pinnacle
Environmental Compliance
...for agriculture

620 Country Club Road Iowa Falls, Iowa 50126 Office: (641) 648-7300 Fax: (641) 648-7310 www.pinnacleiowa.com

April 27, 2020

Re: Maxwell North Site

Attached you will find a Manure Management Plan, Construction Design Statement and Master Matrix for the Maxwell North Site.

The site does require a Master Matrix that you will find enclosed with a passing score. We will be attending the site visit with the DNR and we will attend the Supervisor meeting and any public hearings. Please sign the enclosed county verification and fax back to 641-648-7310 or e-mail to jean@pinnacleiowa.com. In the meantime, if you have any questions please call us at 641-648-7300.

Thank You,

Brian Ritland

Brian Ritland
Cell 515-290-8626

RECEIVED
MAY 01 2020
STORY CO.
HEALTH DEPT.

Please staple check here

Iowa Department of Natural Resources

Construction Permit Application Form

Confinement Feeding Operations

INSTRUCTIONS:

Prior to constructing, installing, modifying or expanding a confinement feeding operation structure[1], answer questions 1-8 on Item 3, Section A (page 2), to determine if a construction permit is required. To calculate the animal unit capacity (AUC) of the operation, complete Table 1 (page 4). If a construction permit is required, complete the rest of the form, have the applicant(s) sign it on pages 5 and 6. Mail to the DNR (see address on page 5) this application form, documents and fees requested in Checklist No. 1 or 2 (pages 10-15). See item 5 (page 5), to determine which checklist to use.

If a construction permit is not needed, some pre-construction requirements may still apply prior to the construction of a formed manure storage structure[2]. See page 5 for additional DNR contact information.

THIS APPLICATION IS FOR:

1. ☒ A new confinement feeding operation
2. ☐ An existing confinement feeding operation *(answer all of the following questions):*
   a) Facility ID No. (5 digit number): _____
   b) Date when the operation was first constructed: _____
   c) Date when the last construction, expansion or modification was completed: _____

(Not needed if the confinement operation has previously received a construction permit from DNR.)

d) Is this also an ownership change? ☐ Yes ☐ No If yes box is checked additional fees apply. See page 8

ITEM 1 – LOCATION AND CONTACT INFORMATION ***(See page 17 for instructions and an example)*:**

A) Name of operation: Maxwell North

Location:	NE	SW	17	T82N R22W	Indian Creek	Story
	(¼ ¼)	(¼)	(Section)	(Tier & Range)	(Name of Township)	(County)

B) Applicant information:

Name: Maxwell Farms, Inc. Title: Owner

Address: 31075 640th Ave., Maxwell, IA 50161

Telephone: 515-387-1374 Fax: _____ Email: _____

C) Person to contact with questions about this application (if different than applicant):

Name: Brian Ritland Title: Consultant

Address: 620 Country Club Rd., Iowa Falls, IA 50126

Telephone: 641-648-7300 Fax: 641-648-7310 Email: britland@pinnacleiowa.com

☒ Enclose aerial photo or engineering drawing showing the proposed location of the confinement feeding operation structure[1] and all applicable separation distances, as requested in Attachment 1 (pages 11-12 or 14-15). See example of aerial photo on pages 18 to 19, at the end of this form.

☐ I manage or have a 10% or more ownership interest in another confinement feeding operation located within 2,500 feet of the proposed site. Please contact the DNR AFO Program staff at (712) 262-4177 to verify site adjacency requirements.

[1] Confinement feeding operation structure = animal feeding operation structure (confinement building, manure storage structure or egg washwater storage structure) that is part of a confinement feeding operation. Manure storage structures include formed and unformed manure storage structures.
[2] Formed manure storage structure = covered or uncovered concrete or steel tanks, and concrete pits below the building.

ITEM 2 – SITING INFORMATION:

A) Karst Determination: Go to DNR AFO Siting Atlas at http://programs.iowadnr.gov/maps/afo/. Search for your site by either scrolling into your location or entering an address or legal description in the bottom search bar. Left click on the location of your proposed structure. Make sure the karst layer box is checked on the map layers. If you cannot access the map, or if you have questions about this issue, contact the AFO Engineer at (712) 262-4177. Check one of the following:

- [x] The site is not in karst or potential karst. Print and enclose the map with the name and location of the site clearly marked.
- [ ] The site is in karst. The upgraded concrete standards of 567 IAC 65.15(14)"c" must be used. Refer to "Applicant's submittal checklist" on page 10 for karst documentation.
- [ ] The site is within 1,000 feet of a known sinkhole, Secondary Containment Barrier is required in accordance with 567 IAC 65.15(17).

B) Alluvial Soils Determination: Go to the AFO Siting Atlas as described above. Make sure the alluvial layer box is checked on the map legend. If you cannot access the map, or if you have questions about this issue, contact DNR Flood Plain at (866) 849-0321. Check one of the following:

- [x] The site is not in alluvial soils. Print and enclose the map with the name and location of the site clearly marked.
- [ ] The site is in alluvial soils. You will need to submit a request for a flood plain determination from DNR Flood Plain (866) 849-0321. After receiving determination submit one of the following:
- [ ] Not in 100-year floodplain or does not require a flood plain permit. Include correspondence from the DNR Flood Plain Section.
- [ ] Requires flood plain permit. Include flood plain permit.
- [ ] Documentation has been submitted to determine site is not in alluvial soils. Refer to "Applicant's Submittal Checklist" on page 10 for alluvial soils documentation.

ITEM 3 – OPERATION INFORMATION:

A) A construction permit is required prior to any of the following:

1. [ ] Constructing or modifying any unformed manure storage structure[3], constructing or modifying a confinement building that uses an unformed manure storage structure[3], or increasing animal units in a confinement building that uses an unformed manure storage structure.
2. [x] Constructing, installing or modifying a confinement building or a formed manure storage structure[2] at a confinement feeding operation if, after construction, installation or expansion, the AUC of the operation is 1,000 animal units (AU) or more. This also applies to confinement feeding operations that store manure exclusively in a dry form.
3. [ ] Initiating a change that would result in an increase in the volume of manure or a modification in the manner in which manure is stored in any unformed manure storage structure[3], even if no construction or physical alteration is necessary. Increases in the volume of manure due to an increase in animal capacity, animal weight capacity or AUC up to the limits specified in a previously issued construction permit do not require a new construction permit.
4. [ ] Initiating a change, even if no construction or physical alteration is necessary, that would result in an increase in the volume of manure or a modification in the manner in which manure is stored in a formed manure storage structure[2] if, after the change, the AUC of the operation is 1,000 AU or more. Increases in the volume of manure due to an increase in animal capacity, animal weight capacity or AUC up to the limits specified in a previously issued construction permit do not require a new construction permit.
5. [ ] Constructing or modifying any egg washwater storage structure or a confinement building at a confinement feeding operation that includes an egg washwater storage structure.
6. [ ] Initiating a change that would result in an increase in the volume of egg washwater or a modification in the manner in which egg washwater is stored, even if no construction or physical alteration is necessary. Increases in the volume of egg washwater due to an increase in animal capacity, animal weight capacity or AUC up to the limits specified in a previously issued construction permit do not require a new construction permit.
7. [ ] Repopulating a confinement feeding operation if it was closed for 24 months or more and if any of the following apply:
   1. [ ] The confinement feeding operation uses an unformed manure storage structure[3] or egg washwater storage structure;
   2. [ ] The confinement feeding operation includes only confinement buildings and formed manure storage structures[2] and has an AUC of 1,000 AU or more.
8. [ ] Installing a permanent manure transfer piping system, unless the department determines that a construction permit is not required.

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3 Unformed manure storage structure = covered or uncovered anaerobic lagoon, earthen manure storage basin, aerobic earthen structure.

B) In your own words, describe in detail, the proposed construction, expansion, installation, modification or repair being proposed in this project.(Must be completed) Attach additional pages if necessary:

Construction of two 71'2" x 277' x 8' deep formed concrete manure storage structures covered by swine finishing buildings.

C) Master Matrix *(must check one)*. If any of boxes 1 to 3 are checked, the operation is required to be evaluated with the master matrix if the county, where the confinement feeding operation structure[1] is or would be located, has adopted a 'Construction Evaluation Resolution' (CER). Select the one that best describes your confinement feeding operation:

1. ☒ A new confinement feeding operation proposed in a county that has adopted a CER.
2. ☐ An existing operation constructed on or after April 1, 2002, in a county that has adopted a CER.
3. ☐ An existing operation constructed prior to April 1, 2002, with a current or proposed AUC of 1,667 AU or more, in a county that has adopted a CER.
4. ☐ None of the above. Therefore, the master matrix evaluation is not required.

D) Qualified Operation *(must check one)*. If any of boxes 1 to 4 are checked, the operation is also a 'qualified operation'. A qualified operation is required to use a manure storage structure that employs bacterial action which is maintained by the utilization of air or oxygen, and which shall include aeration equipment. However, this requirement does not apply if box 5 is checked. Select the one that best describes your confinement feeding operation:

1. ☐ A swine farrowing and gestating operation with an AUC of 2,500 AU or more. If the replacement breeding swine are raised and used at the operation, the animal units for those replacement animals do not count in the operations total AUC for the purpose of determining a qualified operation.
2. ☐ A swine farrow-to-finish operation with an AUC of 5,400 AU or more.
3. ☐ A cattle confinement feeding operation (including dairies) with an AUC of 8,500 AU or more.
4. ☐ Other confinement feeding operations with an AUC of 5,333 AU or more.
5. ☒ This is not a qualified operation because:
   a. ☒ It is below the limits shown on boxes 1 to 4.
   b. ☐ It includes a confinement feeding operation structure[1] constructed prior to May 31, 1995.
   c. ☐ It handles manure exclusively in a dry form (poultry).

ITEM 4 – ANIMAL UNIT CAPACITY (AUC) and, if applicable, ANIMAL WEIGHT CAPACITY (AWC):

A) Calculating AUC – Required for all operations

For each animal species, multiply the maximum number of animals that you would ever confine at one time by the appropriate factor, then add all AU together on Table 1 (page 4). Use the maximum market weight for the appropriate animal species to select the AU factor.

You must complete all applicable columns in Table 1. Use column a) to calculate the existing AUC, before permit for existing operations only. Use column b) to calculate the 'Total proposed AUC' (after a permit is issued) including new operations. The number obtained in column b) is the AUC of the operation and must be used to determine permit requirements. Use column c) to calculate the 'New AU' to be added to an existing operation. To calculate the indemnity fee (see page 7), also use column c), however, if the "Existing AUC" (column a) is 500 AU or less, enter the "Total proposed AUC" (column b) in the "New AU" (column c).

In calculating the AUC of a confinement feeding operation, you must include the AUC of all confinement buildings which are part of the confinement feeding operation, unless a confinement building has been abandoned. A confinement feeding operation structure[1] is abandoned if the confinement feeding operation structure[1] has been razed, removed from the site of a confinement feeding operation, filled in with earth, or converted to uses other than a confinement feeding operation structure[1] so that it cannot be used as a confinement feeding operation structure[1] without significant reconstruction. Therefore, in Table 1, enter the animal unit capacity of all the confinement buildings, including those that are from an "adjacent" operation located within 2,500 feet. For more information, contact the AFO Program at (712) 262-4177.

Table 1. Animal Unit Capacity (AUC): **(No. HEAD) x (FACTOR) = AUC**

Animal Species	a) Existing AUC (Before permit)			b) Total Proposed AUC (After permit)		
	(No. Head)	x (Factor)	= AUC	(No. Head)	x (Factor)	= AUC
laughter or feeder cattle		1.0			1.0	
Immature dairy cattle		1.0			1.0	
Mature dairy cattle		1.4			1.4	
Gestating sows		0.4			0.4	
Farrowing sows & litter		0.4			0.4	
Boars		0.4			0.4	
Gilts		0.4			0.4	
Finished (Market) hogs	0	0.4	0	4960	0.4	1984
Nursery pigs 15 lbs to 55 lbs		0.1			0.1	
Sheep and lambs		0.1			0.1	
Goats		0.1			0.1	
Horses		2.0			2.0	
Turkeys 7 lbs or more		0.018			0.018	
Turkeys less than 7 lbs		0.0085			0.0085	
Broiler/Layer chickens 3 lbs or more		0.01			0.01	
Broiler/Layer chickens less than 3 lbs		0.0025			0.0025	
Ducks		0.04			0.04	
Fish 25 grams or more		0.001			0.001	
Fish less than 25 grams		0.00006			0.00006	
TOTALS:		a) Existing AUC:	0		b) Total proposed AUC:	1984

(This is the AUC of the operation)

Note: If the "Existing AUC" (column a) is 500 AU or less, enter the "Total proposed AUC" (column b) in the "New AU" (column c)

c) New AU = b) - a): 1984

B) Calculating AWC - Only for operations first constructed prior to March 1, 2003

The AWC is needed for an operation that was first constructed prior to March 1, 2003, to determine some of the minimum separation distance requirements for construction or expansion.

The AWC is the product of multiplying the maximum number of animals that you would ever confine at any one time by their verage weight (lbs) during the production cycle. Then add the AWC if more than one animal species is present (examples on how to determine the AWC are provided in 567 IAC 65.1(455B).)

If the operation was first constructed prior to March 1, 2003, you must complete all applicable columns in Table 2:

Table 2. Animal Weight Capacity (AWC): **(No. head) * (Avg. weight, lbs) = AWC, lbs**

Animal Species	a) Existing AWC (Before Permit)			b) Proposed AWC (After permit)		
	(No. head) x	avg weight	= AWC	(No. head) x	avg weight	= AWC
Slaughter or feeder cattle						
Immature dairy cattle						
Mature dairy cattle						
Gestating sows						
Farrowing sows & litter						
Boars						
Gilts						
Finished (Market) hogs						
Nursery pigs 15 lbs to 55 lbs						
Sheep and lambs						
Goats						
Horses						
Turkeys 7lbs or more						
Turkeys less than 7 lbs						
Broiler/Layer chickens 3 lbs or more						
Broiler/Layer chickens less than 3 lbs						
Ducks						
ish 25 grams or more						
Fish less than 25 grams						
TOTALS:		a) Existing AWC:			b) Total proposed AWC:	

(This is the AWC of the operation)

c) New AWC = b) - a):

ITEM 5 – SUBMITTAL REQUIREMENTS Checklists No. 1 or 2 (pages 10-15) describe the submittal requirements, which are based on the type of confinement feeding operation structure[1] and AUC proposed. To determine which checklist to use, choose the option that best describes your confinement feeding operation:

A) ☒ Formed manure storage structures[2]: The proposed confinement feeding operation structure[1] will be or will use a formed manure storage structure[2]. Check one of the following boxes:

1. ☐ A swine farrowing and gestating operation with an AUC of 1,250 AU or more. Use Submittal Checklist No. 2 (page 13).
2. ☐ A swine farrow-to-finish operation with an AUC of 2,750 AU or more. Use Submittal Checklist No. 2 (page 13).
3. ☐ A cattle confinement feeding operation (including dairies) with an AUC of 4,000 AU or more. Use Submittal Checklist No. 2 (page 13).
4. ☐ Other confinement feeding operations with an AUC of 3,000 AU or more. Use Submittal Checklist No. 2 (page 13).
5. ☒ None of the above. Use Submittal Checklist No. 1 (page 10).

If any of boxes 1 to 4 are checked, the operation meets the threshold requirements for an engineer[4] and a Professional Engineer (PE), licensed in Iowa, is required. For these cases, use Submittal Checklist No. 2 (page 13).

If you checked box 5, your operation is below threshold requirements for an engineer[4] and a Professional Engineer (PE) is not required. Use Submittal Checklist No. 1 (page 10).

B) ☐ Unformed manure storage structure[3]: The proposed confinement feeding operation structure[1], will be or will use an unformed manure storage structure[3] or an egg washwater storage structure. A Professional Engineer (PE) licensed in Iowa must design and sign the engineering documents for any size of operation. Use Submittal Checklist No. 2 (page 13) and Addendum "A" (page 16).

ITEM 6- UTILIZING RURAL WATER SYSTEM FOR WATER SUPPLY

☐ The proposed facility will utilize rural water and the providing rural water system has been notified and is aware of the proposed increase in water use.

ITEM 7 – SIGNATURE:

I hereby certify that the information contained in this application is complete and accurate.

Signature of Applicant(s): _____ Date: 4/6/2020

MAILING INSTRUCTIONS:

To expedite the application process, follow the submittal requirements explained in Checklist No. 1 or 2 (pages 10 to 16), whichever applies. Page 1 of this form should be the first page of the package. Mail all documents and fees to:

Iowa DNR
AFO Program
1900 N Grand Ave
Gateway North, Ste E17
Spencer, IA 51301

(Note: Incomplete applications will be returned to the sender.)

Questions

Questions about construction permit requirements or regarding this form should be directed to an engineer of the animal feeding operations (AFO) Program at (712) 262-4177. To contact the appropriate DNR Field Office, go to http://www.iowadnr.gov/fieldoffice.

[4] Threshold requirements for an engineer apply to the construction of a formed manure storage structure[2]. Operations that meet or exceed the threshold requirements for an engineer are required to submit engineering documents signed by a professional engineer licensed in the state of Iowa. Please refer to Checklist No. 2 (pages 13-15).

ITEM 8

Interested Parties Form
Confinement Feeding Operation

'nterest means ownership of a confinement feeding operation as a sole proprietor or a 10 percent or more ownership interest held by a person in a confinement feeding operation as a joint tenant, tenant in common, shareholder, partner, member, beneficiary or other equity interest holder. Ownership interest is an interest when it is held either directly or indirectly through a spouse or dependent child, or both.

INSTRUCTIONS:

Please list all persons (including corporations, partnerships, etc.) who have an interest in any part of the confinement feeding operation covered by this permit application.

Full Name	Address	City/State	Zip
Jason Maxwell	31075 640th Ave.	Maxwell, IA	50161
Maxwell Farms, Inc.	31075 640th Ave.	Maxwell, IA	50161

For each name above, please list below all other confinement feeding operations in Iowa in which that person has an interest. Check box "None", below, if there are no other confinement feeding operations in Iowa in which the above listed person(s) has or have an interest.

Operation Name	Location (¼ ¼, ¼, Section, Tier, Range, Township, County)	City
☐ None [There are no other confinements in Iowa in which the above listed person(s) has or have an interest].		
Maxwell West	NW NE 20, 82N, 22W, Indian Creek, Story	Maxwell, IA 50161

I hereby certify that the information provided on this form is complete and accurate.

Signature of Applicant(s): Jason Maxwell Date: 4/6/2020

ITEM 9

Manure Storage Indemnity Fee Form for Construction Permits

CASHIER'S USE ONLY
0474-542-474A-0431
Facility ID #
County

Credit fees to: Maxwell Farms, Inc.

Name of operation: Maxwell North

INSTRUCTIONS:

1) Use the 'Total Proposed AUC' from column b), Table 1 (page 4), to select the appropriate fee line in the table below. The 'Total Proposed AUC' is the AUC of the operation.
2) Select the animal specie and row number (see examples). Enter the 'New AU' from column c), Table 1 (page 4). The 'New AU' is the number of AU to be added to an existing operation or being proposed with a new operation. **Note**: If the "Existing AUC" (column a) is 500 AU or less, enter the "Total proposed AUC" (column b) in "New AU" (column c).
3) Multiply the 'New AU' by the appropriate 'Fee per AU'. The resulting number is the indemnity fee due.

- **Example 1**: An existing swine operation is expanding from an 'Existing AUC' of 1,000 AU to a 'Total Proposed AUC' of 1,800 AU, and has previously paid an indemnity fee for the existing 1,000 AU. Calculate the indemnity fee as follows: The 'Total Proposed AUC' is between 1,000 AU and 3,000 AU; the animal specie is other than poultry; enter 800 AU in the 'New AU' column, row 4, and multiply it by $ 0.15:

  (800 AU) x ($ 0.15 per AU) = $ 120.00

- **Example 2**: An existing poultry operation is expanding from an 'Existing AUC' of 250 AU to a 'Total Proposed AUC' of 2,000 AU and has not paid the indemnity fee for animals housed in the existing buildings. Calculate the indemnity fee as follows: The 'Total Proposed AUC' is between 1,000 AU and 3,000 AU; the animal specie is poultry and the indemnity fee has not previously been paid, enter 2,000 AU in the 'New AU' column on row 3, and multiply it by $0.06:

  (2,000 AU) x ($ 0.06 per AU) = $ 120.00

- **Example 3**: If you are proposing a new swine confinement feeding operation with a 'Total Proposed AUC' of 3,500 AU, enter 3,500 AU in the 'New AU' column, row 6 and multiply it by $ 0.20:

  (3,500 AU) x ($ 0.20 per AU) = $ 700.00

- **Example 4**: If you are applying for a construction permit but you are not increasing the AUC of the operation, and has previously paid the applicable indemnity for the animals housed in the existing buildings, there is no indemnity fee due ($ 0.00). If no indemnity fee is due, do not submit this page.

Indemnity Fee Table:

Total Proposed AUC (After Permit (from column B, Table 1)	Row	Animal species	New AU (from column C Table 1)	x	Fee per AU	Indemnity Fee
Less than 1,000 AU	1	Poultry		x	$ 0.04 =	
	2	Other		x	$ 0.10 =	
1,000 AU or more to less than 3,000 AU	3	Poultry		x	$ 0.06 =	
	4	Other	1984	x	$ 0.15 =	297.60
3,000 AU or more	5	Poultry		x	$ 0.08 =	
	6	Other		x	$ 0.20 =	

ITEM 9 (Cont.)

Filing Fees Form
for Construction Permits

CASHIER'S USE ONLY
0473-542-473A-0431
0474-542-474A-0431
Facility ID #
County

Credit fees to: Maxwell Farms, Inc.

Name of operation: Maxwell North

INSTRUCTIONS:

1. If the operation is applying for a construction permit enclose a payment for the following:
   ☒ Construction application fee $250.00.
   (Note: This fee is non-refundable)

2. A manure management plan must be submitted with a filing fee.
   ☒ Manure management plan filing fee $250.00
   (Note: This fee is non-refundable)

3. If this is a change in ownership then indemnity fees must also be paid on the current (existing) total AUC at the appropriate rate on page 7.
   ☐ Indemnity fee due to ownership change $ _____

4. Total filing fees: Add the fees paid in items 1, 2 and 3 (above): $ 500.00

SUMMARY:

- Manure Storage Indemnity Fee (see previous page) to be deposited in the Manure Storage Indemnity Fee Fund (474)	$	297.60
- Total filing fees (see item 4 on this page) to be deposited in the Animal Agriculture Compliance Fund (473)	$	500.00
TOTAL DUE:	$	797.60

Make check payable to: Iowa Department of Natural Resources or Iowa DNR; and send it along with the construction application documents (See Submittal Checklist No. 1 or 2, pages 10-15.) Note: Do not send this fee to the county.

Construction Design Statement (CDS)

Instructions:

1. This form is for new or expanding confinement feeding operations with an AUC[1] of more than 500 AU, not required to have a professional engineer (PE)[2], that are proposing to construct a formed manure storage structure[3].
2. Complete and submit Sections 1, 2 and 3 (pages 1 to 6).
3. Complete and submit Section 4 (page 6) only if you are applying for a construction permit and are constructing three or more confinement feeding operation structures[4].
4. Mail only pages 1 to 6, as instructed on page 6 and 7. Do not mail the remainder of this form.
5. If the site-specific design is sealed by a PE[2], do not use this CDS instead use DNR Form 542-8122.

Section 1 - Information about the proposed formed manure storage structure[3](s)

A) Information about the operation:

Name of operation: Maxwell North Facility ID No.: N/A

Location: NE (¼ ¼) SW (¼) 17 (Section) T82NR22W (Tier & Range) Indian Creek (Name of Township) Story (County)

B) Description of the proposed formed manure storage structure[3]. Include dimensions (length, width, or diameter, depth). Indicate if it is aboveground or belowground; covered or uncovered, made of concrete or steel, address location of pit fans, if applicable, and address water line entry into buildings. If necessary attach more pages:

(2) -71'2" x 277" OD x 8' deep manure pit. Pit is below grade, covered by building and concrete slats.

The pit containment is constructed of reinforced concrete.

C) Utilizing Rural Water System and Domestic Sewage Disposal

☐ The proposed facility will utilize rural water and the providing rural water system has been notified and is aware of the proposed increase in water use.

☒ I understand that no domestic wastewater (toilets, showers, or sinks) or laundry facilities can be discharged to the manure storage structure.

D) Aerial photos: Aerial photos must be submitted that clearly show the location of all existing and proposed confinement feeding operation structures and show at least a one-mile radius around the structures. The photos must either show roads on the north and south or east and west sides of a section (so that a mile distance is apparent), or include a distance scale.

The photo(s) must show that the proposed structures comply with all statutory minimum required separation distances to the objects listed below:

- Residences (not owned by the permit applicant), churches, businesses, schools, public use areas
- Water wells (depends on type)
- Major water sources, wellhead or cistern of an agricultural drainage well or known sinkholes
- Water sources (other than major water sources) and surface intakes of an agricultural drainage well
- Designated wetlands
- Road right-of-way

The separation distance to each of the above objects must be noted with a straight line between the proposed structure(s) and the object. If any of the above objects is not located within one mile from the proposed structures, note the fact on the photo(s) or use additional pages. (Example: "No agricultural drainage wells within one mile.")

All separation distances that are not clearly in excess of the required minimum separation distance must be measured according to 567 IAC 65.11(9) using standard survey methods. Go to the DNR Fact Sheet Page on our website and select DNR fact sheet "Distance Requirements for Construction" to find the required separation distances. Or, go directly to the Minimum Separation Distances for Construction or Expansion of Confinement Feeding Operation Structures Form. An example aerial photo can be found on pages 18 to 19 of the AFO Construction Permit Application (DNR Form 542-1428), or at the previously listed link.

[1] To determine the AUC see the 'Manure Storage Indemnity Fee' (Form 542-4021) or the 'Construction Permit Application' (Form 542-1428), or visit http://www.iowadnr.gov

[2] PE is a professional engineer licensed in the state of Iowa or a NRCS-Engineer working for the USDA-Natural Resources Conservation Service (NRCS).

[3] Formed manure storage structure means a covered or uncovered concrete or steel tank, including concrete pits below the floor.

[4] Confinement feeding operation structure = A confinement building, a formed or unformed manure storage structure, or an egg washwater storage structure.

Note: If a master matrix is required, the photos must also show that the additional separation distances required for any points claimed in matrix criteria one through ten will be met for the objects listed above. Note the additional separation distance by drawing a straight line between the proposed structures and the matrix item.

E) **Karst Determination:** Go to DNR AFO Siting Atlas at http://programs.iowadnr.gov/maps/afo/. Search for your site by either scrolling into your location or entering an address or legal description in the bottom search bar. Left click on the location of your proposed structure. Make sure the karst layer box is checked on the map layers. If you cannot access the map, or if you have questions about this issue, contact the AFO Engineer at 712-262-4177. Check one of the following:

- ☒ The site is not in karst or potential karst. Print and enclose the map with the name and location of the site clearly marked.
- ☐ The Siting Atlas has indicated that the site is in karst. The upgraded concrete standards of 567 IAC 65.15(14)"c" must be used. Complete and sign Section 3.H (page 5).

F) **Alluvial Soils Determination:** Go to the AFO Siting Atlas as described above. Make sure the alluvial box is checked on the map layers. If you cannot access the map, or if you have questions about this issue, contact DNR Flood Plain at 866-849-0321. Check one of the following:

- ☒ The site is not in alluvial soils. Print and enclose the map with the name and location of the site clearly marked.
- ☐ If the site is in alluvial soils contact DNR Flood Plain at 866-849-0321. You will be required to submit a petition for a declaratory order if less than 1000 AU or request a flood plain determination if 1000 AU or greater. After receiving Flood Plain determination, submit one of the following:
- ☐ Include correspondence from the DNR showing the site is not in 100-year flood plain or does not require a Flood Plain permit.
- ☐ Include copy of the Flood Plain permit if a Flood Plain permit is required.

NOTE: You may not be in a flood plain per DNR, however in a County Flood Hazard Area and need a county permit.

Section 2 - Manure management plan:

☒ An original manure management plan (MMP) is enclosed with this form, even if a MMP was previously filed.

Jason Maxwell		4/6/2020
Owner's Name (print)	Owner's Signature	Date

Section 3 - Construction design standards: The person responsible for constructing the formed manure storage structure(s)[3] must complete Section 3.

A) **Liquid and semi-liquid manure:** The proposed formed manure storage structure[3] will be (check one):

- A.1 ☒ A non-circular concrete tank, belowground, with walls laterally braced or below the building concrete pit designed according to 567 IAC Chapter 65, Appendix D.
- A.2 ☐ A non-circular concrete tank, belowground, walls designed according to MidWest Plan Service (MWPS), publication MWPS-36. Include design calculations.
- A.3 ☐ A circular concrete tank, walls designed according to MidWest Plan Service (MWPS), publication MWPS TR-9. Include design calculations.
- A.4 ☐ Will be made of steel, constructed aboveground according to the manufacturer's recommendations.

B) **Dry manure:** The proposed formed manure storage structure[3] will be (check one):

- B.1 ☐ An aboveground concrete tank, with walls designed according to MWPS-36. Include design calculations.
- B.2 ☐ Will be made of steel, constructed aboveground according to the manufacturer's recommendations.
- B.3 ☐ Will be a belowground or partially belowground concrete tank, with walls laterally braced designed according to 567 IAC Chapter 65, Appendix D or MWPS-36. Include design calculations.

C) Details of the proposed design: Submit an additional completed copy of this page 3 for each formed manure storage structure[3] that have different dimensions. Complete all of the following information:

Number of buildings: 2 Building name: _____

Dimensions of proposed formed manure storage structure[3]

	Length	Width	Height or depth	Wall thickness	Diameter (circular tanks only)
Feet	277	71	8		
Inches		2		8	

To determine the appropriate vertical steel in walls, first check one of the following boxes (must check one):

a. ☐ To use Tables D-1 and D-2 (on pages 7-8), backfilling of walls shall be performed with gravel, sand, silt, and clay mixtures (less than 50 percent fines), with coarse sand with silt or clay (less than 50 percent fines), or cleaner granular material (see page 9 for the unified soils classification). You will need to submit a copy of a USDA soil survey map with the proposed location of the formed manure storage structures[3] clearly marked showing the unified soil classification; or a statement signed by a qualified organization or NRCS staff.

b. ☒ Use Tables D-3 and D-4 (on pages 8-9) if backfilling of walls will be performed with soils that are unknown or with low plasticity silts and clays with some sand or gravel (50 percent or more fines); or fine sands with silt or clay (less than 50 percent fines); or low to medium plasticity silts and clays with little sand or gravel (50 percent or more fines); or high plasticity silts and clays (see page 9 for unified soils classification). You must use Tables D-3 and D-4 if you do not submit the soils information requested in box "a", above.

