nitrogen was reduced by 84% o Phosphorus was reduced by 70% o Winter efficiency was reduced by 5-10% o Surface aerators prevented odour problems and kept oxygen levels greater than 2ppm	• Require significant land and construction costs in areas where land availability is restricted Because winery waste water flows are so highly variable, the efficiency of mechanically aerated lagoons can swing from nearly 95% to less than 50% efficiency in treating BOD through a typical season (Storm 1985). • Odours and freezing have been the main problems in such systems but they can usually be handled by proper operating procedures.
FIXED GROWTH SYSTEMS	TRICKLING FILTERS	• Smaller in area than aerated lagoons. • Generally easier to operate than activated sludge plants.	• Prior equalisation and/or pH control appear to be necessary • Must be designed to receive less than conventional loading rates
	RBC	• Low operating costs and efficiency	• Sensitive to shock loads, pH changes and temperature variations.

TABLE 14 Continued

TREATMENT	ADVANTAGES	DISADVANTAGES
MEMBRANE BIOREACTORS	• Very good sterile effluent suitable for reuse • Costs have reduced for membranes • Do not depend on good settling character for sludge • Can operate at high sludge ratios • Better BOD, Nitrogen and Solids removal • Typically better disinfection than UV • More robust and consistent operation • Extremely compact plant • No need for gravity settling of solids • Not susceptible to sludge bulking problems • Cyclic aeration extends membrane life	• High capital costs • High energy use • Require excellent screening and removal of grease • Require alternating membranes for cleaning • Close operational control required • Good design & operation required • Replacement of membranes
ANAEROBIC TREATMENT	• Feasible technology used in large Australian wineries • With proper waste equalisation, close operational control and high temperature, this method achieves substantial BOD reductions	• More complex to control than aerobic biological treatment • Not used in New Zealand wineries • Further polishing treatment of the waste by other methods would be needed
CHEMICAL METHODS	• With modern technology most lime sludges can be dewatered easily.	• Dewatering of the resulting sludge may be difficult • Coagulation, flocculation and sedimentation treatment of stillage may be difficult because of the sludge volume produced

TABLE 14 Continued

TREATMENT	ADVANTAGES	DISADVANTAGES
WETLANDS	• Can function as wildlife habitat for invertebrates and fish • Properly built, maintained & operated, treatment wetlands can effectively reduce many pollutants-including suspended solids, pathogens, nitrogen, phosphorus, BOD, hydrocarbons and some metals without compromising habitat value. • Use of wetlands is currently being trialled in California, where wineries are concerned with the level of treatment of the wastewater, and also the aesthetic appeal of any treatment system • Provide final 'polishing' to reduce concentrations of BOD/COD, total suspended solids and pathogens, as well as nitrogen, phosphorus, and metals • Tolerant of seasonal pulse of pollutants • For those using land application, can recover and free formerly degraded lands for productive uses • Reclaim and reuse water for other beneficial uses • Passive, self-sustaining – low energy & oversight costs • Cost-share available for habitat-focused projects • Community education & tourism • Improved public relations and aesthetics	• Require a significant land area, good engineering design and maintenance • Maintenance and replanting at intervals • Site-specific nature – may require studies to validate treatment efficiency, cost savings and habitat quality • Influent requires pre-treatment to at least secondary level • Variability of natural systems – exposed to weather • May require multiple permits/consents • Do not reduce salt concentrations • Concern about toxicity to groundwater or wildlife • Nuisance species • Lengthy start up period of plants (12 - 36 months). • Unknown internal detention times within constructed wetlands (Grismer et al., 2001)

9.2 STORMWATER

There are a number of options for stormwater management in wineries, depending on their size and location.

1. If the winery is in a rural area, areas of land can be set aside to act as a disposal area where by infiltration can be used to treat the stormwater by discharging it to land.

2. Contaminated stormwater could be collected and treated using an onsite treatment system and then re-used for irrigation or wash down water.

3. Another option is to dispose of the stormwater to local pipework or services if readily available.

4. Finally a winery could dispose of the stormwater along with the wastewater via the chosen wastewater treatment and disposal method.

9.3 SOLID WASTE

Wineries also need to appropriately manage and dispose all solid wastes generated in a responsible manner, no matter how small the volume. Frequently too little attention is given in the early planning stages to solids handling/disposal and storage. It is important that solids are considered early in winery planning as odours and leachate can be a problem.

9.3.1 Leachate from Stockpiled Marc or Composting Operations

Leachate from a marc stockpile aged 4 to 6 months old is lower in strength than silage leachate. Silage leachate typically discharges for approximately eight weeks at near full strength. Covering of stockpiles would reduce the quantity of leachate for treatment.

Leachate quantity is dependent on rainfall-evaporation moisture balance, on say a monthly basis. The initial leachate may be as strong as BOD 5,000 to 20,000 mg/l. However test results are required of leachate over a season as a stockpile matures.

If marc is to be stockpiled then the following is recommended:

- Locate stockpile clear of neighbours and public areas because of odours

- Seal the base of the stockpile area with clay/concrete sloped to create a leachate collection system

- Collect leachate and pump it into winery effluent system or irrigate to pasture.

