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May 22, 2012

Charles R. Hoppin, Chairman and Members
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Re: Comments on UC Davis Report On Nitrate In Groundwater

Dear Chair Hoppin and Members of the Board :

I am a registered agricultural and civil engineer with extensive experience with water quality issues, including assisting numerous dairymen with the Dairy General Order. I represent the Kern River Watershed Coalition Authority that currently administers the surface water program in Kern County.

As we consider promising options to deal with nitrate issues, I urge you to keep in mind that agriculture is an important industry and has a part in this issue. While water quality is very important, we need to maintain competitiveness and the viability of agriculture in the state. The potential options being considered portend radically higher operating costs. If the rationale for action is in this UC Davis report, we need to look at the report very carefully. Wise decisions must be made based on sound data to ensure good results, finding the optimal and reasonable path forward. The UC Davis report was a monumental effort and it has been a big undertaking just to review it. We have only begun to review the report. The following are some preliminary comments and observations of fundamental shortcomings and incorrect assumptions on which the report relies—based on additional review we will undoubtedly have further comments.

We are concerned about the design of the study: leaching to groundwater is deduced by subtracting estimates of other outputs from estimated inputs, with attendant errors. We fear that errors can be magnified in this way. Direct empirical analysis regarding leaching is lacking. The report suggests that approximately $200 million per year is wasted over 3.12 million acres. It is difficult to believe that farmers could waste an average of $64/ac. This averages out to 137 lb/ac/yr N going to groundwater, a very large number compared to typical nitrogen fertilizer recommendations. See attachment A. The report notes that there is significant uncertainty (+/-30%) in the 195 Gg N/yr leaching estimate to groundwater. Based on my review of the assumptions below, I submit that this must be much lower.

The report lacks measurements and makes many significant assumptions. One of these assumptions was that the growth of the dairy industry created an excess pool of nitrogen that is unabsorbed by crops. The report fails to take into account that dairies are under a General Order of Waste Discharge Requirements which includes mandatory nutrient management plans (NMPs). The report acknowledged that little is known about the amount of synthetic fertilizer applied on fields receiving manure, but assumed that much of the manure applied on and off dairies was not used beneficially. Largely, it was assumed that crop needs were met by synthetic fertilizer and much of the manure was applied as surplus.

Figure ES-2 in the UC Davis report suggests that nitrogen from land-applied dairy manure is nearly enough to meet the harvest uptake of 3.12 million acres of crops. Assuming an uptake of 425 lb N/ac for double cropped wheat and corn (attachment A) and 10% atmospheric losses, the 127 Gg N/yr of land-applied dairy manure can be utilized on approximately 423,000 acres. This is 32% more than the 320,000 acres that is estimated to be under dairy management. See equation 1.

$$127\ Gg\ N * 90\% * \frac{lb}{453.6\ g} * \frac{ac}{425\ lb} * \frac{1}{1.4} = 423{,}000\ ac$$

Equation 1

The 320,000 acres of dairy land that is available can harvest 62 Gg N/yr. See equation 2.

$$320{,}000\ ac * \frac{425\ lb\ N}{ac} * \frac{453.6\ g}{lb} = 62\ Gg\ N$$

Equation 2

The 381 Gg N/yr applied over 3.12 million acres averages out to 242 lb N/ac/yr. This seems in the acceptable range given the table of nitrogen uptake values in attachment A. The simple average of all crop uptakes in this table is 200 lb/ac. However, looking at the average harvest uptake over the study area raises some doubt. 130 Gg N/yr averaged over 3.12 million acres yields 92 lb N/ac/yr. See equation 3. This is very low, perhaps 1/2 to 1/3 of what it should be, judging by the nitrogen uptake values in attachment A.

$$\frac{130\ Gg\ N}{yr} * \frac{1}{3{,}120{,}000\ ac} * \frac{lb}{453.6\ g} = \frac{92\ lb}{ac * yr}$$

Equation 3

If dairy land and the associated harvest uptake (calculated in equation 2) is taken out and averaged over the remaining acres, it further supports that the harvest value is significantly underestimated. See equation 4. This is much less than the lowest values on the table in attachment A.

$$\frac{(130 - 62)\ Gg\ N}{yr} * \frac{1}{2{,}800{,}000\ ac} * \frac{lb}{453.6\ g} = \frac{54\ lb}{ac * yr}$$

Equation 4

The data that this report is based on is five years old. Several notable changes have occurred in this time, and would likely affect the data. The Dairy General Order has been implemented and data is being collected that could potentially address some of the assumptions that were made. There has been increased adoption of subsurface drip irrigation (SSDI) and other low volume irrigation methods with higher irrigation efficiencies and precision water and nutrient application. Higher irrigation efficiencies result in less deep percolation and less opportunity for nutrients to leave the root zone.

It is important to note that the whole study area is not homogeneous. The Kern sub-watershed is different in several ways. The study assumed a typical groundwater recharge rate of 1 ac*ft/ac/yr. I submit that the average in Kern is significantly less than that, due to good irrigation efficiency and even regulated deficit irrigation. Due to reductions in available water supplies, Kern is chronically water-short. Water is rationed and valuable, and the same is true for nitrogen fertilizers. I believe that the state of nutrient management in the Kern sub-watershed is good, as farmers already have a profit motivation to be good stewards. There are other unique issues in Kern such as moisture deficient soils, aquitards, and naturally occurring brackish waters that all indicate a low threat to groundwater quality, even if deep percolation existed.

Altogether, this report raises questions regarding conclusions that can be made about current impacts. What we are seeing in groundwater now are legacy issues. In light of the questions that we have and the importance of the subject, we would like to have more outreach sessions regarding assumptions that were made and how the conclusions may be different with different assumptions. We'd like an opportunity to help with better assumptions. One of the biggest assumptions that we've questioned above has been regarding manure applications. We submit that synthetic applications likely went down as manure became available. We are concerned whether similar assumptions were applied to sludge applications as well. We do not agree with assumptions that manure or other resources are not being used beneficially by farmers, especially in light of the Dairy General Order. With indicated harvest uptake numbers likely underestimated, leaching has to be much lower than 138 lb/ac/yr. Agriculture can't be wasting an average of $64/ac/yr.

Please continue to strive for a true assessment of legacy vs. current issues and use good data and conclusions to make wise, optimal, and reasonable decisions.

Respectfully,

John Schaap
RAE 563, RCE 61754

Attachment A. Table of nitrogen uptake for various crops.

Attachment A

Plant Food Utilization by Various Crops
Western Fertilizer Handbook, 8th edition

Crop **N, lb/ac**

Field crops

Barley	160
Canola (whole plant)	240
Corn (grain)	240
Corn (silage)	250
Cotton (lint)	180
Grain sorghum	250
Oats	115
Rice	110
Safflower	200
Sugar Beets	255
Wheat	175

198 average

Vegetable crops

Asparagus	95
Beans (snap)	175
Broccoli	80
Cabbage	270
Celery	280
Lettuce	95
Potatoes (Irish)	270
Squash	85
Sweet potatoes	155
Tomatoes	180

169 average

Fruit and nut crops

Almonds (in shell)	200
Apples	120
Cantaloupes	220
Grapes	125
Oranges	265
Peaches	95
Pears	85
Prunes	90

150 average

Forage crops

Alfalfa	480
Bromegrass	220
Clover-grass	300
Orchardgrass	300
Sorghum-sudan	325
Timothy	150
Vetch	390

309 average

Average 201