LIQUIDS WORKSHEET 1 EXAMPLE - ESTIMATING NUTRIENTS GENERATED PER CONFINEMENT PERIOD

Step 1. Nutrients Generated (As Excreted)

	Animal Type (See Table 1.1)	Number of Animals	x	Percent Waste as Liquid [a]	x	Average Weight (lbs)	÷	1,000	x	Confinement Period [b] (days/year)	=	Animal Unit Days		Table 1.1 Values		N	P_2O_5	K_2O
													N	0.45	=	2,835		
													P_2O_5	0.21	=	+	1,323	
1.)	Dairy Cows	50	x	50%	x	1,400	÷	1,000	x	180	=	6,300	x K_2O	0.35	=		+	2,205
													N	0.27	=	486		+
													P_2O_5	0.11	=	+	198	
2.)	Dairy Heifers	20	x	50%	x	1,000	÷	1,000	x	180	=	1,800	x K_2O	0.14	=		+	252
													N		=			+
													P_2O_5		=			
3.)			x		x		÷	1,000	x		=		x K_2O		=	=	=	
																		=
														Step 1 Total	=	**3,321**	**1,521**	**2,457**
																	(lbs)	

Step 2. Manure Generated (As Excreted)

	Animal Unit Days (from Step 1)	x	Manure/A.U. (See Table 1.1)	x	Conversion	=	Volume of Manure	
1.)	6,300	x	1.4	x	7.5	=	66,150	gallons
2.)	1,800	x	0.9	x	7.5	=	12,150	gallons
3.)		x		x	7.5	=		gallons

Step 2 Total = **78,300** **gallons**
1 + 2 + 3

Step 3. Water Added by Flushing, Wastage, or Cleaning

	Gallons/Day (See Table 1.1)	x	Number of Animals	x	Confinement Period (from Step 1)	=	Volume of Water	
1.)	5	x	50	x	180	=	45,000	gallons
2.)	5	x	20	x	180	=	18,000	gallons
3.)		x		x		=		gallons

Step 3 Total = **63,000** **gallons**
1 + 2 + 3

Step 4. Water Added by Feedlot Runoff

	Width (feet)	x	Length (feet)	x	Frequency of Pump [c]	x	Conversion	=	Feedlot Runoff	
Paved Surface [d]	15	x	60	x	0.5 (days before pump ÷ 365)	x	18.75	=	8,438	gallons
Unpaved Surface [e]		x		x	(days before pump ÷ 365)	x	11.25	=		gallons

Step 4 Total = **8,438** **gallons**
Paved + Unpaved

Step 5. Water Added from Rainfall minus Evaporation on Storage Pond

	Width (feet)	x	Length (feet)	x	Frequency of Pump [c]	x	Conversion	=	Net Rainfall on Storage Pond
Lagoon/Pond Surface Area	224	x	464	x	0.5 (days before pump ÷ 365)	x	11.25	=	

Step 5 Total = **584,640** **gallons**

Step 6. Total Volume of Manure Produced

Step 2	+	Step 3	+	Step 4	+	Step 5	=	
78,300	+	63,000	+	8,438	+	584,640	=	

Step 6 Total = **734,378** **gallons**

Step 7. Weighted Nutrient Values Before Nutrient Losses

	Step 1	÷	Step 6 Total	x	Conversion	=
N	3,321	÷	734,378	x	1,000	=
P_2O_5	1,521	÷	734,378	x	1,000	=
K_2O	2,457	÷	734,378	x	1,000	=

	N	**P_2O_5**	**K_2O**
Step 7 Total =	**4.5**	**2.1**	**3.3**
	(lbs/1,000 gallons)		

[a] The percent of the manure that is handled as a liquid.

[b] Confinement period should be adjusted for animals that are only in confinement for a portion of the day. For example, if animals spend 16 hours on pasture and 8 hours in confinement, then the confinement period would be 1/3 of a day or 122 days/year.

[c] The number of days before the storage pond/lagoon is pumped for land application divided by 365. For example, if the pond is pumped twice a year, it would be .5 (180 ÷ 365 = .5).

[d] Impervious surface areas such as concrete, asphalt, and roofs without gutters that contribute water to storage pond/lagoon.

[e] Pervious surface areas such as gravel, dirt, or soil cement that contribute water to storage pond/lagoon.

EXAMPLE LIQUIDS WORKSHEET 2 - NUTRIENT BALANCE

Modified January 14, 2014

Tract	Field No.	Acres
	1	28

Soil Test P Value (Mehlich 3) 401

Step 1. Crop or Crop Sequence/Rotation — Corn silage (ton)

See Table 2.1 Options

Step 2. Realistic Yield (Average from 5-10 Years on a per acre basis) — 20

	N	P_2O_5	K_2O
Step 3. Plant Nutrients Needed or Allowed (lbs/ac)	194	72	160

N	9.7 (Table 2.1 Value for N)	×	20 (Step 2)	=	194
P	3.6 (Table 2.1 Value for P)	×	20 (Step 2)	=	72
K	8 (Table 2.1 Value for K)	×	20 (Step 2)	=	160

