Request for Pre-Applications
Iowa Department of Agriculture and Land Stewardship

Water Quality Initiative
Targeted Demonstration Watershed Projects

Pre-Applications are Due:
NO LATER THAN 5:00 PM
Monday, November 17, 2014
PROGRAM OBJECTIVES AND DESIRED OUTCOMES
The Iowa Department of Agriculture and Land Stewardship (IDALS) is issuing this request for pre-applications (RFP) to provide funding for targeted watershed demonstration projects.

IDALS is seeking pre-applications for watershed demonstration projects located in the priority HUC8 watersheds (see enclosure) adopted through the Water Resources Coordinating Council (WRCC) which is comprised of 19 state and federal agencies and academic institutions. These priority watersheds were developed by a working group of the WRCC membership that included IDALS, DNR, NRCS, and the University of Iowa along with diverse private sector stakeholder input from cities, businesses, industries, utilities, environmental organizations, and agricultural organizations through the Watershed Planning Advisory Council (WPAC) representative on this working group.

IDALS is seeking applications for projects that demonstrate strong ties to the Iowa Nutrient Reduction Strategy by focusing on adoption of practices outlined in the science assessment that have the highest potential to provide nutrient load reductions to water resources in combination with outreach and education components demonstrating how projects will work to support the nonpoint source action items outlined in Section 1 of the Strategy. The Iowa Nutrient Reduction Strategy can be viewed at http://www.nutrientstrategy.iastate.edu.

Applicants should demonstrate a proven track record of delivering these types of activities and established strong partnerships with stakeholders that have or will be contributing significant resources to the project.

Desired outcomes for these projects will include concentrated efforts to demonstrate conservation practices paired with strong outreach/education components to disseminate information on these practices to promote increased awareness and adoption of available practices and technologies for achieving reductions in nutrient loads to surface waters. Quarterly, annual, and final reports will be required to document project progress and products as well as to provide aggregate accounting of practice adoption levels. Successful projects will serve as local and regional hubs for demonstrating practices and providing practice information to farmers, peer networks, and local communities. We look forward to working with applicants for these funds to support demonstration projects across the state in priority HUC8 watersheds.

ELIGIBLE PRIORITY WATERSHED AREAS
Projects must be located within priority HUC8 watersheds that have been identified by the Water Resources Coordinating Council (WRCC). A map is attached for reference. These HUC8 watersheds include all or parts of 68 Iowa counties and include 429 HUC12 subwatersheds. The priority HUC8 watersheds are:

- Floyd
- North Raccoon
- Skunk
- East Nishnabotna
- Boone
- South Skunk
- West Nishnabotna
- Middle Cedar
- Turkey

WATERSHED SCALE FOR PROJECTS
Applications will be accepted for individual HUC12 watershed projects within the priority HUC8 watersheds. Applications will also be accepted for individual projects that group multiple HUC12 watersheds into one project. All HUC12 watersheds included in the project application must be located within the boundaries of the priority HUC8 watersheds listed above. Multiple applications for separate projects may be submitted by interested parties.

ELIGIBLE APPLICANTS
Soil and Water Conservation Districts (SWCDs), watershed groups, and other non-governmental organizations (NGOs) are eligible to submit applications. Due to the nature of this demonstration program and the emphasis on conservation practice implementation and documentation supportive of the nutrient reduction strategy, watershed groups and NGOs are strongly encouraged to partner with associated SWCDs. Applicants are also strongly encouraged to partner with or otherwise involve support from agricultural retailers that are uniquely qualified to provide assistance working with farmers on management practices.
**ELIGIBLE EXPENSES**

Eligible expenses include:

- Project costs for cost-sharing of practices (State funds not to exceed 50% of cost)
- Outreach/education components such as field days, publications, signs, and informational meetings
- Technical assistance and staffing needs for project coordination and implementation

**PROJECT DURATION**

Projects funded under this RFA will be allowed up to three years for initial project duration with the possibility of future extensions depending on future funding availability and project performance. Project funds will be available upon execution of a funding agreement with IDALS and projects cannot incur reimbursable expenses before that time.

