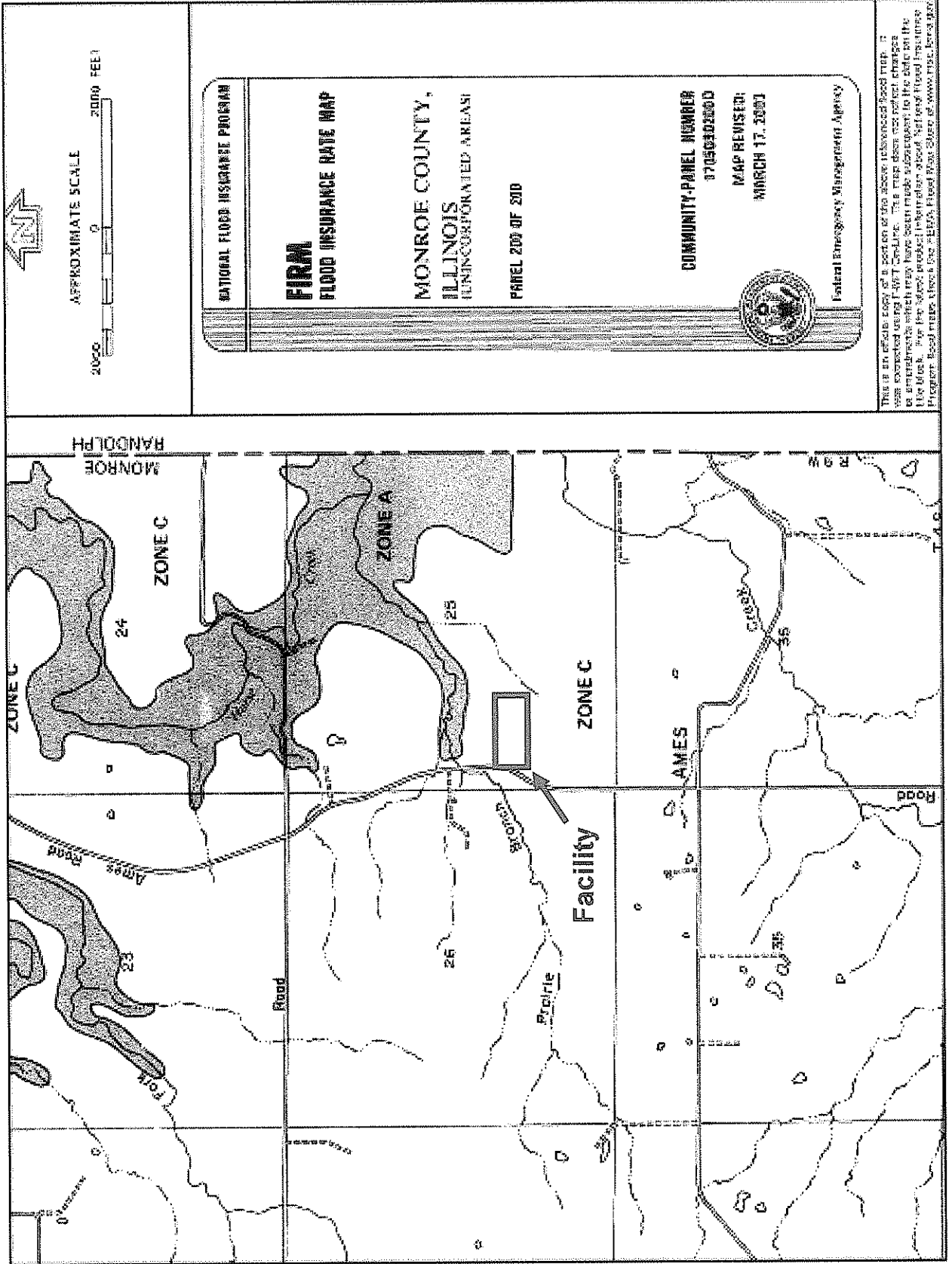
