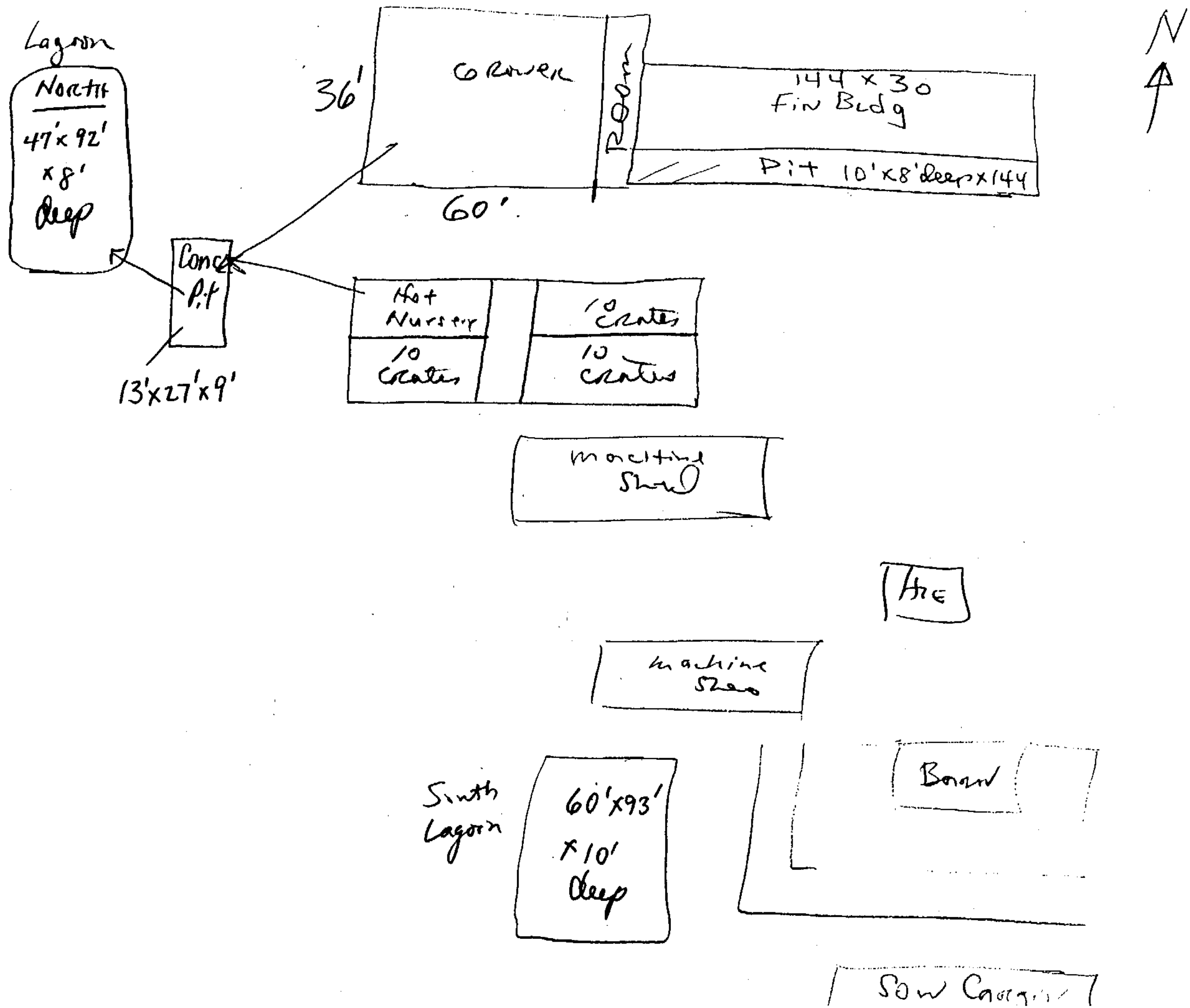
E. GENERAL APPLICATION STATEMENTS


Lagoon
North
47'x 92'
x 8'
deep
36'
Grower
Room
144 x 30
Fin Bldg
Pit 10'x8'deep x 144
60'
N
Conc Pit
13'x27'x9'
Hot Nursery
10 crates
10 crates
10 crates
Machine Shed
Hire
Machine Shed
Sixth Lagoon
60'x93'
x 10'
deep
Board
Sow Canopy