**DISBURSEMENT OF FUNDS**

The Primary Grantee will be responsible for submitting payment requests to IDALS. Payments for Technical Assistance/Staffing will be available through a monthly advance payment schedule which will be outlined in the project agreement. All other expense payments will be made on cost reimbursable basis. The Grantee will submit invoices and/or other required documentation to IDALS for the disbursement of funds. An explanation of the process and the required documentation will be provided to the Grantee by IDALS as part of the project agreement process.

**FISCAL MANAGEMENT**

The Primary Grantee must include documentation of their ability to provide appropriate fiscal management of the funds requested in the project application. If the group is unable to meet this requirement themselves, they may include documentation of their partnership with an entity that has an appropriate fiscal management structure in place in order to be considered an eligible applicant.

**PRE-APPLICATION DETAILS**

Pre-applications must be submitted following the format and page limits provided. Maps and letters of support will not count against stated page limits. Pre-applications will be reviewed by IDALS, and proposals requested to submit full applications will be notified by December 1, 2014.

**FULL-APPLICATION DETAILS**

Full-applications will be requested by a select number of pre-applications based an internal review by IDALS. Applicants requested to provide full applications to IDALS will be notified by December 1, 2014 and full applications expected to be due by February 1, 2015. Additional guidance on developing a full proposal will accompany notification to applicants by IDALS on December 1, 2014.

The projected timeline for the complete application process is detailed below:

- Pre-applications open: October 13, 2014
- Pre-applications due: November 17, 2014
- Selected pre-applications notified: December 1, 2014
- Full-applications due: February 2, 2015
- Selected full-applications notified: February 25, 2015
- Anticipated project start date: April 1, 2015

**PRE-APPLICATION REVIEW & SELECTION**

Pre-applications will be reviewed by IDALS. Notification by IDALS of request to submit full applications is December 1, 2014. Selected applicants will have the opportunity to meet with a representative(s) of IDALS at a mutually agreed upon time and location to discuss the pre- and full-application prior to the full-application due date of February 1, 2015.
Pre-Application Evaluation Factors (points in parentheses- 170 points possible)

- Scope and objectives correlation to the Iowa Nutrient Reduction Strategy (25)
- Collaborative outreach/education efforts to increase practice adoption and disseminate information broadly (25)
- Demonstrated landowner willingness/participation levels (20)
- Project evaluation: Are the expected outcomes measurable and is the evaluation plan suitable for measuring the outcomes? (20)
- Integration of in-field and edge-of-field practices (15)
- Targeting of most effective practices to areas providing most benefit (15)
- Identified financial and in-kind support available from project partners as matching funds/resources (15)
- Demonstrated need for project (10)
- Justification of staffing and technical resource costs for proposed project activities (10)
- Justification of identified watershed(s) (10)
- Farmer recognition efforts associated with project (5)

**PRE-APPLICATION ASSISTANCE**
For help with pre-applications you may obtain assistance from the Regional Coordinator for your area:

- Bob Waters - Western Iowa-515-306-7012 or Bob.Waters@Iowaagriculture.gov
  - Floyd
  - East & West Nishnabotna
  - North Raccoon
- Jeff Tisl - Northeast Iowa-563-422-6201 or Jeff.Tisl@Iowaagriculture.gov
  - Turkey
  - Middle Cedar
  - Boone
- James Martin - Southeast Iowa-641-472-8411 ext. 104 or James.Martin@Iowaagriculture.gov
  - Skunk
  - South Skunk
- Kyle Ament - North Central Iowa-515-242-6196 or kyle.ament@dnr.iowa.gov
  - North Raccoon

**SPECIAL NOTES**
The Iowa Department of Agriculture and Land Stewardship (IDALS) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.)

Distribution of pre-applications is limited to people involved in the review process, but note that all pre-applications and subsequent reports and related information are in the public domain. All reports related to funded projects will be made available to all interested parties in printed, electronic, or other means of communication, without discrimination.