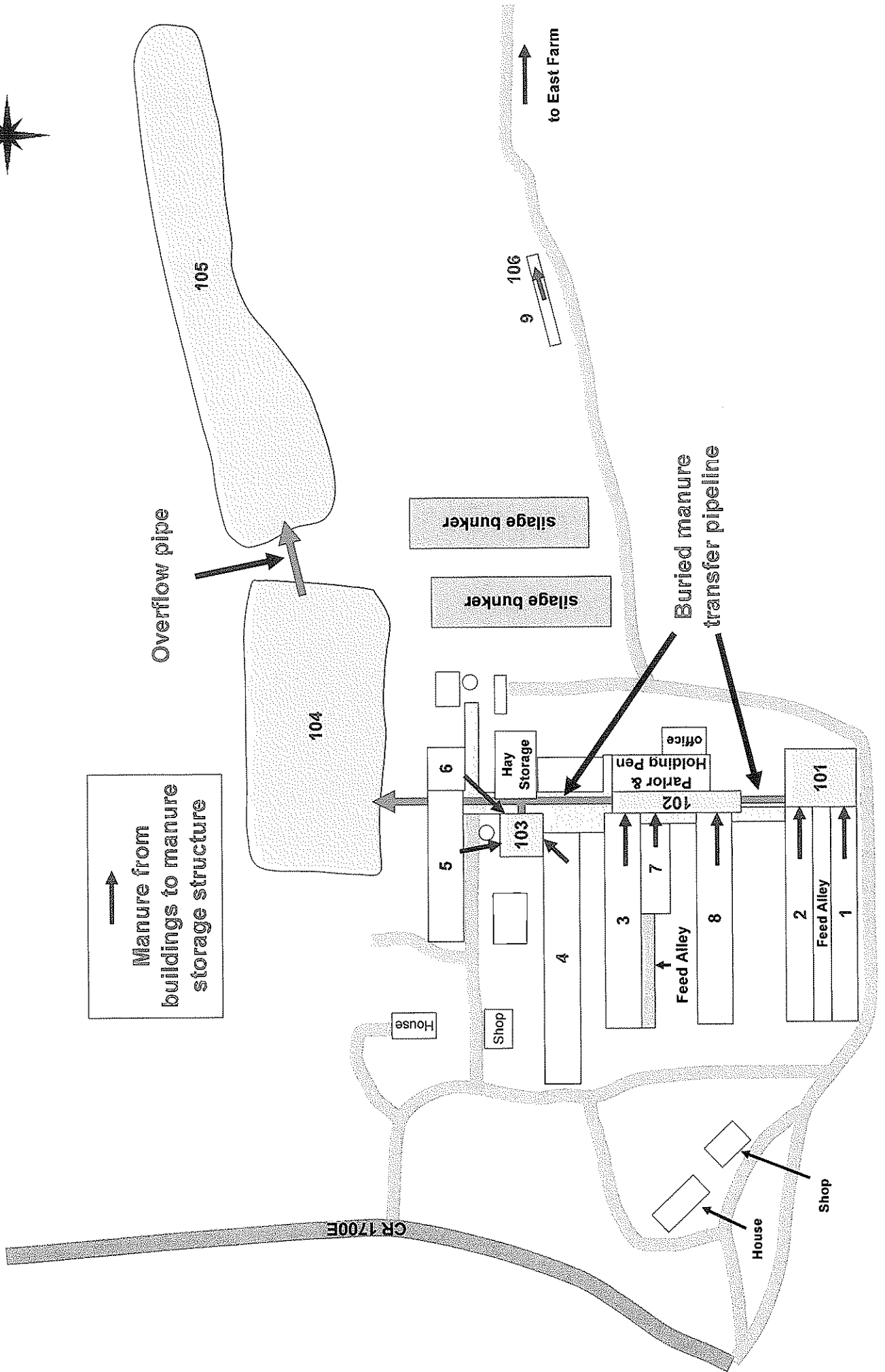


