NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE GENERAL SPECIFICATION

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

GENERAL SPECIFICATIONS

Procedures, technical detail, and other information listed below provide additional guidance for carrying out selected components of the named practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

Soil Test Interpretations

Soil test recommendations are located in Oklahoma Cooperative Extension Service Publication ***PSS-2225, OSU Soil Test Interpretations (http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1490/PSS-2225web.pdf)***. The information contained in the tables shall be used in conjunction with a current soil test analysis to prepare nutrient budgets and to develop nutrient management plans for land users.

Nutrient requirements for crops not listed within the tables should be referred to OSU Extension Educators or Specialists.

Oklahoma State Extension Fact Sheets are available on-line at the following web site:

http://pods.dasnr.okstate.edu/docushare/dsweb/View/Collection-12

Soil Sampling Requirements

Fields used for production of cultivated crops may be sampled any time after harvest or before planting. Non-cultivated fields should be sampled during the dormant season. Do not sample immediately after lime, fertilizer or manure applications.

All soil samples will be collected to the depth of tillage or six (6) inches. Occasionally, there will be reasons for taking shallower soil samples (1-3 inch depth) for analysis (e.g. potential pH concerns on a no till field, salinity concerns, etc.).

A minimum of 20 core samples shall be taken randomly from the field or sample area. The core samples shall be collected and mixed thoroughly in a clean plastic container. Approximately one (1) pint of the mixed core samples will be placed in a bag and sent for testing.

When the soil test for N exceeds the recommended plant requirements (excessive), a representative soil sample will be taken for the subsoil in addition to the 6-inch sample. This sample shall represent the soil layer from 7 to 18 inches in depth. The Oklahoma Cooperative Extension Service Office is available to assist with the soil testing process. Additional information concerning soil sampling can be found in the Oklahoma Cooperative Extension Service Publication ***PSS-2207, How to Get a Good Soil Sample (http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2762/PSS-2207web.pdf)***.

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If a soil test laboratory other than OSU is used, the lab shall use the same phosphorus and potassium extractant (Mehlich-3) as used by the OSU lab and nutrient recommendations will be the same as those used by OSU. The soil testing laboratory shall be a member of the North American Proficiency Testing Program - Performance Assessment Program (NAPT-PAP) or Agricultural Laboratory Proficiency Program.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient management plan (e.g. N, P, K, micro-nutrients, salinity and pH).

Nutrient Application Timing and Method

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, cropping system limitations, weather and climatic conditions, and field accessibility.

Nutrients shall be applied anytime during active forage growth by broadcasting, injection or incorporation. For warm season plants (bermudagrass, corn, etc.), late spring application is optimal. However, for cool season plants (fescue, wheat, etc.), a split application in the early fall and early spring works best.

Biosolids Application

When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soils shall be monitored in accordance with the US Code, Reference 40CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations. The role of monitoring the application of sewage or municipal sludge in Oklahoma is the responsibility of the Oklahoma Department of Environmental Quality (DEQ). Contact DEQ for information concerning the use of municipal sludge. Additional information pertaining to biosolids can be found in Oklahoma Cooperative Extension Service Publication ***CR-2201, Using Biosolids as a Plant Nutrient Source.*** ***http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2646/CR-2201web.pdf***

Oil/Gas Well Waste Application

The Oklahoma Corporation Commission regulates land applications of waste material from oil and gas wells. Contact the Oklahoma Corporation Commission for information concerning regulations and permitting for land applications of these materials.