Names, addresses and telephone numbers of Project Coordinators (from funded projects) may be provided to interested news entities, farmers, ranchers, or organizations for subsequent inquiries. Applications are used in the peer review process and submission of an application establishes consent by the author for appropriate distribution to fulfill review requirements.

Selected applicants of pre-applications will be requested to provide a full-application for consideration of funding. Full-applications approved for funding will be required to enter into a project agreement with IDALS. Sponsors of approved projects will be required to submit quarterly, annual, and final project reports utilizing forms and guidance provided by IDALS.
PROCEDURE FOR SUBMITTING PRE-APPLICATIONS
Submit one electronic copy project application to IDALS. Arrival date and time of the electronic copy will be used to determine whether an application has been submitted on time. **Pre-applications must be received by 5:00 pm on November 17, 2014.**

Applications will be accepted by either of the following methods:

1. Submit the electronic copy of the pre-application on some type of magnetic storage medium (CD, Flash drive, etc.) and deliver it to the address below:

   Iowa Department of Agriculture and Land Stewardship
   Division of Soil Conservation
   c/o Mary Baker
   502 East 9th Street
   Des Moines IA 50319

2. Submit the electronic file containing your application in an attachment by e-mail addressed to Mary.Baker@iowaagriculture.gov. The file size limit for submission of applications by e-mail is 10MB in size. Hard copies of the pre-application will not be accepted without an electronic copy.

If you need assistance submitting your pre-application, please contact Mary Baker at 515-281-4246 or Mary.Baker@iowaagriculture.gov.
Proposal Cover Sheet: (1 page maximum)
Provide the Following Information on the Proposal Cover Sheet. Additionally, include the signature of the District Chairperson Authorizing submission of the proposal.

1. Project Title:
   Applicant Entity:
   Contact Person:
   Address:
   Phone:
   E-mail:

2. List the Name(s) and HUC number(s) of HUC12 watersheds included in the proposal:

3. Project duration, including anticipated start and completion dates:

4. Include a listing of all project partners at the time of pre-application:

5. Provide a budget summary, utilizing the format shown here:

<table>
<thead>
<tr>
<th></th>
<th>IDALS Request</th>
<th>Partner Contributions</th>
<th>Landowner Contributions</th>
<th>Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Year 2</td>
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<tr>
<td>Year 3</td>
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<tr>
<td>Overall</td>
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</tbody>
</table>

Proposal Narrative: (4 page maximum)
Provide brief, yet thorough, responses to the following set of questions, with the number and title for each of the sections at the top of the corresponding response. The Regional Basin Coordinator for your area can offer assistance with your responses.

1. Project Overview
Provide a brief overview of the proposed approach to the demonstration project. Address the following questions in your response:

- What are the critical watershed opportunities and/or focus area(s) that will be addressed by your project?
- How is the opportunity important in demonstration and advancement of the Iowa Nutrient Reduction Strategy?
- What is the specific action that your project will take to address this focus or opportunity?
- What is the intended change that you hope to bring about?
- How is this change of importance and value in the area in which you are working, regionally, and/or statewide?
2. **Background Information**

Provide information on the HUC12 watershed(s) and the concern(s) to be addressed. This should include the need for the project, why it has been chosen, issue(s) to be addressed, a description of the watershed such as size and general location, HUC12 name(s), primary land uses, water bodies that are being affected by the concern(s).

What do farmers and landowners need in order to participate? What other groups: ag businesses, agronomists, conservation groups, consultants, others are needed to be involved in this project and how will they be engaged? How will you meet those needs for each of those groups so that they can actively participate in and support the project in achieving its intended change(s)?

What information available indicates landowner interest and willingness to participate in the project? What efforts, if any, have been conducted in the area in the past? What kind of community involvement is exhibited in the proposed project area?

3. **Project Objectives**

Provide information on the primary objectives of the proposed demonstration project. Describe any innovative approaches and what cross-cutting actions among partners taken across objectives.

How will this project be organized and managed to achieve the project’s intended change? How will this project achieve and implement the intended change?

