

# Kennedy/Jenks Consultants

## Engineers & Scientists

622 Folsom Street  
San Francisco, California 94107  
415-243-2150  
FAX 415-896-0999

30 November 2007

Mr. Johnny Gonzales  
State Water Resources Control Board  
101 I Street  
P.O. Box 100  
Sacramento, CA 95812

Subject: Comments on Winery Project Team Draft Literature Review Report  
K/J 020112.03

Dear Mr. Gonzales:

On behalf of the Wine Institute (WI), Kennedy/Jenks Consultants (Kennedy/Jenks) has reviewed the Winery Project Team Draft Literature Review Report, dated 15 August 2007 and prepared this response letter. The sections that follow provide our general comments on the applicability of the literature review to the WI's report, *Land Application of Winery Stillage and Non-Stillage Process Water, Study Results and Proposed Guidelines* (August 2004); our understanding of the State Water Resources Control Board (SWRCB) Principal Investigator's (PI's) conclusions from the literature review, in terms of the originally hypothesized possible outcomes; and additional comments on specific issues.

### General Comments

1. As previously indicated to you via email on 19 October 2007, one of our primary concerns is whether the findings and conclusions of the literature review pertain equally to two fundamentally different types of land application: (1) high-rate application in spreading basins designed for rapid infiltration, where alternate wetting and drying cycles are employed to optimize treatment; or (2) slow-rate, continuous application for crop irrigation at rates that are optimized for plant and soil agronomic capacities. Since the Wine Institute's study specifically investigated use of spreading basins, conclusions and recommendations of the literature review that relate to best practices for crop irrigation are not directly transferable to the WI's guidelines. The scope of the literature review did, however, include addressing the potential applicability of the guidelines to crop irrigation specifically under Issue 6. The WI suggests that the Literature Review Report be modified to differentiate the findings based on research related to spreading basins. This could be accomplished in the Report by consolidating the analysis and conclusions related to crop irrigation within the discussion of Issue 6.

2. The literature discusses two types of nitrogen removal that are naturally occurring in the environment: reactions where nitrogen is incorporated into soil microbial biomass, and reactions that have biogeochemical drivers (e.g., nitrification/denitrification). Although both types can contribute to nitrogen control, the WI study focused only on identifying conditions and practices

Mr. Johnny Gonzales  
State Water Resources Control Board  
30 November 2007  
Page 2

to optimize nitrification/denitrification processes. As a result, the conclusions and recommendations of the literature review that are oriented toward enhancing soil aerobic microbial biomass activity would be out of context if incorporated in the guidelines. In fact, some practices and conditions intended to promote microbial activity could be detrimental to denitrification. The WI suggests that the Report be modified to separate the conclusions and recommendations that are applicable to optimizing the denitrification process from the alternative concepts developed based on the literature review.

3. The Report provides information on some topics that are outside the intended scope of the literature review, as defined by the original 10 unresolved issues. These areas include mulching and composting of solid wastes, use of wetlands, and consideration of other treatment methods. For clarity, the WI suggests that these materials be transferred to appendices of the Report. This would ensure that useful findings are conveyed for reference, while keeping the full focus of the Report on application of process water to spreading basins.

4. For each of the 10 issues, the Report provides the PI's analysis of the issue, literature review results, literature review conclusions, and conclusions for the WI study and guidelines (or recommendations). In some cases, it is difficult to readily discern which of the conclusions and recommendations are directly indicated by the literature, and which were inferred by the PI from the findings. The WI would welcome modification of the Report to more clearly differentiate the source of conclusions and recommendations. This could be accomplished by adding a separate section for PI comments and recommendations to the discussion of each issue.

### **Literature Review Findings by Issue**

Based on the Report and the Project Team's discussion with the PI during our meeting on 24 October 2007, we have summarized our understanding of the literature review's outcome for each of the 10 original unresolved issues. The five possible outcomes are listed on page 2 of the Report.

*1. Are the draft guidelines for land application of winery waste equally applicable to loams and silt loams (<20% clay) as well as loamy sands and sandy loams that characterized the study sites in the Land Application Study and Proposed Guidelines?*

Information that was gathered substantiates applicability of the guidelines to loams, silt loams, loamy sands and sandy loams, with some limitations that should be indicated in the text. However, as noted in General Comment #1 above, conclusions regarding soil texture are quite different for slow rate irrigation-style land application and the rapid infiltration practice that was the focus of the Wine Institute's study. For example, the Report indicates that finer textured soils are better for land application. Although this is accurate for irrigation-style land application, for a rapid infiltration system, the higher permeability of coarser textured soils is more desirable.

*2. Is the method of determining waste nitrogen removal by denitrification through measured soil solubility of iron and manganese verifiable and reproducible? Are the procedures, data, and explanations of waste*

Mr. Johnny Gonzales  
State Water Resources Control Board  
30 November 2007  
Page 3

*nitrogen transformations within the soil sufficient to assure protection of groundwater quality under the proposed land application guidelines?*

Information that was gathered substantiates that measurement of iron and manganese can be used as an indicator of lowered redox potential conditions where denitrification will occur. Specifically, the literature review found a direct relationship between iron and manganese concentrations and the absence of nitrate in groundwater (refer to page 19, paragraph 2 of the Report). We agree with the reported finding that nitrogen removal also occurs under other conditions and through other means.

