Winery Wastewater BMPs and Land Application Guideline

Prepared for CV-SALTS

Based on research sponsored by the Wine Institute

21 January 2010

Kennedy/Jenks Consultants
Engineers & Scientists

Wine Institute Water, Salt and Nitrogen Management Activities

TOPICS

- **The Wine Institute's involvement in water management**
- **Last regulatory guidelines for winery wastewater discharge - 1980**
- **2002 - 2010 technical studies and key research results:**
  - **Land Application Field Studies**
  - **Waste Minimization in Wineries**
- **Proposed BMPs and land application guidelines**

Wine Institute Water and Salt Management Goals and Objectives

- **Develop industry-wide standards for conservation and sustainability**
- **Update 1980 land application guidelines**
- **Develop tools for monitoring and analysis**
- **Establish BMPs and land application guidelines**

Wine Institute Project History

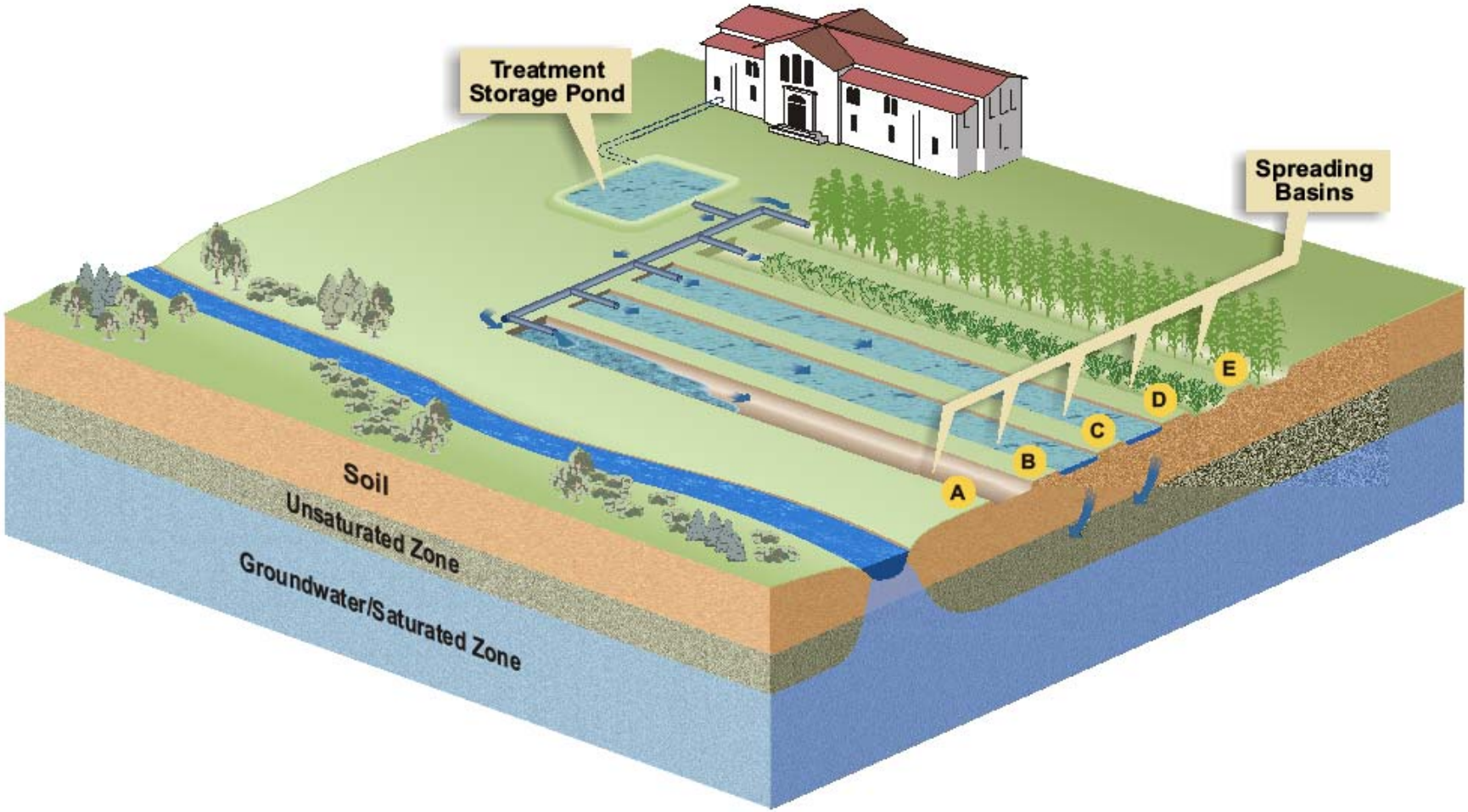
- **2002: Sustainable Winegrowing Program Initiated**
- **2002 – 2004 Field Studies of Land Application**
- **2004: Land Application Study Report and Proposed Guidelines**
- **2002 – 2009 Project review with Regional Board**
- **2004 – 2007 Waste Minimization/Source Control Study**
- **2007: Sustainable Winery Practices Report**
- **2008: Guidebook for Sustainable Winery Practices**

