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To: Co-Chair Sen. Weber and Co-Chair Hemmingsen-Jaeger, Members and Staff of the Legislative Subcommittee on Water Policy

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I was not able to attend the Subcommittee meeting on December 5. Still, I watched the YouTube video, and I wanted to add to the discussion and answer some of the questions posed by the Legislative Members about the presentation on advancing fertilizer research in Minnesota.

I appreciate the presentation of Bruce Montgomery and the Ag Department addressing the research efforts and progress made on fertilizer and nutrient applications. It is essential to continue these efforts to promote fertilizer efficiency. Much work needs to be done to stem nutrient loss to the surface and the subsurface, especially considering new crop varieties, emerging techniques for the rate and timing of fertilizer application, and the changes needed in farming practices to address changing climate and more intense storms. These are all critical to improving farm profitability and protecting the environment and are issues we must address concerning nitrate in karst aquifers.

The presenters did a great job explaining the benefits and the needs. Still, they never understood how much nutrient loss and groundwater contamination occur with existing practices or how much groundwater contamination could change with new recommendations and practices.

The question remains unanswered: How much does nutrient loss occur now, in the past, and in the future? Here, we have both established data and ongoing studies that reveal three facts:

- Some nutrient loss is inevitable, especially in the karst and sandy soils where the timing and intensity of rainfall and spring-melt recharge control nitrate leaching into groundwater. The climate has changed to be wetter and warmer in the karst area. However, regional climate differences pose different risks, creating irrigation growth in areas with sandy soils, incentivizing drain tile and ditches in our clay-rich glaciated landscape, and accelerating infiltration and groundwater contamination in both the karst and the central sands. We know with certainty that we have higher nitrate losses in wet areas and from

rapid infiltration. Nitrate-contaminated aquifers are an unavoidable fact that has consequences. In the karst, we now know that our shared aquifers present an imminent health risk to all those who do not test and treat their water.

- University fertilizer recommendations have always been calculated to evaluate profitability and risk. The data for the calculation is weighted to consider the risk prediction of the present cost of fertilizer, the desired yield per acre, and the future price of corn. This risk assessment is based on the commonsense principle that no one would knowingly spend more on fertilizer than they can return on yield; you must consider the bottom line. But variables like the weather-induced runoff of soils and chemicals, leaching loss of fertilizer and chemicals, and the more frequent droughts where the plants wither and leave the years of fertilizer and chemicals in the soil to leach into the ground when the snow melts, or the rain returns.
    - The recommendations do not claim to predict the most significant variables that affect the public: the weather risks and the impacts, health impacts, and costs of runoff and leaching. These essential risk variables are in the public interest but are largely neglected in the current narrative about commonsense farming.
- In SE Minnesota, the recommended risk-based fertilizer application rates recognize 20 pounds/acre of "unavoidable" nutrient loss from leaching, runoff, and mineralization. This 20#/acre unavoidable loss average fluctuates yearly but has rarely been recorded at less than 15 pounds per acre in landscapes with more than 60% row crops. Years of tile drainage studies, water sampling from springs with known infiltration rates, and agronomic studies with shallow soil moisture and shallow groundwater probes prove it impossible to have no unavoidable loss.
    - Multi-year studies by MDA, including the Root River Watershed Field to Stream Partnership, show that the shallow groundwater and springs fed by row crops on silty soils over the karst have a persistent minimum of 15 mg/L (PPM) nitrate if you do the math and consider that 15 ppm from this year, added to 15 ppm from last year and all the years before there is no way to get water with less than ten ppm in a landscape dominated by row crops and feedlots.
    - The nitrate concentrations in the springs are lower with the summer rains when the crops consume the nutrients, and the nitrate levels rise during our long recharge season from October through April. In these

studies, the base flow from the season-to-season infiltration is 15 ppm, and this level has no apparent trends; the base flow nitrate levels stay approximately the same from year to year. The critical factor is that this persistent year-to-year nitrate level is 50% higher than the current ten ppm health risk limit for nitrates and is three times higher than the current five ppm recommendation to protect from cancers and other health risks from nitrates in drinking water.

- Recent management recommendations like cover crops, precision agriculture, and the advent of perennial crops are all proving to have benefits in many trials and pilot programs. These practices promise to improve farm profitability and might protect groundwater and public health. However, in the past, these methods have not yet been proven to be adaptable and practical in the karst region. Minnesota needs long-term investments in new ag practices. Still, we will not have improved aquifer water quality if we continue infiltrating 15 ppm of unavoidable nitrate loss on all the existing croplands.
    - Perennial high nitrate leaching from row crops gives rise to the notion that to protect public health, we must test all the drinking water, provide free, safe drinking water to households with nitrate contamination, and prepare a risk management plan that addresses water from the kitchen tap to the source.
    - Minnesota well code already prohibits drilling new wells in the most vulnerable shallow aquifers but still allows pre-existing, non-conforming wells to use high-risk water. The focus on the karst will enable us to use the large body of science that shows geology, hydrology, and water quality trends and evaluates the risk to underground drinking water sources. The challenge is to protect the aquifers from further damage, not to condemn existing wells or aquifers over eight counties because those aquifers cannot be protected from unavoidable loss.

We believe that omitting major risk factors like weather and groundwater contamination is a conscious decision by the UofM and crop advisors affecting all of us using groundwater for drinking water, not just the individual farmer. We are allowing the self-interests of farmers to make a “no-fault” defense due to unavoidable compound damages to our groundwater. We are allowing them to adversely impact our public health, safety, and welfare everywhere in Minnesota,

where well owners who once had clean water now have increasing nitrate levels from aquifers with an imminent health risk.

We believe that two things are essential:

1. Continuing the research and demonstration of improved nutrient management practices
2. Include weather, climate, and leaching loss variables in the research