Acknowledgments

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Seek management commitment
Engage people at all levels of the organization
Focus on training and education
Recognize and celebrate successes
Make water visible
Set clear goals and targets and measure performance

LIST OF RESOURCES FOR WINERY WASTEWATER MANAGEMENT
INTRODUCTION

About the Handbook

Purpose

British Columbia has seen intense growth of its wine industry over the last decade. The number of grape wine wineries more than doubled from 134 in 2007 to 275 in 2017, and grape wine production was estimated at 21.3 M litres in 2015. Increased wine production has amplified the need for tools, technologies, and practical guidelines for the management of winery wastewater.

Some BC wineries are facing wastewater challenges that are adding costs and operational risks to their businesses. Challenges include inadequate system sizing leading to more frequent need for cleaning or system failure, wastewater strength being too high for municipal treatment, clogged dispersal systems (e.g. drywell), and odours. With the industry expected to grow and mature in the coming years, water conservation and wastewater reuse topics are already, and will continue to be, of interest and importance to the industry.

This handbook provides BC wineries with the latest information on best practices and technologies that will help in the sustainable management of their source water and process wastewater, with the ancillary benefits of increasing energy efficiency.

Organization and scope

The handbook is organized into three sections.

The “The Basics” section provides an overview of the unique characteristics of winery process wastewater and discusses the benefits of good water and wastewater management.

The “How To” section outlines a 5-step approach to understanding your water use and wastewater generation, provides best practices for using water more efficiently and improving the quality of wastewater produced, and discusses the fundamentals of wastewater treatment and discharge, and how to make good wastewater management “business as usual.” Case studies throughout the “How To” section illustrate what BC wineries are doing to use water efficiently and reduce the strength of their wastewater, and what treatment and discharge systems are in use.

The “List of Resources” section provides a list of important handbooks, websites, and other resources related to winery wastewater management.

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About Sustainable Winegrowing British Columbia

Sustainable Winegrowing British Columbia (SWBC) offers free access to online assessments and educational resources and training to help vineyards and wineries establish sustainable practices, share knowledge, and measure and demonstrate ongoing improvement. SWBC was created by a team of BC viticulturists, grape growers, winemakers, hospitality directors, researchers, and sustainability and marketing specialists, who gathered local knowledge and expertise and learned from programs in other winegrowing regions.

Our Vision

Sustainable winegrowing is not only relevant for today, but also important for the future. Sustainable practices help us make outstanding wines while protecting our bottom line, preserving the beauty and health of our environment for future generations, and enhancing our relationships with employees, neighbours, and consumers.

Our Vision is to be good stewards of the land, while enhancing the social and cultural value of the wine and grape industry, and improving its economic viability - for tomorrow, next week, next year, next decade, and next century.

Other SWBC resources

This handbook is one of many resources produced by SWBC to help vineyards and wineries become leaders in sustainability. Other SWBC resources include:

- Sustainable practices guidebooks, checklists, and templates for vineyards, wineries, and winery hospitality services
- Secure online assessment tool for members to evaluate their operations, create visual reports, and prepare a sustainability action plan
- Annual progress reports
- Performance metric tools
- Fact sheets

To view all products, go to: [www.sustainablewinegrowingbc.ca](http://www.sustainablewinegrowingbc.ca).
THE BASICS

What is winery wastewater?

Water is a key resource, used throughout the winemaking process from vineyard to bottle - for irrigation, temperature control, cleaning, sanitation, sterilization, and filter rinsing. **Wastewater is simply water plus anything else that is put down the drain.** Things that go down the drain in a winery can include unused grapes and juice, winemaking remnants such as alcohol and sugars, and chemicals such as cleaning agents. Winery wastewater contains inorganic salts, organic compounds, yeast, and bacteria. The “high-strength” winery process wastewater (i.e. having more than 7,000 mg/L of BOD, with a TSS of over 3,000 mg/L) has unique characteristics that differ significantly from other food processing wastewaters.

Some factors to watch for in winery wastewater are:\(^2\):

- Chemical (or Biochemical) Oxygen Demand (COD and BOD)
- Total suspended solids (TSS) and total dissolved solids (TDS)
- Salts such as sodium (Na), calcium (Ca), magnesium (Mg), and potassium (K)
- Salinity (electrical conductivity)
- Nutrients such as nitrogen and phosphorus
- Acidity or alkalinity (pH)
- Dissolved oxygen levels (DO)

Wastewater characteristics vary from winery to winery and appear to be significantly influenced by climate and wine type produced. Wastewater loads also vary seasonally, with the highest organic loads produced during vintage.

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Cleaning waste is by far the biggest contributor of wastewater because it is generated at every processing stage during wine manufacture.

Cleaning water can be classified as caustic, acidic, and rinsewater. Caustic cleaning agents are most commonly used to dissolve solid deposits of tartrate, pigments, tannins and proteins. Acidic cleaning agents such as dilute solutions of citric and/or tartaric acids are then used to remove caustic residues. Following the caustic/citric washing, water is used to rinse away traces of the cleaning agents. It’s important to note that one-process, non-caustic cleaners such as Cleanskin and Bevsan are now being used by wineries in BC.

Processes associated with wine clarification and stabilization may also produce wastewater.

This includes regeneration of earth drum filters and ion exchange columns and the use of evaporative cooling towers.

<table>
<thead>
<tr>
<th>SOURCES/PROCESS</th>
<th>VOLUME (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinsewater</td>
<td>43</td>
</tr>
<tr>
<td>Caustic washing</td>
<td>33</td>
</tr>
<tr>
<td>Earth filtration</td>
<td>15</td>
</tr>
<tr>
<td>Cooling tower</td>
<td>6</td>
</tr>
<tr>
<td>Ion exchange</td>
<td>3</td>
</tr>
</tbody>
</table>

What are the benefits of good water and wastewater management?

Wastewater management is inextricably linked to efficient winery operations and long-term profit. It is as much a business matter as an environmental or technical issue.

Benefits of effectively managing water and wastewater include:
- Reduced operational costs,
- Reduced time and labour costs from improved cleaning procedures,
- Better production efficiency,
- Reduced water supply costs, wastewater disposal fees, or surcharges,
- Avoidance of environmental harm, and
- Enhanced relationships and reputation with consumers, local community and regulators.

Furthermore, there is a growing market demand for sustainable wine production, and managing water resources effectively and preventing pollution is part of that equation.

Wineries can stay ahead of the game by integrating management strategies before regulations or emergencies (e.g. failed system) demand a quick response. This allows the freedom to choose practices and technologies that make the most economic sense for the business and implement them over a time period that is manageable for the winery.

Photo Credit: Wines of British Columbia, WineBC.com
Good wastewater management helps keep the environment safe and your neighbours happy.

Most wineries in BC do not have sophisticated wastewater treatment systems to deal with their high-strength wastewater; in most cases, the untreated or marginally-treated wastewater is discharged into leach fields, infiltration ponds, or dry wells. This makes it even more important for wineries to make sure the strength and quantity of their wastewater is closely managed.

When winery wastewater is discharged onto soil, it can lead to increased salinity and acidity, which are detrimental to vegetation growth and soil biota. It can also have a detrimental effect on surface and groundwater ecosystems, from increased microbial and algal growth that consume the available oxygen necessary for other organisms to survive.

