

RED LAKE RIVER FARM TO STREAM TILE DRAINAGE STUDY

- Red Lake Watershed District -



Project Background

- **RLWD Received a Grant of \$17,500 from the Northwest Minnesota Foundation**
- **Originally focused upon wild rice paddy drainage water quality but was expanded to include conventional agriculture and flow monitoring**
 - **Interest from farmers, scientists, MPCA, others**

Project Background

- **Red River Watershed Management Board**
 - Took interest in the project
 - Wanted flow measurement
 - Provided funding for accurate flow monitoring
- **The Marshall/Beltrami SWCD received a grant for tile drainage sampling**
 - Paid for sampling and analysis in Beltrami County
 - We were able to include more sites in the study

RLWD Project Partners

- **Northwest Minnesota Foundation**
- **Red River Watershed Management Board**
- **Red Lake Nation DNR**
- **Marshall/Beltrami County SWCD**
- **Red Lake County SWCD**
- **Stanley Farms**
- **Sparby Farms**
- **Bachand Farms**
- **Red Lake Nation Wild Rice Paddies**
- **HDR Engineering**

Data Collected

- **Water quality samples and field measurements**
- **Flow measurement**
- **Rainfall, baro, and temp**
- **Crop and fertilizer usage**
- **Land use, drainage area, soils, and other spatial data about the project sites**



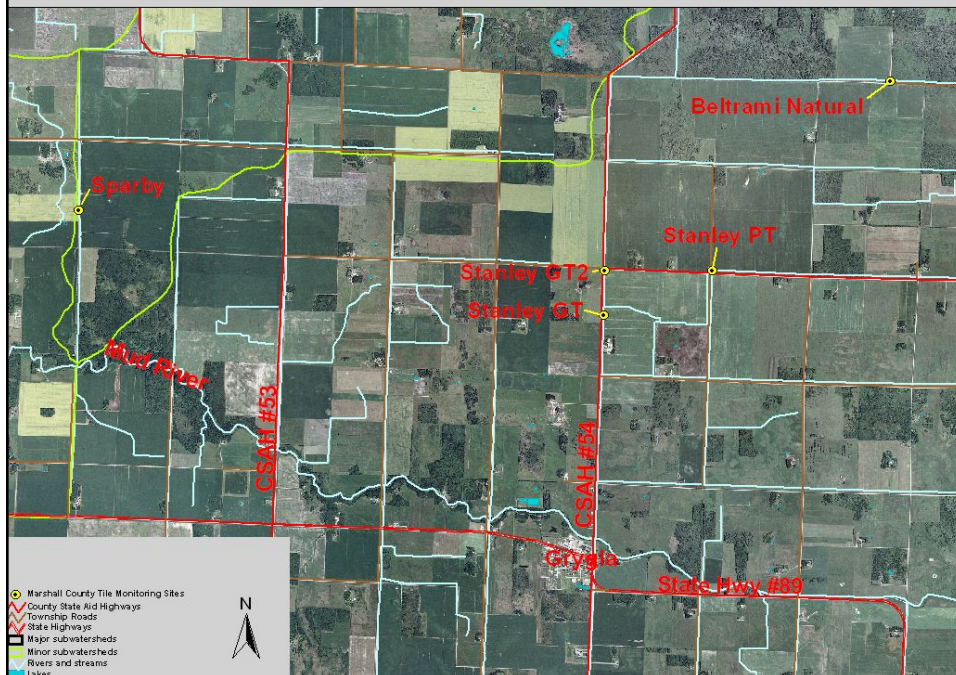
Water Quality Comparisons

- **Conventional Agriculture**
 - Different types of tile outlets
 - Different areas within the Red Lake River Watershed
 - Tile Drainage vs. Surface Drainage vs. Natural Background WQ
- **Wild Rice Paddy Drainage**
 - Different types of drainage systems