Wine Institute Land Application Research

Wine Institute Land Application Research

- **Comparison of proposed and 1980 guidelines**
- **Key results from 2-year field study**
- **Guidelines for land application**
- **Criteria for site selection**
- **Monitoring and management program**

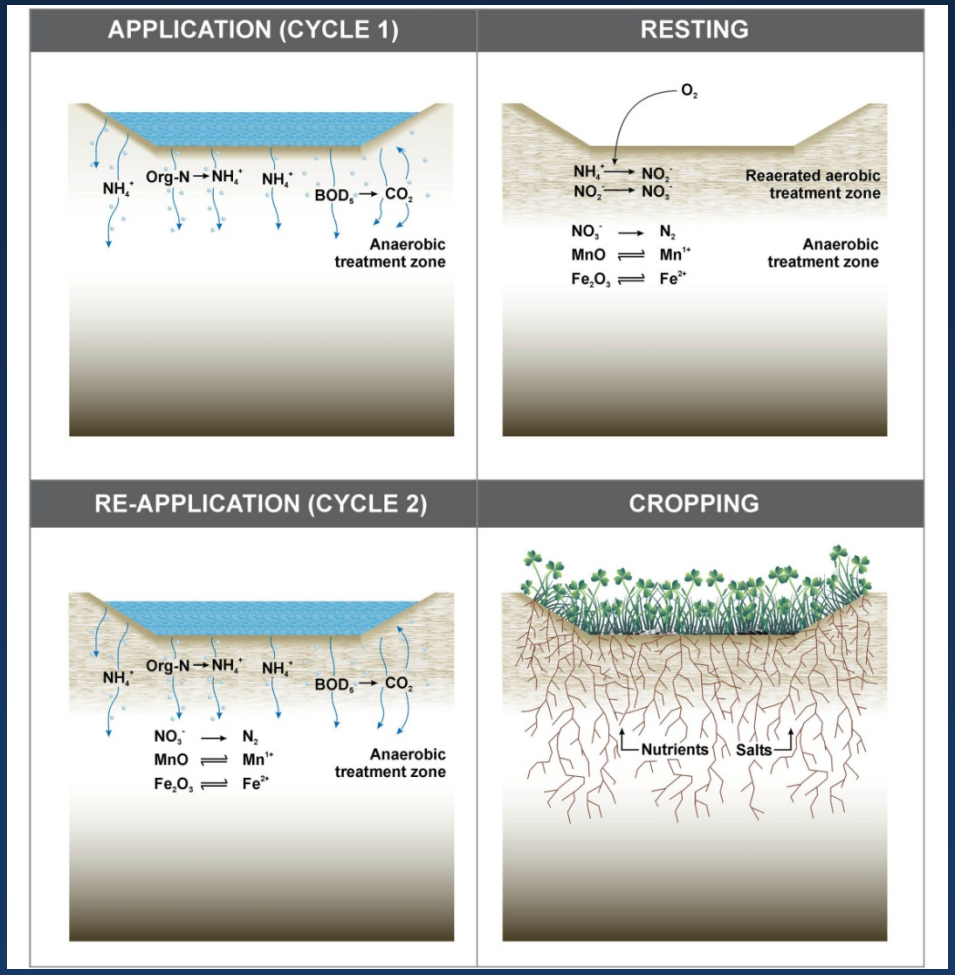
Spreading Basins



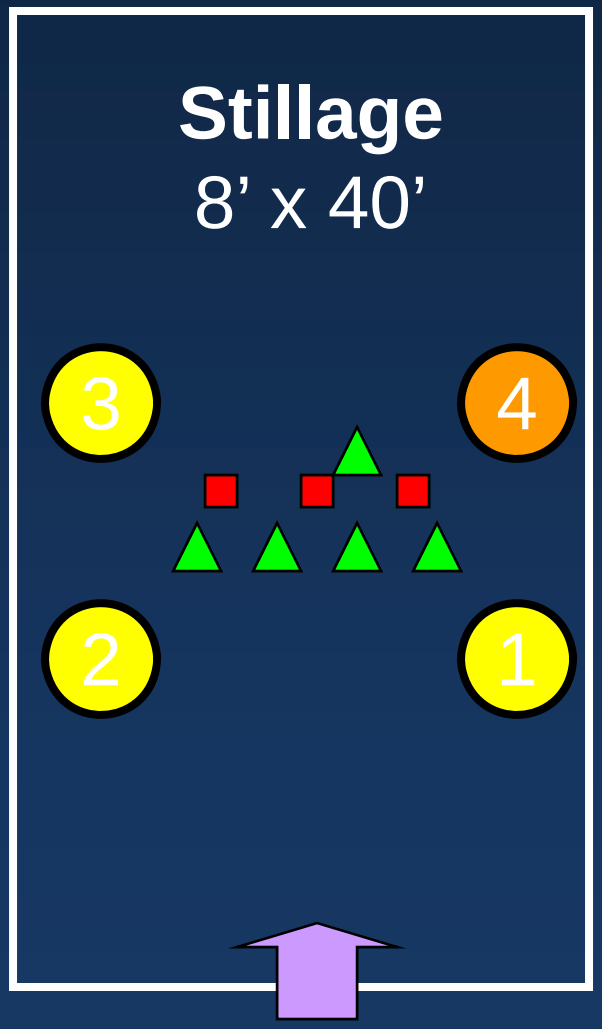
Comparison of Guidelines

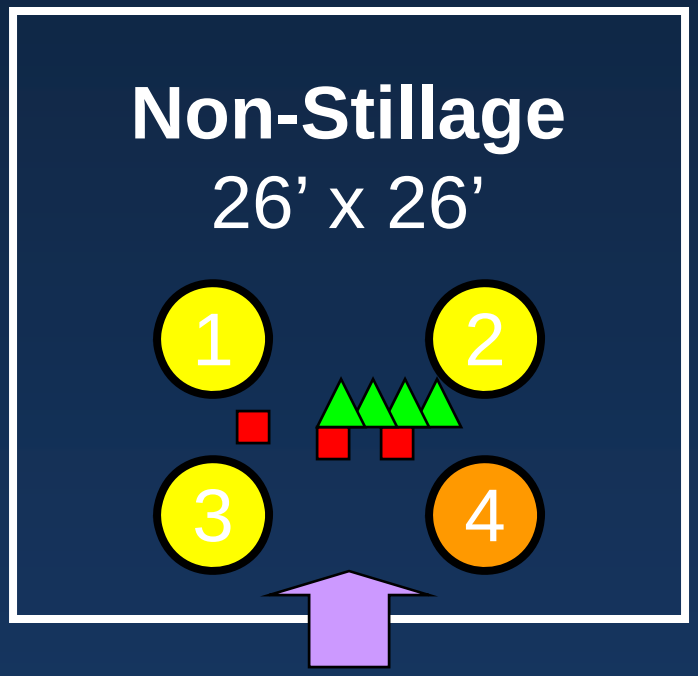
	Metcalf & Eddy (1980)	Proposed (2003)
Objective	Manage odor and nuisance	Avoid potential groundwater impacts
Site Characterization and Selection	• Soil permeability > 2 in/hr • 10-ft soil depth	• Soil hydraulic/chemical properties. • Depth to groundwater
Load Limiting Constituent	Hydraulic criteria only: • 2.5 – 3.7 in/cycle • 24-hour max infiltration time	Consider both flow and chemistry: • Application rate < soil water storage • Evaluate pH, Total N, BOD_5, TDS/FDS
Crush Season Management	• Allow 6 to 13 days resting • Roto-till or disk to remove "leathers"	• Rest cycle length tied to soil re-aeration • Till and **repack** to control infiltration