Maximum spacing of steel, in inches

Description of reinforcing steel in walls	Proposed vertical steel in walls [see boxes "a" and "b", above]				Proposed horizontal steel in walls (use Table D-5)
	Walls where vehicles are **not** allowed within 5 feet (use Table D-1)[a]	All walls with pumpout ports and walls where vehicles are allowed within 5 feet (use Table D-2)[a]	Walls where vehicles are **not** allowed within 5 feet (use Table D-3)[b]	All walls with pumpout ports and walls where vehicles are allowed within 5 feet (use Table D-4)[b]	
Grade 40, No. 4					
Grade 40, No. 5					
Grade 60, No. 4			10	10	12
Grade 60, No. 5					

D) Aboveground tanks or partially aboveground tanks: Liquid and semi-liquid manure (check the following box):

☐ If the proposed tank is to be constructed **aboveground or partially aboveground** and will have an external outlet or inlet below the liquid level, the tank will also be constructed according to the 567 IAC 65.15(20).

E) Steel Tanks: Certification that the tank will be constructed according to the tank manufacturer's specifications:

Name of tank manufacturer company: _____

Address: _____

Telephone: _____ Fax: _____

F) Additional construction design standards:

To determine the additional requirements set forth in 567 IAC 65.15(14) that would apply to the proposed formed manure storage structure[3], check any of the following 3 boxes based on the information entered on Sections 3.A or 3.B (page 2):

☒ If you checked boxes A.1, A.2, A.3 or B.3 (on page 2) **all** of the following 15 additional requirements apply. Complete the numbered items 1 to 15 (below).

☐ If you checked box B.1 (on page 2), only the requirements of numbered items 1, 3, 4, 5, 6, 8 and 12 apply and need to check those boxes (below).

☐ If you checked boxes A.4 or B.2 (on page 2) and the steel tank will have a concrete floor, only the requirements of numbered items 1, 2, 3, 4, 5, 8, 9, 12, apply and need to check those boxes (below).

Additional Requirements that will be followed during construction of the formed manure storage structure(s)[3]:

1. Site preparation (check the following box):
   ☒ The finished subgrade of a formed manure storage structure shall be graded and compacted to provide a uniform and level base and shall be free of vegetation, manure and debris. For the purpose of this subrule, "uniform" means a finished subgrade with similar soils.

2. Groundwater separation requirements (check one of the following boxes):
   ☒ When the groundwater table, as determined in 65.15(7)"c," is above the bottom of the formed structure, a drain tile shall be installed along the footings to artificially lower the groundwater table pursuant to 65.15(7)"b"(2). The drain tile shall be placed within 3 feet of the footings as indicated in Appendix D, Figure D-1, at the end of this chapter and shall be covered with a minimum of 2 inches of gravel, granular material, fabric or a combination of these materials to prevent plugging the drain tile. A device to allow monitoring of the water in the drainage tile lines installed to lower the groundwater table and a device to allow shutoff of the drainage tile lines shall be installed if the drainage tile lines do not have a surface outlet accessible on the property where the formed manure storage structure is located. **Perimeter tiles must be tied into existing tile, day light, or have an operating sump pump installed in tile riser. Perimeter tiles CANNOT dead end at riser or monitoring port.**

   ☐ In lieu of the drain tile, a certification signed by a PE[2], a groundwater professional certified pursuant to 567 Chapter 134, or a qualified staff from NRCS, is being submitted indicating that the groundwater elevation, according to 65.15(7)"c", is below the bottom of the formed structure.

3. Minimum as-placed concrete compressive strength (check the following box):
   ☒ All concrete shall have the following minimum as-placed compressive strengths and shall meet American Society for Testing and Materials (ASTM) standard ASTM C 94: 4,000 pounds per square inch (psi) for walls, floors, beams, columns and pumpouts and 3,000 psi for the footings. The average concrete strength by testing shall not be below design strength. No single test result shall be more than 500 psi less than the minimum compressive strength.

4. Cement and aggregates specifications (check the following box):
   ☒ Cementitious materials shall consist of Portland cement conforming to ASTM C 150. Aggregates shall conform to ASTM C 33. Blended cements in conformance with ASTM C 595 are allowed only for concrete placed between March 15 and October 15. Portland-pozzolan cement or Portland blast furnace slag blended cements shall contain at least 75 percent, by mass, of Portland cement.

5. Concrete consolidation and vibration requirements (check the following box):
   ☒ All concrete placed for walls shall be consolidated or vibrated, by manual or mechanical means, or a combination, in a manner which meets ACI 309.

6. Minimum rebar specifications: (check the following box):
   ☒ All rebar used shall be a minimum of grade 40 steel. All rebar, with the exception of rebar dowels connecting the walls to the floor or footings, shall be secured and tied in place prior to the placing of concrete.

7. Wall reinforcement placement specifications (check the following box):
   ☒ All wall reinforcement shall be placed so as to have a rebar cover of 2 inches from the inside face of the wall for a belowground manure storage structure. Vertical wall reinforcement should be placed closest to the inside face. Rebar placement shall not exceed tolerances specified in ACI 318.

8. Minimum floor specifications. Complete part a) and b):
   a) Floor thickness requirements (check the following box):
   ☒ The floor slab shall be a minimum of 5 inches thick. Nondestructive methods to verify the floor slab thickness may be required by the department. The results shall indicate that at least 95 percent of the floor slab area meets the minimum required thickness. In no case shall the floor slab thickness be less than 4½ inches.

   b) The floor slab reinforcement shall be located in the middle of the thickness of the floor slab (check one of the following boxes):
   ☒ Formed manure storage structures with a depth of 4 feet or more shall have primary reinforcement consisting of a minimum of #4 rebar placed a maximum of 18 inches on center in each direction placed in a single mat.
   ☐ Formed manure storage structure with a depth less than 4 feet shall have shrinkage reinforcement consisting of a minimum of 6 × 6-W1.4 × W1.4 welded wire fabric.

9. Minimum footing specifications (check the following box):
   - [x] The footing or the area where the floor comes in contact with the walls and columns shall have a thickness equal to the wall thickness, but in no case be less than 8 inches, and the width shall be at least twice the thickness of the footing. All exterior walls shall have footings below the frostline. Tolerances shall not exceed -½ inch of the minimum footing dimensions.

10. Requirement to connect walls to footings (check one of the following boxes):
    - [ ] The vertical steel of all walls shall be extended into the footing, and be bent at 90°, OR
    - [x] A separate dowel shall be installed as a #4 rebar that is bent at 90° with at least 20 inches of rebar in the wall and extended into the footing within 3 inches of the bottom of the footing and extended at least 3 inches horizontally, as indicated in Appendix D, Figure D-1 (page 10). Dowel spacing (bend or extended) shall be the same as the spacing for the vertical rebar.
    - [ ] As an alternative to the 90°bend, the dowel may be extended at least 12 inches into the footing, with a minimum concrete cover of 3 inches at the bottom, as indicated in Appendix D, Figure D-1 (page 10). Dowel spacing (bend or extended) shall be the same as the spacing for the vertical rebar.
    - [ ] In lieu of dowels, mechanical means or alternate methods may be used as anchorage of interior walls to footings. Please submit structural calculations and details of this proposal.

11. Concrete forms specifications (check the following box):
    - [x] All walls shall be formed with rigid forming systems and shall not be earth-formed. Form ties shall be non-removable.

12. Curing of concrete requirements (check the following box):
    - [x] All concrete shall be cured for at least seven days after placing, in a manner which meets ACI 308, by maintaining adequate moisture or preventing evaporation. Proper curing shall be done by ponding, spraying or fogging water; or by using a curing compound that meets ASTM C 309; or by using wet burlap, plastic sheets or similar materials.

13. Construction joints and waterstops specifications (check the following box):
    - [x] All construction joints in exterior walls shall be constructed to prevent discontinuity of steel and have properly spliced rebar placed through the joint. Waterstops shall be installed in all areas where fresh concrete will meet hardened concrete as indicated in Appendix D, Figures D-1 and D-2, at the end of this chapter. The waterstops shall be made of plastic, rolled bentonite or similar materials approved by the department.

14. Backfilling of walls specifications (check the following box):
    - [x] Backfilling of the walls shall not start until the floor slats or permanent bracing have been installed. Backfilling shall be performed with material free of vegetation, large rocks or debris.

15. Additional design requirements (check the following box, if applicable):
    - [ ] A formed manure storage structure with a depth greater than 12 feet shall be designed by a PE or an NRCS engineer.

G) Construction Certification: The person responsible for constructing the formed manure storage structure[3] must sign this page. Any change(s) to the specifications of the formed manure storage structure must be first approved by DNR:

"I hereby certify that I have read and understand the minimum design and construction standards of Iowa Code chapter 459, Subchapter III, and the 567 Iowa Administrative Code (IAC) 65.15(14) "Minimum concrete standards" or 567 IAC 65 (if other than concrete)." The proposed formed manure storage structure(s)[3] at the operation:

Name of operation: Maxwell North County: Story

Owner's name: Maxwell Farms, Inc.

will be constructed in accordance with these minimum requirements. Included with this certification are:

- [x] Page 1-3, for each formed manure storage structure[3] that have different dimensions
- [x] Pages 4 to 6 (applicable sections)
- [ ] Other documents (specify):

Steve Fraher	Steve Fraher	4-1-20
(Print name)	(Signature)	(Date)
Hog Slat, Inc	1112 20th St North, Humboldt IA 50548	515-332-4014
(Company)	(Address)	(Phone No.)

(See page 7 for mailing instructions)

H) Upgraded Concrete Standards Certification: If the site is in karst according to Section 1.D (page 2) the person responsible for constructing the formed manure storage structure must also complete this section:

567 IAC 65.15(14)"c". Karst terrain - upgraded standards. If the site of the proposed formed manure storage structure is located in an area that exhibits karst terrain or an area that drains into a known sinkhole, the minimum concrete standards set forth in 65.15(14)"a" or "b" shall apply. In addition, the following requirements apply to all formed manure storage structures that store nondry or dry manure (check all of the following boxes):

- ☐ (1) A minimum 5-foot vertical separation distance between the bottom of a formed manure storage structure and limestone, dolomite, or other soluble rock is required if the formed manure storage structure is not designed by a PE or an NRCS engineer. (The 5-foot separation must be a continuous profile of low permeability soil directly beneath the bottom of the formed manure storage structure.
- ☐ (2) If the vertical separation distance between the bottom of the proposed formed manure storage structure and limestone, dolomite, or other soluble rock is less than 5 feet, the structure shall be designed and sealed by a PE or an NRCS engineer who certifies the structural integrity of the structure. A 2-foot-thick layer of compacted clay soil shall be constructed underneath the floor of the formed manure storage structure. However, it is recommended that any formed manure storage structure be constructed aboveground if the vertical separation distance between the bottom of the structure and the limestone, dolomite, or other soluble rock is less than 5 feet.
- ☐ (3) In addition, in an area that exhibits karst terrain or an area that drains into a known sinkhole, a PE, an NRCS engineer or a qualified organization shall submit a soil exploration study based on the results from soil borings or test pits to determine the vertical separation between the bottom of the formed structure and limestone, dolomite, or other soluble rock. A minimum of two soil borings, equally spaced within each formed structure, or two test pits outside of each formed structure, are required. After soil exploration is completed, each soil boring and pit shall be properly plugged with concrete grout, bentonite, or similar materials.
- ☐ (4) Backfilling shall not start until the floor slats have been placed or permanent bracing has been installed, and shall be performed with material free of vegetation, large rocks, or debris.

"I have read and understand the upgraded concrete standards of IAC 65.15(14)"c", and certify that the proposed formed manure storage structure(s)[3] at the above operation will be constructed according to these standards":

(Print name)	(Signature)	(Date)
(Company)	(Address)	(Phone No.)

Section 4 - Drainage Tile Certification: Required only if applying for a construction permit and constructing three or more confinement feeding operations structures[4]. This section must be completed and signed by the person responsible for excavating the confinement feeding operation structure[4]:

567 IAC 65.15(1) - Drainage tile removal for new construction of a manure storage structure. Prior to constructing a manure storage structure, other than storage of manure in an exclusively dry form, the site for the animal feeding operation structure shall be investigated for drainage tile lines as provided in this subrule. All applicable records of known drainage tiles shall be examined for the existence of drainage tile lines.

c. The applicant for a construction permit for a formed manure storage structure shall investigate for tile lines during excavation for the structure. Drainage tile lines discovered upgrade from the structure shall be rerouted around the formed manure storage structure to continue the flow of drainage. All other drainage tile lines discovered shall be rerouted, capped, plugged with concrete, Portland cement concrete grout or similar materials or reconnected to upgrade tile lines. Drainage tile lines installed at the time of construction to lower a groundwater table may remain where located. A device to allow monitoring of the water in the drainage tile lines and a device to allow shutoff of the drainage tile lines shall be installed if the drainage tile lines do not have a surface outlet accessible on the property where the formed manure storage structure is located.

"I certify that I have read and understand the requirements of 567 IAC 65.15(1)"c" and that to the best of my knowledge, information and belief, the proposed confinement feeding operation structures[4] at:

Name of operation: _____ County: _____

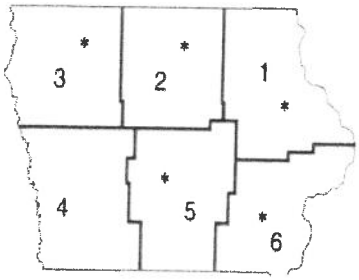
Owner's name: _____

will not impede the drainage of established drainage tile lines which cross their property lines and if construction disturbs drainage tile lines, I will take the necessary measures to reestablish drainage and, upon completion of construction, file a statement that those measures were taken to reestablish drainage."

(Print name)	(Signature)	(Date)
(Company)	(Address)	(Phone No.)

Mailing Instructions: Mail only pages 1 to 6 of this CDS according to the following:

1. Operations not needing a construction permit (AUC[1] between 501 and 999 AU and constructing a formed manure storage structure[3]) but required to submit a manure management plan (MMP), at least **30 days** prior to beginning construction must file this CDS, the required karst and alluvial soils documentation requested in Section 1,C and 1,D (page 1) along with the required MMP documents and fees with the nearest DNR Field Office:



Field Office 1
909 W Main St Ste 4
Manchester, IA 52057
(563) 927-2640

Field Office 2
2300 15th St SW
Mason City, IA 50401
(641) 424-4073

Field Office 3
1900 N Grand Ave
Spencer, IA 51301
(712) 262-4177

Field Office 4
1401 Sunnyside Ln
Atlantic, IA 50022
(712) 243-1934

Field Office 5
502 E 9th St
Des Moines IA 50319
(515) 725-0268

Field Office 6
1023 W Madison
Washington, IA 52353
(319) 653-2135

2. If a construction permit is required (AUC[1] = 1,000 AU or more and constructing a formed manure storage structure[3]), mail this CDS, the required construction application documents and fees, at least 90 days prior to beginning construction, to allow for all actions required by Iowa law, to the AFO-Program (DNR Field Office 3, 1900 N Grand, Gateway North Ste E17, Spencer IA 51301). You must follow the instructions in the construction application form (DNR Form 542-1428).

If you have any questions regarding the concrete standards requirements and CDS, contact an engineer of the AFO- Program at 712-262-4177, the nearest DNR Field Office, or visit http://www.iowadnr.gov/afo.

567—Iowa Administrative Code (IAC) Chapter 65, APPENDIX D

DESIGN SPECIFICATIONS—FORMED MANURE STORAGE STRUCTURES

The following design specifications apply to a formed manure storage structure that is constructed belowground, is laterally braced and is not designed using MWPS-36 or by a PE or an NRCS engineer:

(1) The walls of a rectangular formed structure with a depth up to 12 feet shall be designed in accordance with the tables provided in this appendix.

(2) Consideration shall be given to internal and external loads including, but not limited to, lateral earth pressures, hydrostatic pressures, wind loads, and floor or cover, building and equipment loads.

(3) Each wall shall be braced laterally at the top of the wall.

(4) The walls shall be constructed above the groundwater table, or a drain tile shall be installed to artificially lower the groundwater table.

(5) Each wall that includes a pumpout port shall be constructed under the design consideration that vehicles will be operating within 5 feet of the wall as provided in Tables D-2 and D-4.

(6) Minimum wall thickness and minimum vertical steel reinforcement shall be in accordance with one of the following:

(a) Table D-1, if **all** of the following conditions are met:

1. There will be **NO VEHICLES** operating within 5 feet of the wall.
2. Backfilling is performed with **gravel, sand, silt, and clay mixtures (less than 50 percent fines), with coarse sand with silt or clay (less than 50 percent fines), or cleaner granular material** (see NRCS Conservation Practice Standard, "Waste Storage Facility," Code 313, Table 2, for description and unified classification or ASTM D 2488 and D 653).

APPENDIX D, TABLE D-1 [See footnote "a" on page 9]

Minimum Wall Thickness and Vertical Steel Reinforcement

Wall height (feet)	Wall thickness (inches)	Steel Grade			
		Grade 40		Grade 60	
		Bar	Space o.c. (inches)	Bar	Space o.c (inches)
4 or less	6	# 4	16.5	# 4	18.0
		# 5	18.0	# 5	18.0
4 or less	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
6	6	# 4	14.5	# 4	18.0
		# 5	18.0	# 5	18.0
6	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
8	8	# 4	9.5	# 4	13.5
		# 5	14.5	# 5	18.0
8	10	# 4	9.5	# 4	11.0
		# 5	15.0	# 5	17.0
10	8	# 4	6.5	# 4	9.5
		# 5	10.0	# 5	13.5
10	10	# 4	6.5	# 4	9.5
		# 5	10.0	# 5	15.0
12	10	# 4	5.0	# 4	7.5
		# 5	7.5	# 5	11.5

(b) Table D-2, if **all** of the following conditions are met:

1. There will be **VEHICLES** operating within 5 feet of the wall.
2. Backfilling is performed with **gravel, sand, silt, and clay mixtures (less than 50 percent fines), with coarse sand with silt or clay (less than 50 percent fines), or cleaner granular material** (see NRCS Conservation Practice Standard, "Waste Storage Facility," Code 313, Table 2, for description and unified classification or ASTM D 2488 and D 653).

APPENDIX D, TABLE D-2 [See footnote "a" on page 9]

Minimum Wall Thickness and Vertical Steel Reinforcement

Wall height (feet)	Wall thickness (inches)	Steel Grade			
		Grade 40		Grade 60	
		Bar	Space o.c. (inches)	Bar	Space o.c. (inches)
4 or less	6	# 4	16.5	# 4	18.0
		# 5	18.0	# 5	18.0
4 or less	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
6	6	# 4	10.5	# 4	15.5
		# 5	16.5	# 5	18.0
6	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
8	8	# 4	6.5	# 4	10.0
		# 5	10.5	# 5	16.0
8	10	# 4	8.5	# 4	11.0
		# 5	13.5	# 5	17.0
10	8	# 4	4.5	# 4	6.5
		# 5	7.0	# 5	10.5
10	10	# 4	5.0	# 4	7.5
		# 5	8.0	# 5	12.0
12	10	# 4	3.5	# 4	5.5
		# 5	5.5	# 5	8.5

(c) Table D-3, if **all** of the following conditions are met:

1. There will be **NO VEHICLES** operating within 5 feet of the wall.
2. Backfilling is performed with performed with **low plasticity silts and clays with some sand or gravel (50 percent or more fines); or fine sands with silt or clay (less than 50 percent fines); or low to medium plasticity silts and clays with little sand or gravel (50 percent or more fines); or high plasticity silts and clays** (see NRCS Conservation Practice Standard, "Waste Storage Facility," Code 313, Table 2, for description and unified classification or ASTM D 2488 and D 653).

APPENDIX D, TABLE D-3 [See footnote "b" on page 9]

Minimum Wall Thickness and Vertical Steel Reinforcement

Wall height (feet)	Wall thickness (inches)	Steel Grade			
		Grade 40		Grade 60	
		Bar	Space o.c. (inches)	Bar	Space o.c. (inches)
4 or less	6	# 4	16.5	# 4	18.0
		# 5	18.0	# 5	18.0
4 or less	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
6	6	# 4	10.5	# 4	15.5
		# 5	16.5	# 5	18.0
6	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
8	8	# 4	6.5	# 4	10.0
		# 5	10.5	# 5	16.0
8	10	# 4	9.0	# 4	11.0
		# 5	14.0	# 5	17.0
10	8	# 4	4.5	# 4	6.5
		# 5	7.0	# 5	10.0
10	10	# 4	5.0	# 4	7.5
		# 5	8.0	# 5	12.0
12	10	# 4	3.5	# 4	5.0
		# 5	5.5	# 5	8.0

(d) Table D-4, if **all** of the following conditions are met:

1. There will be **VEHICLES** operating within 5 feet of the wall.
2. Backfilling is performed with performed with **low plasticity silts and clays with some sand or gravel (50 percent or more fines); or fine sands with silt or clay (less than 50 percent fines); or low to medium plasticity silts and clays with little sand or gravel (50 percent or more fines); or high plasticity silts and clays** (see NRCS Conservation Practice Standard, "Waste Storage Facility," Code 313, Table 2, for description and unified classification or ASTM D 2488 and D 653).

APPENDIX D, TABLE D-4 [See footnote "b" on bottom of this page]

Minimum Wall Thickness and Vertical Steel Reinforcement

Wall height (feet)	Wall thickness (inches)	Steel Grade			
		Grade 40		Grade 60	
		Bar	Space o.c. (inches)	Bar	Space o.c. (inches)
4 or less	6	# 4	16.5	# 4	18.0
		# 5	18.0	# 5	18.0
4 or less	8	# 4	12.0	# 4	13.5
		# 5	18.0	# 5	18.0
6	6	# 4	8.0	# 4	12.0
		# 5	12.5	# 5	16.5
6	8	# 4	9.5	# 4	13.5
		# 5	15.0	# 5	18.0
8	8	# 4	6.0	# 4	9.0
		# 5	9.0	# 5	11.5
8	10	# 4	6.0	# 4	9.0
		# 5	9.5	# 5	14.0
10	8	# 4	3.0	# 4	4.5
		# 5	4.5	# 5	7.0
10	10	# 4	4.5	# 4	6.5
		# 5	6.5	# 5	10.0
12	10	# 4	2.5	# 4	4.0
		# 5	4.0	# 5	6.0

(7) Minimum horizontal steel for a rectangular tank shall be selected and placed according to Table D-5, regardless of wall height, and shall be tied to the soil side of vertical steel:

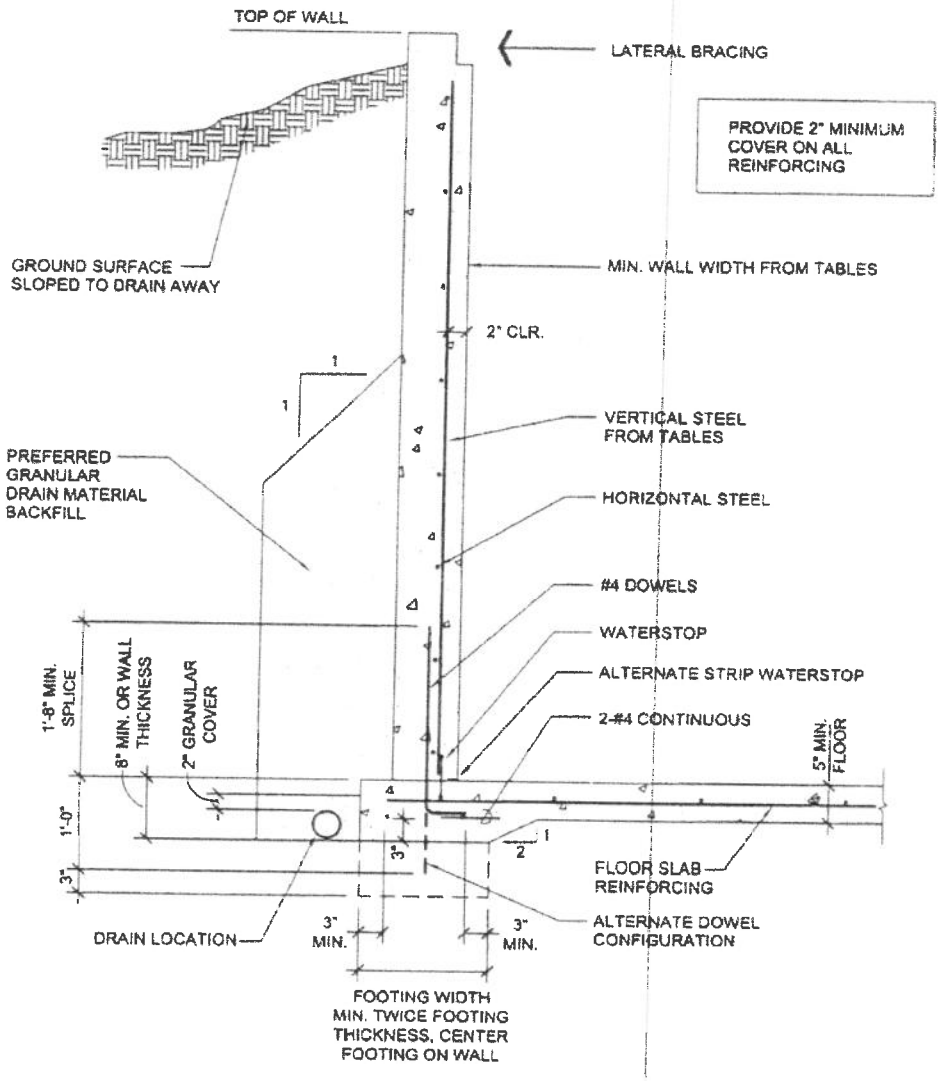
APPENDIX D, TABLE D-5

Horizontal Steel Reinforcement

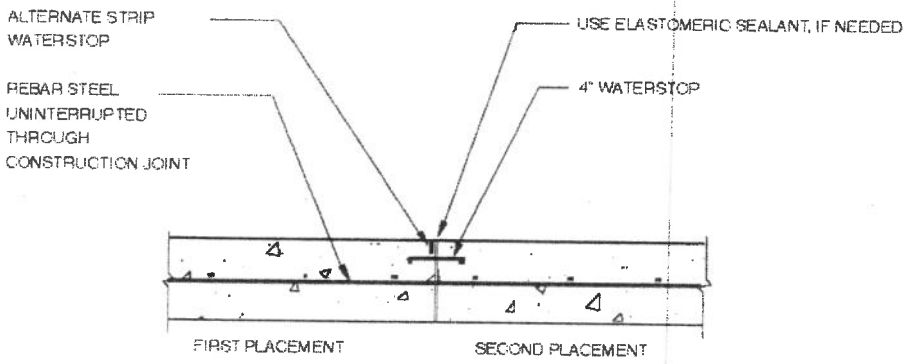
Wall thickness	Steel Grade			
	Grade 40		Grade 60	
	Bar	Space o.c. (inches)	Bar	Space o.c (inches).
6	# 4	16.5	#4	18.0
	# 5	18.0	# 5	18.0
8	# 4	12.0	# 4	13.5
	# 5	18.0	# 5	18.0
10	# 4	9.5	# 4	11.0
	# 5	15.0	# 5	17.0

[a]To use Tables D-1 and D-2, the backfilling of the walls will be performed with gravel, sand, silt, and clay mixtures (less than 50 percent fines), with coarse sand with silt or clay (less than 50 percent fines), or cleaner granular material. The "Unified Soil Classification" corresponds to: GP, GW, SP, SW, GM, GC, SW, SC, SM, SC-SM. You will need to submit a copy of a USDA soil survey map with the proposed location of the formed manure storage structures[3] clearly marked showing the unified soil classification; or a statement signed by a qualified organization or NRCS staff.

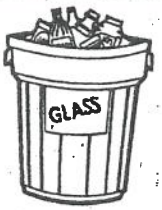
[b]Use Tables D-3 and D-4 if the soils to be used for backfilling the walls are unknown or performed with low plasticity silts and clays with some sand or gravel (50 percent or more fines); or fine sands with silt or clay (less than 50 percent fines); or low to medium plasticity silts and clays with little sand or gravel (50 percent or more fines); or high plasticity silts and clays. The "Unified Soils Classification" corresponds to: CL, ML, CL-ML, SC, SM, SC-SM. Tables D-3 and D-4 must be used, if a copy of a USDA soil survey map with the proposed location of the formed manure storage structures[3] clearly marked showing the unified soil classification; or a statement signed by a qualified organization or NRCS staff is not submitted.