Inorganic/Commercial Nutrient Application Rates

Application rates of inorganic/commercial sources of nutrients shall be based on recommendations that consider current soil test results, realistic yield goals and management capabilities. OSU nutrient recommendations for major crops and grasses are contained in OSU Publication PSS-2225

The following guidance shall also be used when applying inorganic/commercial sources of nutrients:

- **Nitrogen Application** - N application rates shall match the plant uptake rate for the yield goal as closely as possible. The nitrogen requirement is calculated by subtracting the soil test nitrogen value from the nitrogen required for a selected crop and yield goal**.**
- **Phosphorus (P_2O_5) Application -** P_2O_5 application rates must not exceed OSU fertilizer recommendations.
- **Potassium (K_2O) Application** - K_2O application rates shall match the required rates as closely as possible.
- **Other Plant Nutrients -** The planned rates of application for secondary and micronutrients shall be consistent with OSU guidance *(Publication PSS-2225)*.
- **Available fertilizer blends** can sometimes make it difficult to apply fertilizer to meet specific recommendations. Applications of inorganic/commercial nutrients will be considered

adequate when the applied rate is no more than 10% or 10 pounds (whichever is greater) below or above the recommended target application rate.

- **Starter Fertilizers** - Starter fertilizers containing N, P, and/or K may be applied to row crops to overcome early stress of the root environment such as a cool, wet soil. Starter fertilizers are typically applied in the row with the seed or banded alongside the seed. When fertilizers containing N and K_20 dissolve in the soil they can contribute to salt concentration in the soil solution. The distance of the fertilizer from the seed is the most important factor when considering potential salt injury. A common method of starter fertilizer placement to reduce potential salt damage is 2 inches below and 2 inches to the side of the seed row. Typically the sum of the N and K_2O is used as a guideline as to how much can be applied without causing salt injury. In general, OSU guidance recommends no more than 30 lbs. of applied N + K_2O per acre for wheat or 7 lbs/ac for corn. No more than 90 lbs. per acre of P_2O_5 will be used in a starter fertilizer. These rates will vary with crop selection and climate conditions. The OSU Cooperative Extension Service Office is available for assistance in this area. The amount of starter fertilizer applied will be included in the nutrient budget.

Organic Nutrient Application Rates

All manure or organic by-products shall be tested prior to land application.

Preliminary planning decisions may be based on values found in the Agricultural Waste Management Field Handbook, Chapter 4 - Agricultural Waste Characteristics. Actual application rates will be adjusted accordingly based on the current manure analysis.

Plant nutrient removal rates can be found in Table 6. Crops not listed in Table 6 may be found in the Agricultural Waste Management Field Handbook, Chapter 6 – Role of Plants in Waste Management (Table 6-6).

Do not apply manure or organic by-products in the following situations as described in the Published County Soil Survey or Section II of the NRCS Field Office Technical Guide:

- Liquid animal manure will not be land applied within 500 feet of the corner of an occupied residence not owned or operated by the feeding operation.
- Liquid animal manure will not be land applied within 300 feet of an existing public or private drinking water well.
- To areas within 100 feet of a perennial stream, pond, well, wetland or sinkhole, unless an established buffer strip is present. The width of the buffer strip will be used as a setback distance for application purposes. The buffer strip must meet the requirements for design and maintenance established in the appropriate NRCS buffer standard and specification.
- To areas within 50 feet of an intermittent stream unless an established buffer strip is present. The width of the buffer strip will be used as a setback distance for application purposes. The buffer strip must meet the requirements for design and maintenance established in the appropriate NRCS buffer standard and specification.
- To fields with >15% slope.
- To soils less than 10 inches in depth to bedrock.
- On soils that are frequently flooded.
- On soils that are frozen, snow covered, or water saturated (including periods of heavy rain when water ponding has occurred on the soil surface).
- On soils where the rock fragments in the surface layer are 3 to 10 inches in diameter and exceed 50% by weight.
- On soils where the rock fragments in the soil surface layer are >10” in diameter and exceed 25% by weight.