Westridge Dairy FEMA MAP



Westridge Dairy Manure Flow - Main Farm



Westridge Dairy

Manure Calculations

Barn 1

120 Head of Dairy Cow -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft ³	Cubic Feet	
Daily Sand Bedding Use each =	120.00	62.0	1.935	
% Confinement =	31.00	102.0	0.304	
Manure Storage and Containment Needs per Animal =	100%	67.4	2.239	
	151.00			
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet	Tons/Day
	2.239	120	268.73	9.06

Barn 2

120 Head of Dairy Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft ³	Cubic Feet	
Daily Sand Bedding Use each =	120.00	62.0	1.935	
% Confinement =	31.00	102.0	0.304	
Manure Storage and Containment Needs per Animal =	100%	67.4	2.239	
	151.00			
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet	Tons/Day
	2.239	120	268.73	9.06

Barn 3

120 Head of Dairy Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft3	Cubic Feet
Daily Sand Bedding Use each =	120.00	62.0	1.935
% Confinement =	31.00	102.0	0.304
Manure Storage and Containment Needs per Animal =	100%		
	151.00	67.4	2.239
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	2.239	120	Needs/Day
			268.73
			Tons/Day
			9.06

Barn 4

120 Head of Dairy Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft3	Cubic Feet
Daily Sand Bedding Use each =	120.00	62.0	1.935
% Confinement =	31.00	102.0	0.304
Manure Storage and Containment Needs per Animal =	100%		
	151.00	67.4	2.239
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	2.239	120	Needs/Day
			268.73
			Tons/Day
			9.06

Barn 5

100 Head of Dairy Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft3	Cubic Feet
Daily Sand Bedding Use each =	120.00	62.0	1.935
% Confinement =	31.00	102.0	0.304
Manure Storage and Containment Needs per Animal =	100%	67.4	2.239
	151.00		
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	2.239	100	Needs/Day
			223.94
			Tons/Day
			7.55

Barn 6

60 Head of Dairy Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft3	Cubic Feet
Daily Sand Bedding Use each =	120.00	62.0	1.935
% Confinement =	31.00	102.0	0.304
Manure Storage and Containment Needs per Animal =	100%	67.4	2.239
	151.00		
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	2.239	60	Needs/Day
			134.36
			Tons/Day
			4.53

Barn 7

30 Head of Dairy Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft ³	Cubic Feet
Daily Straw Bedding Use each =	120.00	62.0	1.935
% Confinement =	6.00	18.0	0.333
Manure Storage and Containment Needs per Animal =	100%	55.5	2.269
	126.00		
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	2.269	30	68.06
			Tons/Day
			1.89

Barn 8

100 Head of Dry Cows -- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft ³	Cubic Feet
Daily Straw Bedding Use each =	120.00	62.0	1.935
% Confinement =	8.00	102.0	0.078
Manure Storage and Containment Needs per Animal =	100%	63.6	2.014
	128.00		
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	2.014	100	201.39
			Tons/Day
			6.40

Barn 11

75 Head of Dairy Calves -- Average Weight 150 pounds

Daily Manure Production each =	Pounds	Lbs/Ft3	Cubic Feet
Daily Straw Bedding Use each =	13.00	62.0	0.210
% Confinement =	3.00	18.0	0.167
Manure Storage and Containment Needs per Animal =	100%	42.5	0.376
	16.00		
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	0.376	75	Needs/Day
			28.23
			Tons/Day
			0.60

Barn 12

40 Head of Dairy Cows --- Average Weight 1400 pounds

Daily Manure Production each =	Pounds	Lbs/Ft3	Cubic Feet
Daily Straw Bedding Use each =	120.00	62.0	1.935
% Confinement =	0.00	18.0	0.000
Manure Storage and Containment Needs per Animal =	10%	62.0	0.194
	12.00		
Daily Manure Production =	Cubic Feet	Inventory	Cubic Feet
	0.194	40	Needs/Day
			7.74
			Tons/Day
			0.24

100 Head of Dairy Calves --- Average Weight 250 pounds

	Pounds	Lbs/Ft3	Cubic Feet
Daily Manure Production each =	22.00	62.0	0.355
Daily Straw Bedding Use each =	3.00	18.0	0.167
% Confinement =	100%		
Manure Storage and Containment Needs per Animal =	25.00	47.9	0.522
	Cubic Feet	Inventory	Cubic Feet
Daily Manure Production =	0.522	100	Needs/Day
			52.15
			Tons/Day
			1.25

Manure Calculations Summary

Storage Needs	Daily		Yearly Manure Tons by Storage Type			
	Cubic Feet	Tons	Manure Basins 40%	Holding Pond 50%	Lagoon 10%	Total
Barn 1	268.73	9.06	1,323	1,653	331	3,307
Barn 2	268.73	9.06	1,323	1,653	331	3,307
Barn 3	268.73	9.06	1,323	1,653	331	3,307
Barn 4	268.73	9.06	1,323	1,653	331	3,307
Barn 5	223.94	7.55	1,102	1,378	276	2,756
Barn 6	134.36	4.53	661	827	165	1,653
Barn 7	68.06	1.89	276	345	69	690
Barn 8	201.39	6.40	934	1,168	234	2,336
Daily Total	1,702.68	56.61	8,265	10,331	2,066	20,663

Storage Needs	Daily		Yearly Tons
	Cubic Feet	Tons	
Barn 9	9.68	0.30	109.5
Barn 10	28.23	0.60	219.0
Barn 11	28.23	0.60	219.0
Barn 12	7.74	0.24	87.6
Barn 13	52.15	1.25	456.3
Daily Total	126.02	2.99	1,091.35