567 IAC Chapter 65, Appendix D, Figure D-1 "Monolitic footing floor detail"



567 IAC Chapter 65, Appendix D, Figure D-2 "Wall and floor construction joint"

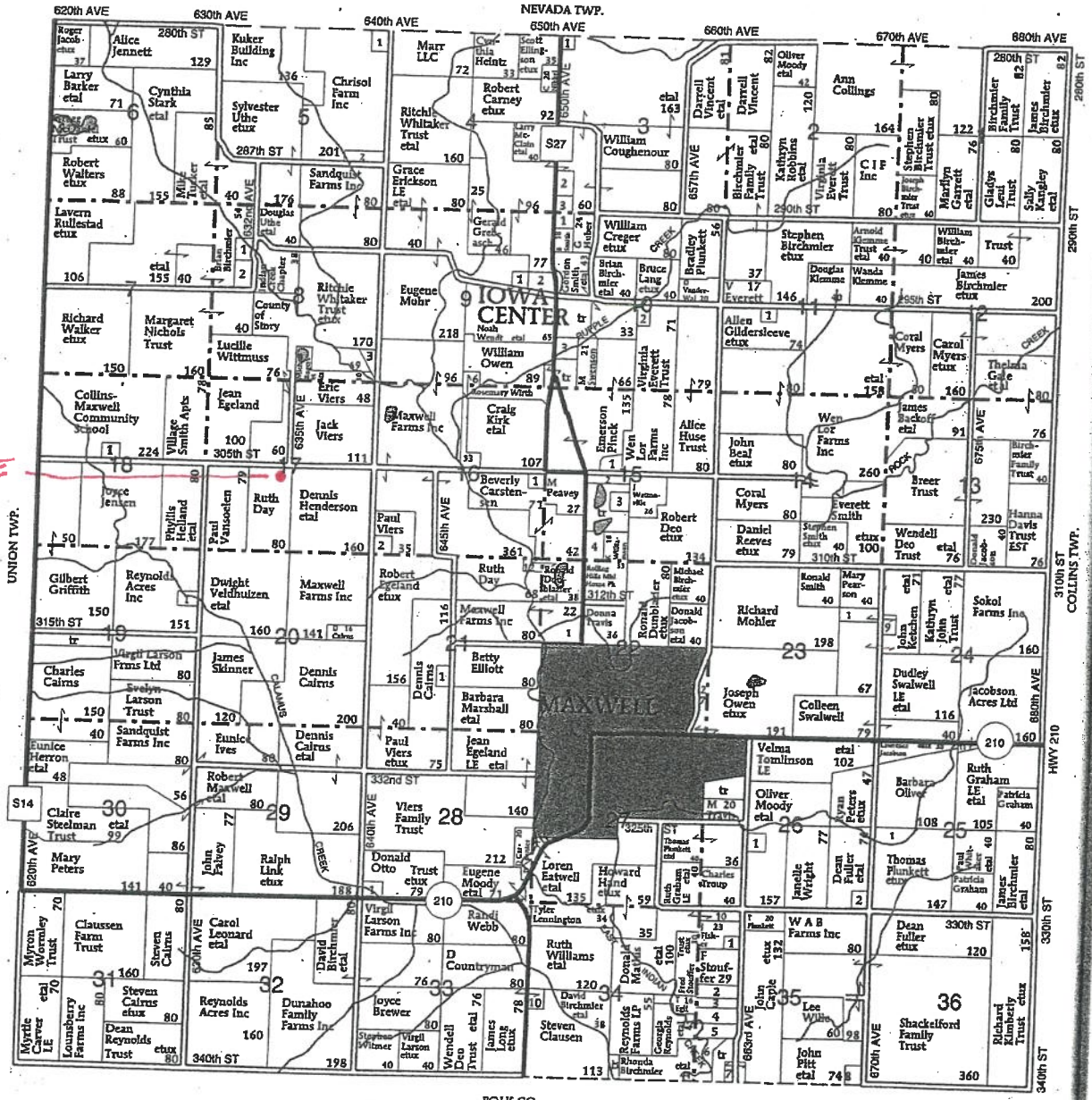


RECYCLING GLASS:

Any color glass can be recycled.
Rinse all bottles and jars and remove metal caps

T-82-N **INDIAN CREEK PLAT** **R-22-W**

(Landowners)



INDIAN CREEK TOWNSHIP

SECTION 3
1. Huhn, Marion
2. Sinclair, Roger
3. Birchmier, Sheryl

SECTION 5
1. Bowman, Thomas
2. Moffitt, Dustin

SECTION 8
1. Orcutt, Dennis
2. Alleman, Louise
3. Moore, Bernard

SECTION 9
1. Lewis, Michael
2. Carney, Robert

SECTION 10
1. Carney Jr, Robert
2. Nelson, August
3. Kahler, Richard

SECTION 11
1. Andrew Jr, Francis

SECTION 15
1. Rozinek, Russell
2. Rozinek, Russell
3. Lengel, Mark
4. Rolling Hills Mobile Home Park LLC

SECTION 16
1. Helming, Stuart
2. Lee, John

SECTION 18
1. Debaca, Suzanna

SECTION 19
1. Napier, William

SECTION 21
1. Cummings, Gary

SECTION 22
1. Peters, Timothy

SECTION 23
1. Ketchum, Mark

SECTION 25
1. Means, Deanna

SECTION 26
1. Bruns, Andrew
2. Senter, Marvin

SECTION 28
1. Gibbs, George

SECTION 35
1. Dunnbaugh, Tom
2. Hunter, Sandra
3. Davies, Christian
4. Hindman, Rich
5. Davies, Christian
6. Caple, J
7. Peoria Cemetery Association
8. Goodwin, Kevin

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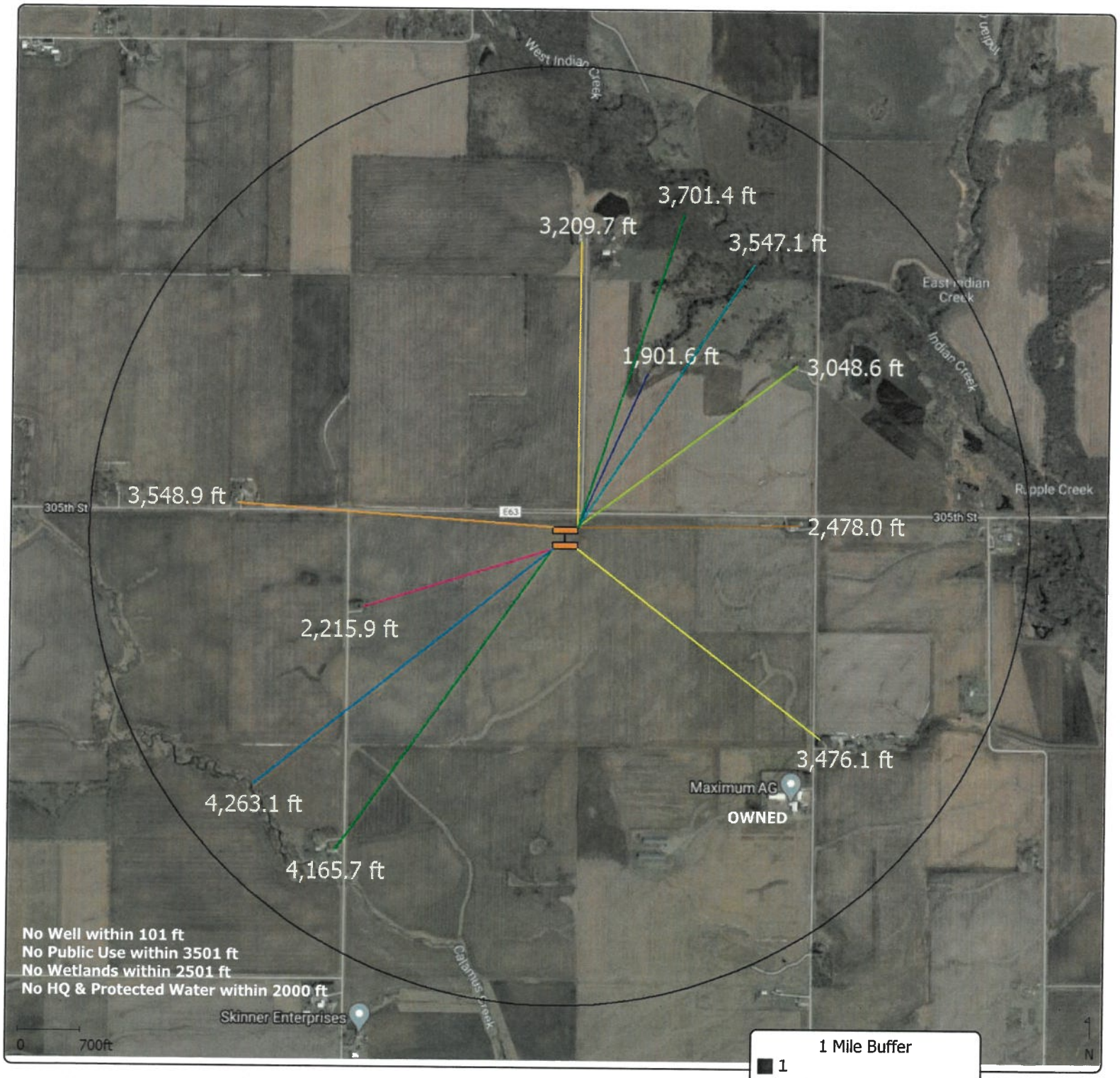
Maxwell North

Site Placement



1 Mile Buffer
1

Distance to Major Water (ft)
3547

Distance to Water (ft)
1901
4263

Distance to Residences (ft)
4165
3048
3476
2478
3209
3548
2215

Feature ID
Site

Distance to Remote Campsite (ft)
3701

Date: Mar 23, 2020
Maxwell North
Story County, Iowa
Section 17, T82N, R22W

Grower : Maxwell North
Farm : Site
Field : Site Placement

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Maxwell North

Site Placement

Feature ID
Site

Feature ID
Drive

Feature ID
Composter

Distance to ROW
(ft)
130

Distance Between Barns
(ft)
100

Date: Mar 23, 2020
Maxwell North
Story County, Iowa
Section 17, T82N, R22W

Grower : Maxwell North
Farm : Site
Field : Site Placement

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
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iowa.gov Services Agencies Social

DNR IOWA DEPARTMENT OF NATURAL RESOURCES

Basemaps Measure Bookmarks Mail Map Info

Map layers Legend

AFO Siting Data

Sinkholes

Ag Drainage Well

Major Water Source (Rivers)

Public Land

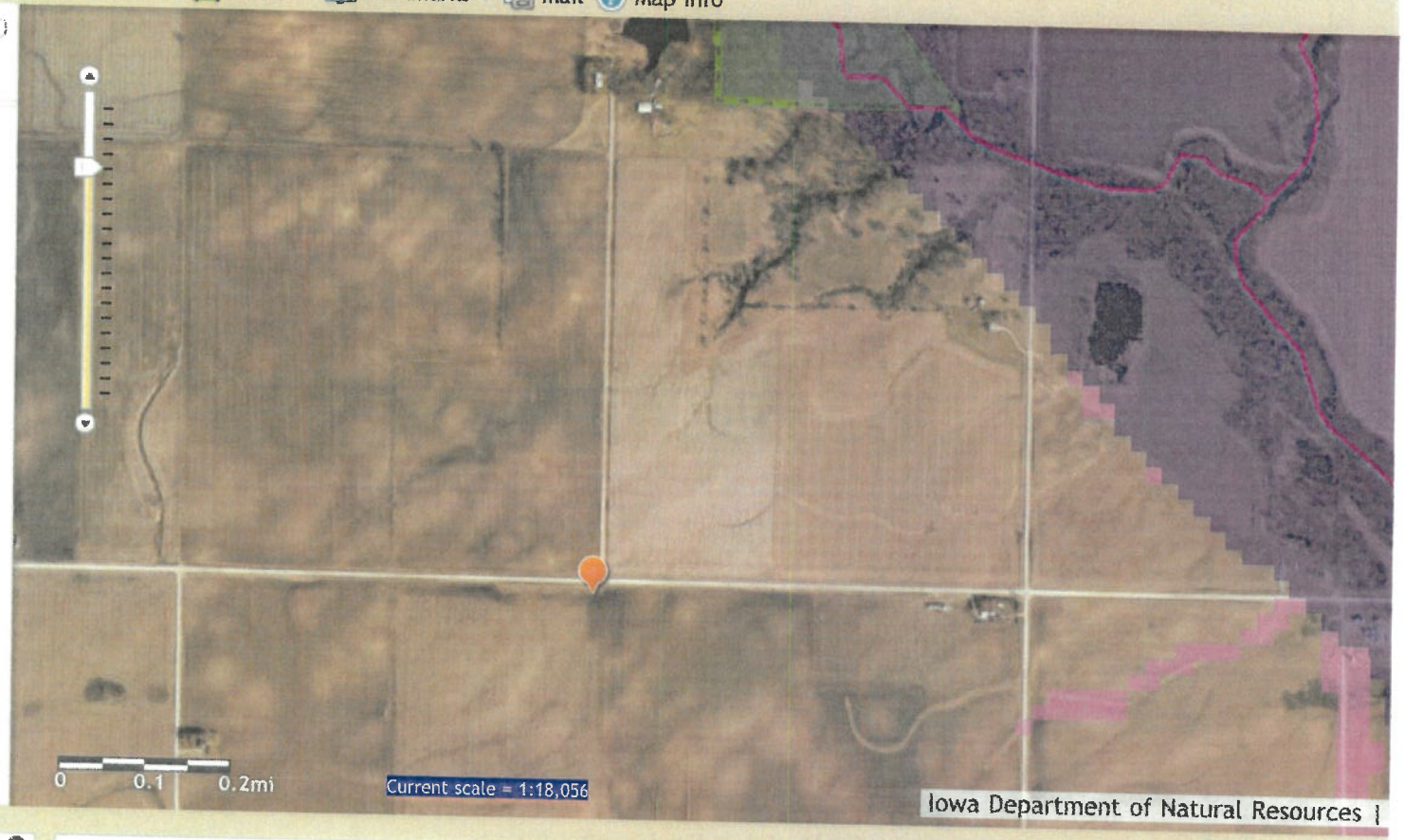
Alluvial Soils

Alluvial Aquifer

Alluvial Soils

AFO Model/Support Data

Sinkhole or Potential Karst



502 E. 9th St, Des Moines, IA 50319

T82NR22W17

UTM Zone 15 NAD83 463391.20, 4640539.58

WGS84 -93.441460, 41.915959

iowa.gov Services Agencies Social

DNR IOWA DEPARTMENT OF NATURAL RESOURCES

Basemaps Measure Bookmarks Mail Map Info

Siting Information

Location	-93.4 41.9
Ag Drainage Well Distance	> on
Well Distance	3158
Alluvial Soils present	No
Distance to surface water	4530
Distance to Major Source River	3622
Distance to Major Source Lake	> on
Distance to HQ/HQR water	> on
Karst features	Not kars
Designated Wetland Distance	> 25
Percent slope	0 %
Distance to public land	3257

Distances are estimates best available data. Dista

502 E. 9th St, Des Moines, IA 50319 T82NR22W17

UTM Zone 15 NAD83 463715.70, 4640665.56 WGS84 -93.437555, 41.917109

MAXWELL NORTH

APPENDIX C MASTER MATRIX

Proposed Site Characteristics

The following scoring criteria apply to the site of the proposed confinement feeding operation. Mark one score under each criterion selected by the applicant. The proposed site must obtain a minimum overall score of 440 and a score of 53.38 in the "air" subcategory, a score of 67.75 in the "water" subcategory and a score of 101.13 in the "community impacts" subcategory.

1. Additional separation distance, above minimum requirements, from proposed confinement structure to the closest:
   * Residence not owned by the owner of the confinement feeding operation,
   * Hospital,
   * Nursing home, or
   * Licensed or registered child care facility.

2215' - 1875' = 340'

	Score	Air	Water	Community
250 feet to 500 feet	25	16.25		8.75
501 feet to 750 feet	45	29.25		17.50
751 feet to 1,000 feet	65	42.25		22.75
1,001 feet to 1,250 feet	85	55.25		29.75
1,251 feet or more	100	65.00		35.00

(A) Refer to the construction permit application package to determine the animal unit capacity (or animal weight capacity if an expansion) of the proposed confinement feeding operation. Then refer to Table 6 of 567--Chapter 65 to determine minimum required separation distances.
(B) The department will award points only for the single building, of the four listed above, closest to the proposed confinement feeding operation.
(C) "Licensed child care center" – a facility licensed by the department of human services providing child care or preschool services for seven or more children, except when the facility is registered as a child care home.
(D) "Registered child development homes" - child care providers certify that they comply with rules adopted by the department of human services. This process is voluntary for providers caring for five or fewer children and mandatory for providers caring for six or more children.
(E) A full listing of licensed and registered child care facilities is available at county offices of the department of human services.

2. Additional separation distance, above minimum requirements, from proposed confinement structure to the closest public use area.

3701' - 2500' = 1201'

	Score	Air	Water	Community
250 feet to 500 feet	5	2.00		3.00
501 feet to 750 feet	10	4.00		6.00
751 feet to 1,000 feet	15	6.00		9.00
1,001 feet to 1,250 feet	20	8.00		12.00
1,251 feet to 1,500	25	10.00		15.00
1,501 feet or more	30	12.00		18.00

(A) Refer to the construction permit application package to determine the animal unit capacity (or animal weight capacity if an expansion) of the proposed confinement feeding operation. Then refer to Table 6 of 567--Chapter 65 to determine minimum required separation distances.
(B) "Public use area" - a portion of land owned by the United States, the state, or a political subdivision with facilities which attract the public to congregate and remain in the area for significant periods of time. Facilities include, but are not limited to, picnic grounds, campgrounds, cemeteries, lodges, shelter houses, playground equipment, lakes as listed in Table 2 of 567--Chapter 65, and swimming beaches. It does not include a highway, road right-of-way, parking areas, recreational trails or other areas where the public passes through, but does not congregate or remain in the area for significant periods of time.

3. Additional separation distance, above minimum requirements, from proposed confinement structure to the closest:
   * Educational institution,
   * Religious institution, or
   * Commercial enterprise.

1501' + 1875' = None within 3376'

	Score	Air	Water	Community
250 feet to 500 feet	5	2.00		3.00

501 feet to 750 feet	10	4.00		6.00
751 feet to 1,000 feet	15	6.00		9.00
1,001 feet to 1,250 feet	20	8.00		12.00
1,251 feet to 1,500	25	10.00		15.00
1,501 feet or more	30	12.00		18.00

(A) Refer to the construction permit application package to determine the animal unit capacity (or animal weight capacity if an expansion) of the proposed confinement feeding operation. Then refer to Table 6 of 567--Chapter 65 to determine minimum required separation distances.
(B) The department will award points only for the single building, of the three listed above, closest to the proposed confinement feeding operation.
(C) "Educational institution" - a building in which an organized course of study or training is offered to students enrolled in kindergarten through grade 12 and served by local school districts, accredited or approved nonpublic schools, area educational agencies, community colleges, institutions of higher education under the control of the state board of regents, and accredited independent colleges and universities.
(D) "Religious institution" - a building in which an active congregation is devoted to worship.
(E) "Commercial enterprise" - a building which is used as a part of a business that manufactures goods, delivers services, or sells goods or services, which is customarily and regularly used by the general public during the entire calendar year and which is connected to electric, water, and sewer systems. A commercial enterprise does not include a farm operation.

4. Additional separation distance, above minimum requirement of 500 feet, from proposed confinement structure to the closest water source.

1901' - 500 = 1401'

	Score	Air	Water	Community
250 feet to 500 feet	5		5.00	
501 feet to 750 feet	10		10.00	
751 feet to 1,000 feet	15		15.00	
1,001 feet to 1,250 feet	20		20.00	
1,251 feet to 1,500	25		25.00	
1,501 feet or more	30		30.00	

"Water source" - a lake, river, reservoir, creek, stream, ditch, or other body of water or channel having definite banks and a bed with water flow, except lakes or ponds without an outlet to which only one landowner is riparian.

5. Separation distance of 300 feet or more from the proposed confinement structure to the nearest thoroughfare.

	Score	Air	Water	Community
300 feet or more	30	9.00		21.00

(A) "Thoroughfare" - a road, street, bridge, or highway open to the public and constructed or maintained by the state or a political subdivision.
(B) The 300-foot distance includes the 100-foot minimum setback plus additional 200 feet.

6. Additional separation distance, above minimum requirements, from proposed confinement structure to the closest critical public area.

2500 + 500 = None within 3000'

	Score	Air	Water	Community
500 feet or more	10	4.00		6.00

(A) All critical public areas as defined in 567--65.1(455B), are public use areas, and therefore subject to public use area minimum separation distances.
(B) Refer to the construction permit application package to determine the animal unit capacity (or animal weight capacity if an expansion) of the proposed confinement feeding operation. Then refer to Table 6 of 567--Chapter 65 to determine minimum required separation distances.

7. Proposed confinement structure is at least two times the minimum required separation distance from all private and public water wells.

	Score	Air	Water	Community
Two times the minimum separation distance	30		24.00	6.00

Refer to Table 6 of 567--Chapter 65 for minimum required separation distances to wells.

8. Additional separation distance, above the minimum requirement of 1,000 feet, from proposed confinement structure to the closest:

* Agricultural drainage well,
* Known sinkhole, or
* Major water source.

3547' - 1000' = 2547'

	Score	Air	Water	Community
250 feet to 500 feet	5	0.50	2.50	2.00
501 feet to 750 feet	10	1.00	5.00	4.00
751 feet to 1,000 feet	15	1.50	7.50	6.00
1,001 feet to 1,250 feet	20	2.00	10.00	8.00
1,251 feet to 1,500 feet	25	2.50	12.50	10.00
1,501 feet to 1,750 feet	30	3.00	15.00	12.00
1,751 feet to 2,000 feet	35	3.50	17.50	14.00
2,001 feet to 2,250 feet	40	4.00	20.00	16.00
2,251 feet to 2,500 feet	45	4.50	22.50	18.00
2,501 feet or more	50	5.00	25.00	20.00

(A) The department will award points only for the single item, of the three listed above, that is closest to the proposed confinement feeding operation.
(B) "Agricultural drainage wells" - include surface intakes, cisterns and wellheads of agricultural drainage wells.
(C) "Major water source" - a lake, reservoir, river or stream located within the territorial limits of the state, or any marginal river area adjacent to the state which can support a floating vessel capable of carrying one or more persons during a total of a six-month period in one out of ten years, excluding periods of flooding. Major water sources in the state are listed in Tables 1 and 2 in 567--Chapter 65.

9. Distance between the proposed confinement structure and the nearest confinement facility that has a submitted department manure management plan.

	Score	Air	Water	Community
Three-quarter of a mile or more (3,960 feet)	25	7.50	7.50	10.00

Confinement facilities include swine, poultry, and dairy and beef cattle.

10. Separation distance from proposed confinement structure to closest:
* High quality (HQ) waters,
* High quality resource (HQR) waters, or
* Protected water areas (PWA)

is at least two times the minimum required separation distance

1000' x 2 = None within 2000'

	Score	Air	Water	Community
Two times the minimum separation distance	30		22.50	7.50

(A) The department will award points only for the single item, of the three listed above, closest to the proposed confinement feeding operation.
(B) HQ waters are identified in 567--Chapter 61.
(C) HQR waters are identified in 567--Chapter 61.
(D) A listing of PWAs is available at:
http://www.iowadnr.gov/Recreation/CanoeingKayaking/StreamCare/ProtectedWaterAreas.aspx

11. Air quality modeling results demonstrating an annoyance level less than 2 percent of the time for residences within two times the minimum separation distance.

	Score	Air	Water	Community
University of Minnesota OFFSET model results demonstrating an annoyance level less than 2 percent of the time	10	6.00		4.00e

(A) OFFSET can be found at http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/feedlots-and-manure-storage/offset-odor-from-feedlots/. For more information, contact Dr. Larry Jacobson, University of Minnesota, (612) 625-8288, jacob007@tc.umn.edu.
(B) A residence that has a signed waiver for the minimum separation distance cannot be included in the model.
(C) Only the OFFSET model is acceptable until the department recognizes other air quality models.

12. Liquid manure storage structure is covered.

	Score	Air	Water	Community
Covered liquid manure storage	30	27.00		3.00

(A) "Covered" - organic or inorganic material, placed upon an animal feeding operation structure used to store manure, which significantly reduces the exchange of gases between the manure and the ambient air, which

Organic materials include, but are not limited to, a layer of chopped straw, other crop residue, or a naturally occurring crust on the surface of the stored manure. Inorganic materials include, but are not limited to, wood, steel, aluminum, rubber, plastic, or Styrofoam. The materials shall shield at least 90 percent of the surface area of the stored manure from the outside air. Cover shall include an organic or inorganic material which current scientific research shows reduces detectable odor by at least 75 percent. A formed manure storage structure directly beneath a floor where animals are housed in a confinement feeding operation is deemed to be covered.

(B) The design, operation and maintenance plan for the manure cover must be in the construction permit application and made a condition in the approved construction permit.

13. Construction permit application contains design, construction, operation and maintenance plan for emergency containment area at manure storage structure pump-out area.

	Score	Air	Water	Community
Emergency containment area	20		18.00	2.00

(A) The emergency containment area must be able to contain at least 5 percent of the total volume capacity of the manure storage structure.

(B) The emergency containment area must be constructed on soils that are fine-grained and have low permeability.

(C) If manure is spilled into the emergency containment area, the spill must be reported to the department within six hours of onset or discovery.

(D) The design, construction, operation and maintenance plan for the emergency containment area must be in the construction permit application and made a condition in the approved construction permit.

14. Installation of a filter(s) designed to reduce odors from confinement building(s) exhaust fan(s).

	Score	Air	Water	Community
Installation of filter(s)	10	8.00		2.00

The design, operation and maintenance plan for the filter(s) must be in the construction permit application and made a condition in the approved construction permit.

15. Utilization of landscaping around confinement structure.

	Score	Air	Water	Community
Utilization of Landscaping	20	10.00		10.00

The design, operation and maintenance plan for the landscaping must be in the construction permit application and made a condition in the approved construction permit. The design should contain at least three rows of trees and shrubs, of both fast and slow-growing species that are well suited for the site.

16. Enhancement, above minimum requirements, of structures used in stockpiling and composting activities, such as an impermeable pad and a roof or cover.

	Score	Air	Water	Community
Stockpile and compost facility enhancements	30	9.00	18.00	3.00

(A) The design, operation and maintenance plan for the stockpile or compost structure enhancements must be in the construction permit application and made a condition in the approved construction permit.

(B) The stockpile or compost structures must be located on land adjacent or contiguous to the confinement building.

17. Proposed manure storage structure is formed

	Score	Air	Water	Community
Formed manure storage structure	30		27.00	3.00

(A) "Formed manure storage structure" -a covered or uncovered impoundment used to store manure from an animal feeding operation, which has walls and a floor constructed of concrete, concrete block, wood, steel, or similar materials. Similar materials may include, but are not limited to, plastic, rubber, fiberglass, or other synthetic materials. Materials used in a formed manure storage structure shall have the structural integrity to withstand expected internal and external load pressures.

(B) The design, operation and maintenance plan for the formed manure storage structure must be in the construction permit application and made a condition in the approved construction permit.

18. Manure storage structure is aerated to meet departmental standards as an aerobic structure, if aeration is not already required by the department.

	Score	Air	Water	Community
Aerated manure storage structure	10	8.00		2.00

(A) Aerobic structure - an animal feeding operation structure other than an egg wash water storage structure which relies on aerobic bacterial action which is maintained by the utilization of air or oxygen and which includes

aeration equipment to digest organic matter. Aeration equipment shall be used and shall be capable of providing oxygen at a rate sufficient to maintain an average of 2 milligrams per liter dissolved oxygen concentration in the upper 30 percent of the depth of manure in the structure at all times.

(B) The design, operation and maintenance plan for the aeration equipment must be in the construction permit application and made a condition in the approved construction permit.

19. Proposed confinement site has a suitable truck turnaround area so that semitrailers do not have to back into the facility from the road

	Score	Air	Water	Community
Truck turnaround	20			20.00

(A) The design, operation and maintenance plan for the truck turn around area must be in the construction permit application and made a condition in the approved construction permit.

(B) The turnaround area should be at least 120 feet in diameter and be adequately surfaced for traffic in inclement weather.

20. Construction permit applicant's animal feeding operation environmental and worker protection violation history for the last five years at all facilities in which the applicant has an interest.

	Score	Air	Water	Community
No history of Administrative Orders in last five years	30			30.00

(A) "Interest" - means ownership of a confinement feeding operation as a sole proprietor or a 10 percent or more ownership interest held by a person in a confinement feeding operation as a joint tenant, tenant in common, shareholder, partner, member, beneficiary or other equity interest holder. Ownership interest is an interest when it is held either directly, indirectly through a spouse or dependent child, or both.

(B) An environmental violation is a final Administrative Order (AO) from the department of natural resources or final court ruling against the construction permit applicant for environmental violations related to an animal feeding operation. A Notice of Violation (NOV) does not constitute a violation.

21. Construction permit applicant waives the right to claim a Pollution Control Tax Exemption for the life of the proposed confinement feeding operation structure.

	Score	Air	Water	Community
Permanent waiver of Pollution Control Tax Exemption	5			5.00

(A) Waiver of Pollution Control Tax Exemption is limited to the proposed structure(s) in the construction permit application.

(B) The department and county assessor will maintain a record of this waiver, and it must be in the construction permit application and made a condition in the approved construction permit.

22. Construction permit applicant can lawfully claim a Homestead Tax Exemption on the site where the proposed confinement structure is to be constructed

- OR -

the construction permit applicant is the closest resident to the proposed confinement structure.

	Score	Air	Water	Community
Site qualifies for Homestead Tax Exemption or permit applicant is closest resident to proposed structure	25			25.00

(A) Proof of Homestead Tax Exemption is required as part of the construction permit application.

(B) Applicant includes persons who have ownership interests. "Interest" - means ownership of a confinement feeding operation as a sole proprietor or a 10 percent or more ownership interest held by a person in a confinement feeding operation as a joint tenant, tenant in common, shareholder, partner, member, beneficiary or other equity interest holder. Ownership interest is an interest when it is held either directly, indirectly through a spouse or dependent child, or both.

23. Construction permit applicant can lawfully claim a Family Farm Tax Credit for agricultural land where the proposed confinement feeding operation is to be located pursuant to Iowa Code chapter 425A.

	Score	Air	Water	Community
Family Farm Tax Credit qualification	25			25.00

Applicant includes persons who have ownership interests. "Interest" - means ownership of a confinement feeding operation as a sole proprietor or a 10 percent or more ownership interest held by a person in a confinement feeding operation as a joint tenant, tenant in common, shareholder, partner, member, beneficiary or other equity interest holder. Ownership interest is an interest when it is held either directly, indirectly through a spouse or dependent child, or both.

24. Facility size.

4960 x .4 = 1984 AUC

	Score	Air	Water	Community
1 to 2,000 animal unit capacity	20			20.00
2,001 to 3,000 animal unit capacity	10			10.00
3,001 animal unit capacity or more	0			0.00

(A) Refer to the construction permit application package to determine the animal unit capacity of the proposed confinement structure at the completion of construction.

(B) If the proposed structure is part of an expansion, animal unit capacity (or animal weight capacity) must include all animals confined in adjacent confinement structures.