- On soils where the rock fragments are >10 inches in diameter which covers >3% of the soil surface and the slope is >8%. (Soil map unit name will include the description of Extremely Stoney, Extremely Bouldery, or Extremely Rubbly or Very Rubbly)
- On areas eroding at levels greater than the soil loss tolerance, "T", from wind or water erosion or active gullies unless following a conservation plan that will reduce erosion below "T". Use current Oklahoma NRCS soil loss prediction methods.
- On soils that are occasionally flooded. However, manure may be applied between June 20 and September 20 on soils classified as occasionally flooded. Manure may also be applied to soils classified as occasionally flooded between February 1 and April 20 if the area is established to cool season grasses 4 inches in height at the time of application. In no case will manure be applied when the soil is water saturated or when ponding has occurred on the soil surface after periods of heavy rain.

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, cropping system limitations, weather and climatic conditions, and field accessibility. Nutrients materials will be applied uniformly to the area.

The application rate for waste water effluent applied with irrigation shall not exceed field capacity for the soil, create runoff and shall minimize ponding.

The following shall also be used when applying manure or organic by-products:

- **Nitrogen Application –** The amount of N applied from manure will not exceed the annual crop requirement for N. In some situations, additional N from inorganic/commercial sources may be required to supplement the organic sources. The N applied from inorganic/commercial sources shall match the crop requirement as closely as possible and shall not exceed 10% of the recommended inorganic/commercial fertilizer rate. Manure may be applied to a legume crop at a rate equal to the estimated N removal in the harvested plant biomass.
- **Phosphorus Application –** The maximum planned rates of P application shall be determined using the Oklahoma Phosphorus Assessment Worksheet.

Field Scale Sensor Based Technologies

This nutrient management technique involves the utilization of N-Rich Strips in conjunction with a GreenSeeker™ hand held sensor and the Sensor Based Nitrogen Rate Calculator to make top-dress nitrogen rate recommendations to an entire field. This technology is adapted to winter wheat, canola, cotton, corn, and grain sorghum.

An N-Rich Strip is an area within the field that has received enough nitrogen fertilizer so that nitrogen will not be deficient during the growing season within that area or strip. The N-Rich strip should receive no less than 125 percent of the total nitrogen recommended from the yield goal. The rest of the field shall receive a standard pre-plant nitrogen application of at least 33% of the total nitrogen needed for the yield goal.

The application of the N-Rich Strip should take place at the time of pre-plant fertilizer application, planting, or soon thereafter. For winter wheat, the placement of the strips can be delayed for up to one month after sowing.

The N-rich strip will then be used in conjunction with the GreenSeeker™ hand held sensor to determine mid-season N rates. By knowing the yield potential of the reference strip and the yield potential of the rest of the field, the N rate can then be calculated by using the "Sensor-Based Nitrogen Rate Calculator" (http://www.soiltesting.okstate.edu/SBNRC/SBNRC.php).

Refer to Oklahoma State University, Department of Plant and Soil Sciences, Nitrogen Use Efficiency webpage (http://nue.okstate.edu/) and the Oklahoma Cooperative Extension Service Current Report "Reference Strip Series: Applying your Nitrogen-Rich and Ramp Calibration Strips"

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(http://npk.okstate.edu/referencestrips/Documents/CR-2255web.pdf) for additional information and guidance.

Precision Application (Variable Rate)

The basic principles of soil sampling still apply to precision sampling. An adequate number of samples should be collected to accurately characterize the field unit. Samples should be collected to the proper depth for non-mobile and mobile nutrients and field conditions.

***Sensor Based*:**
Utilizing optical sensors mounted on fertilizer applicators or variable rate Nitrogen top-dressing. Aerial imagery can also be used to create application maps prior to nitrogen fertilization. Proper sensor technologies require the use of N-Rich strips. Application of N-rich strip should follow the methods described in the Field Scale Sensor Based section.

Variable Rate systems incorporate biomass sensors mounted on the fertilizer applicator, sprayer or spreader. The sensors collect canopy reflectance measurement and according to predetermined algorithms, changes nitrogen rate as the applicator moves through a field.