Wastewater treatment processes can also generate nitrous oxide, which is a significant greenhouse gas. In addition, high strength wastewater that is directly applied to the vineyard can stimulate soil microbes, thereby increasing the amount of nitrous oxide released to the atmosphere.

Good wastewater management will also reduce the risk of odours, which are often caused by loading large amounts of organic materials in the wastewater, or treatment systems that are over-capacity or not operating properly. Odours can impact neighbours, winemaking, and tasting experiences.
HOW TO...

This section presents detailed information to assist wineries in carrying out comprehensive planning and evaluation of their operations, improve operating practices to use water more efficiently and reduce wastewater load, and select appropriate treatment processes and technologies.

Section Overview

Know your operation: planning and assessment outlines a 5-step approach to understanding water use and wastewater generation at your winery. When water use and waste streams are well understood, it is possible to consider what can be done in the winery to improve the quality of the wastewater and reduce its quantity.

Use less water and keep solids and chemicals out of your drains provides best practices for using water more efficiently and improving the quality of wastewater produced. Case studies are provided to highlight the source reduction practices at five BC wineries.

Select a suitable treatment system discusses the fundamentals of wastewater treatment and factors to consider when choosing a system. Examples of new and innovative treatment technologies are provided to highlight what is being done elsewhere. Case studies are provided to show the treatment and discharge systems at five BC wineries, highlighting the opportunities and challenges with each type of system.

Initiate change and build internal support provides guidance on how to make good wastewater management an integral part of your operations by engaging people at all levels of the organization, training and educating all staff, and measuring and celebrating progress.
Know your operation: planning and evaluation

KEY POINTS:

• To make informed and cost-effective improvements to your processes, you need a good understanding and a baseline of how you use water and generate wastewater.

• The source, volume and quality of wastewater – and how that varies during vintage and non-vintage – must all be considered.

You can use a 5-step process to get a better understanding of your water use and wastewater composition and identify the best ways to make improvements.

Step 1: Prepare a flow diagram to see the big picture

Step 2: Monitor water consumption and wastewater production

Step 3: Identify hotspots

Step 4: Identify root causes

Step 5: Set goals and targets
KEY QUESTIONS TO ANSWER:

- How much water is used in each operation at your winery?
  - Equipment cleaning and sanitation
  - Cellar cleaning and sanitation
  - Process (crush pad, wine movements, press operations)
  - Lab
  - Tasting room, kitchen, bathrooms
  - Boilers
  - Evaporative cooling towers
  - Water softening
  - Bottling
  - Landscaping

- How much wastewater is collected and/or discharged at your winery?
  - Wastewater sump
  - Wastewater collection system – intermediate points
  - Wastewater reclamation for reuse
  - Septic system for sanitary wastewater
  - Stormwater runoff
  - Process water runoff
  - Discharge methods
  - Digester

- What are the sources of wastewater generated at your winery?

- What is the capacity of your wastewater containment and discharge?

- What types of housekeeping practices are used to conserve water and limit the quantity of wastewater generated?

- What types of process controls are used to improve process efficiency?

- Are any of the wastewater streams classified as hazardous? What characteristics make them hazardous?

- What regulatory permits are required for your wastewater system and discharge?

- What wastewater monitoring and treatment is necessary to comply with regulations?
Thinking about wastewater begins with thinking about winemaking. What happens in the winery dictates the effluent that is produced, which in turn determines the type of treatment required and influences how well the waste treatment system functions, which in turn controls the end use to which the effluent may be applied.4

Prepare a flow diagram of your inputs and outputs. Winemaking typically involves receiving grapes, crushing and pressing, processing, and bottling. Each process has associated inputs and outputs. Inputs will include grapes, must, wine, chemicals used for filtration, ion exchange, sanitation and cleaning, and water. Outputs include things like suspended solids, grape solids, tartrate solids, dissolved sugar, sodium and potassium.

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**Step 2:** **Monitor water consumption and wastewater production**

Data on water use and wastewater generation can be used to establish baselines, benchmark performance, identify opportunities for improvement and better plan for growth. What you want to achieve will determine what level of monitoring you need to do. You can:

- **Monitor total water consumption** by collecting data from water bills or reading the municipal water meter weekly, monthly, or more frequently during periods of high water use.
- **Monitor how much water is used in different operations** by installing meters at key points in the winery, like where a water line splits between production and hospitality.
- **Monitor how much water is used by different activities**, like washing barrels and cleaning of the crush pad, by installing point-of-use meters at faucets and hoses (for example). This level of monitoring will enable you to better identify hot spots (Step 3).

**Determine metering requirements and locations**

A **plumbing diagram** can be created for the winery that illustrates how water moves through the facilities and identifies the appropriate locations to install meters to track water use. The plumbing diagram should include:

- Source(s) of water such as wells and municipal connections
- Piping sizes and materials
- Treatment equipment such as filtration, disinfection, or water softening
- Points of use including taps, washrooms, sinks, and other fixtures

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**PLUMBING DIAGRAM EXAMPLE**

![Plumbing Diagram Example](http://waterandwine.bloomcentre.com/)

Select and install meters

Water meters can be installed permanently in-line or on water fixtures such as hoses or taps. Where possible, locate meters in easily accessible but protected locations and on smaller diameter copper pipes. In-line meter costs increase significantly for pipes larger than 1.5”. It may be cheaper to install multiple meters on smaller pipes than one meter on a larger pipe.

The most cost-effective in-line meter is a simple paddle wheel accumulator that measure total water flow. They start at around $80 for a ¾” plastic paddle wheel model; prices increase with pipe size. The meters can be purchased on-line from water meter suppliers, or through local plumbers. They are relatively easy to install, taking between 15-30 minutes per meter. It is easiest if the water supply is shut off so plan installation for a time that will not impact winery operations. Ensure proper sanitation is practiced so as not to contaminate the drinking water.

Hose meters can be used to monitor water use at the point of use. They can simply be screwed on to existing hose bibs or faucets. The meters can often be found in hardware or gardening stores and cost from $20-$60. Plastic hose meters may be damaged through rough handling of hoses. Use a hose kink protector or something that restricts hose movement at the meter to protect it from damage. More durable metal hose meters are also available for additional cost. Hose meters must be removed from outside fixtures and brought indoors during sub-freezing temperatures.

Photo credits: BLOOM Water & Wine online platform: http://waterandwine.bloomcentre.com/
Collect water data

**Operational data** should be recorded at least monthly. During periods of high water use, such as harvest, data should be collected daily or weekly.

Create a tracking sheet to record your data (or download from [http://waterandwine.bloomcentre.com/modules/water-use-monitoring/collecting-data/#tab-id-2](http://waterandwine.bloomcentre.com/modules/water-use-monitoring/collecting-data/#tab-id-2)).

