

Wine Production Effluent Treatment : Aerated Ponds and Irrigation



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Outline

- Project background & current situation
- Effluent constituents
- Design considerations
- Treatment process design
- Pros/Cons
- Conclusion

Background

- M.S. in Environmental Engineering, University of New Haven 2007
- B.S. in Environmental Management, Rochester Institute of Technology 1997
- RIT Department of Civil Engineering Technology, Environmental Management & Safety
- Environmental Engineer, Pratt & Whitney Aircraft
 - Wastewater treatment plant management
 - Water-related permit and regulatory compliance management
 - EH&S management systems development and implementation
 - International EH&S standards (ISO, BSI)
- Finger Lakes Tourism Business Owner (Innkeeper)
- Oenophile

Current Situation

- Many farm wineries with small-scale production and distribution
 - Significant expansion in last decade
 - Production facilities may not have been updated for increased water discharge
 - Majority discharge to septic system leach fields
 - Septic systems not designed to handle flows with extremely high solids and organic content
 - Overloaded/plugged systems → transport of contaminants beyond leach field

Current Situation

- 2000 study by an ad-hoc citizen and government group expressed concerns over Seneca Lake water quality
 - High weed growth, low dissolved oxygen
 - Zebra mussel populations disrupting water supply
 - Organics from failed septic systems and nutrients from agricultural run-off may be contributors

Effluent Constituents

- Effluent Characterization
 - Grape solids/pomace
 - Yeast lees, bacteria, sugars (measured as BOD)
 - Precipitated proteins, tannins, potassium tartrate crystals
 - Rinse water (slightly acidic)
- Primary concern: biochemical oxygen demand (BOD)
 - High organic content = food for microorganisms
 - Lots of "bug" use up dissolved oxygen
 - Impacts other aquatic life
- Other issues - suspended solids, nutrients, pH

Design Considerations

- System criteria
 - Biological treatment
 - Able to handle high BOD
 - Simple, low maintenance
 - Maintainable by current staff
 - Reasonable cost
 - Resource efficient
 - Aesthetic value

Treatment Design

- What's the best design?
- Depends on...
 - Winery's environment
 - Size/production level
 - Layout
 - Resources (staff, budget)
 - Required standard of treatment
 - Stakeholder concerns

Treatment Design Assumptions

- Based approach on winery producing ~20,000 cases/year
 - Annual flows of ~80,000 gallons per year
 - Average daily flow during peak season ~1000 gpd
 - Average daily flow in off-season ~ 200 gpd

Pre-Treatment Efforts

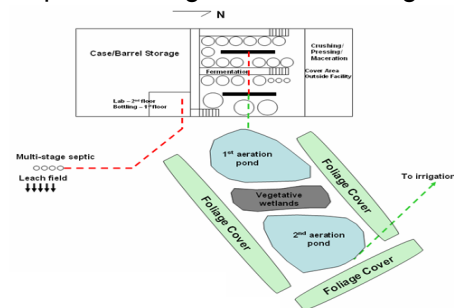
Wastewater Minimization

- I. Wastewater segregation
 - Separate sanitary flows from production flows
- II. Pollution Prevention
 - Identify ways to reduce wastewater volume, where possible
 - Make diligent efforts to remove solids
 - Screens, rotary drum, filters
- III. pH Adjustment
 - May need to adjust pH for optimal biological treatment

Proposed Design

- Aeration & Irrigation
 - Screen/filter macro solids
 - Gravity flow to series of aerated ponds:
 - Preliminary pond → vegetative wetland → polishing pond → irrigation
 - Provides "natural" biological removal of organic matter (BOD), other undesirable constituents
 - Aeration can be as simple as a standard fountain spray
 - Old technology, but may fit best with needs

Proposed Design: Aeration & Irrigation



How it Works

- Ponds provide attractive environment for good bacteria → metabolize organics
- Maintain aerobic environment with aeration to avoid odor issues
- Water can be used for irrigation for vineyard (if permitted by ATF) or decorative plantings
- Ponds are attractive, support wildlife
- Makes use of hillside locations – allows gravity feed (little or no need for pumps)

Sizing

- 9000 cu. ft per pond
- 750 cu. ft wetland-like area
- Overall footprint ~ ¼ acre

Cost

- Factors:
 - Excavation
 - Liner
 - Other equipment
 - Administrative
- ~ \$10-12,000 based on design model

“We hear of the conversion of water into wine at the marriage in Cana as of a miracle. But this conversion is, through the goodness of God, made every day before our eyes. Behold the rain which descends from heaven upon our vineyards, and which incorporates itself with the grapes, to be changed into wine; a constant proof that God loves us, and loves to see us happy.”

Benjamin Franklin