***Zone Management*:**
Utilizing information to determine zones within a field to collect soil samples or determine yield goals. Data / information may consist of but is not limited to: Soil type, soil texture, depth to limiting layer, soil electrical conductivity (EC), landscape position, and yield monitor data. Zones delineate areas of a field with similar characteristics. Composite soil samples are collected from each zone. For example, Based on NRCS Soil Survey field X consists of three primary soil textures Clay loam, Silty Clay loam, and Loamy sand. Three zones are defined by the soil textures and composite samples are collected from each textural zone. Fertilizer rates should be based upon Oklahoma State University, Department of Plant and Soil Sciences recommendations as described in the Nutrient Application Rates section. Sampling and Testing Standards should be followed as described in Soil Sampling Requirements Section.

***Grid Soil Sampling*:**
Use of grid soil sampling, at a resolution of 0.5 – 6 acre grids, to determine needs of essential plant nutrients or lime.

A field is laid out into quadrants of equal size and proportion. Quadrant (grid) size may range from 0.5 to 6.5 acres is size depending upon field, environment, and crop potential. Composite soil samples are collected from each quadrant. Each nutrient, measured through soil testing, spatial distribution is independently analyzed. Distribution maps and recommendation maps are then developed for each nutrient. Fertilizer rates should be based upon Oklahoma State University, Department of Plant and Soil Sciences recommendations as described in the Nutrient Application Rates section. Sampling and Testing Standards should be followed as described in Soil Sampling Requirements Section.

Field Risk Assessment

The NRCS-approved nutrient risk assessment for nitrogen shall be completed, as listed below, on all sites when the application of inorganic or organic amendments is planned.

When applications of manure or other organic by-product amendments are planned, a field specific NRCS approved nutrient risk assessment of the potential for phosphorus transport from the site shall be completed, as listed below.

NITROGEN

Nitrogen is most often associated with the impairment of the quality of groundwater. Nitrogen leaching out of the root zone may enter and contaminate the ground water drinking supply.

To supply the needed plant nutrients to achieve realistic yield goals and minimize the transport of nitrogen to the ground water, a nutrient risk assessment procedure for nitrogen has been developed. This risk assessment procedure was developed to assist with the identification of fields or areas of a field that have varying risks of nitrogen transport and to assist with the development of land treatment and management alternatives to minimize nitrogen transport.

A nutrient risk assessment for nitrogen shall be completed by determining the Leaching Index (LI) from the Revised Universal Soil Loss Equation (RUSLE2) and determining the Vulnerability Class from the Nutrient Vulnerable Groundwater Map of Oklahoma (Exhibit 2). (http://efotg.sc.egov.usda.gov/references/public/OK/nut_vulner_groundwater_map.pdf)

The minimum number of mitigating activities shall be applied according to **Table 1**:

Table 1

Leaching Index (LI)	Groundwater Vulnerability Rating	Mitigating Activities	RATING
0 - 5	Very Low/Low	None (0)	**LOW**
	Moderate	None (0)	
	High	One (1) activity	
	Very High	One (1) activity	
5 - 10	Very Low/Low	None (0)	**MODERATE**
	Moderate	One (1) activity	
	High	Two (2) activities	
	Very High	Two (2) activities	
10+	Very Low/Low	One (1) activity	**HIGH**
	Moderate	Two (2) activities	
	High	Three (3) activities	
	Very High	Four (4) activities	

Mitigating Activities:

- Delay nitrogen application until plants are actively growing (4" minimum height).
- Apply split applications of 50% of the total nitrogen needs.
- Seasonal nitrogen requirements for actively growing plants shall be split to provide no more than 40 lbs of actual nitrogen every 4-6 weeks. Warm season plants – apply ≤40 lbs/acre Nitrogen during early spring (green up), after first cutting or grazing (late May - early June), or late summer. Cool season plants - apply ≤40 lbs/ac in the fall at planting. Add the remaining recommended amount in the early spring (Feb-March).