### OPERATIONAL WATER USE TRACKING

<table>
<thead>
<tr>
<th>Meter Number</th>
<th>Meter Type</th>
<th>Water Measured</th>
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<tbody>
<tr>
<td>Meter 1</td>
<td>In-line</td>
<td>Total water consumption</td>
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<tr>
<td>Meter 2</td>
<td>In-line</td>
<td>Total water used in production and hospitality</td>
</tr>
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<td>Meter 3</td>
<td>In-line</td>
<td>Total water supplied from above-ground tank</td>
</tr>
<tr>
<td>Meter 4</td>
<td>Hose meter</td>
<td>Water used in wine production (interior)</td>
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<tr>
<td>Meter 5</td>
<td>Hose meter</td>
<td>Water used for landscaping (patio)</td>
</tr>
<tr>
<td>Meter 6</td>
<td>Hose meter</td>
<td>Water used in wine production (main crush pad)</td>
</tr>
<tr>
<td>Meter 7</td>
<td>Hose meter</td>
<td>Water used in wine production (crush pad at house)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Meter 1 (litres)</th>
<th>Meter 2 (litres)</th>
<th>Meter 3 (litres)</th>
<th>Meter 4 (litres)</th>
<th>Meter 5 (litres)</th>
<th>Meter 6 (litres)</th>
<th>Meter 7 (litres)</th>
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**TIP**

It is good practice to occasionally record the reading on meters before or after a period of inactivity (such as overnight) to identify any unexpected water use, which could indicate leaks or faulty equipment.
Activity data should be tracked daily or as actions are undertaken using tracking sheets posted near water fixtures. Activities to track include barrel cleaning and sanitation, barrel hydration, tank cleaning and sanitation, press/crusher cleaning and sanitation, filter cleaning and sanitation, and bottling.

Create a tracking sheet to record your data (or download from http://waterandwine.bloomcentre.com/modules/water-use-monitoring/collecting-data/#tab-id-3).

### ACTIVITY WATER USE TRACKING

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Initial Meter Reading (L)</th>
<th>Final Meter Reading (L)</th>
<th>Activity Details (e.g. # of barrels washed or hydrated, tanks cleaned, bottles filled, etc)</th>
<th>Employee Initials</th>
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Source: BLOOM Water & Wine online platform: http://waterandwine.bloomcentre.com/

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The California Sustainable Winegrowing Alliance has also developed an Excel-based “Winery Water Efficiency and Hot Spot” data tracking spreadsheet. It’s available for download at: https://www.sustainablewinegrowing.org/economic-tools.php.
Identify hotspots

Tackle the source not the symptoms. There are common hotspots in a winery that are major contributors to volume of water used and wastewater strength. They represent areas where winemakers and employees can focus and prioritize their efforts to be more water efficient. The diagrams prepared in Step 1 and the data collected in Step 2 can be used to identify the hotspots in your winery.

Common hot spots wineries can look at for improvements that will have the most impact:

- **General water use activities** - Cleaning transfer lines and washing floors, walls, and ceilings often doesn’t consume a lot of water at once, but these activities occur frequently so small improvements can have a large impact.

- **Barrel cleaning and sanitation** – This is one of the largest water-using activities in a winery and presents a significant opportunity for water savings through process improvements and the use of water-efficient equipment.

- **Barrel hydration** – Changes to barrel hydration practices is one of the easiest ways to achieve low-cost water savings.

- **Cleaning and sanitizing tanks, presses, crushers, and other equipment** – This is another one of the largest uses of water in the winery; therefore, improved practices can reduce the amount of water used and the strength of wastewater.

- **Bottling** – There are many opportunities to reduce the amount of time and water used to clean and fill bottles.

- **Solids management** – Improving solids management is an essential component of reducing wastewater strength; wineries can reduce the strength of their wastewater by 90% by diverting organic material such as pomace and lees out of the water system. This aids in not overloading the septic system.
**Step 4: Identify root causes**

Once a winery has identified hot spots, they must investigate the root causes of the hot spots (i.e. why inefficient water use is taking place and why materials are entering the wastewater stream). Ask the question “why” to uncover behaviours, actions, inactions, or conditions that are leading to unnecessary water use or wastewater loading. Include employees in the discussion because they will have important insight into the day-to-day operations.

**EXAMPLE: DETERMINING ROOT CAUSES IN A SAMPLE WINERY**

The winery was interested in understanding why so much more water was used to clean the cellar floors compared to the floors in the production room.

The winery brought together their employees to investigate why this was the case. They ended up identifying the root causes.

1. **Why is so much water used to clean the cellar floor?**
   - It takes a long time to clean and hoses are left running the entire time.

2. **Why does it take so long?**
   - The floor is rough and it requires a lot more scrubbing and rinsing.

3. **Why is the floor so rough?**
   - It does not have an epoxy finish like the other floors in the winery.

4. **Why are hoses left running when employees are trained to only turn them on when needed?**
   - The tap for the hose is far away from where most of the cleaning takes place and there are barrels in the way.

5. **Why is it so difficult to turn off the hoses?**
   - The hoses don't have shut-off nozzles like in the production room.

Step 5: Set goals and targets

Operational and activity metrics (or key performance indicators) should be developed and used to estimate future consumption and wastewater generation, facilitate regulatory approvals and inspections, and compare performance over time and against industry benchmarks.

Water-to-wine ratio and peak daily water use are examples of operational metrics. Create a tracking sheet to record your data (or download from http://waterandwine.bloomcentre.com/modules/water-use-monitoring/key-performance-indicators/#toggle-id-1).

OPERATIONAL KEY PERFORMANCE INDICATORS

Key Performance Indicators can be calculated by combining water use data with data on wine production and number of visitors.

Peak wastewater generation can be determined through daily measurements of water consumption during harvest.

If daily data is not available, an estimate can be obtained by dividing the volume of water used over a given period by the number of days covered by period covered by a single meter reading, the less accurate the estimate of peak daily wastewater generation will be.

<table>
<thead>
<tr>
<th>Key Performance Indicators</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water-to-Wine Ratio</td>
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<tr>
<td>Water Consumed per Visitor (litres/visitor)</td>
<td></td>
<td></td>
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<tr>
<td>Water Consumed per Restaurant Patron (litres/visitor)</td>
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<tr>
<td>Water Consumed per Accomodations Guest (litres/visitor)</td>
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<tr>
<td>Daily Peak Wastewater Generation (litres)</td>
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<tr>
<td>Total Water Consumption (litres)</td>
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</table>

Source: BLOOM Water & Wine online platform: http://waterandwine.bloomcentre.com/

TIP

The BLOOM Water and Wine platform includes a Production Calculator in its Water Use Monitoring module. According to the calculator, the industry benchmark water-to-wine ratio is 3:1 to 10:1 and for peak daily water use is 2 – 5% of production volume.
**Activity metrics** can be used to identify opportunities for improvement and support business cases for strategic improvements and equipment upgrades. Examples of activity metrics are shown in the tracking sheet below.

Create a tracking sheet to record your data (or download from [http://waterandwine.bloomcentre.com/modules/water-use-monitoring/key-performance-indicators/#toggle-id-1](http://waterandwine.bloomcentre.com/modules/water-use-monitoring/key-performance-indicators/#toggle-id-1)).