How will this project communicate with producers and other stakeholders key to the project’s success, about its work in order to help achieve the intended change? Specify the audiences and stakeholder groups you intend to engage through the project.

How will project results be documented and disseminated to local, regional, and state-level stakeholders in order to connect project outcomes to the overall objectives of the Iowa Nutrient Reduction Strategy? Who are the specific audiences that will receive this information?

4. **Project Evaluation**

Describe your plans for evaluating the project. What evaluation indicators that will be measured or monitored at each stage of project implementation?

How will the project leaders, participants, and stakeholders know if the project is successful? What information will be collected to measure success, and how will it be collected? Indicators could include, but limited to these categories: inputs, attitudes, land/practice changes, water quality, etc.

Describe your evaluation plans for activities (process indicators) and for your results (outcome indicators). How will you measure the success of each outcome, including the evaluation indicators, information to be collected, and methods of measurement?

**Proposal Budget:** *(2 page maximum, including narrative)*

Use the table format shown on the following page to provide an estimated budget for the project. You are encouraged to copy and paste this table here into your proposal. Be sure to review column and row totals for accuracy. In addition to the tables, include a narrative providing the following information:

- Explain the amount and type of all local and partner contributions that will be made to the project. This may be in the form of in-kind contributions, cash contributions, or the commitment of other program funds to be used in conjunction with the financial assistance provided by the project. There is not a matching funds requirement for this program, but it is a consideration of the reviewers. Make sure that the role for staff whose costs are included in the budget is clear in the application.

- Provide detailed information on any anticipated subcontracts that will be funded through this project, including identified work products and costs associated with the subcontract.
Table 1. Budget Template

<table>
<thead>
<tr>
<th>Component</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Total</th>
<th>WQI</th>
<th>Local Match</th>
<th>Match Source(s)**</th>
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</thead>
<tbody>
<tr>
<td>Salary &amp; Benefits</td>
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<td>Equipment*</td>
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<td>Practices (list &amp; number)</td>
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<td>**TOTALS</td>
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</tbody>
</table>

*Provide detail on planned expenditures under Equipment and Other in the budget narrative.

**Include landowner contributions in local match. Use acronyms for other partners and identify acronyms in budget narrative.

Maps and Supporting Data:
Please attach any maps and other supportive data relevant to the proposal as Exhibits, labeling each Exhibit at the top of the first page.

The lead applicant is required to complete and sign the Minority Impact Statement included on the following page. This should be included in the application as Exhibit A.

Additionally, at a minimum, the proposal must include a map of the project area for the proposal which clearly delineates the name and location of all HUC12 watersheds to be included in the demonstration project. This map should be included as Exhibit B.

Letters of support and/or commitment of matching funds are not required as part of the pre-application, but will be required as Exhibits in the full application for applicants invited to submit full proposals.
Minority Impact Statement

Pursuant to 2008 Iowa Acts, HF 2393, Iowa Code Section 8.11, all grant applications submitted to the State of Iowa which are due beginning January 1, 2009 shall include a Minority Impact Statement. This is the state’s mechanism to require grant applicants to consider the potential impact of the grant project’s proposed programs or policies on minority groups.

Please choose the statement(s) that pertains to this grant application. Complete all the information requested for the chosen statement(s).

☐ The proposed grant project programs or policies could have a disproportionate or unique **positive** impact on minority persons.

   Describe the positive impact expected from this project:

   Indicate which group is impacted:

   ☐ Women   ☐ Persons with a Disability   ☐ Blacks
   ☐ Latinos   ☐ Asians   ☐ Pacific Islanders
   ☐ American Indians   ☐ Alaskan Native Americans   ☐ Other

☐ The proposed grant project programs or policies could have a disproportionate or unique **negative** impact on minority persons.

   Describe the negative impact expected from this project:

   Present the rationale for the existence of the proposed program or policy.

   Provide evidence of consultation of representatives of the minority groups impacted.