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- Nitrogen will not be applied during expected heavy rainfall months (April, May, and June) on warm season plants.
- Lower realistic yield expectation by 25%.
- Use enhanced efficiency fertilizer products (sulfur coated urea products, polymer coated fertilizers, uncoated slow release fertilizers).
- Utilize nitrogen rich strip and GreenSeeker sensors to make mid-season nitrogen applications.
- Use precision agricultural technologies to precisely apply variable rates of nitrogen fertilizer.
- Utilize annual soil testing.
- Banding nitrogen applications.
- Use legume crops and cover crops to provide nitrogen through biological fixation and nutrient recycling.

PHOSPHORUS

Phosphorus is most often associated with the impairment of the quality of surface water. Phosphorus leachate or runoff entering the surface water may contribute to excessive algae growth which may cause low oxygen levels in surface water. This in turn may impair aquatic life and adversely affect the taste of water.

To minimize the transport of phosphorus to surface water, a nutrient risk assessment procedure for phosphorus has been developed. This risk assessment procedure was developed to assist with the identification of fields or areas of a field that have varying risks of phosphorus transport and to assist with the development of land treatment and management alternatives to minimize phosphorus transport.

A nutrient risk assessment for phosphorus will be completed when:

- Manure or organic by-products amendments are applied.

This assessment shall be prepared using the Oklahoma Phosphorus Assessment Worksheet **(Exhibit 1, Tables 2 and 3)**.

Table 2

Nutrient Risk Assessment for Phosphorus (Non-Nutrient Limited Waters) - Annual Manure Application Rates

Rating	Soil Test P Index	0 – 8% Slope	8 to 15% Slope	0 to 15% Slope	Rocks >10" in diameter which cover >3% of the soils surface and <8% slope
		Soil > 20" Deep	Soil > 20" Deep	Soil 10" to 20" Deep	
*Low	0 – 65	Full Rate	Full Rate Split Application	Half Rate	Half Rate
*Moderate	66 – 250	Full Rate	Half Rate	Half Rate	Half Rate
*High	251 – 400	Half Rate	Half Rate	Half Rate	Half Rate
*Severe	> 400	No Application	No Application	No Application	No Application

Table 3

Nutrient Risk Assessment for Phosphorus (Nutrient Limited Watershed) - Annual Manure Application Rates

Rating	Soil Test P Index	0 – 8% Slope	8 to 15% Slope	0 to 15% Slope	Rocks >10" in diameter which cover >3% of the soils surface and <8% slope
		Soil > 20" Deep	Soil > 20" Deep	Soil 10" to 20" Deep	
*Low	0 – 65	Full Rate	Full Rate Split Application	Half Rate	Half Rate
*Moderate	66 – 120	Full Rate	Half Rate	Half Rate	Half Rate
*High	121 – 300	Half Rate	Half Rate	Half Rate	Half Rate
*Severe	> 300	No Application	No Application	No Application	No Application

* Check for specific site characteristics which may deem the field inadequate for manure application.

Annual manure application rates are listed and explained below.

Manure Application Rates

Full Rate – Not to exceed the Nitrogen requirement of the crop and the following P_2O_5 rates:

1. 200 lbs P_2O_5 per acre when surface applied.
2. 300 lbs P_2O_5 per acre when application is by sprinkler irrigation and managed to prevent runoff from the field.
3. 400 lbs P_2O_5 per acre if injected below the soil surface or surface applied and incorporated within 7 days.

Half Rate – Not to exceed the Nitrogen requirement of the crop and the following P_2O_5 rates:

1. 100 lbs P_2O_5 per acre when surface applied.
2. 150 lbs P_2O_5 per acre when application is by sprinkler irrigation and managed to prevent runoff from the field.
3. 200 lbs P_2O_5 per acre if injected below the soil surface or surface applied and incorporated within 7 days.

Split Application

1. Nitrogen - Not to exceed the annual Nitrogen requirement of the crop, applied during the growing season.
2. Phosphorus - Application will be no more than ½ the allowed P_2O_5 rate per application at least 30 days apart.