ILLINOIS WEATHER & CROPS

ILLINOIS AGRICULTURAL STATISTICS SERVICE

P.O. Box 19283, Springfield, IL 62794-9283
Phone: (217)492-4295

U.S. DEPARTMENT OF AGRICULTURE
ILLINOIS DEPARTMENT OF AGRICULTURE
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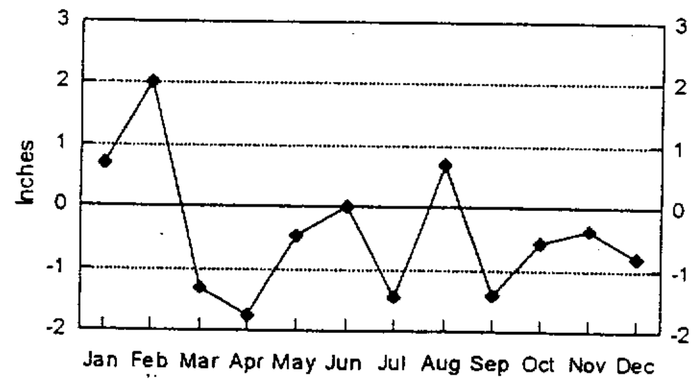
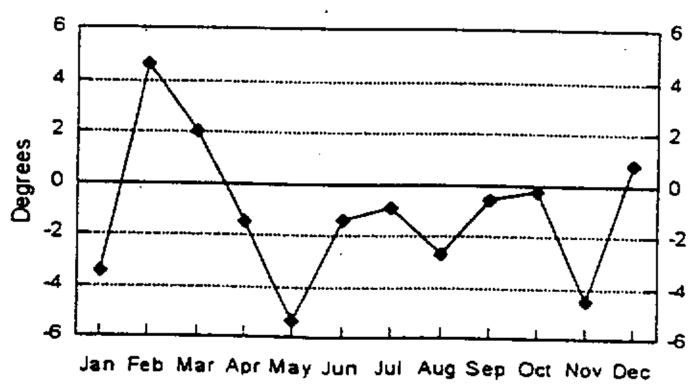
RELEASED: January 12, 1998

VOL. 19, NO. 2

ANNUAL WEATHER SUMMARY FOR ILLINOIS--1997





Grass-Hay	5	6tons	210		140	155	130	90	80	40	0	180	165	150	135	120	105
Grass-Pasture	1	2tons	55		125	100	70	25	25	15	0	60	30	25	20	10	0
Grass-Pasture	3	4tons	100		150	125	100	50	50	25	0	120	55	50	45	20	0
Grass-Pasture	4	6tons	150		180	155	130	90	80	40	0	180	85	75	65	30	0
Ins Bermuda Grass	2	4tons	225		100	80	50	40	30	20	0	120	110	100	85	75	60
Ins_Bermuda_Grass	3	12tons	525		160	140	110	100	80	40	0	300	285	270	245	220	150
Grass/Legume_Hay	1	2tons	115	40	125	95	70	25	25	15	0	240	220	200	180	160	140
Grass/Legume_Hay	2	4tons	225	40	150	125	100	50	50	25	0	340	320	300	290	260	240
Grass/Legume_Hay	4	6tons	335	40	190	155	130	90	80	40	0	440	420	400	380	360	340
Grass/Legume_Hay	6	8tons	450	40	200	180	155	105	105	50	0	540	520	500	480	460	440
Grass/Legume_Pasture	1	2tons	100	40	125	100	70	25	25	15	0	120	110	100	90	80	70
Grass/Legume_Pasture	2	4tons	210	40	150	125	100	50	50	25	0	170	160	150	140	130	120
Grass/Legume_Pasture	4	6tons	320	40	180	155	130	90	80	40	0	220	210	200	190	180	170
Grass/Legume_Pasture	6	8tons	430	40	200	180	155	105	105	50	0	270	260	250	240	230	220
Tobacco	0	1.5tons	250		175	120	75	75	50	25	0	350	300	250	200	130	100
Summer_Annual_Forag	0	3tons	110		100	70	50	30	20	10	0	100	85	70	60	50	25
Summer_Annual_Forag	3	5tons	165		120	90	60	40	20	10	0	150	135	120	95	70	35
Summer_Annual_Forage	5	7tons	190		130	100	70	50	30	10	0	180	160	140	115	90	45

*legumes add N to soil. Take a credit of 30 or 40 /lb/acre against the next year's crop.
-For small grains, apply one-third of N in fall and the rest of plants' requirement in the spring.

Table 4: Annual manure production and composition*.