9.3.2 Lees Filtering and Sludge from Settlement Tanks

Solids from lees filtering and sludge require special treatment because of the high organic and potassium bitartrate loading. Disposal to landfill is probably the most economic option where sludge treatment facilities are not available.

Other options include spreading at low application rates on pasture land. Spreading lees filter cake containing bentonite on vineyards or effluent irrigation areas is not recommended due to the potential to clog the soil.

Monitoring is recommended to confirm the effectiveness of regular desludging.

9.4 PRACTICAL ADVICE

RECOMMENDATIONS

1. Determine the quantity and quality of winery discharges (see Section 8).

2. Make allowances for any reduction in quantities achieved by applying Cleaner Production Strategies.

3. Taking into account the legislative requirements and relevant receiving environment, select the most appropriate treatment option for each waste stream.

4. Assume that the existing Regional or Unitary Plan Rules will change and become more stringent

5. When considering the future of the winery wastewater system estimate the winery production out to minimum of 35 years to future proof the operations and allow space for wastewater treatment and disposal/reuse options

6. Consider modular treatment systems that can be readily upgraded.

7. Design and build the treatment system with automated control systems, data collection, flow monitoring, fault diagnostics and reporting through internet system with auto-diallers to phones for alarms.

8. Consider how the plant can be arranged and operated manually if the automatic control system or power systems fail.

9. The final selection and design of the treatment system will most likely be undertaken by a specialist and/or suppliers. Any information you can provide them will assist in the design process.

10. When selecting the treatment system consider sustainability and lifecycle costs and the on going level of support and expertise you will need.

11. Require only infrequent operator attention for operation, maintenance and monitoring requirements. The plant should have simple operations, maintenance and testing requirements.

12. Contract to have commissioning and operation of the treatment plant for 1-2 years to identify any consent compliance issues and associated maintenance issues.

13. Have an adequate maintenance budget for the wastewater treatment system.

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11. GLOSSARY OF TERMS

Aerobic: In the presence of free oxygen.

Anaerobic: In the absence of free oxygen.

Aquifer: A layer of gravel, rock or soil that is able to hold or transmit water.

Best practicable option: The best effluent treatment method identified after due consideration of its adverse effects on the environment, the sensitivity of the environment to such effects, the financial implications as compared with other options, and the state of technical knowledge at the time.

BOD, Biochemical Oxygen Demand: The quantity of oxygen required by bacteria to oxidise organic material in a specified time.

Buffer zone: The separation distance between activity and neighbouring property or other activity.

Composting: The process in which organic material undergoes biological degradation (mainly under aerobic conditions) to a stable end product.

Contaminant (s2 Resource Management Act 1991): Includes any substance (including gases, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat.

a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water: or

b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.

Discharging: Includes 'emitting', 'depositing', or 'allowing to escape' any contaminant into the environment.

Dissolved oxygen: The concentration of free oxygen dissolved in water, and usually expressed as g/m3 or mg/L.

Wastewater treatment: Any treatment resulting in the alteration of the characteristics of wastewater, including pretreatment, anaerobic and aerobic lagoons, facultative lagoons, solids/liquids separators, and package treatment systems.

Evaporation: The loss of water, from a surface (e.g. soil) to the air, in the form of vapour. Usually expressed in mm in a given time period (e.g. mm/month).

K: Potassium.

Leaching: The removal of soluble constituents (e.g. salts, fertiliser nutrients) from the soil by water moving downward through the soil profile.

Mg: Magnesium.

Micro-organisms: Microscopic organisms, such as bacteria, viruses, algae, protozoa and fungi, that can live in water, soil, air, animals and plants.

Mineralisation: Conversion of organic matter into a mineral substance.

N: Nitrogen.

Non-complying activity: Contravenes a rule in a District or Regional plan and is allowed only if a resource consent is obtained from the relevant local authority.

P: Phosphorus.

Permeability: The rate with which water can pass through soil.

Permitted activity: An activity that is allowed by a Regional Plan without a Resource Consent if it complies in all respects with any conditions.

pH: The pH is degree of acidity or alkalinity, defined as the negative log of the hydrogen ion activity in water. A pH of 7.0 is neutral whereas lower values are said to be acidic and higher values are alkaline.

Porosity: Ratio of pores to the total volume of soil

Prohibited activity: An activity that is expressly prohibited in a Regional or District plan.

Salinity: The amount of dissolved inorganic solids, or salts, in the water.

Stormwater: Rain water that has drained from the buildings and paved areas.

Sodicity: The accumulation of sodium in soil, resulting in structural deterioration and toxicity to plants.

Sodium Adsorption ratio: A measure of the amount of sodium relative to the amount of calcium and magnesium in the water or in saturated soil extract.

SAR ratios greater than 10 indicate a potential for soil clogging due to sodium especially in clay soils. SAR= Na/square root ((Ca+Mg)/2))

Suspended solids: Solids that are in suspension within the wastewater that are removed by filtering.

Total solids: The sum of dissolved solids and suspended solids in effluent or water.

Water holding capacity: Maximum amount of water that the soil can hold which is available to plants measured in mm.

Water table: The surface below which the ground is saturated with water. Where the water table rises above ground level a body of standing water exists.

12. APPENDICES

WINERY WASTE MANAGEMENT CHECKLIST

CD OF WINERY WASTE INFORMATION