(C) Two or more animal feeding operations under common ownership or management are deemed to be a single animal feeding operation if they are adjacent or utilize a common area or system for manure disposal. In addition, for purposes of determining whether two or more confinement feeding operations are adjacent, all of the following must apply:

(a) At least one confinement feeding operation structure must be constructed on and after May 21, 1998.

(b) A confinement feeding operation structure which is part of one confinement feeding operation is separated by less than a minimum required distance from a confinement feeding operation structure which is part of the other confinement feeding operation. The minimum required distance shall be as follows:

(1) 1,250 feet for confinement feeding operations having a combined animal unit capacity of less than 1,000 animal units.

(2) 2,500 feet for confinement feeding operations having a combined animal unit capacity of 1,000 animal units or more.

25. Construction permit application includes livestock feeding and watering systems that significantly reduce manure volume.

	Score	Air	Water	Community
Wet/dry feeders or other feeding and watering systems that significantly reduce manure volume	25		12.50	12.50

The design, operation and maintenance plan for the feeding system must be in the construction permit application and made a condition in the approved construction permit.

Proposed Site Operation and Manure Management Practices

The following scoring criteria apply to the operation and manure management characteristics of the proposed confinement feeding operation. Mark <u>one</u> score under each criterion that best reflects the characteristics of the submitted manure management plan.

26. Liquid or dry manure (choose only one subsection from subsections "a" - "e" and mark one score in that subsection).

		Score	Air	Water	Community
a.	Bulk dry manure is sold under Iowa Code Chapter 200A and surface-applied	15		15.00	
	Bulk dry manure is sold under Iowa Code Chapter 200A and incorporated on the same date it is land-applied	30	12.00	12.00	6.00
b.	Dry manure is composted and land-applied under the requirements of an approved department manure management plan	10	4.00	4.00	2.00
	Dry manure is composted and sold so that no manure is applied under the requirements of an approved department manure management plan	30	12.00	12.00	6.00
c.	Methane digester is used to generate energy from manure and remaining manure is surface-applied under the requirements of an approved department manure management plan	10	3.00	3.00	4.00
	After methane digestion is complete, manure is injected or incorporated on the same date it is land-applied under the requirements of an approved department manure management plan	30	12.00	12.00	6.00
d.	Dry manure is completely burned to generate energy and no	30	9.00	9.00	12.00

	remaining manure is applied under the requirements of an approved department manure management plan				
	Some dry manure is burned to generate energy, but remaining manure is land-applied and incorporated on the same date it is land applied	30	12.00	12.00	6.00

e.	Injection or incorporation of manure on the same date it is land-applied	30	12.00	12.00	6.00

(A) Choose only ONE line from subsection "a", "b," "c," "d," or "e" above and mark only one score in that subsection.
(B) The injection or incorporation of manure must be in the construction permit application and made a condition in the approved construction permit.
(C) If an emergency arises and injection or incorporation is not feasible, prior to land application of manure the applicant must receive a written approval for an emergency waiver from a department field office to surface-apply manure.
(D) Requirements pertaining to the sale of bulk dry manure under pursuant to Iowa Code chapter 200A must be incorporated into the construction permit application and made a condition of the approved construction permit.
(E) The design, operation and maintenance plan for utilization of manure as an energy source must be in the construction permit application and made a condition in the approved construction permit.
(F) The design, operation and maintenance plan for composting facilities must be in the construction permit application and made a condition in the approved construction permit.

27. Land application of manure is based on a two-year crop rotation phosphorus uptake level.

	Score	Air	Water	Community
Two-year phosphorus crop uptake application rate	10		10.00	

(A) Land application of manure cannot exceed phosphorus crop usage levels for a two-year crop rotation cycle.
(B) The phosphorus uptake application rates must be in the construction permit application and made a condition in the approved construction permit.

28. Land application of manure to farmland that has USDA Natural Resources Conservation Service (NRCS) approved buffer strips contiguous to all water sources traversing or adjacent to the fields listed in the manure management plan.

	Score	Air	Water	Community
Manure application on farmland with buffer strips	10		8.00	2.00

(A) The department may request NRCS maintenance agreements to ensure proper design, installation and maintenance of filter strips. If a filter strip is present but not designed by NRCS, it must meet NRCS standard specifications.
(B) The application field does not need to be owned by the confinement facility owner to receive points.
(C) On current and future manure management plans, the requirement for buffer strips on all land application areas must be in the construction permit application and made a condition in the approved construction permit.

29. Land application of manure does not occur on highly erodible land (HEL), as classified by the USDA NRCS.

	Score	Air	Water	Community
No manure application on HEL farmland	10		10.00	

Manure application on non-HEL farmland must be in the construction permit application and made a condition in the approved construction permit.

30. Additional separation distance, above minimum requirements (0 or 750 feet, see below), for the land application of manure to the closest:

* Residence not owned by the owner of the confinement feeding operation,
* Hospital,
* Nursing home, or
* Licensed or registered child care facility.

	Score	Air	Water	Community
Additional separation distance of 200 feet	5	3.25		1.75
Additional separation distance of 500 feet	10	6.50		3.50

(A) The department will award points only for the single building, of the four listed above, closest to the proposed confinement feeding operation.
(B) Minimum separation distance for land application of manure injected or incorporated on the same date as application: 0 feet.

(C) Minimum separation distance for land application of manure broadcast on soil surface: 750 feet.
(D) The additional separation distances must be in the construction permit application and made a condition in the approved construction permit.
(E) "Licensed child care center" – a facility licensed by the department of human services providing child care or preschool services for seven or more children, except when the facility is registered as a child care home.
(F) "Registered child development homes" - child care providers certify that they comply with rules adopted by the department of human services. This process is voluntary for providers caring for five or fewer children and mandatory for providers caring for six or more children.
(G) A full listing of licensed and registered child care facilities is available at county offices of the Department of Human Services

31. Additional separation distance, above minimum requirements (0 or 750 feet, see below), for land application of manure to closest public use area.

	Score	Air	Water	Community
Additional separation distance of 200 feet	5	2.00		3.00

(A) "Public use area" - a portion of land owned by the United States, the state, or a political subdivision with facilities which attract the public to congregate and remain in the area for significant periods of time. Facilities include, but are not limited to, picnic grounds, campgrounds, cemeteries, lodges, shelter houses, playground equipment, lakes as listed in Table 2 in 567--Chapter 65, and swimming beaches. It does not include a highway, road right-of-way, parking areas, recreational trails or other areas where the public passes through, but does not congregate or remain in the area for significant periods of time.
(B) Minimum separation distance for land application of manure injected or incorporated on the same date as application: 0 feet.
(C) Minimum separation distance for land application of manure broadcast on soil surface: 750 feet.
(D) The additional separation distances must be in the construction permit application and made a condition in the approved construction permit.

32. Additional separation distance, above minimum requirements (0 or 750 feet, see below), for the land application of manure to the closest:

* Educational institution,
* Religious institution, or
* Commercial enterprise.

	Score	Air	Water	Community
Additional separation distance of 200 feet	5	2.00		3.00

(A) Minimum separation distance for land application of manure broadcast on soil surface: 750 feet.
(B) Minimum separation distance for land application of manure injected or incorporated on same date as application: 0 feet.
(C) The additional separation distances must be in the construction permit application and made a condition in the approved construction permit.
(D) "Educational institution" - a building in which an organized course of study or training is offered to students enrolled in kindergarten through grade 12 and served by local school districts, accredited or approved nonpublic schools, area educational agencies, community colleges, institutions of higher education under the control of the state board of regents, and accredited independent colleges and universities.
(E) "Religious institution" - a building in which an active congregation is devoted to worship.
(F) "Commercial enterprise" - a building which is used as a part of a business that manufactures goods, delivers services, or sells goods or services, which is customarily and regularly used by the general public during the entire calendar year and which is connected to electric, water, and sewer systems. A commercial enterprise does not include a farm operation.

33. Additional separation distance of 50 feet, above minimum requirements (0 or 200 feet, see below), for the land application of manure to the closest private drinking water well or public drinking water well - OR well is properly closed under supervision of county health officials.

	Score	Air	Water	Community
Additional separation distance of 50 feet or well is properly closed	10		8.00	2.00

(A) Minimum separation distance for land application of manure injected or incorporated on the same date as application or 50-foot vegetation buffer exists around well and manure is not applied to the buffer: 0 feet.
(B) Minimum separation distance for land application of manure broadcast on soil surface: 200 feet.
(C) If applicant chooses to close the well; the well closure must be incorporated into the construction permit application and made a condition in the approved construction permit.

34. Additional separation distance, above minimum requirements, for the land application of manure to the closest:

* Agricultural drainage well,
* Known sinkhole,
* Major water source, or
* Water source

	Score	Air	Water	Community
Additional separation distance of 200 feet	5	0.50	2.50	2.00
Additional separation distance of 400 feet	10	1.00	5.00	4.00

(A) "Agricultural drainage wells" - include surface intakes, cisterns and wellheads of agricultural drainage wells.
(B) "Major water source" - a lake, reservoir, river or stream located within the territorial limits of the state, or any marginal river area adjacent to the state, which can support a floating vessel capable of carrying one or more persons during a total of a six-month period in one out of ten years, excluding periods of flooding. Major water sources in the state are listed in Tables 1 and 2 in 567--Chapter 65.
(C) "Water source" - a lake, river, reservoir, creek, stream, ditch, or other body of water or channel having definite banks and a bed with water flow, except lakes or ponds without an outlet to which only one landowner is riparian.
(D) The additional separation distances must be in the construction permit application and made a condition in the approved construction permit.

35. Additional separation distance above minimum requirements, for the land application of manure, to the closest:

* High quality (HQ) water,
* High quality resource (HQR) water, or
* Protected water area (PWA).

	Score	Air	Water	Community
Additional separation distance of 200 feet	5		3.75	1.25
Additional separation distance of 400 feet	10		7.50	2.50

(A) HQ waters are identified in 567--Chapter 61.
(B) HQR waters are identified in 567--Chapter 61.
(C) A listing of PWAs is available at:
http://www.iowadnr.gov/Recreation/CanoeingKayaking/StreamCare/ProtectedWaterAreas.aspx.

36. Demonstrated community support.

	Score	Air	Water	Community
Written approval of 100% of the property owners within a one mile radius	20			20.00

37. Worker safety and protection plan is submitted with the construction permit application.

	Score	Air	Water	Community
Submission of worker safety and protection plan	10			10.00

(A) The worker safety and protection plan must be in the construction permit application and made a condition in the approved construction permit.
(B) The worker safety and protection plan and subsequent records must be kept on site with the manure management plan records.

38. Applicant signs a waiver of confidentiality allowing public to view confidential manure management plan land application records

	Score	Air	Water	Community
Manure management plan confidentiality waiver	5			5.00

The waiver of confidentiality must be in the construction permit application and made a condition in the approved construction permit. The applicant may limit public inspection to reasonable times and places.

39. Added economic value based on quality job development (number of full time equivalent (FTE) positions), and salary equal to or above Iowa department of workforce development median (45-2093)
-OR-
the proposed structure increases commercial property tax base in the county.

	Score	Air	Water	Community
Economic value to local community	10			10.00

The Iowa Department of Workforce Development regional profiles are available at http://www.iowaworkforce.org/centers/regionalsites.htm. Select the appropriate region and then select "Regional Profile."

40. Construction permit application contains an emergency action plan.

	Score	Air	Water	Community
Emergency action plan	5		2.50	2.50

(A) Iowa State University Extension publication PM 1859 lists the components of an emergency action plan. The emergency action plan submitted should parallel the components listed in the publication.
(B) The posting and implementation of an emergency action plan must be in the construction permit application and made a condition in the approved construction permit.
(C) The emergency action plan and subsequent records must be kept on site with the manure management plan records.

41. Construction permit application contains a closure plan.

	Score	Air	Water	Community
Closure Plan	5		2.50	2.50

(A) The closure plan must be in the construction permit application and made a condition in the approved construction permit.
(B) The closure plan must be kept on site with the manure management plan records.

42. Adoption and implementation of an environmental management system (EMS) recognized by the department.

	Score	Air	Water	Community
EMS	15	4.50	4.50	6.00

(A) The EMS must be in the construction permit application and made a condition in the approved construction permit.
(B) The EMS must be recognized by the department as an acceptable EMS for use with confinement operations.

43. Adoption and implementation of NRCS approved Comprehensive Nutrient Management Plan (CNMP).

	Score	Air	Water	Community
CNMP	10	3.00	3.00	4.00

The implementation and continuation of a CNMP must be in the construction permit application and made a condition in the approved construction permit.

44. Groundwater monitoring wells installed near manure storage structure, and applicant agrees to provide data to the department.

	Score	Air	Water	Community
Groundwater monitoring	15		10.50	4.50

(A) Monitoring well location, sampling and data submission must meet department requirements.
(B) The design, operation and maintenance plan for the groundwater monitoring wells, and data transfer to the department, must be in the construction permit application and made a condition in the approved construction permit.

	Total Score	Air	Water	Community
	880	213.50	271.00	404.50
Score to pass	440	53.38	67.75	101.13

Site: Maxwell North

Date: 4/12/2020

APPENDIX C
MASTER MATRIX

Question	Score	Air	Water	Community	
1	25	16.25	0	8.75	
2	20	8	0	12	
3	30	12	0	18	
4	25	0	25	0	
5	0	0	0	0	
6	10	4	0	6	
7	0	0	0	0	
8	50	5	25	20	
9	0	0	0	0	
10	30	0	22.5	7.5	
11	0	0	0	0	
12	30	27	0	3	
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	30	9	18	3	
17	30	0	27	3	
18	0	0	0	0	
19	20	0	0	20	
20	30	0	0	30	
21	0	0	0	0	
22	0	0	0	0	
23	25	0	0	25	
24	20	0	0	20	
25	25	0	12.5	12.5	
26	30	12	12	6	Only for: "b,c, or d" Only for: "a & e"
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	
31	0	0	0	0	
32	0	0	0	0	
33	0	0	0	0	
34	0	0	0	0	
35	10	0	7.5	2.5	
36	0	0	0	0	
37	0	0	0	0	
38	0	0	0	0	
39	0	0	0	0	
40	0	0	0	0	
41	5	0	2.5	2.5	
42	0	0	0	0	
43	0	0	0	0	
44	0	0	0	0	
Total	**445**	**93.25**	**152**	**199.75**	
Total to Pass	**440**	**53.38**	**67.75**	**101.13**	

Requires: "Design, Operation, and Maintenance Plan"

Requires: "Supporting Documentation

Design, Operating, & Maintenance Plans & Supporting Documentation

MAXWELL NORTH

Master Matrix #1
The swine facility is located an additional **340 feet**, above the required **1,875 feet**, away from the closest residence not owned by the owner of the confinement feeding operation, Hospital, Nursing Home, and Licensed or registered child care facility. Refer to site map.
Credits of **25** pts have been counted in the Master Matrix for **Item 1**.

Master Matrix #2
The swine facility is located at least an additional **1,201 feet,** above the required **2,500 feet**, away from the closest Public Use Area; defined as a portion of land owned by the United States, the state, or a political subdivision with facilities which attract the public to congregate and remain in the area for significant periods of time. Refer to site map.
Credits of **20** pts have been counted in the Master Matrix for **Item 2**.

Master Matrix #3
The swine facility is located at least an additional **1,501 feet**, above the required **1,875 feet**, away from the closest Educational Institute, Religious Institution, or Commercial Enterprise. Refer to site map.
Credits of **30** pts have been counted in the Master Matrix for **Item 3**.

Master Matrix #4
The swine facility is located an additional **1,401 feet**, above the required **500 feet**, away from the closest water source. Refer to site map.
Credits of **25** pts have been counted in the Master Matrix for **Item 4**.

Master Matrix #6
The swine facility is located an additional **500 feet**, above the required **2,500 feet**, away from the closest critical public area. Refer to site map.
Credits of **10** pts have been counted in the Master Matrix for **Item 6**.

Master Matrix #8
The swine facility is located an additional **2,547 feet**, above the required **1,000 feet**, away from the closest Agricultural drainage well, known sinkhole, or major water source. Refer to site map.
Credits of **50** pts have been counted in the Master Matrix for **Item 8**.

Master Matrix #10
The swine facility is located at lease two times the minimum separation distance of **1000 feet**, from the closest high quality water, high quality resource water, or protected water areas. Refer to site map.
Credits of **30** pts have been counted in the Master Matrix for **Item 10**.

Master Matrix #12

Points: We are claiming 30 points because this Manure Storage Structure has a cover. Iowa Code states that "a formed manure storage structure directly beneath a floor where animals are housed in a confinement feeding operation is deemed to be covered." On this Site the building roof is the cover.

Design: The site will consist of **two** swine finishing buildings that have manure storage pits directly beneath the roof and floor where the pigs are housed, as required by DNR rules to be considered covered liquid manure storage. The roof has been designed and warranted using ribbed painted, or galvanized steel to withstand appropriate snow and wind loads for **Story** County, Iowa.

Operation: The roof is part of the Structure and has no moving parts, therefore it does not require an operating plan.

Maintenance: Each building's roof and floor will be maintained to provide coverage of the manure storage structure. Maintenance of this cover will be minimal since it consists of steel. This facility will have a caretaker on site and in the buildings daily, if there is evidence of storm damage, or any holes/water leaks, which would be evidence of a hole; if found, they will be immediately repaired with appropriate materials to achieve as-built condition.

Credits of **30** points have been counted in the Master Matrix for **Item 12**.

Master Matrix #16

Design: A structure consisting of a packed lime or concrete floor, steel roof, and wooden or concrete walls will be constructed to contain the mortality and composting materials. We will construct a primary bin with a minimum capacity of **843** cubic feet based on ISU PM 1917 for a **4,960** head **wean** to finish site turning **two** groups per year, finishing **9,920** head of pigs per year. We will also be constructing a secondary bin with a minimum capacity of **843** cubic feet, and potentially a third bin for storage of finished compost waiting for field application. As an example, a structure with dimensions of **11'** x **20'** x **4'** deep divided into two equal bins would have a total capacity of **1,760** cubic feet (**104%** of requirement) satisfying the primary and secondary bin capacity requirements. The composting unit is located outside of wetlands and 100- year floodplain areas. It is also located at least 100 feet from all private wells, 200 feet from public wells, 50 feet from property lines, 500 feet from neighboring residences, and 100 feet from flowing or intermittent streams, lakes, or ponds.

Operation: The facility will be used for stockpiling and composting activities. All carcasses will be placed on a bed of 12" of composting material and then covered with 12" of composting material to allow proper decomposing. Dead animals will be placed in the composter within 24 hours of death. Following the primary heating cycle, the partially composted carcasses are removed from the primary bin and placed in a secondary bin. The mechanical action of moving the compost breaks up the pile, redistributes excess moisture, and introduces a new oxygen supply. The design of the composting facility does not allow the release of leachate, preventing runoff or leaching of pollutants into surfaces or groundwater, controls flies, rodents and other vermin. The compost will not be removed from the composting unit until fully stabilized and all flesh, organs and soft tissue are fully decomposed. The third storage bin used for finished compost, shall be limited to 18 months and shall be applied to cropland or pastureland at

rates consistent with the nitrogen use levels necessary to obtain optimum crop yields and shall be applied in a manner as to prevent runoff to surface waters of the state. Maintenance: The facility will be inspected weekly for required maintenance, and kept up to "as built" standards. Credits of **30 pts** have been counted in the Master Matrix for **Item 16**.

Master Matrix # 17

Points: We are claiming 30 points because the manure storage structure is formed. The pit is "cast in place" reinforced concrete.

Design: The site will utilize an 8' deep cast in place reinforced concrete pit. The reinforced cast in place structure meets requirements of Chapter 65 for manure storage, the housing of swine, and the support of roof, slats and walls. Tables for steel grade, size and spacing are reviewed by a DNR engineer through the permitting process. Wall and floor thickness, concrete strength, backfill soil categories, and traffic patterns are also reviewed. There will be a wall poured over an approved footing and floor incorporating a water stop that prevents infiltration/exfiltration. Refer to the Construction Design Statement for specifics. The Construction Design Statement has been completed and signed by the building contractor and contains a Construction Certification stating that it was designed in accordance with DNR rules.

Operation: The Manure Storage Structure is static and has no moving parts. The pit will be cleaned and inspected before animals are placed in building looking for any defects, such as cracks or honeycombing, and if discovered will be repaired to industry standards. The facility will be operated as a below building concrete pit. There will be a Caretaker on site and in the buildings daily, and will visually monitor manure levels. In addition water usage meters are routinely monitored by the caretaker to insure the ample water supply to pigs, and will also be used to identify excessive usage or leaks. The concrete walls of the manure storage pit are designed for heavy equipment to be operated no less than 5 feet from the walls. The pump-out pits are designed to allow heavy equipment to be operated closer than 5 feet, and are constructed using stronger design specifications. Perimeter Tile are requirement of this CDS and every tile outlet will have a monitoring location consisting of either a monitoring port including a valve in case of leak, or an outlet to the surface.

Maintenance: Due to the concrete design and specifications for the formed structure, maintenance is expected to be minimal for this structure. As a requirement of the CDS all concrete will be cured to minimize shrinking and cracking. Approximately 12" of pit will be exposed above the soil surface. There will be a Caretaker on site and in the buildings daily, and will routinely looking for cracks in the walls.. The building contractor will be notified if any cracking is discovered.

The Caretaker will make routine observations of the perimeter footing tile discharge point, or monitoring port for signs of contamination; such as manure odor, visual discoloration, excessive liquid in the tile during dry periods, and dead foliage. If contamination is observed, an immediate investigation will be conducted to locate the source and the problem will immediately be corrected. A groundwater and/or structural

expert will direct the investigation, and the investigation will include closing the tile shutoff valve and taking water samples for visual and laboratory analysis.

Initial Settling of soils will be monitored and corrected to eliminate standing water next to the manure storage structure.

Credits of **30** pts have been counted in the Master Matrix for **Item 17.**

Master Matrix # 19

Design: The site will have a truck turnaround area at least 120 feet in diameter and adequately surfaced for traffic in inclement weather. The site will have a truck turnaround area allowing the trucks to pull into the site completely off the road and turn around.

Operation: The driveway will be operated to provide for safe entrance and exit to the property for delivery vehicles and not obstruct the public thoroughfare.

Maintenance: The driveway will be maintained to a level that will support regular truck traffic. The driveway will be constructed with a 2-3 inch base. Road rock gravel will be used as a road surface that will be monitored for the purposes of leveling, filling potholes, and adequate snow removal.

Credits of **20** pts have been counted in the Master Matrix for **Item 19**.

Master Matrix #20

The construction permit applicant has no history of Administrative Orders in the last five years at any site in which the applicant has any interest.

Credits of **30** pts have been counted in the Master Matrix for **Item 20**.

Master Matrix # 23

The construction permit applicant, **Maxwell Family Farms, Inc.**, can lawfully claim the Family Farm Tax Exemption on the site where the confinement structure is being constructed. The owner, Maxwell Family Farms, Inc., holds 100% ownership interest and also farms the contiguous farm ground.

Credits of **25** pts have been counted in the Master Matrix for **Item 23**.

Master Matrix #24

The facility has a capacity of **1 to 2,000** animal units. Refer to Construction Permit Application, page 3.

Credits of **20** pts have been counted in the Master Matrix for **Item 24**.

Master Matrix #25

Design: The buildings on the site will utilize a wet/dry feeder, dry feeder with watering cups, or swinging nipples. Industry wide accepted data shows significant water savings from any of the three options as compared to a gate mounted watering nipple. Please refer to the attached scientific article illustrating the water savings and benefits any of the three methods mentioned above.

Operation: Feeders, watering cups, or swinging nipples will be adjusted to reduce waste and optimize feed efficiency for the facility. The water savings result in reducing the gallons of water in the pit that later has to be hauled out onto farm fields.
Maintenance: The feeders, watering cups, or swinging nipples will be inspected on a regular basis and adjusted as needed. Water flow will be monitored and adjusted to control waste and excess manure volume.
Credits of **25** pts have been counted in the Master Matrix for **item 25**.

Master Matrix # 26 "e"
All manure will be injected or incorporated on the same date that it is applied.
Credits of **30** pts have been counted in the Master Matrix for **Item 26e**.

Master Matrix #35
A separation distance of **400 feet** from the closest high quality water, high quality resource water, or protected water area, will be kept when land application of manure occurs.
Credits of **10 pts** have been counted in the Master Matrix for **Item 35**.

Master Matrix #41
THIS CLOSURE PLAN MUST BE KEPT ON SITE WITH ALL OTHER MMP DOCUMENTS. Closure Plan as of **4/2/20**. This plan has been written in accordance with NRCS Conservation Practice Standard "Closure of Waste Impoundments". The closure plan is based on NRCS Code #360. This also meets the standards and requirements, which are set forth by the Iowa DNR. The closure shall comply with all federal, State of Iowa, local, and tribal laws, rules and regulations that are in place at the time of the closure. **Maxwell Farms, Inc.,** will notify the DNR Filed office of their intent to close the structures on this farm which consists of two 8' deep pit barns, subsequent to six (6) months of the structure being empty of livestock. Applicant will follow any closure rules that may be established at that time that is more stringent than this closure plan. **Maxwell Farms, Inc.** and the DNR will establish a time line of completion for the closure plan.

1. Manure should be well agitated to try to remove as much manure as possible. The effluent, solids and any sludge will have an analysis for both nitrogen and phosphorus. This analysis will be used in determining the amount of material to be applied on a per acre basis according to the Manure Management Plan.
2. Non-concrete construction material should be removed and disposed of following DNR guidelines.
3. Slats should be removed for pit cleaning. Slates can be broken and added back after the pit is clean and walls have been knocked in.
4. All solids left in concrete containment shall be removed and field applied using agronomic rates.
5. After concrete containment is cleaned, applicant shall contact the DNR Field Office for visual inspection if DNR so advises. If DNR determines containment is clean enough to no create environmental impact, applicant may proceed to the next step.
6. Floor of containment shall be broken up so as to not impound water. Sub drain tile may be removed. Containment walls will be broken up and pulled into pit

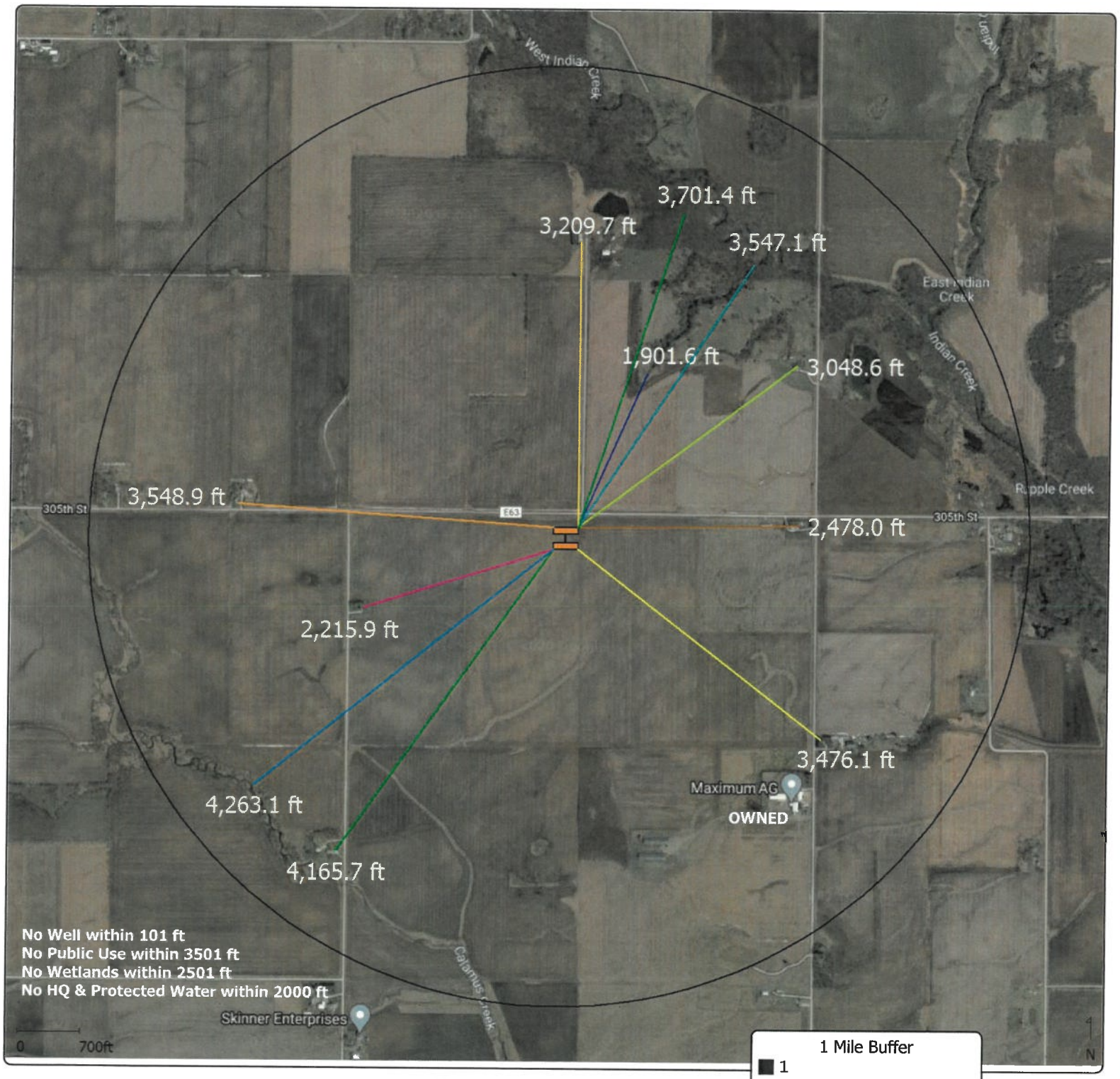
area. Demolished building materials shall be placed on top of concrete if not disposed of in another way.

7. Materials are to be covered with soil to a settled depth of one foot, and the backfill be sufficiently mounded such that runoff will be diverted from the site after the backfill settles.
8. Measures shall be taken during the construction to minimize site erosion and pollution of downstream water resources. This may include such items as silt fences, hag able barriers, temporary vegetation, and mulching.