### ACTIVITY KEY PERFORMANCE INDICATORS

*Data should be kept over time to compare performance year-to-year*

<table>
<thead>
<tr>
<th>Activity Key Performance Indicators</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
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<tr>
<td><strong>Barrel Cleaning &amp; Sanitation</strong></td>
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<tr>
<td>Average Water Used per Barrel (litres)</td>
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<tr>
<td>Max. Water Used per Barrel (litres)</td>
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<tr>
<td>Min. Water Used per Barrel (litres)</td>
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<tr>
<td><strong>Barrel Hydration</strong></td>
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Initial measurement of your key performance indicators will establish operational baselines from which you can set goals and gauge progress over time. Wineries should track the indicators year-to-year to see if and what improvements they are making.


![Water to Wine Ratio](water_and_wine_ratio.png)
Use less water and keep solids and chemicals out of your drains

**KEY POINTS**

- Tackle the source, not the symptoms.
- Improving the wastewater quality of any winery operation depends on understanding both the quantity of process water being generated and the quality of that water.
- Two-thirds of all water used in a winery is for cleaning and sanitation: start here first.
- Simply reducing your water use does not improve the quality of the process water and can concentrate organics and inorganics, degrading the quality of the process water further.
- Cleaner production practices that stop solids and other contaminants from going down the drain, reduce water use, and segregate wastes (especially strong wastes) are key.
- It is always more cost effective not to generate waste than to spend energy to remove it.

**Low-to no-cost best practices include:**

- Track and monitor water use
- Prepare and follow standard operating procedures (SOPs) for cleaning and sanitation activities
- Provide employee education, training and incentives
- Provide employees with enough of the right tools (e.g. timers on hoses, spray nozzles, brooms, and squeegees)
- Patrol and fix leaks

**TIP**

Focusing only on reducing water use without reducing wastewater loading can result in higher wastewater concentrations. The concentration of your wastewater is a product of your loading divided by your volume.
Cleaning and sanitation

- Use brushes, brooms and/or squeegees to pre-clean equipment, tanks, and floors before using water. Colour code your brushes to emphasize their use and make it easier on your employees, and organize the brushes and cleaning materials on a cart with wheels to allow for movement throughout the facility.

- Use high pressure nozzles with automatic shut off whenever possible.

- Use PIGs instead of flushing with large amounts of water. PIGs (pipeline inspection gauges) are inserted into transfer lines and pressure-driven through the pipeline along with the wine and/or water using compressed gas such as nitrogen.

- Develop standard operating procedures for washing barrels, cleaning and sanitizing tanks and equipment, and other processes. Post the procedures where employees can see them and provide training and regular refreshers.

- Capture, filter and reuse cleaning solutions.

- Consider ease of cleaning when purchasing new equipment.

- Use sanitation methods and products that don’t require a final rinse. Examples include Cleanskin and Bevsan.

- Evaluate whether ozone could be substituted for the final rinse. Ozone offers higher sanitization quality, time and energy savings and decreased chemical use. Typical applications for ozone include: barrel washing, surface and equipment sanitization, tank cleaning, and clean-in-place of process and transfer piping.

- Automate sanitization procedures or set cleaning times.

- Substitute steam cleaning for individual sanitation steps or throughout the winery.

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**TIP**

Automate Cleaning and Recycle Water Where You Can. Using an automated or semi-automated cleaning system such as clean-in-place (CIP) for tanks and bottling lines can reduce water and chemical use by up to 50% while ensuring more consistent results. These systems can also reuse water in cleaning cycles, significantly reducing water use and costs. Many options are available, from semi-automated systems to mobile CIP carts to fully-integrated CIP systems.

Photo credit: BLOOM Water & Wine online platform: [http://waterandwine.bloomcentre.com/](http://waterandwine.bloomcentre.com/)
Winery Process Wastewater Management

Crush pad

- Cover the reception area and crush pad to shade the waste material. The juice and grape skins will be easier to remove from equipment, thereby reducing the amount of effort (and water) needed for cleaning.
- Consider using a water-recycling bin washer rather than cleaning picking bins individually.
- Segregate stormwater from process wastewater.

**TIP**

During vintage, a large percentage of solids are generated from the crush operations. Filtering out solids from the wastewater stream is the most cost-effective way to reduce BOD in the wastewater. If solids get into the wastewater they can accumulate, putrify and require increased amounts of energy to process.

**CASE STUDY:**

**HILLSIDE WINERY**
NARAMATA BENCH, PENTICTON

In 2015, Hillside Winery’s infiltration field failed during crush, prompting the winery to become much savvier at handling their wastewater! They scheduled picking/crushing to process as much fruit as possible before full crush pad clean up. The crew used rakes, squeegees, hands and other tools to remove as much organic material as possible before using water for rinsing. Waste solids were collected and composted by a contractor. A pressure-washer was used wherever possible. While a new greywater system was installed in 2016, the winery continues these good housekeeping practices to reduce their load on the system. Juice lees are collected and filtered offsite and all wine lees are provided to a local distiller to make spirits and liqueurs. Barrels and filler (bottling line) are cleaned with steam instead of water. Other practices include sequential barrel hydration, keeping tank transfers and equipment changeovers to a minimum, and following standard operating practices for tank washing.
Barrels

• Use only enough water to soak the end of a barrel.
• Hydrate multiple barrels consecutively.
• Leave barrels wrapped until they are ready to be used.
• Use rinse water from one barrel to do initial cleaning of the next.
• Minimize tank and barrel transfers.
• Adopt clean in place barrel washing.

Tanks and transfer lines

• Minimize tank transfers and equipment changeovers.
• Adopt clean in place tank washing.
• Recycle ozone rinse water when feasible.
• Use pigging for transfers (can also result in faster turnovers) and to help clean hoses.
• Capture and recirculate water and caustic.
• Use the shortest and smallest diameter hose necessary for transfers.
• Use nitrogen to transfer wine instead of water.

Example standard operating procedure – barrel washing

Standard operating procedures are established or prescribed methods to be followed routinely for the performance of designated operations or in designated situations. For example, standard procedures for barrel washing may include:

• What temperature of water to use
• How long wash and rinse cycles should last
• How water is captured and reused
• What type of equipment to use
CASE STUDY:

JACKSON-TRIGGS OKANAGAN ESTATE WINERY
OLIVER, BRITISH COLUMBIA

As one of the largest wineries in Canada, Jackson-Triggs had a significant impact on the municipal system in their small community of Oliver, BC. To help support the community, the winery started down the path to find ways to reduce their effluent volumes and went through a series of audits of what was going down the drain on a process by process basis. Through this structured approach the winery achieved a 40% reduction in their volumes in one year. Their goal has always been to find ways to reduce reuse recycle in any and every way possible.

BOD values were another challenge. The overall kg of BOD going down the drain was also reduced by 40% thanks to their process audits, but the concentration (mix) remained the same. To ensure the best possible outcome, the winery installed an anaerobic wastewater treatment plant in 2011 - for primary and secondary treatment to bring down the BOD concentration. At this time the anaerobic plant reduces their BOD concentration by around 95%.

Clarification, filtration and bottling
- Use nitrogen instead of water to rinse bottles.
- Use protein adsorption columns to eliminate the need for bentonite.
- Use in-line white juice flotation for clarification to remove solids at the point of generation.