Severe Rating - No Manure Application

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TABLE 4
Crop pH Preference*

Crop	Preferred pH Range
Cowpeas, Mungbeans, Corn, Guar, Oats, Rye, Sorghum, Sudan, Wheat	5.5 – 7.0
Cotton	5.7 – 7.0
Canola, Soybeans, Peanuts,	5.8 – 7.0
Barley	6.5 – 7.0
****Forages**	**Preferred pH Ranges**
Bluestem, Native Hay, Fescue, Weeping Lovegrass	4.5 – 7.0
Vetch, Crimson Clover, Orchardgrass, Ryegrass	5.5 – 7.0
Bermudagrass	5.7 – 7.0
Alsike, Red and White (ladino) Clovers, Arrowleaf	6.0 – 7.0
Alfalfa, Sweet Clover	6.2 – 7.5

* Most legumes will tolerate a pH 0.5 units less and 1.0 unit higher than indicated above, but production will be significantly reduced. Non-legumes tend to tolerate a pH 0.5 to 1.0 unit less (but not less than a pH of 4.0) and 1.0 to 2.0 units higher that indicated above.

** Lime will be required for grass establishment when the soil test pH is <4.5 for fescue and lovegrass and <5.0 for all other grasses.

TABLE 5
Nitrogen Credits
Average Nitrogen Remaining After Legume Crop

Legume	*Nitrogen remaining for next crop (Legume hayed or harvested) Lbs of N/Ac	**Green manure crop nitrogen remaining (Legume unharvested) Lbs of N/Ac
Alfalfa	80	200
Ladino Clover	60	180
Sweet Clover	60	120
Red Clover	40	115
White Clover	20	100
Soybeans	20	60
Cowpeas	30	90
Vetch	40	80
Lespedeza (annual)	20	85
Peas	40	70
Peanuts	20	40
Beans	20	40

* These numbers are derived from crops that are harvested and have the remaining crop residues returned to the soil by tillage. (Reference - Oklahoma Soil Fertility Handbook, Sixth Edition (2006), pg. 18)

** A green manure crop is not harvested or grazed and is returned to the soil just prior to maturity. These numbers reflect the amount of nitrogen available for the next crop when the legume is used as a green manure crop. The numbers are adjusted to account for 30% nitrogen loss due to volatilization, leaching, and microbial action. (Reference – Soil Fertility and Fertilizers, Tidsdale and Nelson, pg. 128 and 566)

TABLE 6

Crop Nutrient Removal *

% of Dry Material Harvested					
Crop	Unit	Weight/Unit	% N	% P	% K
Barley	grain	48 lbs/bu	1.82	0.34	0.43
	straw	72 lbs/bu	0.75	0.11	1.25
Corn	grain	56 lbs/bu	1.61	0.28	0.40
	stover	56 lbs/bu	1.11	0.20	1.34
Oats	grain	32 lbs/bu	1.95	0.34	0.49
	straw	64 lbs/bu	0.63	0.16	1.66
Rye	grain	56 lbs/bu	2.08	0.26	0.49
	straw	84 lbs/bu	0.50	0.12	0.69
Sorghum	grain	56 lbs/bu	1.67	0.36	0.42
	stover	56 lbs/bu	1.08	0.15	1.31
Soybeans	beans	60 lbs/bu	6.25	0.64	1.90
	stover	75 lbs/bu	2.25	0.22	1.04
Wheat	grain	60 lbs/bu	2.08	0.62	0.52
	straw	102 lbs/bu	0.67	0.07	0.97
Cotton	lint & seed	500 lbs/bale	2.67	0.58	0.83
	burs & stalks	3 lbs/lb of lint	1.75	0.22	0.83
% of Dry Material Harvested					
Forage Crop			% N	% P	% K
Alfalfa			2.25	0.22	1.87
Bermuda			1.88	0.19	1.40
Tall Fescue			1.97	0.20	2.00
Ryegrass			1.67	0.27	1.42
Wheatgrass			1.42	0.27	2.68
Dallisgrass			1.92	0.20	1.72
Native Hay			1.06	0.40	1.58
Clovers			2.00	0.22	1.66
Lespedeza			2.33	0.21	1.06

* These crop nutrient removal figures come from the NRCS Agricultural Waste Management Field Handbook, Chapter 6, Role of Plants in Waste Management (Table 6-6). The handbook lists additional crops not listed above. These numbers represent average figures taken from multiple sources and are nutrients removed in the harvested portion of the crop. These figures can be used as guidance for waste management planning purposes. Actual waste application will be based on soil test.

