The Lower Loup Natural Resources District
Area 28 Groundwater Management Study
Project Summary
October 25, 2012

• Project Goals
• Work Completed
• Project Results/Recommendations
Project Goals

• To identify/understand the sources of nitrate contamination and the hydrogeologic setting of Area 28.

• To provide recommendations on best management practices to help reduce nitrate levels in groundwater.
Project Task List

✓ Task 1 – Compile Existing Data
✓ Task 2 – Database Development
✓ Task 3 – GIS Mapping/Development
✓ Task 4 – Well Installation
✓ Task 5 – GW Well Sampling
✓ Task 6 – Age Dating Testing
✓ Task 7 – Isotope Testing
✓ Task 8 – Recharge Monitoring
✓ Task 9 – Project Management
✓ Task 10 – Status Presentations
✓ Task 11 – Report Preparation
Task 4 – Well Installation

- Installed 12 permanent groundwater monitoring wells.
Permanent Monitoring Well Locations
Geologic Cross Sections (A-A’, B-B’)

Legend:
- No Sample
- Clay
- Silt
- Sand
- Gravel
- Limestone (Nottapah Formation)
- shale (Carlife Formation)
- Sand and Gravel
- Silt and Clay
- Well Casing
- Screen interval

Sources:
University of Nebraska - Conservation and Survey Division (CSD)
3D Fence Diagrams

Source: University of Nebraska - Conservation and Survey Division (CSD)

FENCE DIAGRAM
Area 28 - Lower Loup NRD
Nance and Platt Counties, Nebraska

OLSSON ASSOCIATES
3D Hydrogeology of Area 28
3D Hydrogeology of Area 28
3D Hydrogeology of Area 28
3D Hydrogeology of Area 28
3D Hydrogeology of Area 28
3D Hydrogeology of Area 28
# Task 5 – GW Well Sampling

## Area 28 Nitrate Sampling Results

### Nitrate Concentration (mg/L)

<table>
<thead>
<tr>
<th></th>
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<td>11</td>
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<td>0</td>
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<td>0.59</td>
<td>16.9</td>
<td>10.7</td>
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The Lower Loup Natural Resources District - Area 28 Groundwater Management Study
Average Groundwater Sample Results

- Confining units have influenced nitrate concentrations
- Nitrate contamination increases to the east
- Nitrate contamination highest in shallow wells, lowest in confined wells
- Exception to this is A28-C1 Deep
Task 6 - Groundwater Age Dating

<table>
<thead>
<tr>
<th>Sample I.D.</th>
<th>Age using EA Method (yrs)</th>
<th>Age Error +/- (using EA)</th>
<th>Screen Interval (Feet bgs)</th>
<th>Midscreen (feet bgs)</th>
<th>Depth to Water (Feet below TOC)</th>
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<tbody>
<tr>
<td>A1-Shallow</td>
<td>TBD</td>
<td>TBD</td>
<td>5-10</td>
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<td>A1-Deep</td>
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<td>0.6</td>
<td>53-58</td>
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<td>B1-Shallow</td>
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<td>4-9</td>
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<td>B1-Deep</td>
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<td>0.7</td>
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<td>3.0</td>
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<td>120-125</td>
<td>122.5</td>
<td>73.51</td>
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</table>

Notes:
- Cross section lithology symbols described in Figure 4
- Pink boxes indicate confined conditions
- bgs = below ground surface
- EA= Excess Air Method
- TOC = top of casing
- TBD = To Be Determined – analysis pending at the time of report publication

Results and relative age interpretations from the University of Utah, Dissolved and Noble Gas Laboratory
Task 7 - Nitrogen Isotope Analyses

Lower Loup NRD, Area 28 Nitrate Study
Nitrate Isotope Evaluation

Fertilizer
Livestock Waste

Nitrate from Fertilizer
Soil Nitrate
Nitrate from Animal Waste / Sewage

A28-E1 Shallow
A28-D1 Shallow
A28-C1 Shallow
Task 3 – GIS Mapping Interpretation

• Prepare GIS maps and datasets illustrating the hydrogeology and nitrate contamination
  – Why? to see if there is any correlation between the distribution of nitrates and mapped datasets.
STATSGO Soils and 2011 Nitrates
Depth to Water and 2011 Nitrates
Depth to Bedrock and 2011 Nitrates
Land Use and 2011 Nitrates
Average Application Exceeding NRD Recommendation and 2011 Nitrates
Basis for Final Recommendations in Report

- GIS Mapping Findings
- UNL and other research
- Workable Solutions
  - NRD
  - Farmers
  - Crop Consultants
  - Costs / Funding
NRD Recommended N Rates

• Revise rates to match UNL Calculator
• Differences with UNL Calculator
  – Organic matter N mineralization
  – Application timing – 5% reduction for split app
  – Manure application
    • 15%, 7%, 4% of N release in subsequent years
    • Accounts for ammonia loss depending on incorporation
• Phase IV – Do not allow more than recommendation
Fertigation

• Match fertilizer application to crop need
• Reduce N loading and potential for leaching
• In-season adjustments versus forecasting
• Use in sprinkler or drip irrigation
Convert from Flood Irrigation

- Sprinkler irrigation
- Drip irrigation for small or odd-shaped fields
- Other irrigation efficiency improvements
- CPNRD research 50% of groundwater nitrate reductions from conversion from flood to sprinkler
Cover Crops

- Planted after fall harvest
- Uptake excess N
- Above ground N sink
- Growing during highest leaching potential
- Release N with decomposition in spring
- MN research reduced N losses by 11-13%
Irrigation Scheduling

- Nitrate issues combination of N and leaching
- UNL Checkbook Method
- Modified ET gauges
- Soil moisture probes
- Combination of the above
- One inch of deep percolation 5 to 25 lbs N
Other Items Evaluated
Potential Future Consideration

• Additional manure management
• Crop rotations and/or alfalfa
• Further narrow pre-plant window
• Variable rate N, N sensors, etc.
• Controlled release fertilizer
• Expected yield revisions
Recommendations Summary

1. NRD recommended N rates
2. Fertigation
3. Conversion from flood irrigation
4. Cover crops
5. Irrigation scheduling
Questions?

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