Lees, pomace and other solids
- Use source control methods to capture solids (screen, sweep, squeegee, or segregate) from production areas (e.g. crush pad, lees handling, fining, centrifuge, filtration).
- Filtration options to assist in lees separation include lenticular filters, cross-flow filters, rotary vacuums, and standard plate-and-frame filters.
- Develop value-added products from pomace and lees.
Winery design

- New wineries should be designed with water-use efficiency and easy removal of solids in mind. The layout should allow for easy isolation of stormwater, and for the separation of process wastewater and domestic wastewater flows.

- Use separate drains for different wastewater streams (e.g. high-strength process water, low-strength process water, greywater). Drain system designs should also include access points and sumps for sampling and wastewater diversion.

- Floors should be level with a slight slope to direct water to drains and should have a smooth, durable surface (such as an epoxy coating).

- Install easily serviceable baskets or screens in trench drains. Screens only work if they are kept clean – train staff to empty them regularly and put them back after cleaning.

- Install pea traps to prevent odour back up.

CASE STUDY:

LE VIEUX PIN WINERY
BLACK SAGE BENCH, OLIVER

Racking as little as possible is part of the winemaker’s style at Le Vieux Pin, but also means less cleaning and less water use is required. Switching from a caustic-citric wash process to a one-step alkaline detergent (Cleanskin) also helped reduce water use at the winery. STARS (Selective Tartrate Removal System) is used rather than cold stabilization to reduce the effort and water required to clean tanks. Their OenoFoss instrument provides instant analysis of key parameters throughout the winemaking process, eliminating cleaning of lab equipment and reducing water use and chemical input. They use crossflow filtration, which drastically reduces water usage versus pad filtration. Other water-saving practices at the winery include using nitrogen to push wine, choosing equipment that is easy to clean, using high pressure washing for cleaning activities, recirculating warm water to reduce wait period, having turn-off nozzles on all hoses, and following a maintenance schedule to replace gaskets and o-rings in the hoses.
Water recycling and reuse

In many other winegrowing regions, a significant effort is being undertaken to explore the principles and practices for water recovery and reuse, including clean in place (CIP), green solutions, storage and solution recovery, reverse osmosis and nanofiltration, rain water harvesting, capture and reuse water systems, high pressure water, and pigging transfer lines.\(^5\)

**Discharges that can potentially be reused are:**

- final rinses from tank cleaning and fermenters,
- bottle soak and rinse water,
- barrel cleaning water,
- cooler flush water, filter backwash, and
- sterilizer water.

**Areas of possible reuse are:**

- first rinses in wash cycles,
- filter backflush,
- caustic dilution,
- boiler makeup,
- refrigeration equipment defrost,
- equipment cleaning, floor and gutter wash, and
- irrigation.

CASE STUDY:

**TINHORN CREEK VINEYARDS**
**GOLDEN MILE BENCH, OLIVER**

Tinhorn Creek Vineyards has a reputation of being a leader in sustainability, and their water management practices are no exception. The winery employs several water-saving measures, including using steam to clean barrels and the bottling line, eliminating one rinse cycle, and using high-pressure low volume washing equipment throughout its operations. They reuse tank cleaning solution to clean two to three tanks before putting it down the drain. Heavy lees is filtered and composted on-site. Tinhorn Creek is currently assessing the feasibility of using ozonated water for sanitation.

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CASE STUDY:

RED ROOSTER WINERY
NARAMATA BENCH, PENTICTON

Red Rooster Winery employs numerous practices to save water at hotspots in the winery. They recycle rinse water from cleaning bins: filtering the rinse water, reusing it to clean bins before putting them back to the vineyard, and then reusing the water again to clean up the area at the end of shift. The team recirculates cleaning solutions and use gamma jets, which are more effective than traditional spray balls. They check solution strength of cleaners and top up the concentration where possible rather than disposing down the drain after first use. They use steam for barrel cleaning, hydration, and leak testing, and time their barrel cleaning activities to extrapolate water use. High-pressure systems are used for cleaning and sanitation activities. The winery is currently looking at a recirculating loop for condensers in the lab - using their existing tank cooling system to connect to their lab cooling, traditionally cooled with running water – and are considering better water metering so they can monitor per process volumes and make improvements.
Select a suitable treatment system

KEY POINTS

• There is no ‘one size fits all’ solution in terms of winery wastewater treatment.

• Knowing the specific quantities and wastewater characteristics of your winery process water is critical to defining the most appropriate treatment technology to invest in.

• When planning an on-site treatment system, wineries must engage a consultant to design and install the system.

Most wineries in BC do not have sophisticated wastewater treatment systems to deal with the high-strength wastewater that is a result of the winemaking process; in most cases, this untreated or marginally-treated wastewater is discharged into leach fields, infiltration ponds, or dry wells. Common wastewater management practices for smaller wineries include sumps, interceptors and/or traps to reduce the solids getting into the wastewater. Some wineries located within a municipality are connected to sewer; however, high-strength wastewater discharges can pose costly challenges within the wastewater treatment systems. Pre-treatment before discharging is most often encouraged or required.

Before considering any on-site treatment options, wineries should reduce the volume and strength of wastewater that needs to be treated as much as possible. Reducing wastewater generation after the design and installation of a treatment system may negatively impact the performance of a system designed to handle higher volumes and loading.
Wastewater treatment basics

The combination of high organic compounds and inorganic compounds, and the variability of the waste streams – both in volume and quality – makes the treatment of winery wastewater challenging. The main purpose of a wastewater treatment process is to reduce the organic matter content or biological oxygen demand to produce a more stabilized effluent and sludge. Wastewater treatment can also lower nitrogen levels and settle out other nutrients, such as phosphorus.

Wastewater treatment can involve a blend of physical – sieves, filters, screening and sedimentation; biological – using microbes to decompose organic substances, and chemical – e.g. pH adjustment (tertiary) treatment processes.

A wastewater system is simply an arrangement of core treatment components in various sequences, and appropriate techniques and equipment options at each component. The options can range from low-tech to high-tech and from high-volume to low volume designs. The components are primary treatment, secondary treatment and tertiary treatment. Many treatment technologies are universal, but must be individually tailored for application in wineries.

**Primary treatment** includes cleaner production practices like grates and sumps that keep solids out of the wastewater system; surge storage to accommodate peak flows, where some pre-treatment may occur (e.g. pH adjustment and solids settling); and screening and/or settling to remove suspended solids in the waste stream.

**Secondary treatment** includes biological processes (anaerobic or aerobic). It may also include clarification or storage of the treated effluent to further remove solids.

**Tertiary treatment** consists of “polishing” the effluent by removing particulate and suspended solids through physical, mechanical, and chemical processes. Nutrients such as nitrogen and phosphorus can be removed through biological oxidation and enhanced biological phosphorus removal respectively. Tertiary treatment may also be used to remove bacterial contamination. Treatment may involve Sedimentation, Flocculation, Clarification and Air Flotation. Final filtration may be used to reduce incidences of blockages in irrigation system.
**Aerobic wastewater treatment processes** take place in a controlled environment where aerobic microorganisms can consume organic matter in wastewater. Microorganisms (i.e. aerobic bacteria) consume organic matter and other components in the wastewater for energy and convert them into new cells, carbon dioxide and water. This effectively reduces the wastewater’s BOD levels. Some components such as nitrogen and phosphorus are also consumed by biological processes. As colonies of these microorganisms grow, they form “activated sludge” that can be removed through mechanical processes and is sometimes partly re-used in treatment processes (i.e. returned-activated sludge systems) or as a low-level fertilizer as it contains nutrient-rich organic materials.