   Indicate which group is impacted:

   ☐ Women   ☐ Persons with a Disability   ☐ Blacks
   ☐ Latinos   ☐ Asians   ☐ Pacific Islanders
   ☐ American Indians   ☐ Alaskan Native Americans   ☐ Other

☐ The proposed grant project programs or policies are **not expected to have** a disproportionate or unique impact on minority persons.

   Present the rationale for determining no impact:

I hereby certify that the information on this form is complete and accurate, to the best of my knowledge:

Name: ___________________________  Title: ___________________________
Definitions

“Minority Persons”, as defined in Iowa Code Section 8.11, mean individuals who are women, persons with a disability, Blacks, Latinos, Asians or Pacific Islanders, American Indians, and Alaskan Native Americans.

“Disability”, as defined in Iowa Code Section 15.102, subsection 5, paragraph “b”, subparagraph (1): b. As used in this subsection:
(1) "Disability” means, with respect to an individual, a physical or mental impairment that substantially limits one or more of the major life activities of the individual, a record of physical or mental impairment that substantially limits one or more of the major life activities of the individual, or being regarded as an individual with a physical or mental impairment that substantially limits one or more of the major life activities of the individual.

"Disability” does not include any of the following:

a) Homosexuality or bisexuality.
b) Transvestism, transsexualism, pedophilia, exhibitionism, voyeurism, gender identity disorders not resulting from physical impairments or other sexual behavior disorders.
c) Compulsive gambling, kleptomania, or pyromania.
d) Psychoactive substance abuse disorders resulting from current illegal use of drugs.

“State Agency”, as defined in Iowa Code Section 8.11, means a department, board, bureau, commission, or other agency or authority of the State of Iowa.
Iowa Strategy to Reduce Nutrient Loss: Nitrogen Practices

This table lists practices with the largest potential impact on nitrate-N concentration reduction (except where noted). Corn yield impacts associated with each practice also are shown as some practices may be detrimental to corn production. If using a combination of practices, the reductions are not additive. Reductions are field level results that may be expected where practice is applicable and implemented.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Comments</th>
<th>% Nitrate-N Reduction*</th>
<th>% Corn Yield Change**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Application Rate</td>
<td>Nitrogen rate at the MRTN (0.10 N:corn price ratio) compared to current estimated application rate. (ISU Corn Nitrogen Rate Calculator – <a href="http://extension.agron.iastate.edu/soil">http://extension.agron.iastate.edu/soil</a> fertility/nrate.aspx can be used to estimate MRTN but this would change Nitrate-N concentration reduction)</td>
<td>10</td>
<td>-1</td>
</tr>
<tr>
<td>Nitrification Inhibitor</td>
<td>Nitrapyrin in fall – Compared to fall-applied without Nitrapyrin</td>
<td>9 (19)</td>
<td>6 (22)</td>
</tr>
<tr>
<td>Cover Crops</td>
<td>Rye</td>
<td>31 (29)</td>
<td>-6 (7)</td>
</tr>
<tr>
<td>Living Mulches</td>
<td>e.g. Kura clover – Nitrate-N reduction from one site</td>
<td>41 (16)</td>
<td>-9 (32)</td>
</tr>
<tr>
<td>Land Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perennial</td>
<td>Energy Crops – Compared to spring-applied fertilizer</td>
<td>72 (23)</td>
<td></td>
</tr>
<tr>
<td>Extended Rotations</td>
<td>Land Retirement (CRP) – Compared to spring-applied fertilizer</td>
<td>85 (9)</td>
<td></td>
</tr>
<tr>
<td>Grazed Pastures</td>
<td>At least 2 years of alfalfa in a 4 or 5 year rotation</td>
<td>42 (12)</td>
<td>7 (7)</td>
</tr>
<tr>
<td>Edge-of-Field</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drainage Water Mgmt.</td>
<td>No impact on concentration</td>
<td>33 (32)</td>
<td></td>
</tr>
<tr>
<td>Shallow Drainage</td>
<td>No impact on concentration</td>
<td>32 (15)</td>
<td></td>
</tr>
<tr>
<td>Wetlands</td>
<td>Targeted water quality</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Bioreactors</td>
<td></td>
<td>43 (21)</td>
<td></td>
</tr>
<tr>
<td>Buffers</td>
<td>Only for water that interacts with the active zone below the buffer. This would only be a fraction of all water that makes it to a stream.</td>
<td>91 (20)</td>
<td></td>
</tr>
<tr>
<td>Saturated Buffers</td>
<td>Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification.</td>
<td>50 (13)</td>
<td></td>
</tr>
</tbody>
</table>

