**PROJECT TITLE:**Adapting 4R Management for the Red River Basin

**I. PROJECT STATEMENT**

There is an urgent need for effective strategies to reduce nutrient runoff in Northern Minnesota’s Red River Basin. Minnesota’s Red River Basin watershed is on the leading edge of the expansion of the Northern Corn Belt. With this expansion comes increases in subsurface (tile) drainage, changes in fertilizer application, and alterations in patterns of nutrient loss. This region is not only undergoing a transformational shift in agricultural practices. It also is also experiencing a transformational threat to public health and aquatic ecosystems: harmful algal blooms (HABs). In Minnesota, HABs have led to serious incidents including human illness and pet deaths. Motivating producers to change production practices based on environmental impact is often difficult. Common middle ground can be found through improvement in nutrient utilization to minimize off-site nutrient loss. The 4R Nutrient Stewardship framework encourages thinking critically about nutrient application. The goal is to apply nutrients at the Right Rate, in the Right Place, at the Right Time, and from the Right Source. Previous research has shown that the 4R framework can help to meet load reduction goals in Ohio’s similarly flat Western Lake Erie Basin watershed. While promising, the 4R framework must be tested in the harsh winters, wet springs, and dry summers of Northern Minnesota. Defining and adapting 4R Nutrient Stewardship for the Red River Basin is critical to reducing the extent and severity of nutrient runoff from agricultural land to Minnesota’s freshwater lakes. Specific project objectives include:

* Evaluate the dual water quality and production benefits of 4R Nutrient Stewardship in the Red River Basin
* Develop outreach programming and resources to engage with stakeholders on 4R Nutrient Stewardship

**II. PROJECT ACTIVITIES AND OUTCOMES**

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| **Activity 1: Establish a Research Network North-to-South across the Red River Basin (ENRTF: $266,665)***We propose to form a basin-wide, regional research network. This research network will collaborate with, and build upon four (4) existing research sites from the Minnesota Department of Agriculture Minnesota Agricultural Water Resource Center’s Discovery Farms Program, and one (1) existing EOF research site in Manitoba in partnership with Canada’s Agricultural Water Futures. Existing EOF data will be analyzed collectively with data from two (2) new EOF sites in Minnesota. Adding two new research sites to this effort will strengthen the reliability of project findings through replication of results over time and broader coverage across landscapes.* |
| **Outcome** | **Completion Date** |
| *1. Install monitoring equipment to establish two new edge-of-field research sites in Northern Minnesota*  | *Spring 2020* |
| *2. Collect baseline data on nutrient loss and farmer management practices* | *Spring 2022* |
| *3. Network of nutrient loss results spanning from north to south across the Red River Basin* | *Spring 2022* |
| *4. Publish one peer-reviewed synthesis paper of nutrient loss trends in Red River Basin* | *Spring 2023* |

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| **Activity 2: *Quantify nutrient loss reduction when using “Right Placement” on nutrient loss in drained and undrained fields (*ENRTF: $165,565)***We propose to conduct a coordinated field experiment on fertilizer placement on four of the field sites included in the Research Network. Activity 2 builds on Activity 1 to quantify the impact of 4R Nutrient Stewardship practices on the productivity, profitability, and environmental sustainability of crop production for the Red River Basin. Three fields will be located on glacial lakebed soils in the northern, central, and southern portions of the Red River Basin. A fourth site will be located in the central basin on the sandy soils of the Lake Agassiz beach ridge. This experiment will evaluate four treatments at each site location:*1. *Subsurface Drainage, fertilizer incorporated with tillage*
2. *Subsurface Drainage, fertilizer injected or banded into the root zone (subsurface placement)*
3. *No subsurface drainage, fertilizer incorporated with tillage*
4. *No subsurface drainage, fertilizer injected or banded into the root zone (subsurface placement)*
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| **Outcome** | **Completion Date** |
| *1. Conduct coordinated fertilizer placement experiment* | *Spring 2024* |
| *2. Critical findings on the interactions of fertilizer management and off-site nutrient loss* | *Spring 2024* |
| *2. Publish one peer-reviewed journal article on experimental findings* | *June 30, 2024* |

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| **Activity 3: Develop outreach programming and resources on 4R Nutrient Stewardship (ENRTF BUDGET: $26,987)***Engagement with stakeholders is critical to adoption of sustainable nutrient management. Our team will produce outreach materials from the start of the project using data from on-going and current projects. As Activities 1 and 2 progress, we will build on these materials and share with the stakeholder networks of the project partners. Stakeholders include growers, nutrient service providers (including co-op agronomists and crop consultants), research and extension personnel, government staff, and the public. We will present findings through field days, seminars, meetings, extension bulletins, news articles, and peer-reviewed manuscripts. The newly established research site in Crookston, MN will serve as a demonstration site for community engagement. The proposed site would be in a highly visible, easily accessible location adjacent to the UMN Crookston campus and Crookston High School. Educational tours will introduce students and community leaders with the efforts of local producers to improve nutrient utilization and reduce off-site nutrient loss.* |
| **Outcome** | **Completion Date** |
| *1. Establish Crookston Research and Demonstration Site*  | *Spring 2020* |
| *2. Host 4R Field Day Events in Northwest Minnesota* | *Summer 2021, 2022, and 2023* |
| *3. Share findings on 4R Nutrient Stewardship with stakeholders*  | *June 30, 2024* |

**III. PROJECT PARTNERS AND COLLABORATORS:**

**Dr. Lindsay Pease**, UMN-Northwest Research and Outreach Center (*ENRTF Supported*)

**Dr. Jeppe Kjaersgaard**, MN Dept of Agriculture (No ENRTF Funds)

**Dr. Heidi Peterson**, UMN-Adjunct (No ENRTF Funds)

**Warren Formo**, MN Agricultural Water Resources Center (No ENRTF Funds)

**Leif Fixen**, The Nature Conservancy (No ENRTF Funds)

**Dr. Amitava Chatterjee**, North Dakota State University (No ENRTF Funds)

**Dr. David Lobb, Univ**. of Manitoba (No ENRTF Funds)

**Mitchell Timmerman**, Manitoba Agriculture (No ENRTF Funds)

**Dr. Merrin Macrae** Univ. of Waterloo (No ENRTF Funds)

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

This project has partial funding through 2024. Acquired funding includes $800,000 from the 4R Research Fund, $35,000 from the Red River Watershed Management Board, and $60,000 from the UMN Northwest Research and Outreach Center. Following the conclusion of this experiment, sponsored funding will be sought to continue data collection and conduct additional experiments on plot infrastructure established as part of this project.

**V. SEE ADDITIONAL PROPOSAL COMPONENTS:**

**A. Proposal Budget Spreadsheet**

**F. Project Manager Qualifications and Organization Description**