Credits of 5 pts have been taken for **Item 41**.

Maxwell North

Site Placement



1 Mile Buffer
- 1

Distance to Major Water (ft)
- 3547

Distance to Water (ft)
- 1901
- 4263

Feature ID
- Site

Distance to Residences (ft)
- 4165
- 3048
- 3476
- 2478
- 3209
- 3548
- 2215

Distance to Remote Campsite (ft)
- 3701

Date: Mar 23, 2020
Maxwell North
Story County, Iowa
Section 17, T82N, R22W

Grower : Maxwell North
Farm : Site
Field : Site Placement

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Maxwell North

Site Placement

Feature ID
Site

Feature ID
Drive

Feature ID
Composter

Distance to ROW
(ft)
130

Distance Between Barns
(ft)
100

Date: Mar 23, 2020
Maxwell North
Story County, Iowa
Section 17, T82N, R22W

Grower : Maxwell North
Farm : Site
Field : Site Placement

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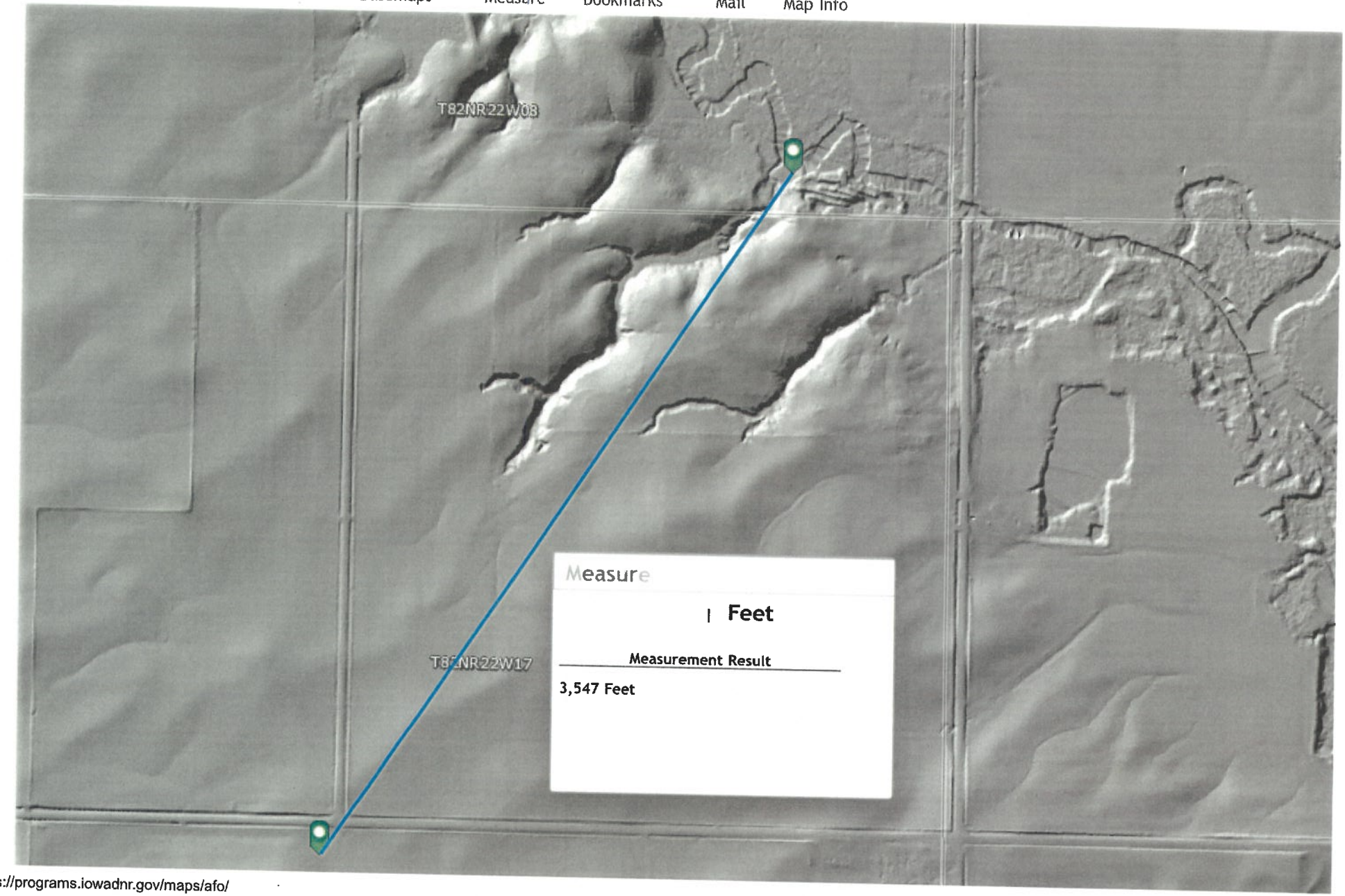
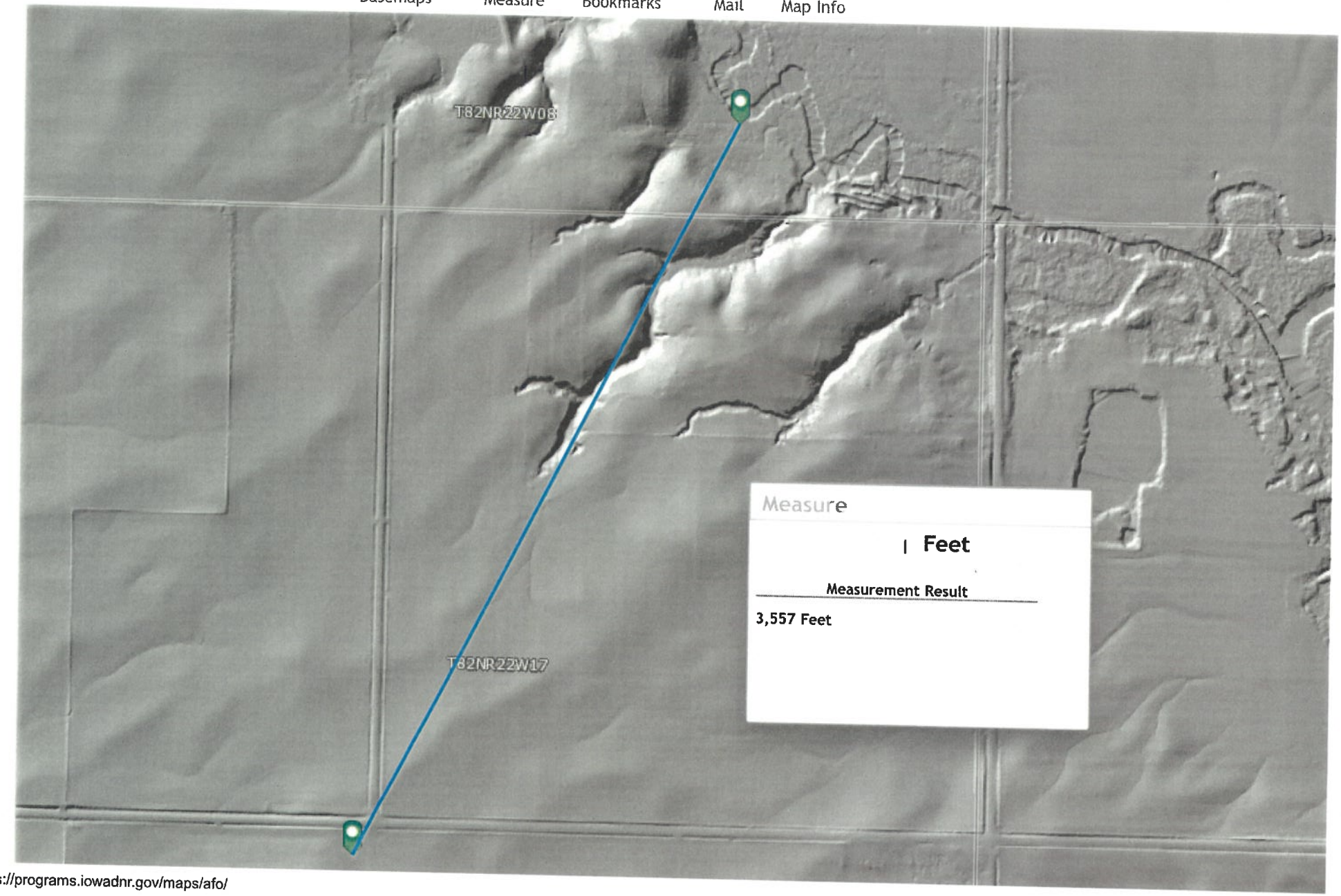
IOWA
DEPARTMENT OF NATURAL RESOURCES

Basemaps Measure Bookmarks Mail Map Info



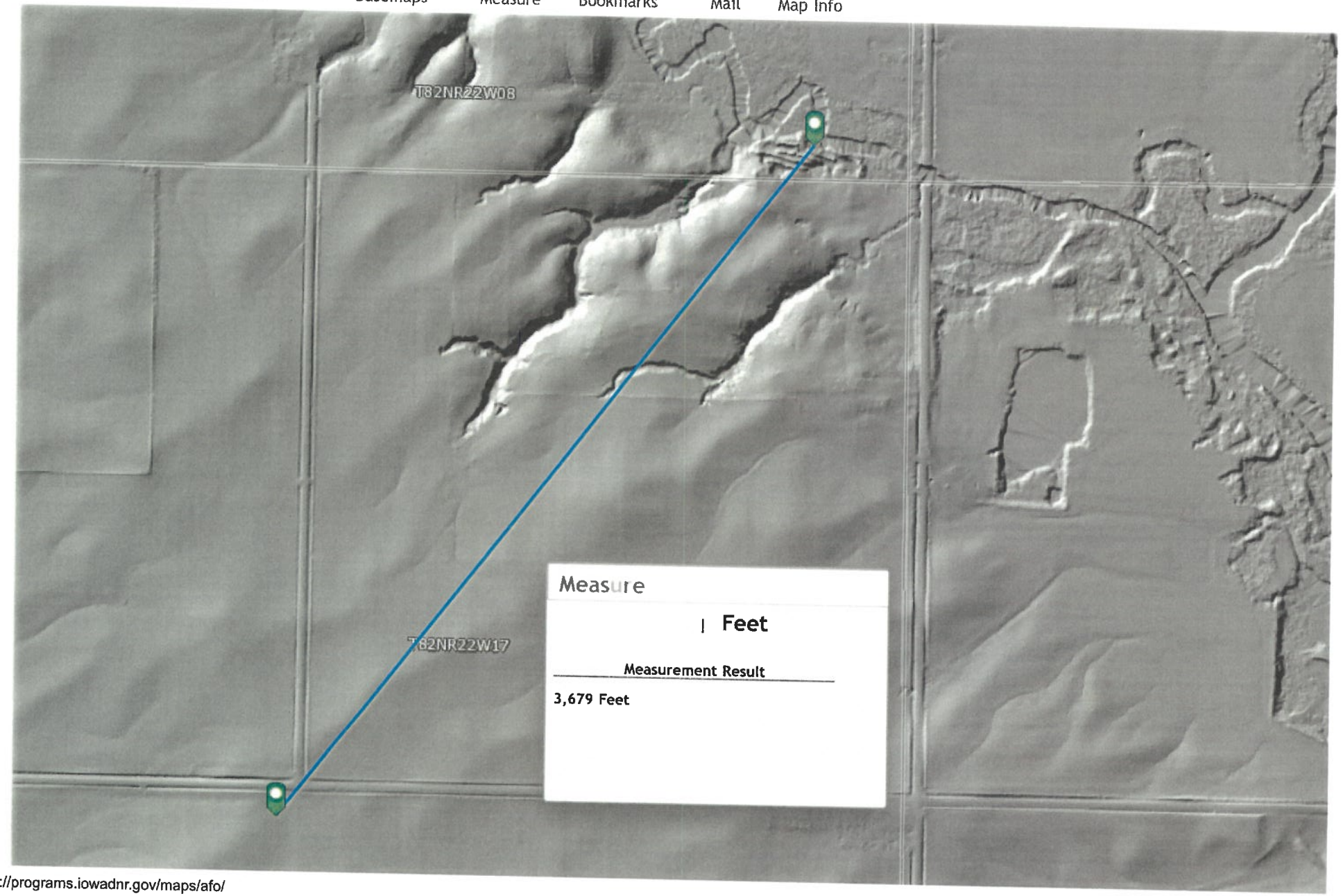
DNR IOWA
DEPARTMENT OF NATURAL RESOURCES

Basemaps Measure Bookmarks Mail Map Info



IOWA
DEPARTMENT OF NATURAL RESOURCES

Basemaps Measure Bookmarks Mail Map Info



Composting Swine Mortalities in Iowa

Composting Gains Popularity

With more than 25 million hogs produced annually in Iowa, cost effective mortality disposal alternatives that minimize risks to herd health and the environment are essential. Following the lead of the poultry industry, where composting has been used successfully for more than a decade, swine producers are finding that composting is a flexible and reasonably priced disposal method that can be used year round. Results of a statewide survey of Iowa swine producers conducted by Iowa State University and the Iowa Pork Producers Association during March of 2001 show that about 12 percent of producers now rely exclusively on composting to dispose of their mortalities. An additional 6 percent of producers say they rely on composting as a backup disposal method when timely rendering service is not available.

Swine producers say they are attracted to composting for a variety of reasons. Composting allows them to manage mortalities promptly, as they occur. With properly designed composting facilities, there is no need to call for rendering service or to worry about options if the rendering truck can't make it that day. Composting also eliminates the need to wait for the ground to dry up or thaw out so that burial can be accomplished.

Composting facilities and equipment

Covered bins versus open windrows?
Composting in moderately sized roofed bins is the recommended method for Iowa's highly variable climate. Use of covered bins simplifies management of the composting operation and maximizes the potential for success regardless of weather conditions. Covered bin systems reduce the potential for seasonal odor problems caused by overly wet compost. Bins also minimize space requirements, improve heat retention during cold weather, and help to avoid problems with scavenging insects and animals. Bin systems need not be complicated or costly. Old corn cribs, open front livestock buildings, and other types of unused farm structures can often be converted for composting at a relatively low cost.

Figure 1. Composting rapidly decomposes swine mortalities, producing a soil-like product that can be spread on cropland.

Though sometimes used for emergencies,composting in open piles or windrows is not recommended for day-to-day mortality management. Open systems are vulnerable to saturation during wet weather, which can lead to odor production and release of contaminated leachate. While these problems can be reduced to some extent by using extra cover material and turning the piles more frequently to break up wet spots, the material, labor, and management resources required to successfully operate open systems during adverse weather conditions will be higher than for bin composting systems.

Equipment
Most of the equipment used in swine mortality composting is commonly found on livestock farms. Machinery needs include a skid loader, or tractor with front-end loader, to load and unload composting bins or windrow; and a solid manure spreader to spread finished compost on cropland. A stainless steel composting thermometer with a three- or four-foot long stem is needed to check internal pile temperatures.

Cover material
The material used to cover the carcasses is an important part of the composting system. The ideal cover material retains heat, absorbs excess moisture, and provides a barrier that helps discourage insects and scavengers. Cover materials also must provide much of the carbon, which is essential to the

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microbes that decompose animal carcasses. Due to its excellent ability to retain heat and absorb excess moisture, sawdust is generally acknowledged as the best cover material. Unfortunately, sawdust and recycled wood products are in high demand for many other uses, making them increasingly hard to obtain and raising their price substantially in recent years.

Alternative cover materials that are much easier to obtain include chopped cornstalks or straw. Since these tend to be less absorptive and have poorer insulating properties than sawdust, their use requires more care during cold or wet weather. Poultry litter, a mixture of sawdust and poultry manure produced during turkey and broiler production, has been used successfully for carcass composting in the poultry industry. Not only does litter have the desirable characteristics of sawdust, the bacteria and nitrogen added by the manure make this mixture more biologically active than sawdust alone. Bedding from swine hoop buildings also can be used as cover material. Since the quality of used bedding from hoop buildings varies considerably, care should be taken to avoid materials that are saturated with liquid or that contain high proportions of manure because these conditions can lead to slow decay and/or excessive odor production.

Figure 2. This low-cost bin composting system was constructed with used materials and is located inside a converted farm building. (photo by Kris Kohl, Iowa State University)

Disposal area

Swine composting operations require cropland or pasture land for final disposal of the finished compost. The finished compost will contain some recognizable bones, particularly if large breeding animals or finishing hogs are composted, so locating the disposal area away from non-farm residences is recommended. If the composting operation is functioning properly, however, bones will be free of all soft tissues, and they will be dry, brittle, and of little or no attraction to scavenging animals or insects.

Producers frequently ask about the fertilizer value of their compost. Unfortunately, the nitrogen value of the compost is difficult to predict because it can vary considerably depending on the type and amount of cover material used. Sampling and testing the compost for nutrient content is the only reliable way to determine its fertilizer value.

Composting procedures

Mortality composting is begun by placing a 12-inch layer of cover material in the bottom of the bin. Decaying carcasses release excess moisture, so a thick absorptive base layer plays an important role in preventing release of excess liquid.

Carcasses placed in the composting bins should not touch each other and should be at least 9 to 12 inches from bin walls. Too many carcasses in one spot leads to localized wet spots and poor decay. Carcasses that are too close to the cool exterior side walls of the bin will decay slowly and are less likely to be exposed to the high temperatures necessary to kill disease-causing microorganisms. After a layer of carcasses has been placed in the bin, add 6 to 9 inches of cover material. Complete coverage is essential to avoid problems with insects, rodents, and scavengers. Daily layering of new carcasses and cover material continues until the bin is filled to a depth of about 5 feet. In some instances, it may help to segregate large and small carcasses in separate bins. This allows smaller carcasses to move through the treatment process quickly, minimizing the amount of bin space tied up in lengthy treatment cycles. To ensure continuous coverage throughout the composting cycle, it may be necessary to add cover material from time to time as material within the bins settles. This is particularly true when large carcasses are composted.

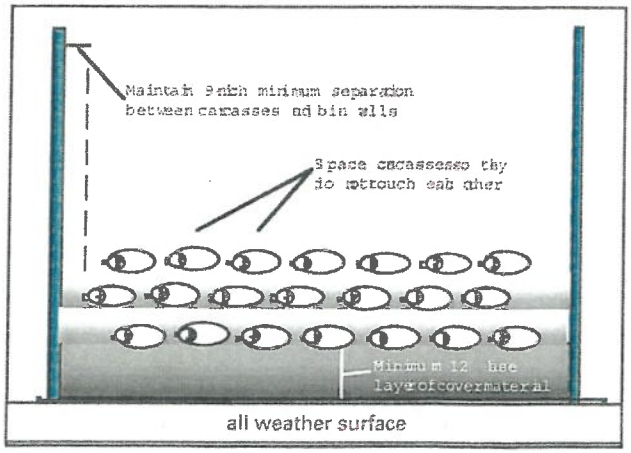

Figure 3. Animal carcasses should not touch each other, and should not be placed in the cool zone near composting bin walls.

properly operating facility, new material added to bins reaches temperatures of 120 to150°F within 24 to 48 hours. Internal temperatures can be monitored with a long-stemmed (36- to 48-inch) composting thermometer. For an accurate picture of internal conditions, probe the bin at several locations. It is normal to find hot and cool spots within the same bin, so a single temperature measurement can be misleading. If a bin fails to heat up, too much or too little moisture is the most common cause. It may be necessary to unload the bin and mix in compost from an active (hot) bin to remedy the problem.

After a bin is completely filled, it must undergo a primary heating cycle of 60 to 90 days. The length of the primary heating cycle will vary with the size of carcasses placed in the bin. For farrowing house and nursery losses, an initial heating cycle of as little as 30 days may be adequate. If the bin is filled with larger market-weight animals or breeding stock, primary heating cycles as long as 6 months may be necessary.

Following the primary heating cycle, the partially composted carcasses are removed from the primary bin and placed in a secondary bin. The mechanical action of moving the compost breaks up the pile, redistributes excess moisture, and introduces a new oxygen supply. Once this takes place, a secondary heating cycle occurs, accompanied by further decomposition. By the end of a 60- to 90-day secondary heating cycle, even large carcasses of breeding stock are normally reduced to a few large bones that are free of soft tissues which cause odors or attract insects and predators.

Figure 4. Checking internal temperatures with a composting thermometer is a quick way to determine if moisture and ot her conditions are suitable for rapid decay and pathogen reduction.

Sizing and layout

Bin-type composting systems lcated under a roof are recommended for best year-round performance, optimal processing, and minimal problems with runoff and scavengers. Total bin volume for a swine mortality composting operation is based on average daily weight of animals to be composted. Typically, about 20 cubic feet of primary bin volume is recommended for each pound of average daily loss, with an equal amount of secondary bin space.

Use Table 1 to estimate the amount of primary bin volume for your particular operation. Write in the annual number of pre-wean and nursery pig litters produced by your operation in the first two rows of column B. The annual number of pigs produced by your finishing operation, and

Table 1. Simplified method for estimating primary bin volume

(A) Phase of operation	(B) Litters per year	(C) * Number of animals	(D) ** Volume factor	(E) Primary bin volume (cubic feet)
Pre-wean pigs	675 litters		X 0.41	= 277
Nursery pigs	675 litters		X 0.26	= 176
Finishing pigs		5,800 pigs	X 0.17	= 986
Breeding stock		300 sows	X 0.57	= 171
			Total	= 1610

* For finishing pigs, use annual number marketed. For breeding stock, use average year-round population.

**Volume factors based on 20 cubic feet of primary bin capacity per pound of average daily loss. Weight of mortalities is calculated assuming average mortality rates as follows: pre-wean mortality, 2.5 pigs/litter @ 3 lbs/pig; nursery mortality, 2 percent (assume 9.5 pigs/litter) @ 25 lb/pig; finishing mortality, 2 percent @ 150 lb/pig; and breeding stock mortality, 3 percent annually @ 350 lbs/animal.

the average breeding stock population, are entered in the bottom two rows of column C. Multiply the values in columns B and C by the composter volume factor in column D, and enter the result in column E. The sum of all the values in column E (entered in Total box) is the estimated total amount of primary composting volume needed for your operation. You will need an equal volume of secondary bin space.

Example values shown in italics in columns B and C of Table 1 are for a 300-sow farrow-to-finish operation producing 675 litters per year, and marketing 5,800 finished pigs per year.

Approximate dimensions for each bin can be estimated following these steps (example values shown in italics):

Step 1: Estimate minimum bin width. Side-to-side dimensions of at least twice the loader bucket width are recommended to provide sufficient maneuvering room. For a skid loader with a 4 ft. wide bucket, for example, bin widths of at least 8 ft. are suggested.

Step 2: Select front-to-back bin dimension. One to two times the minimum bin width is suggested. For the 8 ft. wide bins in this example, a front-to-back dimension of 12 ft. is used.

Step 3: Calculate individual bin volume: Multiply bin width (from step 1) by the front-to-back dimension (from step 2) to obtain bin floor area. Then multiply the floor area by the anticipated working depth to obtain the bin volume. Working depths of 5 ft. or less are recommended (bin walls should be about 1 ft. higher than the working depth). In this example the bin floor area is 8 ft. X 12 ft. = 96 square ft. Using a 5 ft. working depth, the individual bin volume is: 96 sq. ft. X 5 ft. = 480 cubic feet.

Step 4: Estimate number of primary bins: To determine the number of primary bins needed, divide the estimated Total Primary Bin Volume (sum of values in column E of Table 1) by the Individual Bin Volume (step 3). If a fractional value is obtained, round UP to next whole number. For this example, dividing the total primary bin volume of 1610 cubic feet by the individual bin volume of 480 cubic feet yields a value of 3.35. Rounding this value UP, 4 primary bins are recommended.

Step 5: Estimate number of secondary bins: The number of secondary bins should equal the number of primary bins. In this case, 4 secondary bins are recommended.

Step 6: Additional bins for cover material: If space to stockpile dry cover material is NOT available in adjacent buildings, construction of 2 or more additional bins for this purpose is recommended.

Step 7: Select bin layout: Bin layout is usually dictated by the geometry of the available space. Linear and tandem layouts, like the floor plans shown in Figure 6, are most common. If bins will be located outdoors where they are not shielded from wind, the tandem layout is recommended to help retain heat during cold weather.

Livestock producers who are new to composting frequently ask the following questions.

Q. My composting operation is very odorous, the decay is slow, and internal pile temperatures are low even during summer months. What can I do to improve this?

A. Excessive odor production accompanied by low internal temperatures is typical of compost that is too wet. Excess water is normal in the immediate vicinity of the swine carcasses, but each carcass should be surrounded by sufficient amounts of cover material to absorb the liquid and prevent any from seeping out of the base or sides of the pile. Material in the outer envelope of the compost pile (a few inches beneath the outer surface) should feel slightly damp, but if squeezing a handful of the envelope material causes water to drip out, it is too wet. Excess moisture is usually caused by failure to protect the composting operation or cover material stockpiles from excess precipitation, or by using too little absorptive cover material over and around the animal carcasses.

Q. My compost fails to heat up, even during warm weather. Excess moisture does NOT seem to be the problem. What else could cause this?

A. Likely causes are use of cover material that is extremely dry, or too little nitrogen in the cover material. Animal carcasses release considerable moisture into the cover material immediately surrounding them, but dry or extremely porous cover materials can draw moisture away from the carcasses or encourage excessive moisture evaporation. If so, the zone around the carcasses may become too dry for rapid bacterial decay and heat production. If this happens, do not add water directly to the top of the compost bin. This can saturate the pile, causing seepage, anaerobic conditions, and excessive odor. To increase the water content in a controlled way, add water to stockpiled cover material, and then mix the moistened cover material into the compost pile. If moisture content appears adequate, insufficient nitrogen in the cover material is a likely cause of low internal temperatures. To boost the nitrogen content, mix a small amount of manure into the cover

material. Avoid adding large amounts of manure at one time as this can lead to odorous releases of ammonia.

Q. I have trouble getting my compost bins to heat up during cold weather. What can I do to improve heat production and retention?

A. If your composting operation works well in warm weather, but not during the winter, try increasing the size of your cover material stockpile or of your composting bins. Most cover materials produce small amounts of heat while stockpiled. Larger stockpiles help to retain this heat, providing warmer material with which to cover the carcasses that are added to the composting bin. It's also important to use composting bins that are large enough to retain heat during cold weather. Small bins contain insufficient amounts of biodegradable material to produce and retain heat during cold, windy weather. It's also important to **not** let carcasses freeze before putting them into the compost bin. Frozen carcasses require tremendous amounts of heat for thawing before decomposition can begin.

Q. How can I tell if a material will make a good cover material for carcass composting?

A. Stockpile some of the potential cover material and use your composting thermometer to monitor internal temperatures. Good cover materials have sufficient moisture, porosity, and nutrient content to promote self-heating. Avoid cover materials that show little potential for self-heating.

Q. Can I reuse finished compost as cover material to compost subsequent mortalities?

A. Yes, if the moisture content of the finished compost is acceptable (neither too wet nor too dry), limited reuse is possible. Continuous reuse may ultimately lead to a nutrient imbalance that reduces biological activity.

Q. My swine composting operation is working great and I would like to make some extra money by composting pigs from neighboring farms. Are there any limits on the size of on-farm composting operations or other regulations that I need to know about?

A. Composting dead animals that do **not** originate on the same farm where the composting facility is located requires a permit from the Iowa Department of Natural Resources (IDNR). Contact IDNR for further information about permits and operating requirements for commercial composting facilities.

Administrative rules of the IDNR state that on-farm composting of dead animals generated on the same farm as the composting facility is exempt from having a permit if the following operating requirements are met:

- Dead animals are incorporated into the composting process within 24 hours of death and covered with sufficient animal manure, animal bedding, crop residues, or clean wood waste (free of coatings and preservatives) necessary as bulking agents and to prevent access by domestic or wild animals.

- Composting is done in a manner that prevents formation and release of runoff and leachate and controls odors, flies, rodents, and other vermin.

- Dead animals are not removed from composting until all flesh, internal organs, and other soft tissue are fully decomposed.

- Storage of finished compost shall be limited to 18 months and shall be applied to cropland or pasture land at rates consistent with the nitrogen use levels necessary to obtain optimum crop yields and shall be applied in a manner as to prevent runoff to surface waters of the state.

- Application of compost to other lands shall require prior approval by IDNR.

- Composting must be done on an all-weather surface of compacted soil, compacted granular aggregates, asphalt, concrete or similar relatively impermeable material that will permit accessibility during periods of inclement weather and prevent contamination of surface and groundwater.

- If composting is done in a permanent structure, composter construction shall utilize weather and rot-resistant materials capable of supporting composting operations without damage. (Although not mandatory, a roof over the composting facility is recommended to prevent excess moisture accumulation that can lead to production of undesirable odors and leachate.)

- Composting must be done outside of wetlands or the 100-year flood plain and at least 100 feet from private wells, 200 feet from public wells, 50 feet from property lines, 500 feet from inhabited residences, and 100 feet from flowing or intermittent streams, lakes, or ponds.

For additional information visit Iowa State University's award winning swine mortality composting web site on the Internet at: www.abe.iastate.edu/pigsgone

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Original research

Impact of feeders and drinker devices on pig performance, water use, and manure volume

Michael C. Brumm, MS, PhD; James M. Dahlquist, MS; Jill M. Heemstra, MS

Summary

Objective: To determine the impact of feeder and drinker designs on pig performance, water use, and manure volume.

Methods: Experiment One compared a wet/dry feeder to a dry feeder with wall-mounted nipple drinker. Experiment Two compared a swinging nipple drinker to a gate-mounted nipple, and Experiment Three compared a bowl drinker to the swinging drinker of Experiment Two. In all experiments, pigs were housed in pens of 20–24 pigs per pen in partially slatted, mechanically ventilated facilities.

Results: In Experiment One, water disappearance (L per pig per day) was 4.49 for the wet/dry feeder versus 6.06 for the dry feeder plus nipple drinker. In Experiment Two, water disappearance was 4.90 L per pig per day for the swinging drinker versus 5.50 for the gate-mounted drinker. In Experiment Three, water disappearance was 3.78 for the bowl versus 5.01 for the swinging drinker. Summer manure production in Experiment One was 4.96 L per pig per day for the wet-dry feeder versus 7.02 for the nipple drinker. Winter manure production was 3.96 L per pig per day for the swinging drinker versus 4.59 for the nipple drinker in Experiment Two.