* A positive number is nitrate concentration or load reduction and a negative number is an increase.
** A positive corn yield change is increased yield and a negative number is decreased yield. Practices are not expected to affect soybean yield.
* SD = standard deviation. Large SD relative to the average indicates highly variable results.
** This increase in crop yield should be viewed with caution as the side dress treatment from one of the main studies had 95 lb-N/acre for the pre-plant treatment but 110 lb-N/acre to 200 lb-N/acre for the side dress with soil test treatment so the corn yield impact may be due to nitrogen application rate differences.
Iowa Strategy to Reduce Nutrient Loss: Phosphorus Practices

Practices below have the largest potential impact on phosphorus load reduction. Corn yield impacts associated with each practice also are shown, since some practices may increase or decrease corn production. If using a combination of practices, the reductions are not additive. Reductions are field level results that may be expected where practice is applicable and implemented.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Comments</th>
<th>% P Load Reduction</th>
<th>% Corn Yield Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phosphorus Application</strong></td>
<td>Applying P based on crop removal – Assuming optimal STP level and P incorporation</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Soil-Test P – No P applied until STP drops to optimum</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td><strong>Source of Phosphorus</strong></td>
<td>Liquid swine, dairy, and poultry manure compared to commercial fertilizer – Runoff shortly after application</td>
<td>46 (45)</td>
<td>-1 (13)</td>
</tr>
<tr>
<td></td>
<td>Beef manure compared to commercial fertilizer – Runoff shortly after application</td>
<td>46 (96)</td>
<td></td>
</tr>
<tr>
<td><strong>Placement of Phosphorus</strong></td>
<td>Broadcast incorporated within 1 week compared to no incorporation, same tillage</td>
<td>36 (27)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>With seed or knifed bands compared to surface application, no incorporation</td>
<td>24 (46)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Cover Crops</strong></td>
<td>Winter rye</td>
<td>29 (37)</td>
<td>-6 (7)</td>
</tr>
<tr>
<td><strong>Tillage</strong></td>
<td>Conservation till – chisel plowing compared to moldboard plowing</td>
<td>33 (49)</td>
<td>0 (6)</td>
</tr>
<tr>
<td></td>
<td>No till compared to chisel plowing</td>
<td>90 (17)</td>
<td>-6 (8)</td>
</tr>
<tr>
<td><strong>Land Use Change</strong></td>
<td>Energy Crops</td>
<td>34 (34)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Retirement (CRP)</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grazed pastures</td>
<td>59 (42)</td>
<td></td>
</tr>
<tr>
<td><strong>Erosion Control and Edge-of-Field Practices</strong></td>
<td>Terraces</td>
<td>77 (19)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buffers</td>
<td>58 (32)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>Sedimentation basins or ponds</td>
<td>85</td>
</tr>
</tbody>
</table>

a: A positive number is P load reduction and a negative number is increased P load.

b: A positive corn yield change is increased yield and a negative number is decreased yield. Practices are not expected to affect soybean yield.

c: SD = standard deviation. Large SD relative to the average indicates highly variable results.

d: Maximum and average estimated by comparing application of 200 and 125 kg P₂O₅/ha, respectively, to 58 kg P₂O₅/ha (corn-soybean rotation requirements) (Mallarino et al., 2002).

e: Maximum and average estimates based on reducing the average STP (Bray-1) of the two highest counties in Iowa and the statewide average STP (Mallarino et al., 2011a), respectively, to an optimum level of 20 ppm (Mallarino et al., 2002). Minimum value assumes soil is at the optimum level.

f: P retention in wetlands is highly variable and dependent upon such factors as hydrologic loading and P mass input.