Non-Crush Season Management	• Crop the spreading basins • Re-grade surfaces • Deep tillage if needed	• Crop to remove N and salt • Define protocol for non-crush irrigation • Manage deep tillage to avoid excess drainage

Land Application Treatment Process



Experimental Design – Test Basin Instrumentation





- Deep Lysimeter
- Shallow Lysimeter
- Soil Gas Probe
- Soil Moisture Probe

Experimental Test Plots

Results of Two-Year Study

Properties	Observations
FDS (based on lysimeter data)	• Soil salt storage remained the same or small increase • Alkalinity, calcium higher; potassium lower
BOD_5 treatment	• Removal of BOD_5 is 70–90% in top 1 foot
Nitrogen removal	• Denitrification following rest cycle • Annual crop uptake • Removal limited if BOD_5 is low or drainage is too rapid
Iron and Manganese mobilization	• Soluble during loading, precipitates during rest • Presence indicates denitrification
pH control	• Soil and soil water pH not affected • Soil pH cycles are buffered annually
Odor	• Correct by managing load and rest cycles • Minimize ponding

Proposed Land Application Guidelines

1. **Site Selection and characterization**
2. **Limiting constituent analysis**
3. **Management of process water application**
4. **Program management (acreage required, cropping, source control, monitoring and reporting)**