Example calculation to estimate nutrients removed:

Wheat: Yield 40 bu/ac = 60 lbs/bu x 40 bu = 2400 lbs of grain

40 bu/ac x 102 lbs/bu straw = 4080 lbs/ac straw produced

1 ton/ac straw baled and removed from field = 1 ton/ac x 2000 lbs = 2000 lbs of straw/ac

Grain: 2400 lbs/ac x 0.0208 (%N/lb) = 49.92 lbs/ac Nitrogen in grain

2400 lbs/ac x 0.0062 (%P/lb) = 14.88 lbs/ac Phosphorus in grain

2400 lbs/ac x 0.0052 (%K/lb) = 12.48 lbs/ac Potassium in grain

Straw: 2000 lbs/ac x 0.0067 (%N lb) = 13.40 lbs/ac Nitrogen in straw

2000 lbs/ac x 0.0007 (%P lb) = 1.40 lbs/ac Phosphorus in straw

2000 lbs/ac x 0.0097 (%K/lb) = 19.40 lbs/ac Potassium in straw

Total Nutrient Removed = 63.32 lbs/ac N removed, 16.28 lbs/ac P removed, 31.88 lbs/ac K removed

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EXHIBIT 1

OKLAHOMA PHOSPHORUS ASSESSMENT WORKSHEET

Client Name:		**Field(s):**		**Date:**	
Planner:		**Location:**		**Crop:**	
Nutrient Limited Watershed (yes/no):				**Ctrl + C clears worksheet**	**Missing data**

Site Characteristics

Soil Test P Index Mehlich III (lbs./ac)				**Missing data**
Application Method	Surface applied and incorporated within 7 days or injected 2" below the surface	Surface applied or incorporated more than 7 days after application	Surface applied on frozen, snow covered, or water saturated ground	
				Missing data
Land Slope %	0 - 8 %	8.1 - 15 %	> 15.1 %	
				Missing data

Transport Characteristics

Erosion Rate Greater Than "T"	No	Yes		
				Missing data
Flooding Frequency	None	Occasionally	Frequently	
				Missing data
Distance of Manure Application to Perennial Stream, Pond, Well, Sinkhole, or Residence	> 100 ft. to perennial stream, pond, well, sinkhole or a Buffer Strip is Established > 300 ft. to Drinking Water Well (Liquid Manure Application) > 500 ft. to an Occupied Residence (Liquid Manure Application)	< 100 ft. to perennial stream, pond, well, or sinkhole < 300 ft. to Drinking Water Well (Liquid Manure Application) < 500 ft. to an Occupied Residence (Liquid Manure Application)		
				Missing data
Distance of Manure Application to Intermittent Stream	> 50 ft. or a Buffer Strip is Established	< 50 ft.		
				Missing data
Depth of Soil	> 20.1 in.	10.1 - 20 in.	0 - 10 in.	
				Missing data
Rock Fragments in soil surface 3" to 10 " in diameter and exceed 50% by weight or > 10" in diameter and exceed 25% by weight	No	Yes		
				Missing data
Rocks > 10" in diameter which cover > 3% of the soil surface	No	Yes		
				Missing data