A typical, traditional winery aerobic treatment system includes:

- collection of wastewater in the winery, or its connection to the collective system,
- sedimentation facility for collected wastewater,
- screening of wastewater,
- transfer of wastewater into an aeration basin,
- sand filtration of treated wastewater,
- monitoring of treated wastewater in a flow chamber before release into the environment, and
- recovery and spreading of sludge.

Some examples of aerobic treatment processes include Aerated Ponds, Constructed Wetlands, Sequencing Batch Reactors, Aerated Fixed-Bed and Moving-Bed Bioreactors, and Biofilters.

**Anaerobic wastewater treatment processes** occur in reactors sealed from the outside environment to prevent the introduction of air and the release of odours. Anaerobic bacteria ultimately convert organic matter in the wastewater into methane and carbon dioxide. Anaerobic systems are more effective in dealing with high solid loads in the wastewater and therefore more effective in reducing BOD levels in wastewater.
Traditional treatment systems

Winery wastewater systems vary from simple and direct discharge to dry wells or infiltration fields to more complex, capital intensive systems such as aeration ponds and bioreactors.

Wastewater treatment systems include:

- Lagoon: open ponds designed to treat organic matter in wastewater.
- Constructed Wetland/Wetland Biofilter: An artificial wetland that uses plants to break down organic matter in wastewater.
- Bioreactor: A vessel that contains bacteria or other organisms that break down organic material.
  - Membrane Bioreactor (MBR): A system that combines a bioreactor with a membrane to enhance performance and reduce footprint.
  - Sequencing Batch Reactor (SBR): One or more bioreactors that operate on a batch system and use aeration and activated sludge.
  - Anaerobic Digester: Digestion of winery wastewater using anaerobic microbes in a closed high-temperature environment.
- Extended Aeration using Fixed and/or Suspended Activated Sludge: Suspended material that consists of wastewater and organisms that break down organic matter. Treated effluent is then clarified in a settling tank with some sludge reclaimed for reuse and the remainder disposed of.
Examples of innovative treatment technologies

New high-tech and low-tech systems are appearing that offer options for energy capture from biogas generation or worm castings for use in landscaping and/or vineyards. Here are six examples of new treatment technologies that can be used for winery wastewater.

BioFiltro BIDA Closed-Loop Biological Wastewater Treatment at Fetzer Vineyards

http://biofiltro.com/

At Fetzer Vineyards in California, millions of red worms are working in partnership with microbes that can clean up and regenerate up to 64 million litres of water annually for reuse in vineyards and landscaping. The BIDA® system from BioFiltro is a natural biological system that uses 85% less energy to treat winery wastewater compared to Fetzer Vineyards’ former aeration pond system. Winery wastewater is pumped into a passive aerobic bioreactor that filters water through layers of media containing red worms and microbes that can treat the water and remove BOD and TSS. The worm castings will also be collected and used for soil enrichment in the vineyards.

BioFiltro custom designs their systems to the needs of customers. According to BioFiltro, the BIDA® System “thrives off high sugars, and can handle months of low loadings. The system also can survive off the carbon-based wood shavings for clients who only operate a few months of the year.” In the case of Fetzer Vineyards, the footprint is roughly 20,000 square feet.

Photo credit: Fetzer Vineyards
Cambrian EcoVolt
http://cambrianinnovation.com/

The next generation of anaerobic treatment is in the form of bioelectrically-enhanced modular containers that can breakdown the organics in process water, generating a methane-rich biogas for conversion into electricity and heat. This containerized approach minimizes installation and operation costs and hassles and allows for flexible treatment options, from simply reducing organic loading to adding a polishing step to reuse process water back in the winery. In 2013-14, Clos du Bois Winery in California field tested an EcoVolt system. The field testing validated that the system could operate across a range of BOD loadings and wastewater volumes. Each EcoVolt Reactor can process an average 76,000 L of process water per day, while adapting to the extreme fluctuations between vintage and non-vintage operations.

Lyve
http://www.lyvesystems.com/

Lyve wastewater treatment systems have perhaps made the biggest inroads in the Napa Valley, with a new system launched at Ballentine Vineyards in 2017. A big benefit of the modular systems is the small footprint. Tank filters remove big solids, then a bioreactor with blowers and bacteria further cleans the water, followed by a clarifier that provides a final filtration of the treated effluent, allowing water reuse and recycling. The system is enclosed so there are no odour issues. One issue, however, is that energy demands for operation can be quite high.
UltraFine Bubble Aerators

Several wineries in California, with increasing wastewater loads and/or inadequate aeration in their pond systems, causing excessive BOD, sludge accumulation and odour issues, are upgrading to new aeration technology - UltraFine Bubble aerators. These systems not only dramatically increase vertical aeration and the health of the ponds, but they also require significantly less horsepower than traditional surface aerators, driving down operating costs. In the case of Jordan Winery they chose to install the UltraFine Bubble aerators in lieu of an expensive dredging operation to remove 14” of sludge. For their 300,000 and 150,000 gallon ponds the new aerators reduced total horsepower from 22.5 HP to 9 HP and within 12 months the sludge was down to 5”. 6 Similarly, Merryvale Starmont upgraded their old turbine style surface aerators, reducing horsepower from 37.5 to 8 HP, and in conjunction installed an automatic DO controller, qualifying for $13,000 USD in energy efficiency rebates. The resulting water quality is high enough that Merryvale is now able to capture 100% of process water for reuse on vineyards and landscaping.7

ECONSE Systems
http://www.econse.com/

Econse is a Canadian-owned company that designs and manufactures sustainable, affordable solutions to help manage wastewater for industries and communities across North America. Between October 2015 until March 2016, Econse worked closely with several craft breweries in Ontario to develop a solution to specifically meet the needs of the industry. The BRÜ CLEAN system, which was installed at Sawdust City Brewing Company in 2017, was a result of those pilots. BRÜ CLEAN is a small footprint, modular and chemical-free wastewater treatment solution that integrates next-generation process technology components with in-brewery source reduction and design improvements. Econse is starting a pilot with Creekside Estate winery in Ontario to investigate whether a similar system could be developed for the wineries, which also produce high-strength wastewater that is difficult to treat.

BioGill at Cave Spring Cellars
https://www.biogill.com/

Cave Spring Cellars, a winery in Ontario producing approximately 55,000 cases per year, had been using two holding tanks for its wastewater and was paying $4,000-5,000 a year in municipal sewer surcharges due to high BOD loads, as well as approximately $3,000 a year on chemicals to control odours. This was particularly untenable with an odour issue adjacent to the winemaking area. They decided to pilot a new enclosed system with a reasonably small footprint and price tag - BioGill.

This system is able to remove more than 95% percent of BODs, eliminating odour issues and producing wastewater that can be sent to the municipal system with no surcharges. The full-scale BioGill system cost Cave Spring Cellars ~$160,000 and was installed in a newly constructed space beneath their crush pad.