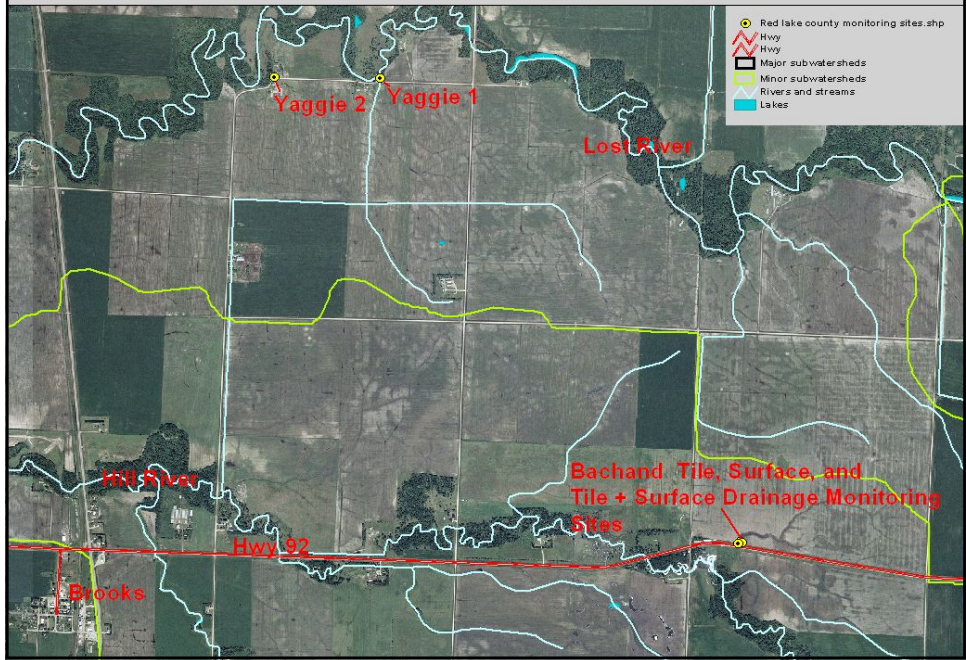
Water Quality Sites

- **Marshall County (near Grygla)**
 - Gravity tile, pumped tile, surface drainage, “reference” natural background site
- **Red Lake County near Brooks**
 - Tile and surface drainage from tiled field
 - Surface drained field
- **Clearwater County Hangaard Township**
 - Red Lake Nation wild rice paddies
 - Completely surface drained
 - Combination of tile and surface drainage
 - Completely tile drained (pattern to main line, out of the paddy to a grassed waterway)

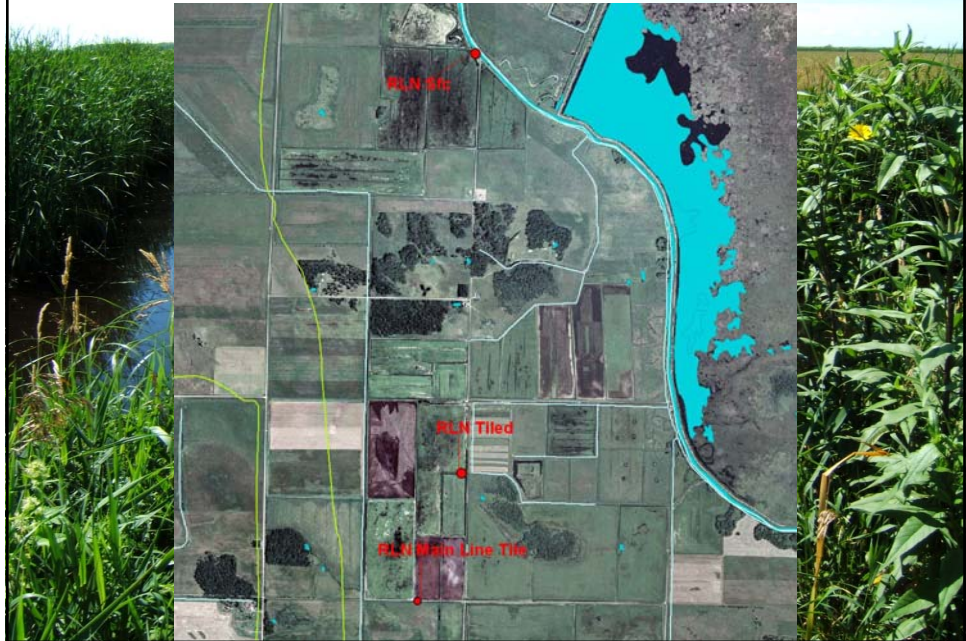
Marshall/Beltrami County Tile Drainage Monitoring Sites



Red Lake County Tile Drainage Monitoring Sites



Clearwater County (Wild Rice) Sites



Water Quality Sampling

- **Parameters**
 - Total Phosphorus
 - Orthophosphorus
 - Nitrates
 - Total Nitrogen
 - Total Suspended Solids
- **Frequency**
 - At least bi-weekly, more frequent during high flow events
 - Sampling during runoff events is essential
 - Wild rice paddies sampled intensively during drawdown in late July, early August