	P_2O_5
Step 4. Adjusted P_2O_5 Application Rate According to Threshold	72

P	72 (Step 3 P_2O_5)	×	1 (Table 2.2 Value)	=	72

	N	P_2O_5	K_2O
Step 5. Fertilizer Credits (lbs/ac)	0	0	0

	N	P_2O_5	K_2O
Step 6. Plant Nutrients Needed Minus Credits (lbs/ac)	194	72	160

N	194 (Step 3 for N)	–	0 (Step 5 for N)	=	194
	If Step 4 > 0:				
P	72 (Step 4 for P)	–	0 (Step 5 for P)	=	72
	If Step 4 = 0:				
	(Step 3 for P)	–	(Step 5 for P)	=	
K	160 (Step 3 for K)	–	0 (Step 5 for K)	=	160

	N	P_2O_5	K_2O
Step 7. Nutrients in Manure (lbs./1,000 gallons)	4.5	2.1	3.3

Step 4 Values from Liquids Worksheet 1 **or** use Lab Results

	N	P_2O_5	K_2O
Step 8. Percent Nutrients Retained in System	35%	50%	65%

Enter Table 2.3 values **or** Enter zero if lab analysis is used (Anaerobic lagoon or stored in waste storage pond diluted >50%)

	N	P_2O_5	K_2O
Step 9. Net Retained Nutrients in Manure (lbs./1,000 gallons)	1.6	1.1	2.2

Enter zero if lab analysis is used

N	4.5 (Step 7 for N)	×	0.35 (Step 8 for N)	=	1.6
P	2.1 (Step 7 for P)	×	0.5 (Step 8 for P)	=	1.1
K	3.3 (Step 7 for K)	×	0.65 (Step 8 for K)	=	2.2

	N	P_2O_5	K_2O
Step 10. Percent of Available Nutrients	45%	80%	100%

Enter Table 2.4 Value for N

(Incorporation: 7 days or more)

	N	P_2O_5	K_2O
Step 11 . Net Available Nutrients (lbs./1,000 gallons)	0.7	0.9	2.2

If Lab Results are used in Step 7:

N	_____ Step 7 for N	×	_____ Step 10 for N	=	_____	
P	_____ Step 7 for P	×	_____ Step 10 for P	=	_____	
K	_____ Step 7 for K	×	_____ Step 10 for K	=	_____	

If Liquid Worksheet 1 Values are used in Step 8:

N	1.6 Step 9 for N	×	0.45 Step 10 for N	=	0.7	
P	1.1 Step 9 for P	×	0.8 Step 10 for P	=	0.9	
K	2.2 Step 9 for K	×	1 Step 10 for K	=	2.2	

	N	P_2O_5	K_2O
Step 12 . Application Rate (1,000 gallons/ac)	277	80	73

N	194 Step 6 for N	÷	0.7 Step 11 for N	=	277	
P	72 Step 6 for P	÷	0.9 Step 11 for P	=	80	
K	160 Step 6 for K	÷	2.2 Step 11 for K	=	73	

	N	P_2O_5	K_2O
Step 13 . Net Application Amount for All Nutrients (1,000 gallons/ac)	9	12	29

N	0.7 Step 11 for N	×	13 Application Rate	=	9	
P	0.9 Step 11 for P	×	13 Application Rate	=	12	
K	2.2 Step 11 for K	×	13 Application Rate	=	29	

	N	P_2O_5	K_2O
Step 14 . Nutrient Needs (negative) or Surpluses (positive) (1,000 gallons/ac)	-165	-60	-131

N	9 Step 13 for N	–	194 Step 6 for N	=	-165	
P	12 Step 13 for P	–	72 Step 6 for P	=	-60	
K	29 Step 13 for K	–	160 Step 6 for K	=	-131	

Step 15 . Balance

Tons Available		-	**Tons Applied in Field**		= **Balance**	
	734,378			**364,000**		**370,378**
	Step 6 from Liquids Worksheet 1 or Balance from Previous Worksheet 2			Application Rate x Field Acres x 1,000 **or** to deplete supply in one field: Gallons Available ÷ Num. of Acres = Uniform App. Rate (Be sure not to exceed 13,000 gallons/acre)		

EXAMPLE LIQUIDS WORKSHEET 3 - APPLICATION RATES AND LAND REQUIREMENTS [1]

Tract No.

Field No.	Acres	Soil Test Phosphorus (STP)	Crop Rotation / Sequence	Planned Application Date or Timing	Planned Application Rate[2] (1,000 gal/ac)	Liquid or Commercial Fertilizer (L or C)	Actual Application Date	Actual Application Rate[2] (1,000 gal/ac)	Weather at Time of Application[3] (Cloudy, Raining, Sunny)	
									24 Hours Before	24 Hours After
1	28	401	Corn Silage (ton)	Spring 2014	13	L	Spring 2014	Spring 2014	Sunny	Sunny

1. Where land application is occurring under long term lease or agreement with adjacent landowner, fields must be included in the above table.
2. Fields that have a "High" soil test phosphorus (>400) should implement Best Management Practices (BMPs) to reduce the risk of nutrient movement to sensitive waterbodies. BMPs may include, but not be limited to: installing conservation buffers, reducing P2O5 application rate, incorporating manure, adding chemical treatments to litter that tie up soluble P and keep it from moving over the landscape, and/or adjusting application timing.
3. It illegal to make land applications when the ground is frozen. It is recommended that land applications are not made within 48 hours of forecasted precipitation.

Modified January 14, 2014