Type off livestock	Manure produced	SOLID MANURE Total N	NH_4	P_2O_5	K_2O
		Nutrients produced, pounds/yr			
	Ton/yr				
Farrow (per S&L cap)	2.4	21.6	8.4	14.4	9.6
Nursery (per pig cap.)	0.2	3.2	1.2	1.9	1.0
Grow-Fin (per pig cap.)	1.1	16.8	6.3	9.5	5.3
Breed-Gest (per sow cap.)	1.0	9.0	5.0	7.0	5.0
Far-Finish (per prod. sow)	8.6	124	48	73	41
Feeder-pig (per prod. sow)	2.3	24	10	16	10
Far-Finish (per pig sold/yr)	0.48	7	3	4	2
Dairy Cow (per mature cow)	14.0	126	31	49	91
Dairy Heifer (per heifer cap.)	6.5	63	15	24	44
Dairy Calf (per calf cap.)	1.5	14	3	5	8
Veal Calf (per calf cap.)	1.1	10	6	4	7
Dairy Herd (per mature cow)	20.1	185	45	72	132
Beef Cows (per mature cow)	6.7	47	20	27	47
Feeder Calves (per 500# calf cap.)	3.5	31	11	16	29
Fattening Cattle (per calf cap.)	5.9	65	24	41	62
Broilers (per bird cap.)	0.009	0A5	0.07	0.36	0.27
Pullets (per bird cap.)	0.011	0.53	0.10	0.39	0.30
Layers (per bird cap.)	0.016	0.61	0.29	0.56	0.35
Tom Turkeys (per bird cap.)	0.023	0.87	0.18	0.69	0.51
Hen Turkeys (per bird cap.)	0.023	0.83	0.18	0.62	0.46
Ducks (per bird cap.)	0.030	0.60	0.15	0.54	0.33
Lamb (per lamb cap.)	0.5	9.0	2.5	5.5	13
Ewe (per ewe)	1.2	16.8	6	10.8	30
Horse (per 1000# horse)	5.2	72.8	20.8	20.8	72.8

*As manure leaves storage for land application.

Table 4: Annual manure production and composition (continued)*.

Type of livestock	Manure produced	LIQUID MANURE PIT Total N	NH_4	P_2O_5	K_2O
		Nutrients produced, pounds/yr			
	gal/yr				
Farrow(per S & L cap)	1,400	21	11	17	15
Nursery (per pig cap.)	130	3	2	2	3
Grow-Fin(per pig cap.)	530	17	10	14	13
Breed-Gest (per sow cap.)	450	11	5	11	11
Far-Finish (per prod. sow)	4,544	130	74	106	103
Feeder-pig (per prod. sow)	1,184	25	13	22	22
Far-Finish (per pig sold/yr)	252	7	4	6	6
Dairy Cow (per mature cow)	6,000	186	39	90	114

Table 10-7. Nutrients in liquid manure.
Approximate fertilizer value of manure from liquid handling systems. Boxed values refer to Example 10-3.

Species	Waste handling	Dry matter, %	Ammonium N	Total N	P_2O_5	K_2O
			lb/1,000 gal raw waste			
Swine	Liquid pit	4	[24]	[36]	[25]	[22]
	Lagoon[a]	1	4	5	3	4
Beef	Liquid pit	9	10	29	18	26
	Lagoon[a]	1	2	4	3	4
Dairy	Liquid pit	8	7	31	15	19
	Lagoon[a]	1	2	4	3	4
Veal calf	Liquid pit	3	21	27	22	40
Poultry	Liquid pit	10	13	60	45	30

[a]Includes lot runoff water.

Table 10-8. Annual manure production.
Raw manure includes feces and urine. Boxed values refer to Example 10-3.

Animal	Raw manure production/ 1,000 lb animal weight	
	ton/yr	gal/yr
Dairy cow	15.7	3,787
Veal calf	11.3	2,730
Beef feeder	10.6	2,514
Beef cow	11.5	2,730
Swine feeder	15.3	[3,699]
Swine breeding herd	6.0	[1,453]
Sheep	7.3	1,706
Poultry layer	11.7	2,912
Poultry broiler	15.5	3,684
Turkey	8.6	2,037
Horse	9.3	2,210

A worksheet is provided to help you find proper application rates. The procedure uses five sections:

A. Manure composition and soil information.
B. Nutrient needs of crop.
C. Annual rate of manure application.
D. Amount of additional fertilizer needed.
E. Amount of land required to dispose of annual manure production.

Worksheet to Determine Manure Application Rates and Disposal Area

Example 10-3:

A swine producer has a 1,500 head (one time capacity) farrow-to-finish operation (average weight 125 lb/market animal; 250 lb/breeding animal) in enclosed buildings. Manure is handled in liquid pits and injected into the soil. The area to be manured had received 6,000 gal/ac of manure last year.

To maximize the manure as fertilizer, what is the proper manure application rate, how much supplemental commercial fertilizer will be needed and how many acres of cropland can utilize the manure?