Implications: These results document the wide range in water use and manure volume associated with feeder and drinker devices installed in swine facilities. They also suggest lower amounts of total water use and manure volume than those currently cited in the literature or used by regulatory officials.

For the overall experiment, pigs on wet/dry feeders used 1 kg of water less per kg of feed than did pigs on the conventional system.

The overall W:F ratio was lowest for the wet/dry feeder (1.78; Experiment One) and similar to the bowl drinker (1.89; Experiment Three).

In observations consistent with ours in Experiment One, Maton and Daelemans[14] concluded that all wet feeders included in their experiments reduced water spillage so that water consumption was only 70%–80% of that observed from conventional feeders and nipple drinkers. In addition, slurry (manure) volume was reduced by 20%–30% in their study.

Table 2: Manure production

	Experiment One (summer)		Experiment Two	
	Dry	Wet/dry	Swing	Nipple
Per pig per day				
Volume	7.02 L (1.85 gal)	4.96 L (1.31 gal)	3.96 L (1.05 gal)	4.59 L (1.21 gal)
Mass*	7.0 kg (15.4 lb)	4.9 kg (10.8 lb)	3.9 kg (8.6 lb)	4.5 kg (9.9 lb)
Per 1000 kg bodyweight				
Mass	109 kg (240 lb)	76 kg (167 lb)	61 kg (134 lb)	70 kg (154 lb)

* 990 kg per m^3 (61.8 lb per cu. foot); ASAE[8]

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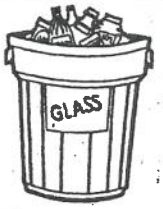

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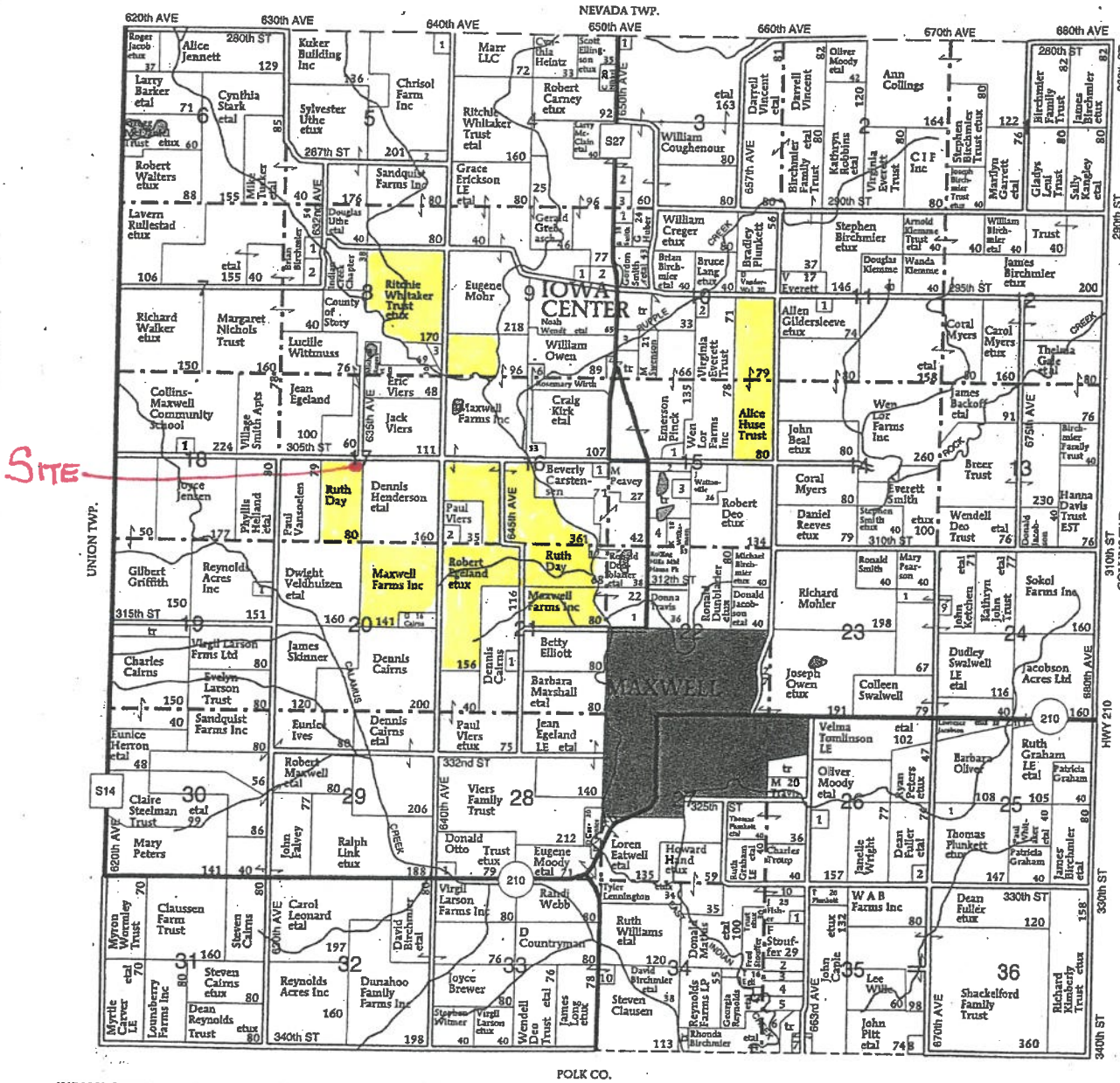

INDIAN CREEK TOWNSHIP

SECTION 3
1. Huhn, Marion
2. Sinclair, Roger
3. Birchmier, Sheryl

SECTION 5
1. Bowman, Thomas
2. Moffitt, Dustin

SECTION 8
1. Orcutt, Dennis
2. Alleman, Louise
3. Moore, Bernard

SECTION 9
1. Lewis, Michael
2. Carney, Robert

SECTION 10
1. Carney Jr, Robert
2. Nelson, August
3. Kahler, Richard

SECTION 11
1. Andrew Jr, Francis

SECTION 15
1. Rozinek, Russell
2. Rozinek, Russell
3. Lengel, Mark
4. Rolling Hills Mobile Home Park LLC

SECTION 16
1. Helming, Stuart
2. Lee, John

SECTION 18
1. Debaca, Suzanna

SECTION 19
1. Napier, William

SECTION 21
1. Cummings, Gary

SECTION 22
1. Peters, Timothy

SECTION 23
1. Ketchum, Mark

SECTION 25
1. Means, Deanna

SECTION 26
1. Bruns, Andrew
2. Senter, Marvin

SECTION 28
1. Gibbs, George

SECTION 35
1. Dunnbaugh, Tom
2. Hunter, Sandra
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NEVADA PLAT

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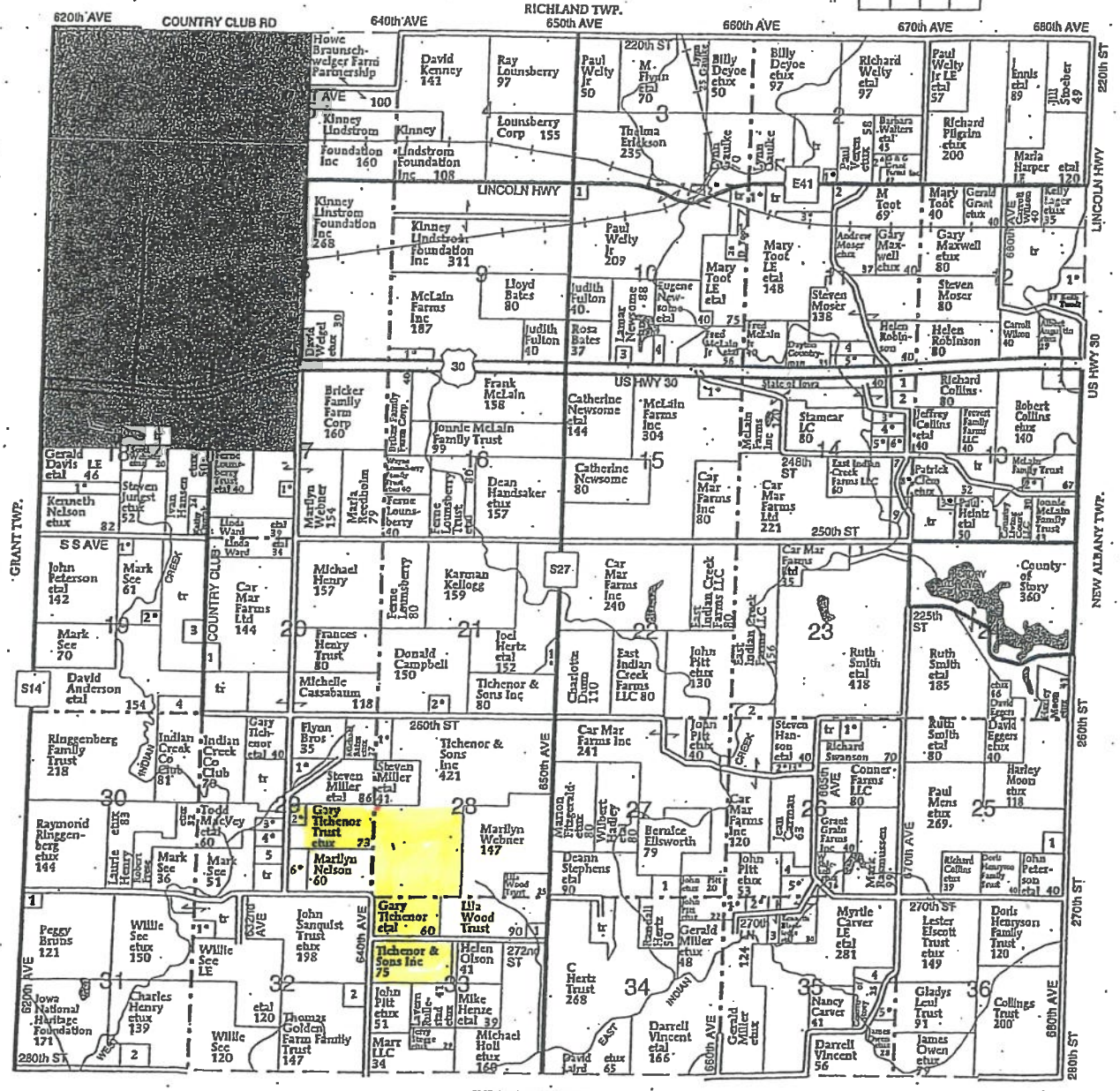
R-22-W



NEVADA TOWNSHIP

SECTION 2
1. Harris, Jeffery 5
2. Tharrington, W 13

SECTION 9
1. Renfrow, Harry 14

SECTION 10
1. Grant Grain Farms Inc 6
2. Houghton, Cindy 11
3. Moreland, Marl 8
4. Newsome, Catherine 9

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1. Vansickle, William 6
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SECTION 12
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1. Hertz, Randall 10

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1. Gordon, Kenneth 11
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3. Leslie, Scott 5
4. Serio Jr, Ronny 10
5. Forest Park Property Mgmt LLC 8
6. Engler, Daniel 11

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1. Kelly, Jamey 7
2. Indian Creek Diary LLC 14

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1. Kelley Trust, David 11
2. Golden, Sandra 13

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1. Vincent, Brian 8

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2. Moore, James 11
3. Ellsworth, Bernice 10
4. Leul Trust, Gladys 11
5. Donaldson, Loren 5

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Manure Management Plan Form

Animal Feeding Operation Information

Instructions: Complete this form for your animal feeding operation. Footnotes are provided on page 4.

The information within this form, and the attachments, describes my animal feeding operation, my manure storage and handling system, and my planned manure management system. I (we) will manage the manure, and the nutrients it contains, as described within this manure management plan (MMP) and any revisions of the plan, individual field information, and field summary sheet, and in accordance with current rules and regulations. Deviations permitted by Iowa law will be documented and maintained in my records.

Signed: X (Signature) JASON MAXWELL (Print name) **Date:** 4/6/2020

Name of operation: Maxwell North **Facility ID No.** N/A

Location of the operation: 305th St. (911 address)

Maxwell (Town) IA (State) 50161 (Zip)

NE (1/4 1/4) 1/4 of the SW (1/4) 1/4 of Sec 17 (Section) T 82N (Tier & Range) R 22W Indian Creek (Township Name) Story (County)

Owner and contacts of the animal feeding operation:

Owner Maxwell Farms, Inc. Phone 515-387-1374
Address 31075 640th Ave., Maxwell, IA 50161
E-mail address (optional) _____ Cell phone (optional) _____

Contact person (if different than owner) Brian Ritland Phone 641-648-7300
Address 620 Country Club Rd Iowa Falls, IA 50126
E-mail address (optional) britland@pinnacleiowa.com Cell phone (optional) _____

Contract company (if applicable) _____ Phone _____
Address _____

This manure management plan is for: (check one)

____ existing operation, not expanding ____ existing operation, expanding ____ existing operation, new owner X new operation

Construction and Expansion Dates: _____ date of initial construction
_____ _____ _____ and all expansions

Table 1. Information about livestock production and manure management system

1	2	3	4	5	6	7	8
Animal type/ Production phase[a]	Max # of animals confined	Manure Storage Structure [b]	N[c]	P_2O_5[c]	gal/space/dy[d]	Days/yr Facility occupied	Annual Manure Produced[e]
Wean/finish (wet/dry)	4960	BBP	56	38	0.7	365	1,267,280
Select production phas			0	0	0.0		000
Select production phas			0	0	0.0		000
						Total Gallons	1,267,280

Estimated annual animal production[1]: 4,960 animals/year

Source of Manure Nutrient Content Data (standard tables, manure analysis, other): Tables

Manure Management Plan Form

Determining Maximum Allowable Manure Application Rates

Instructions: Complete a worksheet for each unique combination of the following factors (crop rotation, optimum crop yield, manure nutrient concentration, remaining crop N need, method of application) that occurs at this operation. Complete form by filling in blanks, yellow-colored cells, and drop down menus. Gray shaded cells will calculate automatically. Footnotes are given on pages 4, 5 and 6.

Management Identification (Mgt ID)[g] Corn - Corn - Soybean N-Based (A)

(identify this application scenario by letter)

Method to determine optimum crop yield[h] USDA Iowa Ag Statistics County yields

Timing of application Spring/Fall

Method of application Knifed in or soil injection of liquid manure

Application loss factor 0.98

If spray irrigation is used, identify method _____

Table 2. Manure nutrient concentration

Manure Nutrient Content (lbs/1000gal or lbs/ton)					
Manure Storage Structure(s) [k]	BBP				
Total N [l]	56		P_2O_5	38	
%TN Available 1st year	90%	2nd year	0%	3rd year	0%
Available N 1st year[m]	49.4	2nd year[n]	0.0	3rd year[o]	0.0

Table 3. Crop usage rates[p]

lb/bu or lb/ton	N	P_2O_5
Corn	1.2	0.32
Soybean	3.8	0.72
Alfalfa	50	13
Other crop	0	0

*Use blank space above to add crop not listed.

Table 4. Calculations for rate based on nitrogen (always required)

1	Applying Manure For (crop to be grown) [q]		Corn	Corn	Soybean	Corn
2	Optimum Crop Yield [h]	bu or ton/acre	212	212	59	212
3	P_2O_5 removed with crop by harvest [r]	lb/acre	67.8	67.8	42.5	67.8
4	Crop N utilization [s]	lb/acre	254	254	224	254
5a	Legume N credit [t]	lb/acre	50.00	0	0	50
5b	Commercial N planned[u]	lb/acre	0	0	0	0
5c	Manure N carryover credit [v]	lb/acre	0	0.0	0.0	0.0
6	Remaining crop N need [w]	lb/acre	204	254	224	204
7	Manure rate to supply remaining N [x]	gal/acre	4138	5151	4539	4138
8	P_2O_5 applied with N-based rate [y]	lb/acre	157	196	172	157

Table 5. Calculations for rate based on phosphorus (fill out only if P-based rates are planned)

9	Commercial P_2O_5 planned [z]	lb/acre	0	0	0	0
10	Manure rate to supply P removal [aa]	gal/acre	1785	1785	1118	1785
11	Manure rate for P based plan [bb]	gal/acre	1785	2903	0	1785
12	Manure N applied with P-based plan [cc]	lb/acree	88	143	0	88

Table 6. Application rates that will be carried over to page 3

13	Planned manure application rate [dd]	gal/acre	4138	5151	0	4138

When applicable, manure application rates must be based on the P index value as follows:
(0-2) N-based manure management.
(>2-5) N-based manure management but P application rate cannot exceed two times the P removal rate of the crop schedule.
(>5-10) Until December 31, 2008, P-based manure management while adopting practices to reduce P index to 5 or below.
(>10) No manure application until practices are adopted to reduce P index to 5 or below

85822208P1800

Grower : Maxwell Farms

Farm : Fields

Field : 85822208P1800

Latitude : 41.92446106

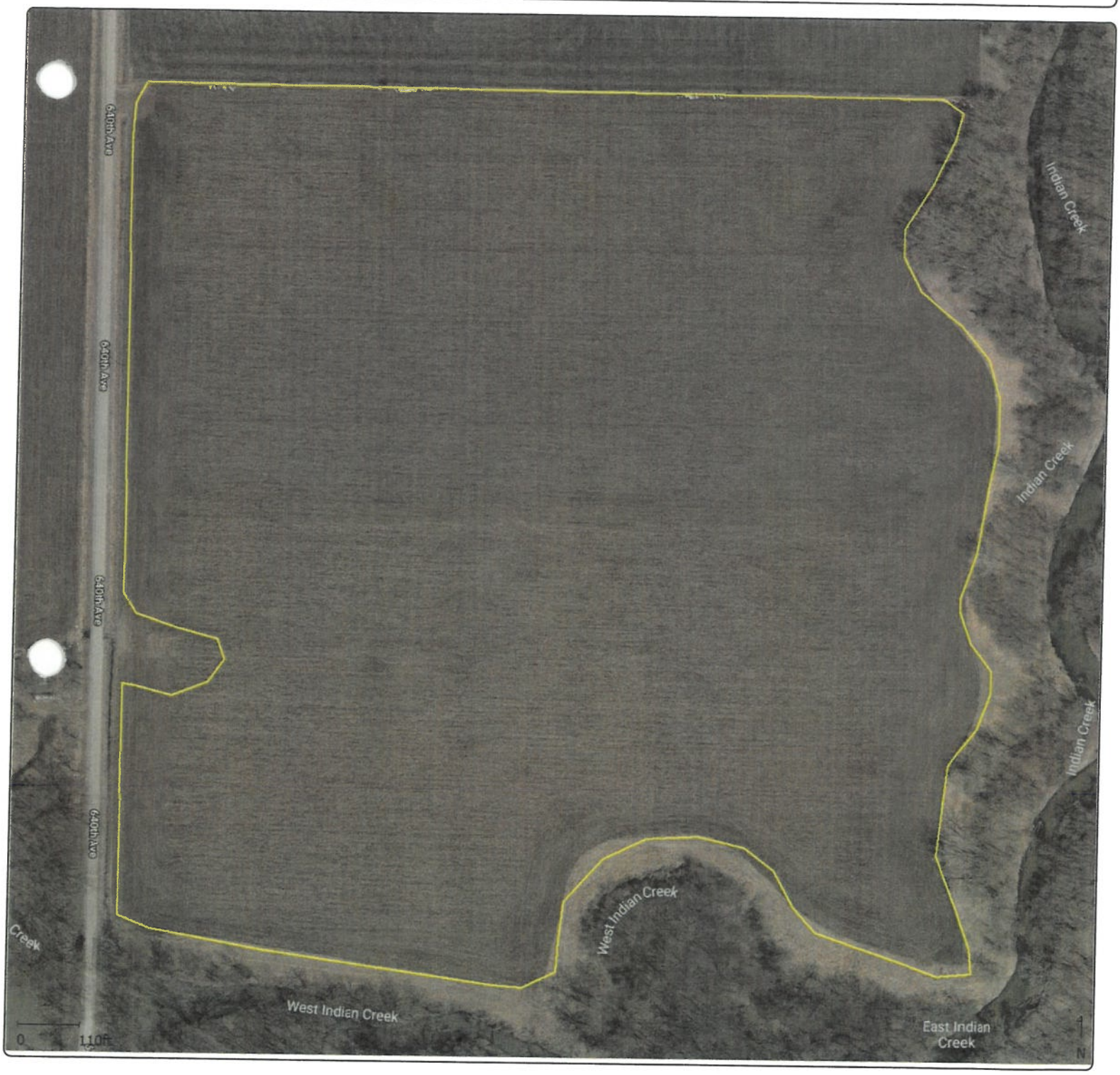
Longitude : -93.42963356

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(122.15 ac)

85822209P3300



Grower : Maxwell Farms

Farm : Fields

Field : 85822209P3300

Latitude : 41.92176389

Longitude : -93.42440868

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(49.68 ac)

85822210P4600

Grower : Maxwell Farms

Farm : Fields

Field : 85822210P4600

Latitude : 41.92124715

Longitude : -93.39053196

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(74.22 ac)

85822215P1600

Grower : Maxwell Farms

Farm : Fields

Field : 85822215P1600

Latitude : 41.91411910

Longitude : -93.39036556

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(75.46 ac)

85822216P3200

Grower : Maxwell Farms

Farm : Fields

Field : 85822216P3200

Latitude : 41.91034068

Longitude : -93.42498194

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(40.71 ac)

85822216P3500

Grower : Maxwell Farms

Farm : Fields

Field : 85822216P3500

Latitude : 41.90888598

Longitude : -93.42033078

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(18.02 ac)

85822216P3600

Grower : Maxwell Farms

Farm : Fields

Field : 85822216P3600

Latitude : 41.90723401

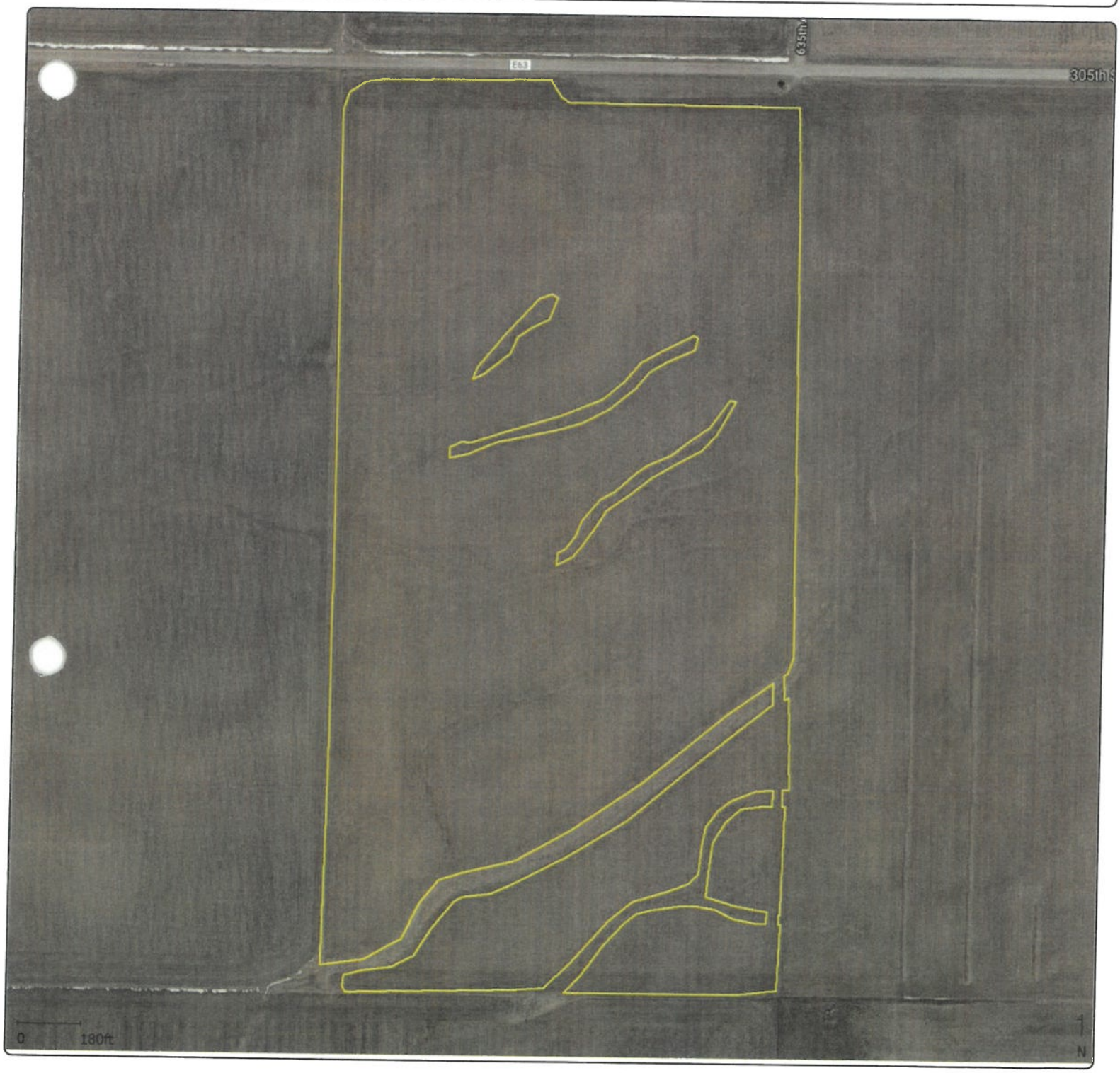
Longitude : -93.41744908

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(35.65 ac)

85822217P3600



Grower : Maxwell Farms

Farm : Fields

Field : 85822217P3600

Latitude : 41.90911040

Longitude : -93.43957671

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
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Feature ID

Total Acres(72.50 ac)

85822220P1000

Field : 85822220P1000

Latitude : 41.90110371

Longitude : -93.43465225

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(92.80 ac)

85822221P1700

Grower : Maxwell Farms

Farm : Fields

Field : 85822221P1700

Latitude : 41.90316066

Longitude : -93.41526594

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(61.53 ac)

85822221P1800

Grower : Maxwell Farms

Farm : Fields

Field : 85822221P1800

Latitude : 41.89963318

Longitude : -93.41303449

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(56.24 ac)

85822221P5000B

Grower : Maxwell Farms

Farm : Fields

Field : 85822221P5000B

Latitude : 41.89598796

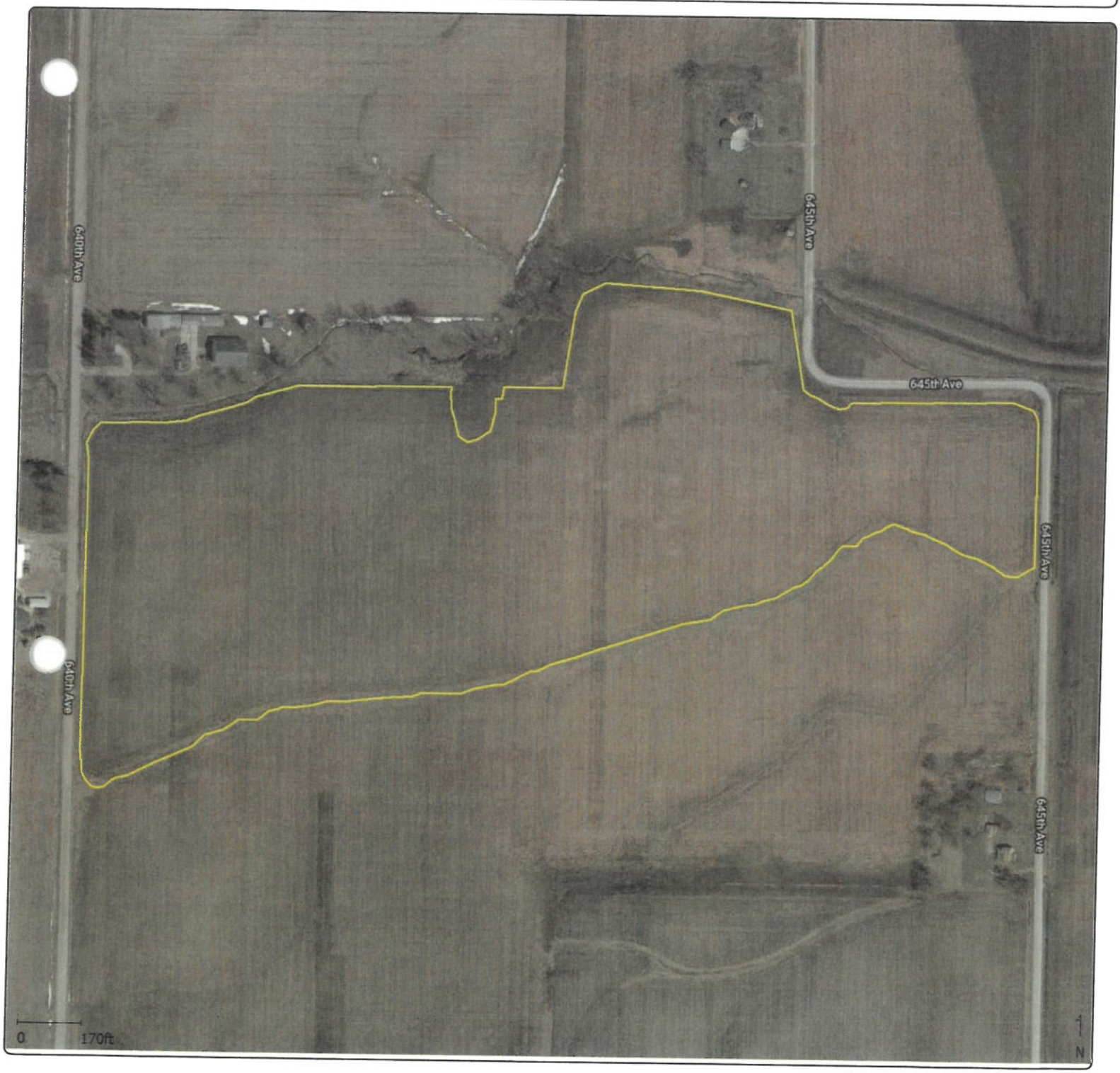
Longitude : -93.42488497

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(94.82 ac)

85822221P5000C



Grower : Maxwell Farms

Farm : Fields

Field : 85822221P5000C

Latitude : 41.90477861

Longitude : -93.42488120

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(43.35 ac)

85822228P3000

Grower : Maxwell Farms

Farm : Fields

Field : 85822228P3000

Latitude : 41.96153459

Longitude : -93.42450167

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(207.62 ac)

85832229P4700

Grower : Maxwell Farms

Farm : Fields

Field : 85832229P4700

Latitude : 41.96864810

Longitude : -93.43150813

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(63.40 ac)

85832233P2700

Grower : Maxwell Farms

Farm : Fields

Field : 85832233P2700

Latitude : 41.95795107

Longitude : -93.42482950

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Feature ID

Total Acres(61.79 ac)

Manure Management Plan Form

Year by Year Manure Management Plan Summary

Instructions: Complete this form for each of the next four growing seasons, to demonstrate sufficient land base to apply manure over multiple crop years. If this page is identical for multiple years (e.g. every other year), submit only once for the identical years, and indicate which years the form represents. Footnotes are given on page 6.