“*The BioGill system, in a nutshell, involves a sealed tank containing vertical membranes (gills) in which micro-organisms grow. Wastewater is poured over these gills, and while that happens the micro-organisms eat the organic materials.*”

Photo credit: BLOOM Water & Wine online platform: http://waterandwine.bloomcentre.com/

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http://www.stcatharinesstandard.ca/2014/10/31/winery-pilot-program-leads-to-cleaner-waste-water
Factors to consider when choosing a system

Winery process water management systems should be cost-effective, reliable, easy to manage, and optimally, reasonably compact.

Several treatment methods exist for winery wastewater, but the efficiency, flexibility and cost associated with each vary greatly. Factors to consider when choosing a system include:

- the full cost of wastewater treatment
- the footprint of the system
- the technical expertise required to operate and maintain the system
- how the system will function during vintage and non-vintage
- what type of maintenance the system will require
- the intended end use of the treated wastewater

Full cost of wastewater treatment: Understanding the full cost of wastewater treatment at the winery – both capital and annual – should be a key factor in choosing an appropriate wastewater treatment system. Because the price of water in BC is relatively low, the financial return on investment for treatment system often drives owners to purchase the cheapest systems, leading to the discovery that these systems are not always the lowest cost to operate and maintain.

Factors that contribute to the full cost of wastewater treatment:

**Wastewater Treatment Capital Costs**
- Engineering design
- Site engineering
- Equipment
- Construction
- Project management
- Commission/start-up
- Equipment installation

**Wastewater Treatment Operational Costs**
- Electricity
- Thermal
- Fresh water
- Wastewater discharge
- Chemicals for pH, treatment
- Sampling/compliance
- O&M labour
- Parts and materials
- Dredging
- Trucking
- Wastewater violations
- Permitting fees

**Overhead/Administration Costs**
- Administration
- Insurance
- Consulting
- Meeting time on wastewater issues
- Time away from making wine
- Dealing with odour complaints
- Property taxes

**Additional Considerations**
- Risk to Brand from wastewater issues
- Risk to production for not doing anything
- Increased production capacity
- Positive “green” marketing from solution
- Value of lost grape production on land used for treatment system
Footprint: One of the main issues is available space for the desired treatment technology. While aeration ponds work well, store the water for future use, and function as rainwater catchment ponds, they require a large land footprint. In addition to the cost of installing and operating a pond, consideration also must go into the price of the land and the value of the land to produce grapes into the future.

If space is available for more advanced treatment systems they should be considered. They often provide more flexibility to add equipment when winery production expands and/or if additional water treatment is required for process water reuse in the winery. These treatment systems can be very effective at reducing organic loading and nitrogen. Of course, with closer proximity of treatment equipment to the winery there is an increased risk of odours impacting neighbours, winemaking, and/or tasting experiences.

Technical expertise: Options such as a Membrane Bioreactor or anaerobic digester take much less space than a lagoon or wetland, but they may require more technical expertise, oversight, labour, and maintenance.

Keeping the microbes alive and happy: Both aerobic and anaerobic technologies are biologically based, depending on different microbial populations to breakdown the organics in the process water to achieve targeted quality levels. One challenge with both technologies is that low flows during non-vintage make it difficult to keep microbes alive. This requires more vigilance to assure viable, active populations. Depending on the treatment system, useful by-products such as biogas and biosolids (sludge) may be produced.

Maintenance: Lagoons require periodic dredging and wetland biofilters must be periodically rehabilitated to remove accumulated materials. On the plus side, these treatment options are low energy and can be cost effective for larger wineries with a large land area.

Purpose of treatment: Winery wastewater should be treated to the standard required for the intended end use (e.g. reuse in vineyards, landscaping, or back into the winery) or disposal method (e.g. sewer, dry well, or infiltration field). This is called ‘fit for purpose’ treatment.
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<tr>
<th>System</th>
<th>Opportunities (Pros)</th>
<th>Challenges (Cons)</th>
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| Lagoon                         | • Low cost - no energy or chemical inputs  
• Nitrogen reduction in anaerobic layer | • Requires large land area  
• Treatment takes considerable time  
• May have odour issues if not operating well  
• Requires periodic dredging |
| Constructed wetland / wetland biofilter | • Easy to manage  
• Low energy input  
• Can enhance local environment | • Requires mid-to-large land area  
• May require pre-treatment to remove large solids (to avoid clogging) and adjust pH in the effluent (to avoid shocks to the ecosystem)  
• Must be periodically rehabilitated to remove accumulated material |
| Bioreactor (various)           | • Small footprint  
• Can be very effective at reducing organic loading and nitrogen  
• Some systems produce biogas, which can be captured and used for energy | • Some systems may require specific start-up procedures or consistent wastewater loading to maintain effectiveness  
• Some systems may have high energy requirements  
• Costly to set up  
• Membranes can foul without proper maintenance  
• SBRs require storage tanks to permit batch feeding |
| Activated sludge               | • Easy to manage – controllable operation  
• Small | • Good equalization needed  
• Energy intensive  
• Requires nutrient (N, P) addition  
• Susceptible to failures  
• Periodic sludge and solids handling |

Examples of wastewater treatment systems being used by British Columbia wineries

The following case studies were prepared by Oland Engineering Limited

ARROWLEAF CELLARS - LAKE COUNTRY

WINE PROCESS WASTEWATER FLOW CHART
16,000 CASES

- 11 cu.m. settling tanks, solids collection and coarse filtration (1/16” slots)
- 2 drywells. Flow can be selected to one or both

Opportunities:
- The 2-tank system provides better separation of solids and a quieter flow for settling in the second tank
- The coarse filter provides feedback to the operator on how much solids are getting through the system
- If drywells are sized correctly with well-draining coarse sand and can be alternated to give each one a rest, they can last for many years
- Dry wells require the least amount of space and if they fail it is relatively inexpensive to move them to a new area

Challenges:
- Dry wells are not suited for poor draining soils as they have a small infiltrative surface area and often plug off and fail
- Dry wells are typically deep and can more easily contaminate groundwater in some cases
RED ROOSTER WINERY – NARAMATA

WINE PROCESS WASTEWATER FLOW CHART
BOTTLED 12,000 CASES - CRUSH EQUIVALENT 80,000 CASES

• 11 cu.m. settling tank, solids collection and coarse filtration (1/16” slots)
• 7 cu.m. aeration tank with sludge return to settling tank
• A 2 flout dosing system 1 to each dispersal bed
• Infiltration chambers on a sand bed
• A port to capture and sample a small portion of sand filtered effluent

Opportunities:
• The aeration and returned aerated sludge reduced the wastewater strength during periods with lower flows
• Sand filtration significantly reduces suspended solids
• After 8 years, the larger surface area infiltration beds continue to perform well

Challenges:
• Winery drains are not efficient for capturing solids so the settling tank must be pumped out frequently
• Aeration, although helpful for treatment, can push odours from the tank to the area around the winery
• Extreme flows are experienced during vintage and must be watched carefully, requiring hauling of solids and effluent at times during vintage
RAINBOW WINERY – LAKE COUNTRY