Calculations

Section A. Manure composition and soil information

1. Manure composition.

a. Values from chemical analysis of manure.

Composition[a]	Your farm
Total N	____%
Ammonium N	____%
Nitrate N	____%
P_2O_5	____%
K_2O	____%

[a]Laboratory data are often given in ppm. To convert ppm to %, divide by 10,000. If composition data are not available, use Table 10-6 or Table 10-7.

b. Determine the amount of each nutrient per ton of solid manure or per 1,000 gal of liquid manure. If nutrient contents are given in %:

% nutrient in manure × 20 = lb nutrients/ton; or × 85 lb nutrients/1,000 gal (e.g. 0.5% Total N = 10 lb/ton or 42.5 lb/1,000 gal)

Composition	Example (Table 10-7)	Your farm
Total N	36 lb/ 1000 gal	lb/
Ammonium N	24 lb/ 1000 gal	lb/
Nitrate N	— lb/	lb/
P_2O_5	25 lb/ 1000 gal	lb/
K_2O	22 lb/ 1000 gal	lb/

2. Soil information:

Soil information	Example	Your soil
Texture	Silty Clay Loam	____
Soil pH	6.2	____
Available P	— lb/ac	____lb/ac
Exchangeable K	— lb/ac	____lb/ac

Section B. Nutrient needs of crop

	Example	Your crop
Crop to be grown	Corn	____
Expected yield/acre	150 bu	____
Nutrients required/ac (based on soil test report or Table 10-3)	N = 185 lb/ac	____lb/ac
	P_2O_5 = 80 lb/ac	____lb/ac
	K_2O = 215 lb/ac	____lb/ac

Section C. Annual rate of manure application

1. Calculate amount of organic N in manure (either per ton or per 1,000 gal):

lb total N − (lb ammonium N + lb nitrate N) = lb organic N

Example:

36 − (24 + —) = 12 lb organic N/1000 gal

Your manure:

____ − (____ + ____) = ____ lb organic N/______

For the greatest return, apply manure first to corn and small cereal grains, then to sorghum and forages, and finally to pasture.

Before heavy manure applications, have your soil tested for fertilizer needs and nutrient imbalance. Adjust waste application rates for your soil conditions against soil tests for nitrogen, phosphorus, and potassium.

Example 10-1:

How much N, P_2O_5, and K_2O are utilized by a corn yield of 150 bu/acre?

Solution:

From Table 10-3, this crop uses 185 lb/acre of N, 80 lb/acre of P_2O_5, and 215 lb/acre of K_2O.

Table 10-3. Crop nutrient utilization.
Values are for the total above-ground portion of the plants. When only grain is removed, many nutrients are left in the residues but are temporarily tied up in them and are not readily available. Estimate nutrient requirements for one crop year by assuming complete crop removal. Alfalfa and soybeans get most of their N from the air, so additional N from manure is usually not needed.
Source: Potash Phosphate Institute of America.
Boxed values refer to Examples 10-1, 10-2, and 10-3.

Crop	Yield	N	P_2O_5	K_2O
		lb/acre		
Corn	80 bu	121	42	77
	100 bu	160 1.23	60	120
	150 bu	[185]	[80]	[215]
	180 bu	240 1.35	100	240
Corn silage	16 tons	130	45	102
	32 tons	200	80	245
Soybeans	30 bu	123	32	52
	40 bu	180	45	80
	50 bu	257	48	120
	60 bu	336	65	145
Grain sorghum	4 tons	250	90	200
Wheat	40 bu	70	30	50
	60 bu	125	50	110
	80 bu	186	54	162
Oats	80 bu	75	35	95
	100 bu	150	55	150
Barley	65 bu	74	32	63
	100 bu	150	55	150
Alfalfa	4 tons	180	40	180
	8 tons	450	80	480
Orchardgrass	6 tons	300	100	375
Bromegrass	5 tons	166	66	254
Tall fescue	3.5 tons	135	65	185
Bluegrass	3 tons	200	55	180
Costal Bermuda grass	4 tons	225	40	160
	10 tons	535	145	410
Clover-grass	4.5 tons	185	60	175
	6 tons	300	90	360
Sugar beets	30 tons	275	85	550
Rice	2.25 tons	110	45	110
	3.5 tons	112	60	168
Timothy	4 tons	150	55	250
Pangola grass	12 tons	299	108	430
Sorghum-Sudan grass	8 tons	319	122	467

Nutrient Value per Animal Unit

The fertilizer value of manure depends upon livestock species and handling and disposal methods. Table 10-4 estimates the acres needed per 100 animal units for land application of manure. Table values consider nutrient losses from handling and disposal. Use Tables 10-3 and 10-4 to estimate the number of acres needed for a specific livestock and cropping operation.