Crop year(s): 2020

1	2	3	4	5	6	7	8	9	10	11
Field Designation [ee]	Field Location ___1/4 of the___ 1/4 Sec___ T___ R___ Townsip Name_____, County Name _____	Mgt Id [ff]	Planned Crop	Acres receiving manure[gg]	Own, rent, agreement (include length of agreement) [hh]	P index value [ii]	HEL (Y/N)[jj]	Planned Application gal/acre	Planned Application gal/field [kk]	Correct Soil Test for P[ll] (Yes or No)
85822208P1800	E1/2, 8, 82, 22, Indian Creek, Story	A	Beans	122.2	Rent	0.54	N	0	0	Yes
85822209P3300	S1/2 SW, 9, 82, 22, Indian Creek, Story	A	Beans	49.7	Own	0.61	N	0	0	Yes
85822210P4600	E1/2 SE, 10, 82, 22, Indian Creek, Story	A	Beans	74.2	Rent	0.61	Y	0	0	Yes
85822215P1600	E1/2 NE, 15, 82, 22, Indian Creek, Story	A	Beans	75.5	Rent	0.58	N	0	0	Yes
85822216P3200	NW SW, 16, 82, 22, Indian Creek, Story	A	Corn	40.7	Own	0.88	Y	4138	168417	Yes
85822216P3500	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Corn	18	Own	0.95	Y	4138	74484	Yes
85822216P3600	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Corn	35.7	Own	0.68	N	4138	147727	Yes
85822217P3600	E1/2 SW, 17, 82, 22, Indian Creek, Story	A	Corn	72.5	Rent	0.63	Y	5151	373448	Yes
85822220P1000	NE, 20, 82, 22, Indian Creek, Story	A	Corn	92.8	Own	0.85	Y	5151	478013	Yes
85822221P1700	N1/2 NE, 21, 82, 22, Indian Creek, Story	A	Corn	61.5	Rent	0.77	N	5151	316787	Yes
85822221P1800	S 1/2 NE, 21, 82, 22, Indian Creek, Story	A	Corn	56.2	Own	0.79	Y	5151	289486	Yes
85822221P5000B	SW NW, S1/2 NE NW, 21, 82, 22, Indian Creek, Story	A	Corn	94.8	Rent	0.66	Y	4138	392282	Yes
85822221P5000C	N1/2 NW, 21, 82, 22, Indian Creek, Story	A	Corn	43.4	Rent	1.53	Y	4138	179589	Yes
85832228P3000	SW 28 & N 1/2 NW 33, 83, 22, Nevada, Story	A	Corn	207.6	Rent	0.51	N	5151	1069348	Yes
85832229P4700	N1/2 SE, 29, 83, 22, Nevada, Story	A	Corn	63.4	Rent	0.72	Y	4138	262349	Yes
85832233P2700	S 1/2 NW 33, 83, 22, Nevada, Story	A	Corn	61.8	Rent	0.48	N	4138	255728	Yes
									0	
									0	
									0	
									0	

Total acres available for manure application 1170

Total gallons that could be applied 4007657

Manure Management Plan Form

Year by Year Manure Management Plan Summary

Instructions: Complete this form for each of the next four growing seasons, to demonstrate sufficient land base to apply manure over multiple crop years. If this page is identical for multiple years (e.g. every other year), submit only once for the identical years, and indicate which years the form represents. Footnotes are given on page 6.

Crop year(s): 2021

1	2	3	4	5	6	7	8	9	10	11
Field Designation [ee]	Field Location ___1/4 of the___ 1/4 Sec___ T___ R___ Townsip Name_____, County Name _____	Mgt Id [ff]	Planned Crop	Acres receiving manure[gg]	Own, rent, agreement (include length of agreement) [hh]	P index value [ii]	HEL (Y/N)[jj]	Planned Application gal/acre	Planned Application gal/field [kk]	Correct Soil Test for P[ll] (Yes or No)
85822208P1800	E1/2, 8, 82, 22, Indian Creek, Story	A	Corn	122.2	Rent	0.54	N	4138	505664	Yes
85822209P3300	S1/2 SW, 9, 82, 22, Indian Creek, Story	A	Corn	49.7	Own	0.61	N	4138	205659	Yes
85822210P4600	E1/2 SE, 10, 82, 22, Indian Creek, Story	A	Corn	74.2	Rent	0.61	Y	4138	307040	Yes
85822215P1600	E1/2 NE, 15, 82, 22, Indian Creek, Story	A	Corn	75.5	Rent	0.58	N	4138	312419	Yes
85822216P3200	NW SW, 16, 82, 22, Indian Creek, Story	A	Corn	40.7	Own	0.88	Y	5151	209646	Yes
85822216P3500	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Corn	18	Own	0.95	Y	5151	92718	Yes
85822216P3600	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Corn	35.7	Own	0.68	N	5151	183891	Yes
85822217P3600	E1/2 SW, 17, 82, 22, Indian Creek, Story	A	Beans	72.5	Rent	0.63	Y	0	0	Yes
85822220P1000	NE, 20, 82, 22, Indian Creek, Story	A	Beans	92.8	Own	0.85	Y	0	0	Yes
85822221P1700	N1/2 NE, 21, 82, 22, Indian Creek, Story	A	Beans	61.5	Rent	0.77	N	0	0	Yes
85822221P1800	S 1/2 NE, 21, 82, 22, Indian Creek, Story	A	Beans	56.2	Own	0.79	Y	0	0	Yes
85822221P5000B	SW NW, S1/2 NE NW, 21, 82, 22, Indian Creek, Story	A	Corn	94.8	Rent	0.66	Y	5151	488315	Yes
85822221P5000C	N1/2 NW, 21, 82, 22, Indian Creek, Story	A	Corn	43.4	Rent	1.53	Y	5151	223553	Yes
85832228P3000	SW 28 & N 1/2 NW 33, 83, 22, Nevada, Story	A	Beans	207.6	Rent	0.51	N	0	0	Yes
85832229P4700	N1/2 SE, 29, 83, 22, Nevada, Story	A	Corn	63.4	Rent	0.72	Y	5151	326573	Yes
85832233P2700	S 1/2 NW 33, 83, 22, Nevada, Story	A	Corn	61.8	Rent	0.48	N	5151	318332	
									0	
									0	
									0	
									0	
									0	

Total acres available for manure application 1170

Total gallons that could be applied 3173809

Manure Management Plan Form

Year by Year Manure Management Plan Summary

Instructions: Complete this form for each of the next four growing seasons, to demonstrate sufficient land base to apply manure over multiple crop years. If this page is identical for multiple years (e.g. every other year), submit only once for the identical years, and indicate which years the form represents. Footnotes are given on page 6.

Crop year(s): 2022

1	2	3	4	5	6	7	8	9	10	11
Field Designation [ee]	Field Location ___1/4 of the___ 1/4 Sec___ T___ R___ Townsip Name_____, County Name _____	Mgt Id [ff]	Planned Crop	Acres receiving manure[gg]	Own, rent, agreement (include length of agreement) [hh]	P index value [ii]	HEL (Y/N)[jj]	Planned Application gal/acre	Planned Application gal/field [kk]	Correct Soil Test for P[ll] (Yes or No)
85822208P1800	E1/2, 8, 82, 22, Indian Creek, Story	A	Corn	122.2	Rent	0.54	N	5151	629452	Yes
85822209P3300	S1/2 SW, 9, 82, 22, Indian Creek, Story	A	Corn	49.7	Own	0.61	N	5151	256005	Yes
85822210P4600	E1/2 SE, 10, 82, 22, Indian Creek, Story	A	Corn	74.2	Rent	0.61	Y	5151	382204	Yes
85822215P1600	E1/2 NE, 15, 82, 22, Indian Creek, Story	A	Corn	75.5	Rent	0.58	N	5151	388901	Yes
85822216P3200	NW SW, 16, 82, 22, Indian Creek, Story	A	Beans	40.7	Own	0.88	Y	0	0	Yes
85822216P3500	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Beans	18	Own	0.95	Y	0	0	Yes
85822216P3600	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Beans	35.7	Own	0.68	N	0	0	Yes
85822217P3600	E1/2 SW, 17, 82, 22, Indian Creek, Story	A	Corn	72.5	Rent	0.63	Y	4138	300005	Yes
85822220P1000	NE, 20, 82, 22, Indian Creek, Story	A	Corn	92.8	Own	0.85	Y	4138	384006	Yes
85822221P1700	N1/2 NE, 21, 82, 22, Indian Creek, Story	A	Corn	61.5	Rent	0.77	N	4138	254487	Yes
85822221P1800	S 1/2 NE, 21, 82, 22, Indian Creek, Story	A	Corn	56.2	Own	0.79	Y	4138	232556	Yes
85822221P5000B	SW NW, S1/2 NE NW, 21, 82, 22, Indian Creek, Story	A	Beans	94.8	Rent	0.66	Y	0	0	Yes
85822221P5000C	N1/2 NW, 21, 82, 22, Indian Creek, Story	A	Beans	43.4	Rent	1.53	Y	0	0	Yes
85832228P3000	SW 28 & N 1/2 NW 33, 83, 22, Nevada, Story	A	Corn	207.6	Rent	0.51	N	4138	859049	Yes
85832229P4700	N1/2 SE, 29, 83, 22, Nevada, Story	A	Beans	63.4	Rent	0.72	Y	0	0	Yes
85832233P2700	S 1/2 NW 33, 83, 22, Nevada, Story	A	Beans	61.8	Rent	0.48	N	0	0	
									0	
									0	
									0	
									0	
									0	
									0	

Total acres available for manure application 1170

Total gallons that could be applied 3686664

Manure Management Plan Form

Year by Year Manure Management Plan Summary

Instructions: Complete this form for each of the next four growing seasons, to demonstrate sufficient land base to apply manure over multiple crop years. If this page is identical for multiple years (e.g. every other year), submit only once for the identical years, and indicate which years the form represents. Footnotes are given on page 6.

Crop year(s): 2023

1	2	3	4	5	6	7	8	9	10	11
Field Designation [ee]	Field Location ___1/4 of the___ 1/4 Sec___ T___ R___ Townsip Name_____, County Name _____	Mgt Id [ff]	Planned Crop	Acres receiving manure[gg]	Own, rent, agreement (include length of agreement) [hh]	P index value [ii]	HEL (Y/N)[jj]	Planned Application gal/acre	Planned Application gal/field [kk]	Correct Soil Test for P[ll] (Yes or No)
85822208P1800	E1/2, 8, 82, 22, Indian Creek, Story	A	Beans	122.2	Rent	0.54	N	0	0	Yes
85822209P3300	S1/2 SW, 9, 82, 22, Indian Creek, Story	A	Beans	49.7	Own	0.61	N	0	0	Yes
85822210P4600	E1/2 SE, 10, 82, 22, Indian Creek, Story	A	Beans	74.2	Rent	0.61	Y	0	0	Yes
85822215P1600	E1/2 NE, 15, 82, 22, Indian Creek, Story	A	Beans	75.5	Rent	0.58	N	0	0	Yes
85822216P3200	NW SW, 16, 82, 22, Indian Creek, Story	A	Corn	40.7	Own	0.88	Y	4138	168417	Yes
85822216P3500	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Corn	18	Own	0.95	Y	4138	74484	Yes
85822216P3600	E1/2 SW, 16, 82, 22, Indian Creek, Story	A	Corn	35.7	Own	0.68	N	4138	147727	Yes
85822217P3600	E1/2 SW, 17, 82, 22, Indian Creek, Story	A	Corn	72.5	Rent	0.63	Y	5151	373448	Yes
85822220P1000	NE, 20, 82, 22, Indian Creek, Story	A	Corn	92.8	Own	0.85	Y	5151	478013	Yes
85822221P1700	N1/2 NE, 21, 82, 22, Indian Creek, Story	A	Corn	61.5	Rent	0.77	N	5151	316787	Yes
85822221P1800	S 1/2 NE, 21, 82, 22, Indian Creek, Story	A	Corn	56.2	Own	0.79	Y	5151	289486	Yes
85822221P5000B	SW NW, S1/2 NE NW, 21, 82, 22, Indian Creek, Story	A	Corn	94.8	Rent	0.66	Y	4138	392282	Yes
85822221P5000C	N1/2 NW, 21, 82, 22, Indian Creek, Story	A	Corn	43.4	Rent	1.53	Y	4138	179589	Yes
85832228P3000	SW 28 & N 1/2 NW 33, 83, 22, Nevada, Story	A	Corn	207.6	Rent	0.51	N	5151	1069348	Yes
85832229P4700	N1/2 SE, 29, 83, 22, Nevada, Story	A	Corn	63.4	Rent	0.72	Y	4138	262349	Yes
85832233P2700	S 1/2 NW 33, 83, 22, Nevada, Story	A	Corn	61.8	Rent	0.48	N	4138	255728	Yes
									0	
									0	
									0	
									0	
									0	

Total acres available for manure application 1170

Total gallons that could be applied 4007657

RUSLE2 Profile Erosion Calculation Record

Info: 85822208P1800

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138B Clarion loam, 2 to 5 percent slopes\Clarion loam 85%
Slope length (horiz): 98 ft
Avg. slope steepness: 3.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	64.000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.1 t/ac/yr
Detachment on slope: 1.1 t/ac/yr
Soil loss for cons. plan: 1.1 t/ac/yr
Sediment delivery: 1.1 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		74
4/12/1	Cultivator, field 6-12 in sweeps		54
4/24/1	Planter, double disk opnr	Corn, grain, high yield	50
10/23/1	Harvest, killing crop 50pct standing stubble		88
11/10/1	Manure injector, liquid high disturb.30 inch		87
12/2/1	Chisel, st. pt.		64

[illegible]	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	61
10/23/2	Harvest, killing crop 50pct standing stubble		63
12/10/2	Chisel, st. pt.		90
4/8/3	Cultivator, field 6-12 in sweeps		67
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	68
10/12/3	Harvest, killing crop 50pct standing stubble		71
			87

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USDA Natural Resource Conservation Service

Field Number	Erosion										Runoff					Tile / Subsurface Recharge				Overall
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	RCN Factor	x (STP Factor	+ P App Factor) =	Runoff PI	+ Flow Factor	x STP Factor =	Tile/Sub PI	= P Index
85822208P1800 --	1.10		1.00		0.09		1.00		1.10		0.86		0.10		1.53	0.24	0.00	0.37	1.00	0.07	0.07	0.54

NRCS

RUSLE2 Profile Erosion Calculation Record

Info: 85822209P3300

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\485 Spillville loam, 0 to 2 percent slopes\Spillville loam occasionally flooded 95%
Slope length (horiz): 82 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	221.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	221.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	64.000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 0.46 t/ac/yr
Detachment on slope: 0.46 t/ac/yr
Soil loss for cons. plan: 0.46 t/ac/yr
Sediment delivery: 0.46 t/ac/yr

Crit. slope length: 82 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		74
4/12/1	Cultivator, field 6-12 in sweeps		54
4/24/1	Planter, double disk opnr	Corn, grain, high yield	50
10/23/1	Harvest, killing crop 50pct standing stubble		88
11/10/1	Manure injector, liquid high disturb.30 inch		87
12/2/1	Chisel, st. pt.		63

4/22/2	Cultivator, field 6-12 in sweeps		
10/23/2	Planter, double disk opnr	Corn, grain, high yield	60
12/10/2	Harvest, killing crop 50pct standing stubble		62
4/8/3	Chisel, st. pt.		89
5/8/3	Cultivator, field 6-12 in sweeps		67
10/12/3	Planter, double disk opnr	Soybean, mw 30 in rows	68
	Harvest, killing crop 50pct standing stubble		71
			87

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Field Number	Erosion										Runoff					Tile / Subsurface Recharge				Overall P Index
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	RCN Factor	x (STP Factor	+ P App Factor) =	Runoff PI	+ Flow Factor	x STP Factor =	Tile/Sub PI	=
85822209P3300 --	0.46		1.00		0.14		1.00		1.10		0.88		0.06		1.53	0.27	0.09	0.55	0.00	0.07	0.00	0.61

RUSLE2 Profile Erosion Calculation Record

Info: 85822210P4600

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138C2 Clarion loam, 5 to 9 percent slopes, moderately eroded\Clarion loam moderately eroded 95%
Slope length (horiz): 98 ft
Avg. slope steepness: 8.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	62.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 2.4 t/ac/yr
Detachment on slope: 2.4 t/ac/yr
Soil loss for cons. plan: 2.4 t/ac/yr
Sediment delivery: 2.4 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		73
4/12/1	Cultivator, field 6-12 in sweeps		53
4/24/1	Planter, double disk opnr	Corn, grain, high yield	49
10/23/1	Harvest, killing crop 50pct standing stubble		87
11/10/1	Manure injector, liquid high disturb.30 inch		86
12/2/1	Chisel, st. pt.		62

4/ /2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	59
10/23/2	Harvest, killing crop 50pct standing stubble		61
12/10/2	Chisel, st. pt.		89
4/8/3	Cultivator, field 6-12 in sweeps		66
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	67
10/12/3	Harvest, killing crop 50pct standing stubble		70
			86

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Field Number	Erosion																										
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	Runoff							+	Tile / Subsurface Recharge			=	Overall P Index
															RCN Factor	x (	STP Factor	+	P App Factor	) =	Runoff PI		Flow Factor	x	STP Factor =	Tile/Sub PI	
85822210P4600 --	2.40		1.00		0.08		1.00		1.10		0.79		0.16		1.53		0.16		0.09		0.38		1.00		0.07	0.07	0.61

RUSLE2 Profile Erosion Calculation Record

Info: 85822215P1600

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138B Clarion loam, 2 to 5 percent slopes\Clarion loam 85%
Slope length (horiz): 98 ft
Avg. slope steepness: 3.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	64.000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.1 t/ac/yr
Detachment on slope: 1.1 t/ac/yr
Soil loss for cons. plan: 1.1 t/ac/yr
Sediment delivery: 1.1 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		74
4/12/1	Cultivator, field 6-12 in sweeps		54
4/24/1	Planter, double disk opnr	Corn, grain, high yield	50
10/23/1	Harvest, killing crop 50pct standing stubble		88
11/10/1	Manure injector, liquid high disturb.30 inch		87
12/2/1	Chisel, st. pt.		64

4/ 2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	61
10/23/2	Harvest, killing crop 50pct standing stubble		63
12/10/2	Chisel, st. pt.		90
4/8/3	Cultivator, field 6-12 in sweeps		67
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	68
10/12/3	Harvest, killing crop 50pct standing stubble		71
			87

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Field Number	Erosion																										
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	Runoff										Tile / Subsurface Recharge			=	Overall P Index
															RCN Factor	x (	STP Factor	+	P App Factor	) =	Runoff PI		Flow Factor	x	STP Factor	=	Tile/Sub PI		
85822215P1600 --	1.10		1.00		0.09		1.00		1.10		0.82		0.08		1.53		0.19		0.09		0.42		1.00		0.07		0.07		0.58

RUSLE2 Profile Erosion Calculation Record

Info: 85822216P3200

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\62D3 Storden loam, 9 to 14 percent slopes, severely eroded\Storden loam severely eroded 95%
Slope length (horiz): 97 ft
Avg. slope steepness: 12 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	146.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	146.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	42.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 6.0 t/ac/yr
Detachment on slope: 6.0 t/ac/yr
Soil loss for cons. plan: 6.0 t/ac/yr
Sediment delivery: 6.0 t/ac/yr

Crit. slope length: 97 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		60
4/12/1	Cultivator, field 6-12 in sweeps		41
4/24/1	Planter, double disk opnr	Corn, grain, high yield	38
10/23/1	Harvest, killing crop 50pct standing stubble		78
11/10/1	Manure injector, liquid high disturb.30 inch		78
12/2/1	Chisel, st. pt.		52

[illegible]/2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	49
10/23/2	Harvest, killing crop 50pct standing stubble		51
12/10/2	Chisel, st. pt.		81
4/8/3	Cultivator, field 6-12 in sweeps		56
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	56
10/12/3	Harvest, killing crop 50pct standing stubble		59
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Field Number	Erosion							+	Runoff					+	Tile / Subsurface Recharge			=	Overall
	Gross Erosion x	Sediment Trap Factor x	SDR x	Buffer Factor x	Enrichment Factor x	STP Factor =	Erosion PI		RCN Factor x (	STP Factor +	P App Factor) =	Runoff PI			Flow Factor x	STP Factor =	Tile/Sub PI		P Index
85822216P3200 --	6.00	1.00	0.08	1.00	1.10	0.83	0.44		1.53	0.20	0.09	0.44			0.00	0.07	0.00		0.88

RUSLE2 Profile Erosion Calculation Record

Info: 85822216P3500

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\62D3 Storden loam, 9 to 14 percent slopes, severely eroded\Storden loam severely eroded 95%
Slope length (horiz): 97 ft
Avg. slope steepness: 12 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	146.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	146.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	42.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 6.0 t/ac/yr
Detachment on slope: 6.0 t/ac/yr
Soil loss for cons. plan: 6.0 t/ac/yr
Sediment delivery: 6.0 t/ac/yr

Crit. slope length: 97 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		60
4/12/1	Cultivator, field 6-12 in sweeps		41
4/24/1	Planter, double disk opnr	Corn, grain, high yield	38
10/23/1	Harvest, killing crop 50pct standing stubble		78
11/10/1	Manure injector, liquid high disturb.30 inch		78
12/2/1	Chisel, st. pt.		52

4/ 2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	49
10/23/2	Harvest, killing crop 50pct standing stubble		51
12/10/2	Chisel, st. pt.		81
4/8/3	Cultivator, field 6-12 in sweeps		56
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	56
10/12/3	Harvest, killing crop 50pct standing stubble		59
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USDA Natural Resource Conservation Service

Field Number	Erosion: Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	Runoff: RCN Factor	x (	STP Factor	+	P App Factor	) =	Runoff PI	+	Tile / Subsurface Recharge: Flow Factor	x	STP Factor	=	Tile/Sub PI	=	Overall P Index
85822216P3500 --	6.00		1.00		0.11		1.00		1.10		0.82		0.58		1.53		0.19		0.00		0.30		1.00		0.07		0.07		0.95

RUSLE2 Profile Erosion Calculation Record

Info: 85822216P3600

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\108 Wadena loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes\Wadena loam 24 to 32 inches to sand and gravel 90%
Slope length (horiz): 89 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	170.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	170.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	49.000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 4.0 t/ac/yr
Soil loss erod. portion: 0.59 t/ac/yr
Detachment on slope: 0.59 t/ac/yr
Soil loss for cons. plan: 0.59 t/ac/yr
Sediment delivery: 0.59 t/ac/yr

Crit. slope length: 89 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		66
4/12/1	Cultivator, field 6-12 in sweeps		46
4/24/1	Planter, double disk opnr	Corn, grain, high yield	42
10/23/1	Harvest, killing crop 50pct standing stubble		82
11/10/1	Manure injector, liquid high disturb.30 inch		81

1	Chisel, st. pt.		
4/12/2	Cultivator, field 6-12 in sweeps		56
4/22/2	Planter, double disk opnr		53
10/23/2	Harvest, killing crop 50pct standing stubble	Corn, grain, high yield	55
12/10/2	Chisel, st. pt.		84
4/8/3	Cultivator, field 6-12 in sweeps		59
5/8/3	Planter, double disk opnr		60
10/12/3	Harvest, killing crop 50pct standing stubble	Soybean, mw 30 in rows	63
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Field Number	Erosion							+	Runoff				+	Tile / Subsurface Recharge			=	Overall P Index
	Gross Erosion ×	Sediment Trap Factor ×	SDR ×	Buffer Factor ×	Enrichment Factor ×	STP Factor =	Erosion PI		RCN Factor × (	STP Factor +	P App Factor) =	Runoff PI		Flow Factor ×	STP Factor =	Tile/Sub PI		
85822216P3600 --	0.59	1.00	0.12	1.00	1.10	0.95	0.07		1.53	0.34	0.00	0.53		1.00	0.07	0.07		0.68

RUSLE2 Profile Erosion Calculation Record

Info: 85822217P3600

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138C2 Clarion loam, 5 to 9 percent slopes, moderately eroded\Clarion loam moderately eroded 95%
Slope length (horiz): 98 ft
Avg. slope steepness: 8.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	62.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 2.4 t/ac/yr
Detachment on slope: 2.4 t/ac/yr
Soil loss for cons. plan: 2.4 t/ac/yr
Sediment delivery: 2.4 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		73
4/12/1	Cultivator, field 6-12 in sweeps		53
4/24/1	Planter, double disk opnr	Corn, grain, high yield	49
10/23/1	Harvest, killing crop 50pct standing stubble		87
11/10/1	Manure injector, liquid high disturb.30 inch		86
12/2/1	Chisel, st. pt.		62

4/	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	59
10/23/2	Harvest, killing crop 50pct standing stubble		61
12/10/2	Chisel, st. pt.		89
4/8/3	Cultivator, field 6-12 in sweeps		66
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	67
10/12/3	Harvest, killing crop 50pct standing stubble		70
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Iowa Phosphorus Index

Credits: Iowa State University
USDA National Soil Tilth Laboratory
USDA Natural Resource Conservation Service

Field Number	Erosion								Runoff				Tile / Subsurface Recharge			Overall
	Gross Erosion	x Sediment Trap Factor	x SDR	x Buffer Factor	x Enrichment Factor	x STP Factor	= Erosion PI	+	RCN Factor	x (STP Factor	+ P App Factor)	= Runoff PI	Flow Factor	x STP Factor	= Tile/Sub PI	= P Index
85822217P3600 --	2.40	1.00	0.07	1.00	1.10	0.81	0.15		1.53	0.18	0.09	0.41	1.00	0.07	0.07	0.63

RUSLE2 Profile Erosion Calculation Record

Info: 85822220P1000

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\638D2 Clarion-Storden loams, 9 to 14 percent slopes, moderately erode\Clarion loam moderately eroded 50%
Slope length (horiz): 98 ft
Avg. slope steepness: 8.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	165.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	165.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	48.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 3.2 t/ac/yr
Detachment on slope: 3.2 t/ac/yr
Soil loss for cons. plan: 3.2 t/ac/yr
Sediment delivery: 3.2 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		65
4/12/1	Cultivator, field 6-12 in sweeps		45
4/24/1	Planter, double disk opnr	Corn, grain, high yield	41
10/23/1	Harvest, killing crop 50pct standing stubble		81
11/10/1	Manure injector, liquid high disturb.30 inch		81
12/2/1	Chisel, st. pt.		55

.2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	52
10/23/2	Harvest, killing crop 50pct standing stubble		54
12/10/2	Chisel, st. pt.		84
4/8/3	Cultivator, field 6-12 in sweeps		59
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	60
10/12/3	Harvest, killing crop 50pct standing stubble		63
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Field Number	Erosion							+	Runoff				+	Tile / Subsurface Recharge			=	Overall
	Gross Erosion x	Sediment Trap Factor x	SDR x	Buffer Factor x	Enrichment Factor x	STP Factor =	Erosion PI		RCN Factor x (	STP Factor +	P App Factor) =	Runoff PI		Flow Factor x	STP Factor =	Tile/Sub PI		P Index
85822220P1000 --	3.20	0.05	1.00	1.00	1.10	0.99	0.17		1.53	0.39	0.00	0.60		1.00	0.07	0.07		0.85

RUSLE2 Profile Erosion Calculation Record

Info: 85822221P1700

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\284B Flagler sandy loam, 2 to 5 percent slopes\Flagler sandy loam 100%
Slope length (horiz): 98 ft
Avg. slope steepness: 4.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	162.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	162.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	47.000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 4.0 t/ac/yr
Soil loss erod. portion: 1.7 t/ac/yr
Detachment on slope: 1.7 t/ac/yr
Soil loss for cons. plan: 1.7 t/ac/yr
Sediment delivery: 1.7 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		64
4/12/1	Cultivator, field 6-12 in sweeps		44
4/24/1	Planter, double disk opnr	Corn, grain, high yield	41
10/23/1	Harvest, killing crop 50pct standing stubble		81
11/10/1	Manure injector, liquid high disturb.30 inch		80
12/2/1	Chisel, st. pt.		55

[illegible] 2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	52
10/23/2	Harvest, killing crop 50pct standing stubble		54
12/10/2	Chisel, st. pt.		83
4/8/3	Cultivator, field 6-12 in sweeps		58
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	59
10/12/3	Harvest, killing crop 50pct standing stubble		62
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Field Number	Erosion									Runoff					Tile / Subsurface Recharge				Overall
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	RCN Factor	x (STP Factor	+ P App Factor) =	Runoff PI	+	Flow Factor	x	STP Factor	=	Tile/Sub PI	=	P Index
85822221P1700 --	1.70		1.00		0.10		1.00		1.10		0.92		0.17		1.53	0.31	0.09	0.61		0.00		0.07		0.00		0.77

RUSLE2 Profile Erosion Calculation Record

Info: 85822221P1800

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138C2 Clarion loam, 5 to 9 percent slopes, moderately eroded\Clarion loam moderately eroded 95%
Slope length (horiz): 98 ft
Avg. slope steepness: 8.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	62.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 2.4 t/ac/yr
Detachment on slope: 2.4 t/ac/yr
Soil loss for cons. plan: 2.4 t/ac/yr
Sediment delivery: 2.4 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		73
4/12/1	Cultivator, field 6-12 in sweeps		53
4/24/1	Planter, double disk opnr	Corn, grain, high yield	49
10/23/1	Harvest, killing crop 50pct standing stubble		87
11/10/1	Manure injector, liquid high disturb.30 inch		86
12/2/1	Chisel, st. pt.		62