Tile Water Quality Findings So Far – Dry Land Ag

- **Very low turbidity**
 - <1 NTU
 - Often similar to distilled water
- **Minimal Phosphorus and Total Suspended Solids**
 - TP interferences
- **Nitrates range from mid-teens to over 40 mg/L**
 - Drinking Water Standard is 10 mg/L
 - Mud River – 0.43 mg/L avg., 3.16 mg/L max
 - Hill River – 0.61 mg/L avg., 1.84 mg/L max
 - RRV ecoregion - .20 mg/L
- **Good DO levels, but high conductivity**

Surface Drainage Water Quality

- Not many samples in 2005
- Significantly higher turbidity levels vs. tile drainage – sometimes extreme
- Higher orthophosphorus
- Higher total Kjeldahl nitrogen
- Lower nitrate concentration

Wild Rice Paddy Water Quality Results



Wild Rice Paddy Water Quality Results

- Main line tile had much cleaner water than the surface drained paddy and the tile & sfc drained paddy



Wild Rice Paddy Water Quality Results

- Simply having tile within a paddy is not enough to achieve WQ benefits
 - Need main line tile
 - Eliminate internal surface drainage
- Wild rice paddy sites had low nitrate levels
 - Saturated/ponded conditions?
 - Plant Uptake?
- Main line tile nearly meets drinking water standards. Occasional measured suspended solids could be due to mineral buildup on inside of outlet/pipe

Wild Rice Paddy Water Quality Results

- Incentives for the installation of main line tile in wild rice paddies would drastically improve water quality within the Clearwater River during the discharge months of Jul-Sept.
- Benefits to Farmer
 - More even quality, maturity
 - Less ditch maintenance
 - Fewer ruts during harvest
 - More control over drainage
 - No topsoil loss



Flow Comparisons

Accurate, continuous measurement of flow

- Tile Drained Field
- Surface Drained Field
- Onset HOB0 Level Loggers
- Need to quantify both surface and tile flow from the tile drained field.



Flow Comparisons

- Needed to find a field or part of a field in which all drainage can be measured, preferably at a single point
- Site selection was a longer and more difficult than anticipated at the start of the project
- Compare peak flow & total flow between the two types of drainage

How will surface flow be measured?

- H flumes
 - Yaggie 2 Surface Drained Field
 - Sfc Drainage from Bachand Tiled Field



How will tile flow be measured?

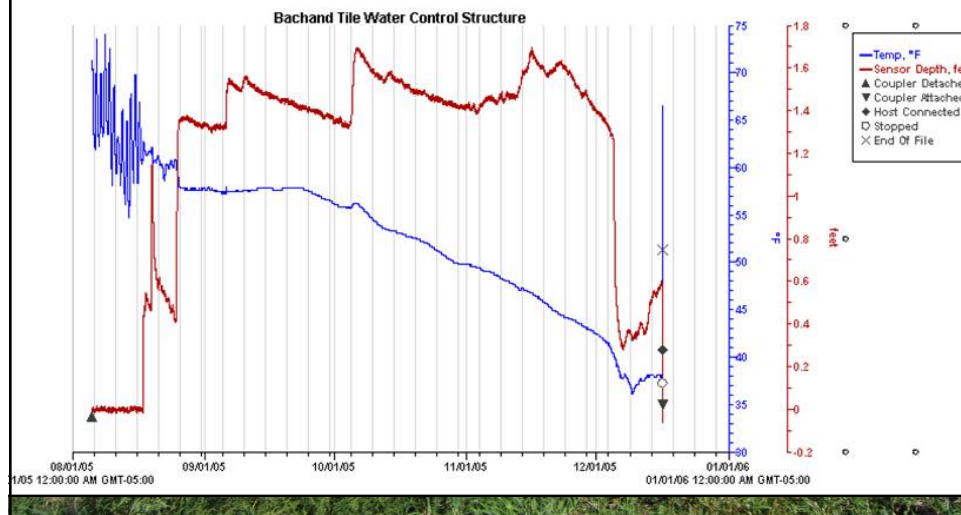
- Water control structure w/ v-notch weir



Flow Monitoring Results

- Late start in 2005 – will get a more complete record in 2006
- Surface drainage is “flashy”
- Tile drained field
 - Very little surface runoff
 - Tile drainage – storage in soil
 - Field was plowed perpendicular to flow
 - Delayed drainage during a storm
 - Flow from tile continues long after a storm

Flow Monitoring Results



Future Monitoring Plans

- **Late start in 2005, but we now have a really good set of sites**
 - start ASAP during spring runoff in 2006
- **Begin recording the amount of sfc. and tile drainage from the flow monitoring sites.**
- **Repeat RLN wild rice paddy sampling**
 - quantify flow from main line tile site
- **Involve the Red Lake County SWCD**
- **Official report of findings this Fall**
- **Possible continuation of some monitoring**
 - especially flow

Questions?