Example 10-2:

A swine producer has a 50-sow farrow-to-finish operation. Liquid waste is stored in an anaerobic pit. The producer intends to broadcast and cultivate the liquid manure into the ground to produce 150 bu/ac corn. How many crop acres are needed?

Solution:

1. From Table 10-4, 152 ac are needed to apply 100 lb N/ac from 100 productive sows.

   50 procutive sows × (152 ac ÷ 100 productive sows) = 76 ac fertilized to 100 lb N/ac

2. From Table 10-3, 150 bu/ac corn requires 185 lb N/ac.
3. How many acres can be fertilized to 185 lb N/ac? Multiply the value from Step 1 by the ratio of 100 lb N/ac to the required lb N/ac.

   76 ac × (100 ÷ 185 lb N/ac) ÷ 41.1 ac fertilized to 185 lb N/ac

4. Apply the liquid waste to 41.1 acres to fully utilize the N fertilizer value of the manure to meet N requirements more than adequately meets crop P_2O_5 and K_2O needs.

Nutrient Value for Crop Production

Tables 10-6 and 10-7 show estimated fertilizer compositions of waste applied to the land (wet basis). Nutrient contents vary widely, so these data are guidelines. For specific situations, have your manure analyzed. Conversion factors:

- Multiply P_2O_5 by 0.44 to convert to elemental P.
- Multiply K_2O by 0.83 to convert to elemental K.
- 27,150 gal = 1 acre-inch (a-in).

Available N is nitrogen the plant can use. Total N is mostly organic and ammonium nitrogen. Organic N is slow releasing N. Ammonium N is equivalent to commercial fertilizer and, except for that lost to the air, can be used by plants in the application year. Organic nitrogen must be released before plants can use it.

Variable amounts of organic nitrogen are released in a plant-available form during the first cropping year after application. Table 10-5 summarizes the percentages of organic nitrogen released (mineralized) during the first cropping season. Organic N released during the second, third, and fourth crop-

10. ANIMAL WASTE UTILIZATION

Most operators use wastes for an economic return, or at least to reduce costs. Animal manure is most commonly used as a fertilizer and soil conditioner.

Other established or potential practices include:

- Irrigation with waste effluent to supplement water needs for crop production.
- Reuse of liquids to flush and transport manure.
- Use of processed solids as bedding or litter.
- Use of processed solids for off-farm fertilizer, soil additive, or mulch.
- Salvage of energy from methane production.
- Reuse as feed ingredients for livestock, poultry, and aquatic life.

Land Application

Effects

Manure nutrients help build and maintain soil fertility. Manure also improves tilth, increases water-holding capacity, lessens wind and water erosion, improves aeration, and promotes beneficial organisms. When wastes include runoff or dilution water, they can supply water as well as nutrients to crops.

The economic value of manure fertilizer is calculated from its available N, P, and K at commercial fertilizer prices. These values change with the costs of fertilizer and handling practices.

Applying excess wastes can harm crop growth, contaminate soil, cause surface and groundwater pollution, and waste nutrients. While most soils have a tremendous capacity to absorb phosphorus, very high soil phosphorus levels can interfere with plant nutrition by inhibiting uptake of metallic trace elements such as iron, zinc, and copper. When plant residue or manure is added to soil, there is an immediate and marked drop in O_2 and an increase in CO_2 in the soil air, which can inhibit plant growth.

The carbon-nitrogen ratio (C/N) of applied wastes affects both microbial and plant growth. If a waste having a high C/N ratio, such as manure with a lot of bedding, is added to a soil, organisms decomposing the organic matter grow until available mineral and nitrogen become limiting. All the immediately available nitrogen is bound by the microorganisms. In the short run, nitrogen is unavailable for plant use and more chemical fertilizer may have to be added than before the waste application.

Heavy manure applications can increase soil salinity, especially in arid regions where little or no leaching occurs. Salts can inhibit plant growth and depress yields. If salinity becomes a problem, consult a crop specialist.

Sodium and potassium can alter soil structure and reduce water movement rates. Field equipment, such as heavy manure wagons, compacts wet soils, alters soil structure, and reduces water movement. Yield reduction can result.

Surface and Groundwater Quality

Several diseases that might infect both animals and man can be transmitted in waterborne livestock wastes. Land application can successfully interrupt infection cycles if water pollution is prevented.

Surface runoff contains pollutants, including plant nutrients, oxygen demanding material, and some infectious agents. Excessive nitrogen applications can cause nitrate pollution of water—the cause of infant cyanosis (blue babies) and perhaps chemical diarrhea.