Spreading Basin Site Selection

Properties	Desirable Characteristics
Groundwater	Depth greater than 15 ft Separate from drinking water aquifer
Soil infiltration rate, 5 ft soil	> 0.6 in / hr without restrictive layers
Available soil water storage capacity, 5 ft soil	> 4 inches Water must be held in the soil to be treated
Soil chemical / physical properties, top 5 ft	Characterize: pH, salinity, N, P, K, Ca, Na, Mg, Cl, SO4, CEC, OM in each soil layer Limits: pH , EC , ESP , clay
Layout and surrounding conditions	Avoid sites near property lines, water features, water supplies

Limiting Constituent Analysis

Evaluate limits for:

Water volume, BOD5, FDS, nitrogen, pH

Pre-Treatment	• To control pH • If Total N >> BOD5 • If FDS is too high, expand source control
Hydraulic limit on loading rate per application	• Available water holding capacity of soil

Land Application Management

Properties	Observations
BOD_5 loading rates	• Apply sufficient BOD_5 to denitrify all nitrate-N • But minimize appearance of Fe and Mn
Loading rate per application	Maximum hydraulic loading rate is the lower of: • Available water holding capacity of soil • BOD_5 load up to 7,000 lb/Ac
Resting time	Rest between loading cycles to allow: • Nitrification of ammonia-N • Precipitation of iron and manganese No reapplication until soil water content at 2 feet depth indicates air entry (field capacity)

Monitoring Plan Elements

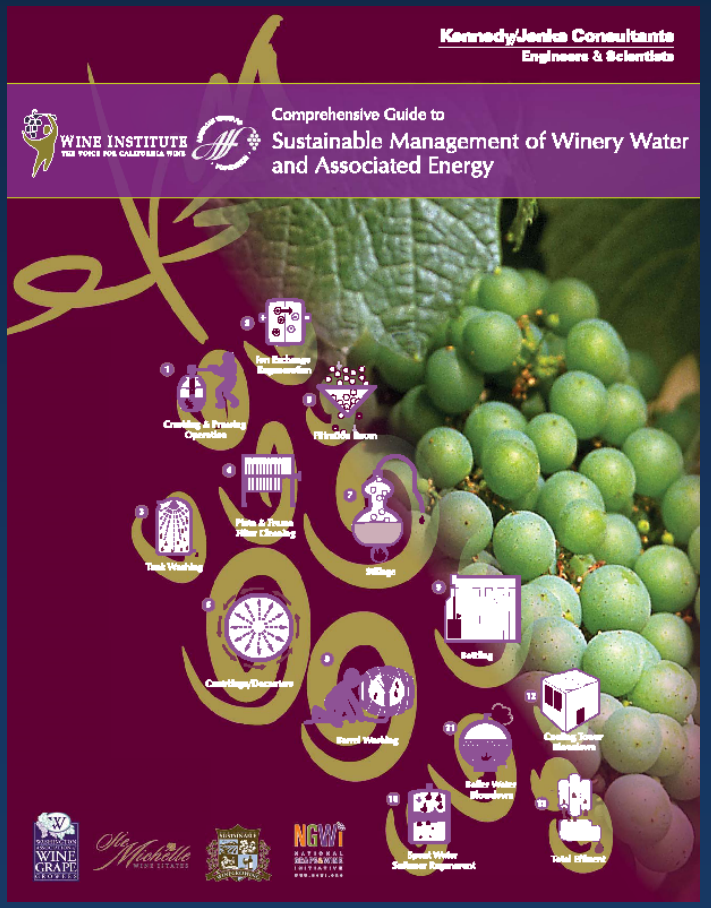
1. **Groundwater monitoring -** Ongoing for most sites with shallow groundwater
2. **Vadose zone monitoring -** Soil-water monitoring, irrigation scheduling to control percolation
3. **Log of activities - water application timing, amounts, and field observations. Track cumulative loadings by field and crop uptake records**
4. **Annual program evaluation – Is acreage adequate for loads?** Use BPTC, identify high strength waste streams, apply Wine Institute BMPs

Waste Minimization Studies for Wineries

- **Case Studies**
- **2004 Draft Waste Minimization Report**
- **2007 Draft Best Practices Report**

Comprehensive Guide to Sustainable Management of Winery Water and Associated Energy

- **Wine Institute guidance for BPTC**
- **Approach for evaluation of water, constituent use, energy to manage water**
- **Can be used by both large and small wineries (other industries too)**
- **Science-based, practical, coordinated with regulators**
- **Tools for benchmarking, identifying opportunities for improvement, and tracking success**



Possible Committee Questions

1. **Will this practice improve salt / nitrate management?**
2. **Is the nitrogen loss coefficient consistent with that seen in other areas / similar materials?**
3. **Should this practice be applied to all winery facilities, other facilities?**
4. **Are there other salt management technologies that should be added in the future?**