Non - Nutrient Limited Watershed - Manure Application Rates

	Incomplete data or invalid data has been	

EXHIBIT 2

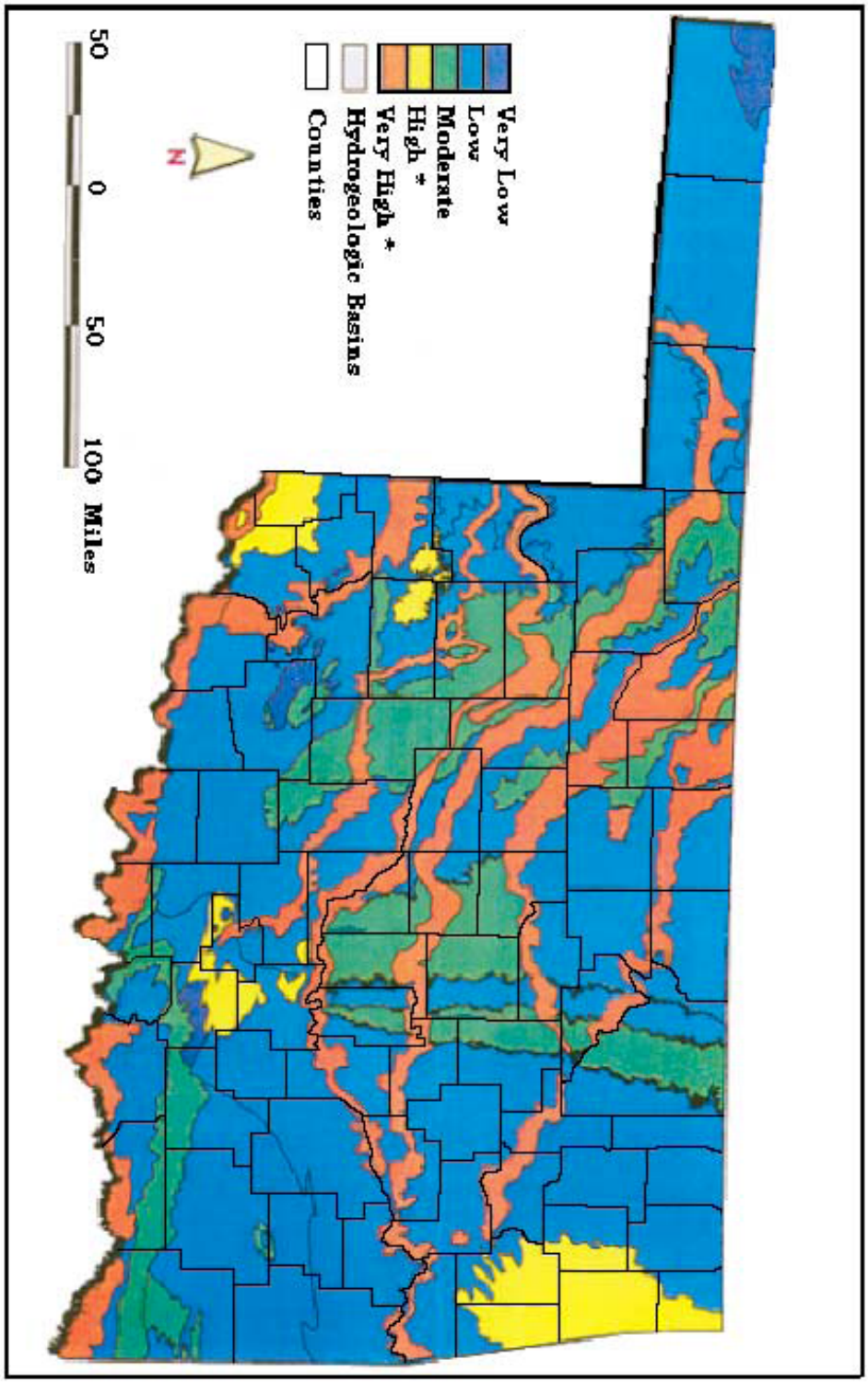

Figure 13. Groundwater vulnerability map of Oklahoma showing Vulnerability classifications by hydrogeologic basin.

* **Only these 2 classes are considered nutrient-vulnerable groundwater.**

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