Nitrogen in excess of crop requirements leaches through the soil once it is in the nitrate form. For local application rates to avoid groundwater pollution, consult your state extension crop and soil specialist or the SCS. Reducing excess nitrogen without pollution is difficult.

Excess nutrients in surface water can cause algae blooms, impaired fisheries, fish kills, odors, and increased turbidity. Nutrients in runoff from land where manure was applied and incorporated in the summer are less than in runoff where no manure was applied. But large nutrient losses can occur in spring runoff from land where manure was applied on frozen ground.

Nutrient Losses During Collection and Storage

Housing and waste handling systems affect the nutrient composition of wastes. Bedding and water dilute manure, resulting in less nutrient value per pound. Much nitrogen can be lost to the air as ammonia. Runoff and leaching in open lots can remove nitrogen. There is much less nitrogen loss from compost pits, liquid storage systems, or roofed feeding areas. See Table 10-1.

Phosphorus and potassium losses are negligible except for open lots or lagoons. About 20%-40% of the phosphorus and 30%-50% of the potassium can be lost by runoff and leaching in open lots. However, much of the P and K can be recovered by runoff control systems such as settling basins and holding ponds. Up to 80% of the phosphorus in lagoons can accumulate in bottom sludges and is not applied to land unless the sludge is removed.

Application

Manure is usually:

- Broadcast (top dressed) with plowdown or disking.
- Broadcast without plowdown or disking.
- Knifed (injected under the soil surface).
- Irrigated.

Table 10-2 shows average nitrogen losses by method of application.

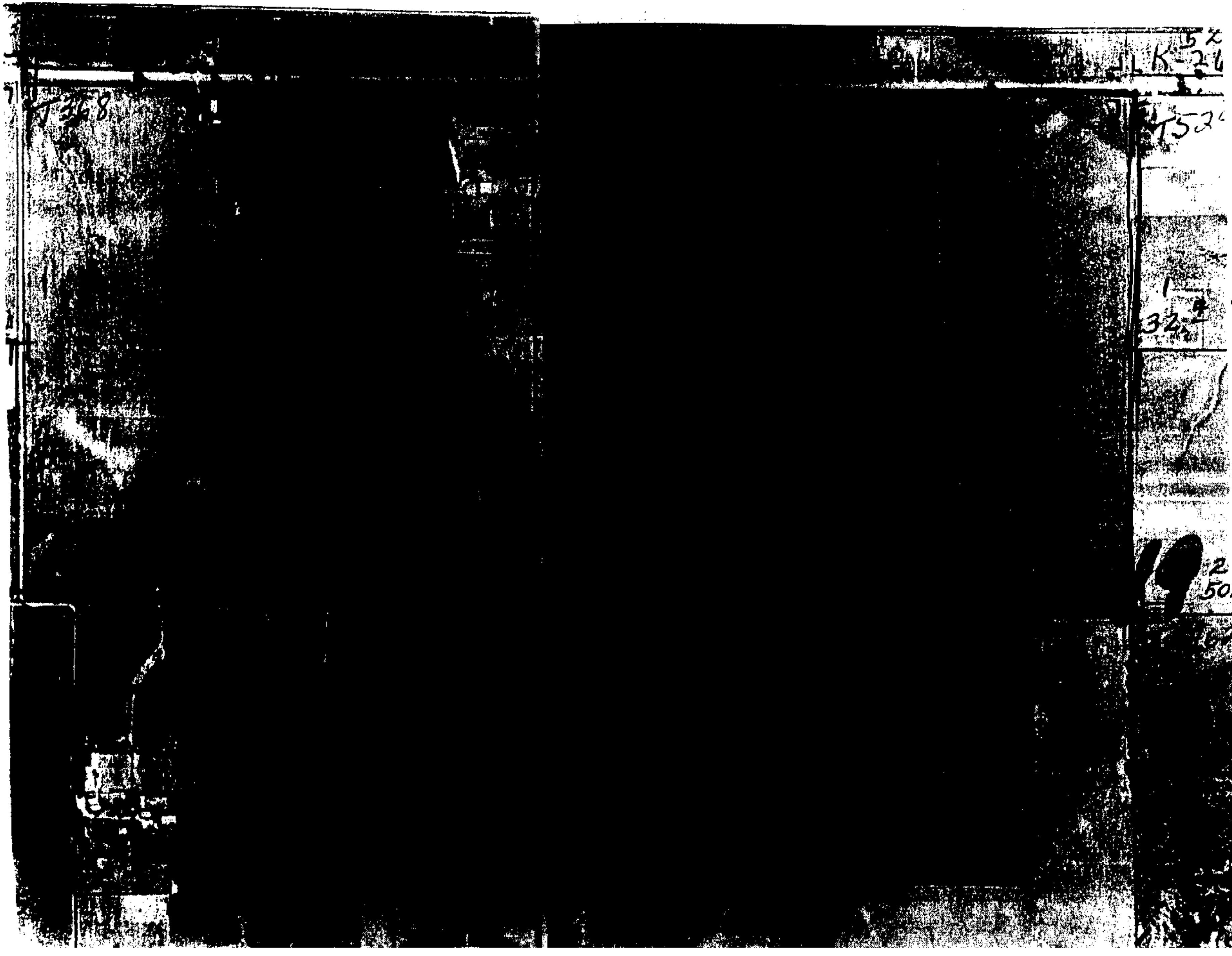
The greatest nutrient response follows land application and immediate incorporation into the soil.