*3. Is the recommended upper limit of BOD loading and the recommended BOD:TN ratio appropriate to assure sufficient decomposition, absorption, volatilization, and uptake of potential contaminants for the protection of groundwater quality?*

The literature review suggests that the upper limit of BOD proposed in the guidelines would be conservative, and concludes that there is no basis for limiting BOD mass loading. It also indicates that the Carbon to Nitrogen ratio (C:N) is a more appropriate measure if the objective is management of soil microbial biomass. The PI recommends a C:N ratio of (25-40:1) and pH (7 - 8); these criteria appear to have been selected for optimal humification of soil and carbon sequestering. However, because the WI guidance pertained to land application in spreading basins, these recommendations are not directly applicable.

*4. Is there sufficient basis to assume or verify that potential groundwater contaminants infiltrating below the five-foot depth of soil will be transformed in vadose zone processes to assure the protection of groundwater quality?*

The literature review substantiated that this is accurate. Key parameters to assure denitrification in the vadose zone include the presence of sufficient amounts of dissolved organic carbon (or BOD) and nitrate. The PI also recommended that the upper five feet should be managed to optimize treatment activity, with particular attention to hydraulic loading, including uniformity of application to mitigate preferential flow paths.

*5. What monitoring programs should be established for land application sites to ensure that the systems are functioning as intended? Will vadose zone monitoring by lysimeters produce representative samples? What type of lysimeter design is appropriate?*

Monitoring programs, as described in the guidelines for site selection and process water application management, were substantiated in the literature. Lysimeters were not found to be reliable for this application. The PI also recommended that measures of soil microbial status be incorporated. However, because soil microbial status monitoring is still considered primarily a research technique, it would not be appropriate to recommend it in the guidance.

*6. Are the resolution of issues and application of guidelines for land application of winery waste equally applicable to the reuse of winery wastewater for crop irrigation with resultant agronomic uptake of dissolved solids and decomposition products as crop nutrients?*

Mr. Johnny Gonzales  
State Water Resources Control Board  
30 November 2007  
Page 4

The literature review supported application of the WI guidelines to irrigation, but also identified additional measures that would contribute to best management. Accordingly, some modification of the WI guidelines would be needed if this is an objective. As indicated in General Comment #1 above, evaluation of this issue led to a set of observations and recommendations that are potentially useful in designing an optimal system for irrigation with wastewater, but not relevant to the rapid infiltration practice investigated by the WI.

*7. To protect underlying groundwater quality, should waste exceeding specified limits of contaminant concentrations be pre-treated before land application? If so, what should the concentration limits and treatment methods be?*

The literature review suggested that some level of pre-treatment or equalization is appropriate to address the variability in winery wastewater characteristics prior to land application for crop irrigation. For spreading basin application, the guidelines for limiting constituent analysis already indicate that there are two cases where pretreatment or alternate disposal is needed: (1) if process water pH is outside the range of 3 to 10, or (2) if the ratio of BOD:TN is less than 20. In the absence of those conditions, adherence to the guidelines will preclude the need for pretreatment.

*8. Does the data collected to date show that the volatile component (VDS) of total dissolved solids (TDS) is fully removed within the top five feet of soil? If not, how should the land application unit be managed to provide full removal?*

No studies on this topic other than the subject WI research were found.

*9. What precise definition of a level of confidence is satisfactory to the Water Boards to ensure protection of groundwater quality under land application sites?*

The literature reviewed did not address this policy issue.

*10. What finding can be made from the existing groundwater quality monitoring data from land application sites regarding the nature and extent of groundwater quality impacts?*

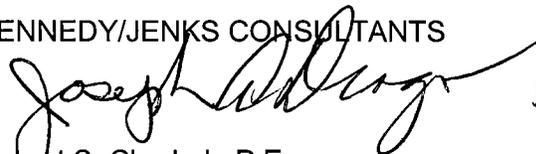
The literature review could not address this issue because data was not available.

Mr. Johnny Gonzales  
State Water Resources Control Board  
30 November 2007  
Page 5

In conclusion, the WI would like to acknowledge the beneficial contribution of the literature review to the further development of best practices for land application in the wine industry. We recommend that the Project Team meet to discuss next steps, including potential strategies for addressing the general comments presented in this letter. One approach that can be considered is a workshop-style meeting to review the Report on an issue-by-issue basis with the goal of identifying items that can be reorganized, such that changes are mutually acceptable and the final report will best accomplish the original objectives for the literature review. We look forward to continuing to collaborate with you in this effort.

Very truly yours,

KENNEDY/JENKS CONSULTANTS

*for*  , P.E., Ph.D.  
Robert S. Chrobak, P.E.  
Vice President

cc: Paul Franzia, Bronco Wine Company  
Sue Giampietro, The Wine Group