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EXECUTIVE SUMMARY

Drainage districts and nitrate pollution in the Des Moines Lobe and Mississippi River Basin

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Agricultural sources of nitrogen are the primary cause of nitrate-contaminated well water, aquifers, and surface waters in the Mississippi River Basin watershed. These sources also are the primary cause for the hypoxic zone at the mouth of the Mississippi River, or "Dead Zone" that occupies an average of 5,300 square miles[1] — a record 8,776 square miles this year.[2]

In Iowa, about two-thirds of land is used for annual row-crop agriculture. Corn and soybean cropland account for about 25 million farm acres in Iowa. More than one-third of all Iowa cropland is tiled for drainage.[3] Some of the most intensively cropped and tiled agricultural lands are in a north-central Iowa area known as the Des Moines Lobe. The approximately level landscape has poor natural drainage and naturally swampy.[4] To produce crops here, subsurface drainage systems were installed to remove excess water, and organized into drainage districts. Water that drains from these districts is a major nitrate contamination threat to the Mississippi River Basin.[5]

How Nutrients Move Through Drainage Systems

Industrial crop production requires extensive nitrogen additions to the soil from (in order of mass) inorganic fertilizer followed by atmospheric fixation, crop residue, soil organic matter, and direct atmospheric deposition, and manure.[6]

Some nitrogen, however, never makes it into crops. Some goes into the atmosphere, some returns to the soil as organic matter, and some leaches to groundwater as nitrate. The systematic artificial drainage of the landscape, which has increased steadily since drainage districts were established more than a century ago, effectively short-circuits the natural flow system of water and nutrients — specifically nitrogen — through the soil.

For most of the year, tiled cropland lacks vegetation to consume nitrate. Thus, nitrate leaches into groundwater that is quickly drained by tiles. Without tile drains, nitrate-contaminated water would be at least partially denitrified in aquifers. Instead, it is discharged at points to streams, creeks, ponds, lakes and rivers. The systematic artificial drainage of the landscape, which has increased steadily since drainage districts were established more than a century ago, effectively short-circuits the natural flow system of water and nutrients through the soil.

Policy Recommendation: Use Drainage Districts as a Mechanism for Change

Iowa's Nutrient Reduction Strategy (NRS), created in 2013, seeks to reduce nitrate pollution leaving the state by nearly half. A five-year study of three different tile-drained catchments in Iowa underscored the importance of working at the drainage district scale to achieve nitrate reductions necessary to meet water quality goals.[7] To improve water quality:

(1) Drainage districts should exercise their existing statutory authority; and
(2) State regulators and others should use the local expertise and outreach available from drainage districts to better target existing voluntary soil and water conservation practices to reduce nutrient loads in our waterways.

Statutory Authority of Drainage Districts

Historically drainage districts have not been held accountable for nutrient inputs into our waterways, or liable for damages inflicted on property or pollution of ground and surface waters. Traditionally the courts have ruled that drainage districts are not required to use their statutory authority to implement pollution reduction measures or to mitigate damages to the environment. This was most recently demonstrated in the 2017 Iowa Supreme Court ruling dismissing the Des Moines Waterworks (DMWW) case against three County Boards of Supervisors for nitrate contamination in the Raccoon and Des Moines Rivers emanating from upstream drainage districts.

Under existing statutory authority, however, drainage districts have the power to level fees and to use eminent domain. Fees are necessary for the maintenance, repair, expansion, and improvement of drainage district infrastructure. Eminent domain is necessary for expansion of drainage district systems. There is an opportunity here to obtain better management practices for existing, new and replacement drainage components to reduce nitrate in our waterways.

We suggest that drainage districts use their statutory authority to mitigate nitrate pollution discharge from drainage district infrastructure. Such mitigation actions can include, but are not limited to, requiring water quality monitoring and reporting, wetlands conservation and restoration, and bioreactor installation at discharge points to reduce nitrate loads.

We also assert a broader obligation for drainage districts to address water quality issues under the existing statutory mandate that drainage "shall be presumed to be a public benefit and conducive to the public health, convenience and welfare."[8] Nitrate pollution is a public health issue as illustrated in the DMWW lawsuit, which sought to reduce the contamination of source water to more easily meet the U.S. EPA standard of 10 mg/L of nitrate. These quasi-government drainage districts can raise funds to develop mitigation actions at the source or at discharge points, actions that could include eminent domain to acquire and manage wetlands and other conservation areas.

Existing Voluntary Soil and Water Conservation Practices

The continued reliance on voluntary conservation practices offers drainage districts another opportunity to reduce nutrient loads in our waterways. Organizing and coordinating conservation measures at the scale of a drainage district — or among several adjoining districts — could aid voluntary efforts under the NRS. Additionally, as drainage infrastructure ages and requires maintenance and replacement, the Iowa Department of Natural Resources permitting process should include requirements that improve the environmental quality of discharge water.

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[1] https://toxics.usgs.gov/hypoxia/hypoxic_zone.html
[2] https://gulfhypoxia.net/research/shelfwide-cruise/?y=2017&p=press_release
[3] Iowa Drainage District Association website, http://www.iowadrainage.org/Facts.html. Accessed August 17, 2017.
[4] Schilling, K. E., C. S. Jones, and A. Seeman. 2013. How Paired Is Paired? Comparing Nitrate Concentrations in Three Iowa Drainage Districts. J. Environ. Qual. 42:1412-1421. doi:10.2134/jeq2013.03.0085
[5] Schilling et al, 2013.
[6] Burkart, M., D. James, M. Liebman, and C. Herndl (2005), Impacts of integrated crop-livestock systems on nitrogen dynamics and soil erosion in western Iowa watersheds, J. Geophys. Res., 110, G01009.
[7] Ikenberry, C. D., M. L. Soupir, K. E. Schilling, C. S. Jones, and A. Seeman. 2014. Nitrate-Nitrogen Export: Magnitude and Patterns from Drainage Districts to Downstream River Basins. J. Environ. Qual. 43:2024-2033. doi:10.2134/jeq2014.05.0242
[8] Chapter 468, Section 2 of Iowa law.