D. REFERENCE TABLES - STANDARD VALUES

C. MANURE LABORATORY ANALYSIS

B. APPLICATION AGREEMENTS

Aerial Photograph

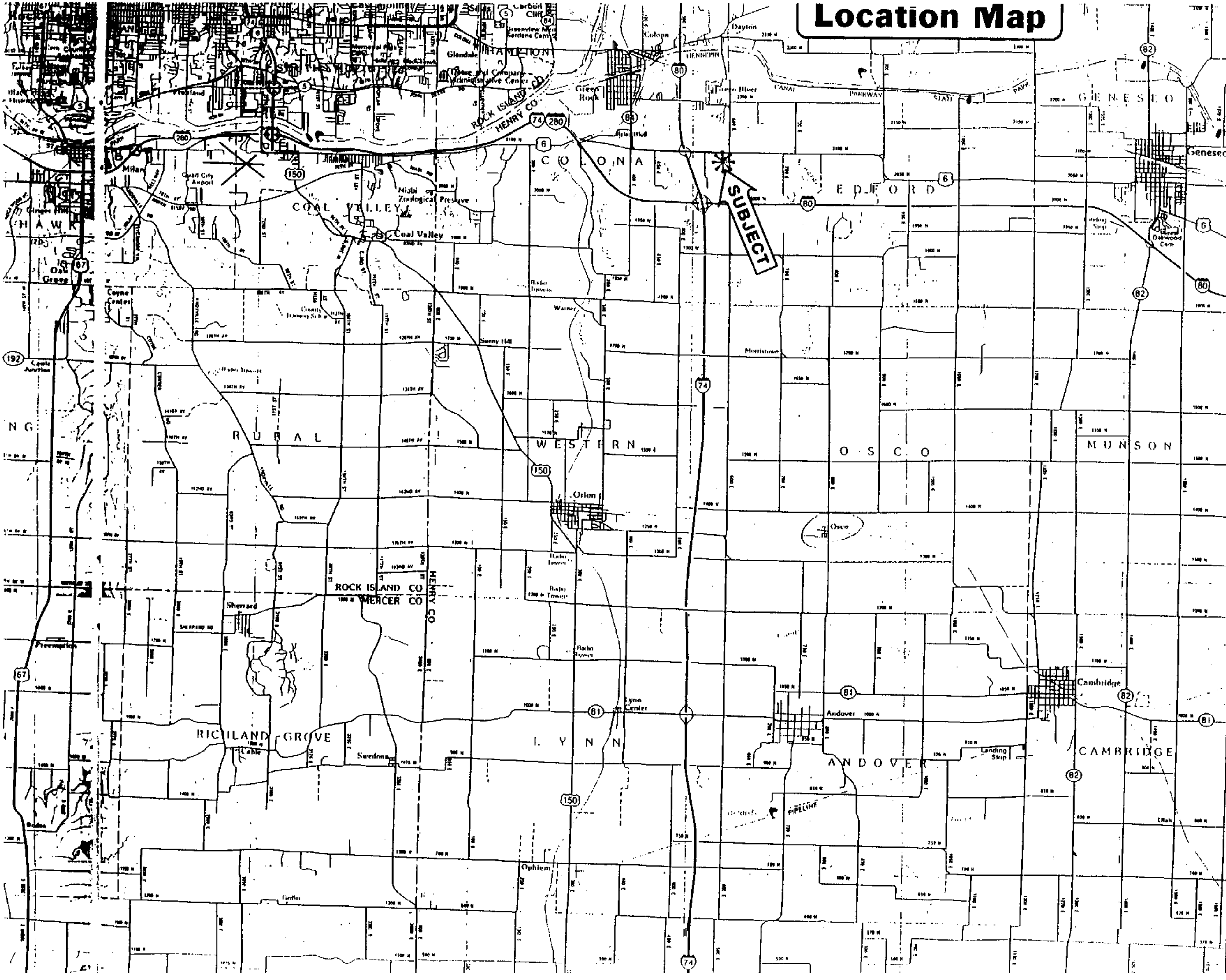


N

Key

1" = 660

Location Map



Continue on Page 32

A. FIELD LOCATIONS AND MAPS

Comments: Rainfall data for last 2 years and annual average is given in Appendix D. An acre-inch of water equals 27,150 gallons
Runoff area feeding the South lagoon is only about 1/3 A.
However, client must pay particular attention to the lagoon after heavy rains or draw it down in anticipation of heavy rain to keep freeboard within limits.

