WATER QUALITY FOR AGRICULTURAL DRAINAGE
GULF OF MEXICO HYPOXIA ISSUE
HYPOXIA IN THE GULF OF MEXICO
GULF OF MEXICO NUTRIENT DELIVERY

State shares of the total nutrient flux

Nitrogen

Phosphorus

Percent Share

- < 1
- 1 to 5
- 5 to 10
- 10 to 17
REDUCING HYPOXIA IN THE GULF OF MEXICO

EPA Goal of **45% Reduction** of both Nitrogen and Phosphorous
IOWA INTENSIVE TILE DRAINED REGION

Des Moines Lobe
CURRENT CONDITIONS OF IOWA DRAINAGE

• Deteriorating drainage infrastructure that will need replacement largely over the next 10-30 years

• Farmed wetlands provide lowered crop production and little wetland function compared to original state

• Most farmed wetlands have drainage installed, but the drainage system capacity is too low to provide adequate drainage for good crop growth

• Farmed wetlands result in high losses of nitrogen fertilizer as result of denitrification

• “Worst of both worlds”— Poor crop production-poor wetland function
EPA HYPOXIA GOAL

- To reduce the size of the Gulf of Mexico Hypoxic Zone - at least 45% reductions in both riverine total nitrogen reflux and riverine total phosphorus flux are called for.

- To achieve these reductions as well as local water quality goals will require a combination of practices implemented at the watershed scale.

- Nitrate removal wetlands are a watershed scale practice that have been shown to be effective in removing nitrate.

- Optimal drainage capacity has the potential to reduce surface runoff, sediment & phosphorus.

- Market driven, public/private partnerships will be essential to achieve these nutrient reductions at full landscape scale.
Integrated Drainage-Wetland Systems to Reduce Nitrate Loads from the Des Moines Lobe Watersheds

- Iowa Initiative – Redesign drainage district tile systems in combination with restored wetlands
- Builds on the ISU Research & technology of CREP wetlands
IOWA CONSERVATION RESERVE ENHANCEMENT PROGRAM (CREP)
IOWA WETLAND LANDSCAPE SYSTEMS INITIATIVE

Iowa Initiative Pilot Demonstration Projects

Monitoring and Assessment IDALS & ISU
IOWA INITIATIVE PILOT DEMONSTRATION HISTORY

• 3,000 Districts solicited by IDALS for interest in program, small response received

• 16 districts further studied to determine pilot project eligibility

• Pocahontas, Palo Alto, Clay, Emmet and Calhoun counties had potential projects

• From this list, 5 districts were chosen to be pilot projects with landowner support:
  – DD No.65, Pocahontas County
  – DD No.48 & 81, Pocahontas County
  – DD No.8 Br.4, Clay County
  – DD No.178, Pocahontas County
  – DD No.15 North, Palo Alto County

• Cost share offered at 30%-50% of project cost
CHALLENGES LEARNED FROM IOWA PILOT PROJECTS

- Grade - not enough or too much
- Containing wetland easements to one landowner
- Find a place to economically site a wetland to achieve the maximum pool to watershed ratio
- Need of splitting surface flows from tile flows if possible
- Typically requires large drop structures and using sheet pile
- Will require wetland determinations, Landowners need to request
- Determining USACE Jurisdiction-Nationwide vs. Individual Permits
- Estimating amount of mitigation credits upfront is difficult
INTEGRATED DRAINAGE AND WETLAND LANDSCAPE SYSTEMS

IOWA INITIATIVE VISION

Redesign the tile system to modern drainage coefficient, which allows for greater infiltration of water and thereby increases crop productivity AND

Incorporate nutrient removal wetlands below outlets and utilize them for mitigation of impacts to continuously-cropped farmed wetlands.
IOWA NUTRIENT REDUCTION STRATEGY (NRS)

• Strategy developed in response to the EPA 2008 Gulf Hypoxia Action Plan
  – 12 States along the Mississippi River
    – A Science and Technology-based Approach
    – Develop strategies to reduce nutrient loading to the Gulf of Mexico

• Voluntary efforts to reduce nutrients in surface water from both point sources and nonpoint
  – Point Sources: 102 major municipal wastewater treatment plants
  – Nonpoint Sources: 90,000 Farmers and Agricultural drainage systems

• In a Scientific, Reasonable and Cost Effective Manner

• Water Quality Initiative established to implement the NRS
IOWA WATER QUALITY INITIATIVE (WQI)

- Seeks to harness collective ability of private and public resources
- Deliver a clear and consistent message to the agricultural community: 
  Reduce nutrient loss and improve water quality
- Tool box of Practices – Land Use Changes, Conservation and Edge of Field
- Statewide Practices cost-share: Cover Crops, No-till/Strip-till, N Inhibitors
IOWA WATER QUALITY INITIATIVE (WQI)

**Edge of Field Practices (EOF)**
- Constructed Wetlands
- Bioreactors
- Saturated Buffers

Highest in terms of efficiency in cost per lb of nitrate-N removed

Science-Based to Reduce Phosphorus and Nitrate
# Funding Sources for Conservation