WINE PROCESS WASTEWATER FLOW CHART
5,000 CASES

- Diversion valves for uncovered crush pad to divert to storm when pad is not in use
- 7 cu.m. settling tank, solids collection and coarse filtration (1/16” slots)
- Effluent pumps to pressure distribution dispersal system
- Storage and filter sand: rock bed with 22 cu.m. of storage & 54 sq.m. of sand area filtration
- Sand filtered effluent to coco husk bio-filtration unit
- Treated effluent to dispersal bed below bio-filter
- Odour filter: bark mulch

Opportunities:  
- Coco husk bio-filter adds aeration and filtration for polishing effluent
- Sand filtration significantly reduces suspended solids and balances flow volume

Challenges:  
- Diversion valves often forgotten and will clog storm system
NAGGING DOUBT WINERY - KELOWNA

WINE PROCESS WASTEWATER FLOW CHART
5,000 CASES

• 7 cu.m. settling tank, solids collection and coarse filtration (1/16” slots)
• Flout dosing system 350 L per cycle
• Selection valve to alternate or split flow between beds
• 2 drain rock filled storage beds 20 cu.m. each over sand filter
• Ports to capture and sample a small portion of sand filtered effluent

Opportunities:
• This system is simple to operate and cost effective to build for small wastewater flows
• Having two beds allows resting and drying of each bed
• The flout system promotes a more even distribution of effluent over the sand filter and allows for a cycle counter to measure daily flows

Challenges:
• The required size of the beds for larger wineries would use up valuable real-estate
• This system would not work well in low permeable soils
TANTALUS VINEYARDS - KELOWNA

WINE PROCESS WASTEWATER FLOW CHART
20,000 CASES

- 12 cu.m. Anaerobic tank, solids collection, settling and fermentation
- Flow balance tank- Pumps approximately 6000L treatment batches
- pH sensor and metering pump to neutralize pH for each batch
- Timed Air blower and diffusers to dissolve oxygen in the bioreactor
- Between aeration cycles sludge settles and clear effluent is decanted
- Effluent is disinfected with UV light and filtered through bag filters
- Effluent is pumped to dispersal field

Opportunities:
- This system produces a high-quality effluent requiring only a small dispersal field and an overall small footprint
- The effluent quality is suitable for irrigation
- Typical strong wine waste odors are eliminated
- Effluent will have no measurable impact on the groundwater
- The system will meet the regulation for domestic sewage

Challenges:
- High initial capital investment
- Experience required for maintenance and operation
- Microbes need to be kept alive with an alternative biomass during seasonal low flow periods
Initiate change and build internal support

KEY POINTS

- Maintaining permanent behaviour change is difficult; it is critical that everyone in the winery – from upper management to the cellar crew – are on board
- Waste minimization needs to be weaved into the company culture through consistent and methodical education and training, incentives, and performance measurement and reporting.

Seek management commitment

Successful implementation and long-term effectiveness of water-use efficiency and wastewater management programs hinges on the commitment of the owner and/or management team of the winery. Connect water management with operational benefits including more effective cleaning and sanitation, time savings, and improved consistency. Integrate data on water performance into regular business reporting to show the link between water management and operational excellence.

Be sure to also connect water to the brand. Improved water management is a vital component of sustainable winemaking and can be part of the story that would positively enhance the brand. Conversely, operational or regulatory issues resulting from poor water management practices can put a brand at risk.

Engage people at all levels of the organization

This includes owners who are responsible for setting priorities and making investment decisions, managers and winemakers who are responsible for identifying opportunities and defining practices and procedures, and employees who undertake the day-to-day operation of the facility.
Focus on training and education

Changing mindset and behaviour on water requires on-going education, training and reinforcement of priorities. Make sure appropriate cleaning techniques and water-wise behaviour is at the core of all employee training, from cellar to tasting room. Employees should be encouraged to own the issue and be engaged in improvements. Training sessions are best held prior to the start of different activities (e.g. before harvest or bottling). For new practices and procedures, instructions can be posted in appropriate areas to act as a reminder.

Recognize and celebrate successes

Be sure to find ways to reward innovation and consistency. This recognition can apply to group achievements, such as meeting water efficiency targets, or individual accomplishments such as identifying new opportunities to reduce water use. Celebrating small wins can lead to broader employee support by building momentum to achieve broader water performance goals.

Make water visible

Making water consumption more visible increases employee awareness and water performance. Ways to make water more visible include installing low-cost point-of-use meters and recording daily numbers on charts in the lunchroom. Wineries have reduced water consumption by 10-20% just by installing water meters, monitoring water consumption, and making water use visible to employees.

Set clear goals and targets and measure performance

Establishing annual, monthly and daily goals around water use is an effective way to change employee behaviour and identify opportunities for improvement. Goals and targets can be tailored to individual process activities such as cleaning barrels, as well as to a time of year. For example, specific goals can be made to keep solids and other materials from entering the wastewater stream during the harvest crush activities. Data on water performance should be integrated into regular business reporting to show the linkage between strategic water management and operational excellence.
# LIST OF RESOURCES FOR WINERY WASTEWATER MANAGEMENT

Author: Insight Environmental Consulting  
Year: 2016  
URL: [https://sustainablewinegrowingbc.ca/resources](https://sustainablewinegrowingbc.ca/resources)

**Water and Wine online platform**  
Author: The Bloom Centre for Sustainability  
URL: [http://waterandwine.bloomcentre.com/](http://waterandwine.bloomcentre.com/)

**Winery Wastewater Online Resource Kit**  
Author: Wine Australia  
URL: [https://www.wineaustralia.com/growing-making/winery-wastewater-online-resource-kit](https://www.wineaustralia.com/growing-making/winery-wastewater-online-resource-kit)

**Comprehensive Guide to Sustainable Management of Winery Water and Associated Energy**  
Author: Kennedy/Jenks Consultants  
Prepared for: American Vineyard Foundation, California Wine Institute, and Pacific Gas & Electric Company  

**Winery Wastewater Handbook: Production, Impacts and Management**  
Author: Jeanette Chapman  
Prepared for: Winetitles  
Year: 2001

**Sustainable Water Management Handbook for Small Wineries**  
Author: California Sustainable Winegrowing Alliance  
Year: 2014  

**Winery Wastewater Management & Recycling: Business Fundamentals**  
Author: Australian Government Grape and Wine Research and Development Corporation  
Year: 2011  
Winery Wastewater Management & Recycling Operational Guidelines
Author: Australian Government Grape and Wine Research and Development Corporation
Year: 2011
URL: https://www.wineaustralia.com/growing-making/winery-wastewater-management-and-recycling

Winery Wastewater Management & Recycling Key Principles for Wineries
Author: Australian Government Grape and Wine Research and Development Corporation
Year: 2011
URL: https://www.wineaustralia.com/growing-making/winery-wastewater-management-and-recycling

Winery Planning and Design, Edition 17, Chapter 8 Winery Water and Wastewater
Editor: Bruce Zoecklein
Available through the industry trade journal Wines and Vines.
Contact Tina Vierra at (415) 453-9700 ext. 102, email: tina@winesandvines.com

Winery Water Efficiency and Hot Spots Tool
Author: California Sustainable Winegrowing Alliance
Instructional video URL: https://vimeo.com/227814995
SUSTAINABLE WINEGROWING
BRITISH COLUMBIA
Inspired people growing outstanding wine
An Initiative of the BC Wine Grape Council