IV. FIELD IDENTIFICATION

			1998	1999	2000
North	Field 1	21 A	corn	corn	oats
	Field 2	21 A	corn	corn	corn
	Field 3	21 A	corn	corn	corn
	Field 4	21 A	corn	corn	corn
South	Field 1	21 A	oats	corn	corn
	Field 2	21 A	corn	corn	corn
	Field 3	21 A	corn	oats	corn
	Field 4	12A	corn	corn	corn
	Field 4A	15 A	hog past.	corn	corn

West Field 1 61.6 A soybeans

- this acreage used only if access to North and South fields is limited.

Manure incorporation and application statements in Appendix will be followed.

Application calculations are based on 1,116,600 gallons/year in 3 major application times:

Spring	pits	100,000 gallons
	lagoons	280,300
Summer	lagoons	400,000
Fall	pits	100,000
	lagoons	280,300
		1,116,600 gallons

II. MANURE STORAGE AND NITROGEN PRODUCTION

Type of waste storage: __X_ Liquid
- __X_ Slurry store/Pit
- __X_ Earthen storage
- ___ Lagoon

Number of animal units:

Swine: 175	farrow to finish	x 0.4 =	70
500	feeders	x 0.03 =	15
800	finish	x 0.4 =	320
____	sow + litter	x 0.4 =	____
		Total =	**405**

Nutrient content of waste:
- __X__ Table value (pit)
- __X_ Lab Analysis (lagoons) 8 -4- 8 (see Appendix)

Application method:

__X_ surface apply	@ 20% N loss
____ broadcast - immediate cultivation	@ 10 % N loss
____ injected (no inhibitor)	@ 2 % N loss
____ injected (inhibitor used)	@ 0 % N loss
____ sprinkler irrigation	@ 33 % N loss

Annual volume of waste generated:
150 sows (farrow-finish) x 7737 gal/year = **1,160,550 gal**
(Purdue data – see Appendix)

Calculation of waste holding capacity:
Lagoons - 190,580 gal See attached calculation (Swine Building Systems Design)
Pit: Finish – 144x10x8 = 86,170 gal
Concrete storage – 27x13x9 = 23,629 gal

TOTAL STORAGE CAPACITY: 300,379 Gallons

Annual amount of Total Nitrogen from waste:

1,050,550 gal x 8 # N/1000 gal = 8404 # total N	
less storage loss (20 %)=	6723.5 # total N
110,000 gal x 36 # N/1000 gal = 3960 # total N	
less storage loss (20%) =	3168 # total N
TOTAL =	**9891.5 # N**

Plant Available Nitrogen :
Lagoon: 5.1 # N available each year + organic N contribution
Pit: 23.0 # N available each year + organic N

MANURE MANAGEMENT PLAN& ENGINEERING STUDY

I. GENERAL INFORMATION

Owner and name of the operation

Owner: Robert Andrews ______________ phone 209/521-5334

Owner: ______________________________ phone ___________

Name of operation : **Robert Andrews Swine Farm**

Address: 2717 Surrey Ave
Modesto, CA 95355

Contact person :

Name Charles Taets Phone 309/949-2207

Address 20820 Osco Road
Geneseo, IL 61254

Type of facility :

__X swine confinement
____ beef
____ dairy
____ poultry

Facility location (legal description):

E1/2 of the NE ¼ Section 24 T17N R1E
Henry County, IL

Directions from nearest Post Office:

From the Colona Post Office, go south 1.0 miles on Rt 84 to Rt 6, then 2 miles east to Osco Road (600 E). Farm is on the SW corner.

Current Status of Operations:

The operation has 211 sows in a confinement and pasture farrow to finish system. The pasture system will be eliminated in the next year and **150 sows will be in the** confinement system. A grower and farrow/nursery building use the North lagoon while the other sows are housed on outdoor pads that use the south lagoon. Manure has been hauled to owner fields usually every month. Oats and pasture acreage is available for summer manure application when crop land is unavailable.