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<tr>
<th></th>
<th>IDALS</th>
<th>IDALS+FSA</th>
<th>FSA</th>
<th>NRCS</th>
<th>Partners</th>
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<td><strong>Nutrient Management</strong> (soil &amp; water reduction)</td>
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<td><strong>Tillage</strong> (no-till, strip till)</td>
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<td><strong>Cover Crops</strong> (rye, oat, clover, radish, ryegrass, etc.)</td>
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<td><strong>Edge-of-Field Erosion Control</strong> (grazed waterways, terraces, ponds)</td>
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<td><strong>Edge-of-Field Practices</strong> (wetlands, saturated buffers, bioreactors)</td>
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<td><strong>Land Use/Alternating Crops</strong> (pasture, buffer, land retirement, extended rotation)</td>
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<td><strong>Livestock/AFO Management Systems</strong></td>
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- **N & P Reduction**
- **Nitrogen (N) Reduction**
- **Phosphorus (P) Reductions**
- **Other Important Practices**
USDA RCPP is a partner-driven, locally-led approach to conservation with technical and financial help from the NRCS

Midwest Agriculture Water Quality Partnership

- IDALS partnered with multiple groups to apply to NRCS for federal funding to leverage State WQI funding to increase practice adoption
  - NRCS Investment: $9.5M (National) $38M (Non-Federal)
- Targeting Priority Landscapes with establishment of RCPP Priority Watersheds
- Iowa Water Alliance: 43 private partners and organizations
  - Founded by the Iowa Corn Growers Association, Iowa Soybean Association and Iowa Pork Producers Association
- Build a public-private collaboration
- Science-based, non-regulatory approach
- Scaling up conservation planning and conservation practices
RCPP-MIDWEST AGRICULTURE WATER QUALITY PARTNERSHIP PROJECTS
IOWA DRAINAGE DISTRICTS

Aging Infrastructure – Over 3000 Drainage Districts in Iowa

- Referenced 1983 studies analyzed drainage districts in 10 Iowa counties in upper Des Moines River Basin
- Crop yields in drainage districts in study area are reduced by 32% from potential by limited drainage
- 95% of the study area was drained by inadequate drain tile mains
- 69% of on-farm drainage systems are newer and have adequate design capacity
HOW MUCH UNDERDESIGNED SYSTEMS IMPACT YIELD?

These estimates are likely on the conservative side. Yield impacts may be greater.
ECONOMICS OF DRAINAGE IMPACT YIELD?

- Payback on tile investment can be achieved utilizing increased revenue only.
- Payback period utilizing increased revenue only is relatively short (10-20 years).
- Payback period is much shorter than the 125+ year service life of the new drainage system.
- Drainage warrants allow for up to 20-year financing, longer than typically needed to payback from increased revenue.
STATUS QUO OR IMPROVEMENTS

• Flat, low-erosion drained landscapes are environmentally-preferred for production of row crops

• Over the next decades the existing drainage systems in Iowa’s drainage districts will be replaced due to age and structural failures

• Critical Issue – will these replacement systems be designed to maintain the status quo or to optimize these landscapes for both environmental benefits and crop production?

• **Iowa Initiative** - treatment wetlands with drainage improvements provide the best of both worlds a *win-win situation*
DRAINAGE DISTRICT IMPROVEMENTS

Achieving Watershed Based Nutrient Reduction

- Treatment wetlands with drainage improvements providing nutrient reduction and mitigation of farmed wetlands
  - No Federal funding can be used for mitigation
  - Funding sources under WQI and SRF Funding
  - Nutrient Reduction Credit Banking and Trading

- Encouraging Districts to consider multi-purpose drainage management, which incorporates Best Management Practices (BMPs)
  - Detention systems that reduce runoff and size of drainage system while reducing nitrates
  - Conservation practices that reduce runoff and sediment
  - Nutrient Treatment Practices
WATER QUALITY BEST MANAGEMENT PRACTICES

- Grassed Waterways
- Riparian Channel Vegetation
- Native Filter Strips and Contour Buffer Strips
- Wetland Restoration
- Water and Sediment Control Basins (WASCOBSs)
- Surge Basin
- Woodchip Bioreactor
- Water Control Structures
- Two Stage Ditch
- Alternative Tile Inlets
- Control Subsurface Drainage
- Saturated Buffer
FUTURE DRAINAGE DISTRICT VISION

“Engineer” the watershed for better drainage and wetland function

- Don’t replace but improve the capacity of the drainage system to provide for better crop production

- Set aside areas where wetlands can be established at the discharge end of the watershed for better wetland function as well as water quality renovation

- Allow these wetlands to be used for mitigation of farmed wetlands in the watershed – Funding Nutrient Credit Trading along with Wetland Mitigation

- Landowners incorporate Conservation and Nutrient Reduction Measures to reduce cost of drainage improvements and improve downstream water quality