2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	59
10/23/2	Harvest, killing crop 50pct standing stubble		61
12/10/2	Chisel, st. pt.		89
4/8/3	Cultivator, field 6-12 in sweeps		66
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	67
10/12/3	Harvest, killing crop 50pct standing stubble		70
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Field Number	Erosion																													
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	Runoff										+	Tile / Subsurface Recharge			=	Overall P Index
															RCN Factor	x (	STP Factor	+	P App Factor	)	=	Runoff PI			Flow Factor	x	STP Factor	=	Tile/Sub PI	
85822221P1800 --	2.40		1.00		0.09		1.00		1.10		0.90		0.22		1.53		0.29		0.09			0.57			0.00		0.07		0.00	0.79

RUSLE2 Profile Erosion Calculation Record

Info: 85822221P5000B

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138C2 Clarion loam, 5 to 9 percent slopes, moderately eroded\Clarion loam moderately eroded 95%
Slope length (horiz): 98 ft
Avg. slope steepness: 8.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	213.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	62.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 2.4 t/ac/yr
Detachment on slope: 2.4 t/ac/yr
Soil loss for cons. plan: 2.4 t/ac/yr
Sediment delivery: 2.4 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		73
4/12/1	Cultivator, field 6-12 in sweeps		53
4/24/1	Planter, double disk opnr	Corn, grain, high yield	49
10/23/1	Harvest, killing crop 50pct standing stubble		87
11/10/1	Manure injector, liquid high disturb.30 inch		86
12/2/1	Chisel, st. pt.		62

2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	59
10/23/2	Harvest, killing crop 50pct standing stubble		61
12/10/2	Chisel, st. pt.		89
4/8/3	Cultivator, field 6-12 in sweeps		66
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	67
10/12/3	Harvest, killing crop 50pct standing stubble		70
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Field Number	Erosion							+	Runoff				+	Tile / Subsurface Recharge			=
	Gross Erosion x	Sediment Trap Factor x	SDR x	Buffer Factor x	Enrichment Factor x	STP Factor =	Erosion PI		RCN Factor x (	STP Factor +	P App Factor) =	Runoff PI		Flow Factor x	STP Factor =	Tile/Sub PI	Overall P Index
85822221P5000B --	2.40	1.00	0.08	1.00	1.10	0.81	0.17		1.53	0.18	0.09	0.41		1.00	0.07	0.07	0.66

RUSLE2 Profile Erosion Calculation Record

Info: 85822221P5000C

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\62D3 Storden loam, 9 to 14 percent slopes, severely eroded\Storden loam severely eroded 95%
Slope length (horiz): 97 ft
Avg. slope steepness: 12 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	146.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	146.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	42.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 6.0 t/ac/yr
Detachment on slope: 6.0 t/ac/yr
Soil loss for cons. plan: 6.0 t/ac/yr
Sediment delivery: 6.0 t/ac/yr

Crit. slope length: 97 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		60
4/12/1	Cultivator, field 6-12 in sweeps		41
4/24/1	Planter, double disk opnr	Corn, grain, high yield	38
10/23/1	Harvest, killing crop 50pct standing stubble		78
11/10/1	Manure injector, liquid high disturb.30 inch		78
12/2/1	Chisel, st. pt.		52

4/12/2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	49
10/23/2	Harvest, killing crop 50pct standing stubble		51
12/10/2	Chisel, st. pt.		81
4/8/3	Cultivator, field 6-12 in sweeps		56
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	56
10/12/3	Harvest, killing crop 50pct standing stubble		59
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Field Number	Erosion							+	Runoff				+	Tile / Subsurface Recharge			=	Overall
	Gross Erosion x	Sediment Trap Factor x	SDR x	Buffer Factor x	Enrichment Factor x	STP Factor =	Erosion PI		RCN Factor x (	STP Factor +	P App Factor) =	Runoff PI		Flow Factor x	STP Factor =	Tile/Sub PI		P Index
85822221P5000C --	6.00	1.00	0.19	1.00	1.10	0.82	1.02		1.53	0.20	0.09	0.44		1.00	0.07	0.07		1.53

RUSLE2 Profile Erosion Calculation Record

Info: 85832228P3000

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138B Clarion loam, 2 to 5 percent slopes\Clarion loam 85%
Slope length (horiz): 98 ft
Avg. slope steepness: 3.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	64.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.0 t/ac/yr
Detachment on slope: 1.0 t/ac/yr
Soil loss for cons. plan: 1.0 t/ac/yr
Sediment delivery: 1.0 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		74
4/12/1	Cultivator, field 6-12 in sweeps		54
4/24/1	Planter, double disk opnr	Corn, grain, high yield	50
10/23/1	Harvest, killing crop 50pct standing stubble		88
11/10/1	Manure injector, liquid high disturb.30 inch		87
12/2/1	Chisel, st. pt.		64

4/ .	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	61
10/23/2	Harvest, killing crop 50pct standing stubble		63
12/10/2	Chisel, st. pt.		90
4/8/3	Cultivator, field 6-12 in sweeps		67
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	68
10/12/3	Harvest, killing crop 50pct standing stubble		71
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Field Number	Erosion																								
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	RCN Factor	x (| STP Factor | + | P App Factor |) =	Runoff PI	+	Flow Factor	x	STP Factor	=	Tile/Sub PI	=	Overall P Index
85832228P3000 --	1.00		1.00		0.06		1.00		1.10		0.80		0.05		1.53		0.16		0.09		0.38		1.00		0.07		0.07		0.51

RUSLE2 Profile Erosion Calculation Record

Info: 85832229P4700

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\638C2 Clarion-Storden loams, 5 to 9 percent slopes, moderately eroded\Clarion loam moderately eroded 50%
Slope length (horiz): 98 ft
Avg. slope steepness: 8.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	200.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	200.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	58.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 2.5 t/ac/yr
Detachment on slope: 2.5 t/ac/yr
Soil loss for cons. plan: 2.5 t/ac/yr
Sediment delivery: 2.5 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		71
4/12/1	Cultivator, field 6-12 in sweeps		51
4/24/1	Planter, double disk opnr	Corn, grain, high yield	47
10/23/1	Harvest, killing crop 50pct standing stubble		86
11/10/1	Manure injector, liquid high disturb.30 inch		85
12/2/1	Chisel, st. pt.		61

4/ 2	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	58
10/23/2	Harvest, killing crop 50pct standing stubble		60
12/10/2	Chisel, st. pt.		88
4/8/3	Cultivator, field 6-12 in sweeps		64
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	65
10/12/3	Harvest, killing crop 50pct standing stubble		68
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USDA Natural Resource Conservation Service

Field Number	Erosion										Runoff					Tile / Subsurface Recharge				Overall
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	RCN Factor	x (STP Factor	+ P App Factor) =	Runoff PI	+ Flow Factor	x STP Factor =	Tile/Sub PI	= P Index
85832229P4700 --	2.50		1.00		0.08		1.00		1.10		0.83		0.19		1.53	0.21	0.09	0.45	1.00	0.07	0.07	0.72

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RUSLE2 Profile Erosion Calculation Record

Info: 85832233P2700

File: profiles\default

Inputs:
Location: USA\Iowa\Story County
Soil: Story County, Iowa\138B Clarion loam, 2 to 5 percent slopes\Clarion loam 85%
Slope length (horiz): 98 ft
Avg. slope steepness: 3.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Corn, grain, high yield	bushels	222.00
managements\CMZ 04\c.Other Local Mgt Records*CCB North	vegetations\Soybean, mw 30 in rows	bu	64.000

Contouring: b. absolute row grade 2 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.0 t/ac/yr
Detachment on slope: 1.0 t/ac/yr
Soil loss for cons. plan: 1.0 t/ac/yr
Sediment delivery: 1.0 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/30/0	Manure injector, liquid high disturb.30 inch		74
4/12/1	Cultivator, field 6-12 in sweeps		54
4/24/1	Planter, double disk opnr	Corn, grain, high yield	50
10/23/1	Harvest, killing crop 50pct standing stubble		88
11/10/1	Manure injector, liquid high disturb.30 inch		87
12/2/1	Chisel, st. pt.		64

4/1.	Cultivator, field 6-12 in sweeps		
4/22/2	Planter, double disk opnr	Corn, grain, high yield	61
10/23/2	Harvest, killing crop 50pct standing stubble		63
12/10/2	Chisel, st. pt.		90
4/8/3	Cultivator, field 6-12 in sweeps		67
5/8/3	Planter, double disk opnr	Soybean, mw 30 in rows	68
10/12/3	Harvest, killing crop 50pct standing stubble		71
			87

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Iowa Phosphorus Index

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Field Number	Erosion									Runoff					Tile / Subsurface Recharge				Overall P Index
	Gross Erosion	x	Sediment Trap Factor	x	SDR	x	Buffer Factor	x	Enrichment Factor	x	STP Factor	=	Erosion PI	+	RCN Factor	x (	STP Factor	+	P App Factor	) =	Runoff PI	+	Flow Factor	x	STP Factor	=	Tile/Sub PI	=	
85832233P2700 --	1.00		1.00		0.07		1.00		1.10		0.78		0.06		1.53		0.14		0.09		0.35		1.00		0.07		0.07		0.48

Manure Management Plan Form

Appendix A8: Iowa Ag Statistics County Corn and Soybean Yield Averages, 2014-2018

(continued)

	Corn			Soybeans		
County	5-yr. avg. yield (bu/ac)	5-yr. ave. yield + 10% (bu/ac)	Avg. yield of 4 highest (bu/ac)	5-yr. avg. yield (bu/ac)	5-yr. ave. yield + 10% (bu/ac)	Avg. yield of 4 highest (bu/ac)
Story	192	212	198	53	59	55
Tama	205	226	211	59	65	61
Taylor	167	184	170	51	56	52
Union	166	183	171	49	54	50
Van Buren	170	187	180	49	54	52
Wapello	175	193	181	52	58	54
Warren	174	192	177	51	57	53
Washington	206	226	210	59	64	60
Wayne	161	177	169	48	53	49
Webster	196	215	197	55	61	56
Winnebago	193	212	198	56	62	59
Winneshiek	194	213	199	54	60	55
Woodbury	201	221	206	58	63	59
Worth	191	210	193	55	61	57
Wright	191	210	196	54	60	57

Using Manure Nutrients for Crop Production

Nutrients in Animal Manure

Manure can supply nutrients required by crops and replenish nutrients removed from soil by crop harvest. Since manure contains multiple nutrients, applications should consider not only what is needed for the crop to be grown but also how the ratio of nutrients in manure could affect soil test levels. This ensures adequate nutrient supply and reduces potential for over- or under-application and subsequent buildup or depletion in the soil. Good manure nutrient management should consider short-term and long-term impacts on crop nutrient supply and soil resources.

Manure has characteristics that make nutrient management different and sometimes more complicated than fertilizer. These include a mix of organic and inorganic nutrient forms; variation in nutrient concentration and forms; variation in dry matter and resultant handling as a liquid or solid; and relatively low nutrient concentration requiring large application volumes. Since manure nutrient composition can vary significantly, sampling and laboratory analysis are always needed, while with fertilizer nutrient concentrations are provided at a guaranteed analysis.

The manure nutrient concentration varies considerably between animal species; dietary options; animal genetics; animal performance; production management and facility type; and collection, bedding, storage, handling, and agitation for land application. Use of average or "book" nutrient values can be helpful for designing a new facility and creating manure management plans but is not very helpful in determining specific manure nutrient supply or application rates due to wide variation in nutrient concentrations between production facilities. For example, a recent sampling across swine finishing facilities found a range in total N from 32 to 79 lb N/1,000 gal, P from 17 to 54 lb P_2O_5/1,000 gal, and K from 23 to 48 lb K_2O/1,000 gal. A similar or larger range can be found with other manure types. Nutrient analyses often vary greatly as storage facilities are emptied or manure is stockpiled, and also among multiple samples collected from loads during land application. Therefore, collecting multiple manure samples and maintaining a history of analysis results will improve use of manure nutrients.

For determining manure application rates and equating to crop fertilization requirements, it is most helpful if manure analyses give N, P_2O_5, and K_2O based on an as-received or wet basis in lb per ton or lb per 1,000 gal units. It is beyond the scope of this publication to give detailed manure sampling and laboratory analysis

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recommendations. Those can be found in the extension materials listed on page 7. If manure analyses are provided from the laboratory in other units, they must be converted to these units. See the ISU Extension manure sampling publication for appropriate conversion factors. If manure average nutrient values or methods to estimate manure nutrient concentrations based on excretion are of interest or needed for planning purposes, those can be found in the Midwest Plan Service bulletins listed on page 7.

Manure Nutrient Availability for Crops

Nutrient management guidelines use the words "manure nutrient availability" when suggesting manure applications to supply nutrients needed by crops. However, the meaning of "availability" for manure nutrients often is not clear or its use not consistent. Available is defined as present or ready for immediate use, or present in such chemical or physical form as to be usable (as by a plant). The main reasoning for using the term "available" in describing manure nutrients is that some portions are in forms that cannot be used by plants immediately upon application to soil and have to be converted to a form that plants can take up. The term "available" is not typically applied to fertilizers because most include chemical forms that plants can take up or are quickly converted upon application to soil. According to this definition, most inorganic fertilizers contain basically 100 percent crop-available nutrients. For example, anhydrous ammonia dissolves in water and rapidly changes to ammonium, urea hydrolyzes to ammonium within a few days, and ammonium is further transformed to nitrate by soil microorganisms. Monoammonium phosphate (MAP) and diammonium phosphate (DAP) are highly soluble in water and dissolve to ammonium and orthophosphate. Potassium chloride (KCl, potash), dissolves in water to potassium (K^+) and chloride (Cl^-) ions. Both orthophosphate and K ions are taken up by plants. Because all K contained in manure is in the K^+ ionic form, manure K is readily crop available in all manure sources.

For manure N and P, there is usually a mix of organic and inorganic materials that varies among manure sources, production systems, bedding, storage, and handling. This variety in forms of N and P in manure contributes to greater uncertainty in manure nutrient management compared with fertilizers. The ratio of inorganic (mainly ammonium) and organic N varies considerably with the manure source. This was shown, for example, by on-farm research that included manure sampling and analysis from swine and poultry operations. The fraction of total N as ammonium N was almost 100 percent for swine manure from the liquid portion of anaerobic lagoons, 65 to 100 percent (average 84 percent) for liquid swine manure from under-building pits or storage tanks, and 10 to 40 percent (average 20 percent) for solid poultry manure. The large ammonium-N concentration and organic-N fraction that is easily mineralized after application to soil explain why N in liquid swine manure is considered "highly" crop available and almost comparable to fertilizer N. Other manures have lower ammonium-N concentrations and greater (and tougher to degrade)

organic materials due to bedding and feed materials. Considerable P in swine manure is orthophosphate and calcium phosphate compounds (derived both from feed and mineral supplements added to rations) that are soluble or dissolve quickly once applied to soil. The rest is organic P, which varies greatly in complexity and reaction in soil. Testing manure for ammonium-N or water-soluble N can be a way of estimating immediately available N. Unfortunately, a similarly useful test does not exist for P. Therefore, the availability estimate for manure N and P can be, and often is, less than 100 percent of total N and P.

Manure Nutrient Supply

There is a clear difference between crop availability of nutrients in fertilizer or manure and season-long supply of nutrients. Significant amounts of plant usable forms of nutrients in both fertilizer and manure might be lost and became unavailable to crops after application. For example, N can be lost through processes such as leaching, volatilization, or denitrification while P can be lost through erosion and surface runoff. Also, these nutrients can be converted for short or long periods of time into forms not usable by plants through processes such as immobilization to organic materials for N and retention by soil mineral constituents for P. Nutrient loss issues are not as pertinent for P and K as for N in Iowa soils as long as there is little soil erosion and surface runoff.

The immediate or long-term fate of plant usable nutrients in soil can be similar for manure and fertilizer. However, variation in manure nutrient concentration, application rate, and application distribution affect nutrient supply and contribute to increased uncertainty with manure management. Application rate and distribution uncertainties affect all applied nutrient sources but are more difficult to manage with manure than with fertilizer. With careful manure sampling, pre-application nutrient analysis, study of nutrient analysis history, and calibration of application equipment, reasonable manure nutrient application rates can be achieved. Due to material characteristics, and sampling and analysis variability, field distribution and application rate variability often is greater for dry manure sources.

These supply issues can be important for N, P, and K, although typically are of greater concern with N. There are several reasons, including manure usually is applied for corn production where N supply is critical, many Iowa soils have optimum or higher P and K test levels where need for and response to P and K is much less than with N, and crop deficiency symptoms and yield loss resulting from nutrient supply problems are more obvious for N.

Manure nutrient loss, application rate, and distribution uncertainties usually are not included in crop nutrient availability estimates. Instead, they are handled by suggested management practices. Not all published guidelines are consistent in this regard and, therefore, suggested crop nutrient availabilities do vary between states and regions. In this publication, use of "availability" refers to manure nutrients potentially available for plant uptake (with no losses) by the first crop after application or beyond, and percent nutrient availability values provided correlate to those for commonly used fertilizers. The guidelines in this publication assume supply issues are handled in the best way possible as is done with fertilizers. It is important to understand that for successful manure nutrient management, in many instances supply issues are as, or more, critical than estimates of nutrient availability.

Improving crop nutrient supply with manure can be achieved by understanding the issues related to manure nutrient analysis, application rate, application distribution, and the benefits and risks related to management practices such as application timing and placement that influence potential losses. Additionally, use of available tools to determine initial soil nutrient levels and adjust application rates can help provide for adequate season-long nutrient supply when either manure or fertilizer is used. These tools include commonly used pre-plant soil testing for P and K, estimates of N application rate need based on response trial data (such as the *Corn Nitrogen Rate Calculator*), and tools to help determine need for

additional N after planting corn such as the late-spring soil nitrate test and in-season crop sensing for N stress.

Manure Nutrient Application Recommendations

To determine manure application rates, the following information is required: needed crop nutrient fertilization rate for N, P, K, or other deficient nutrients; manure type; nutrient analysis; nutrient crop availability; and method of application. Nutrient recommendations for crops are provided in other Iowa State University Extension publications and are not repeated here (see list on page 7). Once the needed nutrient application rate is determined, the manure rate to supply crop available nutrients is calculated based on the specific manure source being used.

An additional consideration is what portion of the needed fertilization will be supplied from manure—to meet the full crop nutrient requirement, or a partial requirement from manure and the remaining from fertilizer. This is an important consideration because manure contains multiple nutrients and a manure rate to supply the most deficient nutrient can over-supply other nutrients. Also, manure application to meet the least deficient or most environmentally restrictive nutrient application can result in under-supply of other nutrients.

In these cases, use of fertilizers in addition to manure application is necessary to appropriately meet all nutrient application requirements.

Manure Nutrient Availability Values

Many of the manure N, P, and K crop availability estimates listed in Table 1 are derived from research trials conducted in Iowa. However, when local research is lacking, applicable information was taken from research conducted in other states. For manure sources not listed in the table, values based on manure with similar characteristics can provide a reasonable estimate. The ranges in nutrient availability are provided to account for variation in the proportion of organic and inorganic N and P forms, bedding type and amount, manure sampling and analysis variation, and application importance at different P and K soil test levels. See the footnote in Table 1 for further information on variability in manure nutrient availability.

First-Year Availability Estimates

Table 1. First-year nutrient availability for different animal manure sources.

Manure Source	Nitrogen[1]	Phosphorus[2]	Potassium[2]
	Percent of Total Nutrient Applied		
Beef cattle (solid or liquid)	30–50	80–100	90–100
Dairy (solid or liquid)	30–50	80–100	90–100
Liquid swine (anaerobic pit)	90–100	90–100	90–100
Liquid swine (anaerobic lagoon)	90–100[3]	90–100[3]	90–100
Poultry (all species)	50–60	90–100	90–100

[1]The estimates for N availability do not account for potential volatile N losses during and after land application. Correction factors for volatile loss are given in Table 2. The ranges are provided to account for variation in the proportion of ammonium N (and for poultry manure also uric acid), bedding type and amount, and both sampling and analysis.

[2]The ranges in P and K availability are provided to account for variation in sampling and analysis, and for needed P and K supply with different soil test levels. A small portion of manure P may not be available immediately after application, but all P is potentially available over time. Use lower P and K availability values for soils testing in the Very Low and Low soil test interpretation categories, where large yield loss could occur if insufficient P or K is applied and a reasonable buildup is desirable. Use 100% when manure is applied to maintain soil-test P and K in the Optimum soil test category, when the probability of a yield response is small.

[3]Values apply for the liquid portion of swine manure in lagoons; the N and P availability will be less and difficult to estimate with settled solids.

Second- and Third-Year Availability Estimates

While manure N may become crop available over multiple years for some sources, there should not be an expectation that all of the manure N will eventually become crop available. This happens because some of the N is in difficult to degrade organic forms (recalcitrant) and will become part of the soil organic matter. For some manure sources, such as with bedded systems, not all of the manure N should be accounted for in manure plans over multiple years and the first-, second-, or third-year availability may not add up to 100 percent.

Animal manure that has considerable organic material can have some residual-N availability in the second or third year after application. The second-year N availability estimate for beef cattle and dairy manure is 10 percent, and 5 percent for the third year. Other manures that have similar organic N and bedding could have similar second- and third-year N availability. Manure sources that have low organic N will not have second-year crop available N. These include liquid systems like swine manure stored in under-building pits and above-ground tanks, and anaerobic lagoons. Poultry manure, since it has considerable organic material, has some but low second-year (0–10 percent) availability and no third-year N availability.

The P and K contained in animal manure are estimated at 100 percent crop available over a long term. Residual effects of P and K not used in the year of application will be reflected in soil tests and crop use, just like fertilizer P and K applied for one year or for multiple years.

Adjusting for Manure Nitrogen Volatilization

The estimates for manure N availability in Table 1 do not consider potential volatile N losses during or after application. Losses are from various volatile N compounds in manure, such as ammonia, and ammonia that is produced when urea, uric acid, or other compounds convert to ammonium. These are similar losses that can occur from some N fertilizers such as anhydrous ammonia, urea, and urea-ammonium nitrate (UAN) solutions. If manure is left on the soil surface, losses may occur until N is moved into the soil with rainfall or incorporated with tillage. Many factors affect the rate and amount of volatile loss, such as temperature, humidity, rainfall, soil moisture, soil pH, surface residue cover, and days to incorporation. Volatile losses at or after application often are difficult to predict accurately. However, losses can be significant, and, therefore, it is important to make an adjustment for volatile N losses from applied manure and for manure management planning purposes. Values given in Table 2 provide guidance on potential volatile losses. The correction factors in Table 2 do not account for N losses during storage and handling (time from excretion to sampling for analysis) and assume a reasonable time period from sampling to land application so that the manure analysis represents the manure being applied. To estimate manure N remaining in soil after application, multiply the applied manure N rate by the appropriate correction factor.

Table 2. Correction factors to account for N volatilization losses during and after land application of animal manure.[1]

Application Method	Incorporation	Volatilization Correction Factor[2]
Direct injection	—	0.98–1.00
Broadcast (liquid/solid)	Immediate incorporation	0.95–0.99
Broadcast (liquid)	No incorporation	0.75–0.90
Broadcast (solid)	No incorporation	0.70–0.85
Irrigation	No incorporation	0.60–0.75

[1]Adapted from Midwest Plan Service MWPS-18, Third Edition. Nitrogen losses during and within four days of application.

[2]Multiply the manure total N rate applied times the volatilization correction factor to determine the portion of total manure N remaining.

Considerations for Time of Application

The time of application influences nutrient availability and potential manure and nutrient loss from soil. Fall applications allow more time for organic N and P portions of manure to mineralize so they are available for plant uptake the next crop season. This is more important for N in manures with high organic matter content, such as bedded systems. Iowa research has shown that fall versus springtime P and K application usually is not an agronomic issue for fertilizers or manure. The increased time for organic N mineralization with fall application also allows for nitrification of ammonium and therefore more potential nitrate loss through leaching or denitrification with excessively wet spring conditions. This is a more important issue for manure with large ammonium-N concentration, such as liquid swine manure. Coarse-textured soils, with high permeability, are the most likely to have leaching losses. Fine- and moderately fine-textured soils, prone to excess wetness, are most likely to have denitrification losses. Manure applied in the spring has less time for organic N and P mineralization before crop uptake. Delayed mineralization can be an important issue for manure with high organic matter content, especially in cold springs. With manure that contains a large portion of N as ammonium, spring application allows for better timing of nitrification to nitrate and subsequent crop use, and less chance of N loss.

As a general rule, do not apply manure in the fall unless the soil temperature is 50° F and cooling at the four-inch soil depth. This will slow the mineralization and nitrification processes and is an especially important consideration for manure containing a large portion of N as ammonium.

Broadcasting manure onto frozen, snow-covered, water-saturated soils increases the potential for nutrient losses with rainfall or snowmelt runoff to surface water systems. If manure must be applied in these conditions, it should be applied on relatively flat land, slopes less than 5 percent, and well away from streams and waterways (see Iowa Department of Natural Resources rules on setback distances).

Example Calculation of Manure Application Rates

***Note:** The N, P, and K fertilization requirements in these examples are determined from appropriate extension publications and Web-based tools listed at the right.*

Example 1

- Manure source: liquid swine manure, finishing under-building pit.
- Manure analysis: 40 lb N/1,000 gal, 25 lb P_2O_5/1,000 gal, 35 lb K_2O/1,000 gal.
- Intended crop: corn in a corn-soybean rotation.
- Soil tests: 19 ppm Bray P-1 (Optimum), 165 ppm Ammonium Acetate K (Optimum).
- Crop yield and P and K removal for determining nutrient rates needed to maintain the Optimum soil test category: 200 bu/acre corn yield; 75 lb P_2O_5/acre and 60 lb K_2O removal.
- Manure rate: based on corn N fertilization requirement at 125 lb N/acre.
- Manure application: injected late fall.
- Manure nutrient availability: 100 percent for N, P, and K.
- Manure N volatilization correction factor: 0.98.
- Manure rate: 125 lb N/acre ÷ (40 lb N/1,000 gal × 0.98) = 3,200 gal/acre.
- Manure available P and K nutrients applied: 3,200 gal/acre × (25 lb P_2O_5/1,000 gal × 1.00) = 80 lb P_2O_5/acre; and 3,200 gal/acre × (35 lb K_2O/1,000 gal × 1.00) = 112 lb K_2O/acre.
- Phosphorus and K applied with the manure are adequate for P (slightly more than expected corn removal) and will supply more than needed K. The extra P and K can be used by the next crop and should be accounted for. However, additional P and K will need to be applied for the following soybean crop.

Example 2

- Manure source: solid layer manure.
- Manure analysis: 72 lb N/ton, 69 lb P_2O_5/ton, 54 lb K_2O/ton.
- Intended crop: corn-soybean rotation.
- Soil tests: 18 ppm Bray P-1 (Optimum), 120 ppm Ammonium Acetate K (Low).
- Manure rate: based on P requirement for the crop rotation at 120 lb P_2O_5/acre.
- Manure application: late fall, incorporated after four days.
- Manure nutrient availability: 55 percent for N, 100 percent for P and K.
- Manure N volatilization correction factor: 0.80.
- Manure rate: 120 lb P_2O_5/acre ÷ (69 lb P_2O_5/ton × 1.00) = 1.7 ton/acre.
- Manure available N and K nutrients applied: 1.7 ton/acre × (72 lb N/ton × 0.60 × 0.80) = 60 lb N/acre; and 1.7 ton/acre × (54 lb K_2O/ton × 1.00) = 92 lb K_2O/acre.
- Corn N fertilization need and K needed for the corn and soybean crops with a Low soil test category: 130 lb N/acre and 172 lb K_2O/acre.
- Crop available N and K applied with manure is not adequate for N, need additional 70 lb fertilizer N/acre (130 lb N/acre – 60 lb N/acre); and applied K is not adequate for the corn and soybean crops, need additional 80 lb K_2O/acre (172 – 92 lb K_2O/acre) from fertilizer.

Additional Resources

CROP 3073 *Nitrogen use in Iowa Crop Production*

PM 1688 *A General Guide for Crop Nutrient and Limestone Recommendations in Iowa*

PM 287 *Take a Good Sample to Help Make Good Decisions*

PM 2015 *Concepts and Rationale for Regional Nitrogen Rate Guidelines for Corn*

PM 1714 *Nitrogen Fertilizer Recommendations for Corn in Iowa*

PM 2026 *Sensing Nitrogen Stress in Corn*

PM 1584 *Cornstalk Testing to Evaluate Nitrogen Management*

PM 1588 *How to Sample Manure for Nutrient Analysis*

A3769 *Recommended Methods of Manure Analysis* (University of Wisconsin)

MWPS-18-S1 *Manure Characteristics: Section 1* (Midwest Plan Service)

MWPS-18 *Livestock Waste Facilities Handbook, Third Edition* (Midwest Plan Service)

Corn Nitrogen Rate Calculator, http://cnrc.agron.iastate.edu/

Summary

- Carefully manage the nutrients in animal manure as you would manage fertilizer.
- Have representative manure samples analyzed to determine nutrient concentration. At a minimum, samples should be analyzed for moisture (dry matter) and total N, P, and K. For additional information on N composition, samples can be analyzed for ammonium. Maintain a manure analysis history for production facilities.
- Set the manure application rate according to crop fertilization requirements and for the crop availability of manure N, P, and K.
- Adjust manure rates for estimated N volatilization.
- For manure application rates, consider the crop N, P, and K fertilization requirements and field P-Index ratings, but do not exceed the crop N fertilization need.
- Consider the nutrient needs of crop rotations rather than just individual crops, which is especially important for P and K management.
- Allocate manure to fields based on soil tests and crops to be grown.
- Fall applications of manure should not be made until the soil temperature is 50° F and cooling, especially for manure sources that have a large portion of N as ammonium.
- Do not apply manure to snow-covered, frozen, or water-saturated sloping ground to reduce risk of nutrient loss and water quality impairment.

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