Lagoon Liquid Calculations

	Annual	Critical 270 Days = Sep - May	Gallons	
Feedlot Runoff Calculation				
Paved Lot Sq Ft	13,240	13,240		
Annual Precipitation Inches	42.11	30.72		
% Runoff	55.08%	53.08%	191,437	134,590
Precipitation Gain				
Sq Ft Surface area	195,875	195,875		
Annual Precipitation Inches	42.11	30.72		
Annual Evaporation Inches	36.00	10.56		
Annual Precipitation Gain Inches	6.11	20.16	746,053	1,289,414
Milk House Waste Water				
Cow Prep	1180	1180		
Bulk Tank Washing	60	60		
Pipeline Washing	125	125		
Equipment Washing	30	30		
Milk House Floor	20	20		
Parlor Floor	75	75		
Total	1,490	1,490	543,850	402,300
Barns 1-8 Annual Manure	10%	10%	464,896	343,895
Annual Lagoon Inputs			1,946,236	2,170,199

Monthly Precipitation Gain

Month	Historical Waterloo Precipitation (a)	Manure Storage			Concrete Feedlot			Total Gain Lot & Storage Cubic Ft	
		% of annual Evaporation	Evaporation Inches (b)	Precipitation Minus Evaporation	Gain Cubic Ft	Runoff %	Runoff Inches		Runoff Gain Cubic Ft
January	2.32	2%	0.72	1.60	26,117	55%	1.28	1,408	27,525
February	2.40	3%	1.08	1.32	21,546	50%	1.20	1,324	22,870
March	3.73	6%	2.16	1.57	25,627	55%	2.05	2,263	27,890
April	4.16	9%	3.24	0.92	15,017	54%	2.25	2,479	17,496
May	4.04	13%	4.68	-0.64	-10,447	57%	2.30	2,541	-7,906
June	4.01	15%	5.40	-1.39	-22,689	60%	2.41	2,655	-20,034
July	4.25	15%	5.40	-1.15	-18,771	62%	2.64	2,907	-15,864
August	3.13	14%	5.04	-1.91	-31,177	59%	1.85	2,038	-29,139
September	3.41	10%	3.60	-0.19	-3,101	62%	2.11	2,333	-769
October	3.05	7%	2.52	0.53	8,651	57%	1.74	1,918	10,569
November	4.21	4%	1.44	2.77	45,214	56%	2.36	2,601	47,816
December	3.40	2%	0.72	2.68	43,745	30%	1.02	1,125	44,871
Total	42.11	100%	36.00	6.11	99,733	55%	23.19	25,591	125,325

(a) <http://mcc.sws.uiuc.edu/Precip/IL/>

(b) AWMFH Table 10C-1 - Urbana

Successive 9 Months of Greatest Precipitation Gain = Sep - May

	Square Feet	Cubic Feet Gain	Gallons Gain
Manure Basin 101	10,000		
Manure Basin 102	5,400		
Manure Basin 103	3,600		
Holding Pond 104	80,000		
Lagoon 105	96,875		
Total	195,875	172,370	1,289,414
paved feedlots	13,240	17,992	134,590
Total precipitation gain going to Lagoon 105	209,115	190,362	1,424,003
25 year/24 hour storm event	5.5 inches	95,844	716,964

Worksheet for Sizing Manure Storage Facilities

Operation Name Westridge Dairy

Facility Type (solid storage, manure tank, lagoon) Lagoon

Selected manure storage period = 270 days

Animal Type	No. of Animals
dairy - cow dry	100
dairy - cow lactating	680

1. Volume of manure and bedding. Using data in Tables 21C-1 through 21C-9, Table 21-2, and Table 21-3, calculate the volume of manure and bedding for the selected storage period.

Manure:

ft ³ d/1,000#	x	no. animals	x	average wt. x	storage period	/	1,000	=				
1.30	x	100	x	1,400	x	270	/	1,000	=	49,140	ft ³ manure	
1.30	x	680	x	1,400	x	270	/	1,000	=	334,152	ft ³ manure	
0.00	x	0	x		x	270	/	1,000	=	0	ft ³ manure	
									Total	383,292		
										Percent of manure produced in barns 1-8 going into lagoon	=	10%
									Total	38,329	ft ³ manure	

Bedding:

lb Bedding/Kwt-d	x	no. animals	x	average wt. x	storage period	/	1,000	=				
8	x	100	x	1,400	x	270	/	1,000	=	302,400	lb Bedding	
31	x	680	x	1,400	x	270	/	1,000	=	7,968,240	lb Bedding	
	x	0	x	0	x	270	/	1,000	=	0	lb Bedding	
									Total	8,270,640		
										Percent of bedding in barns 1-8 going into lagoon	=	0%
									Total	0	lb Bedding	

lb Bedding	x	void factor(.3-.5)	/	bedding density(lb/ft ³)	=		ft ³ bedding
0	x	0.3	/	102	=	0	

38,329	ft ³ manure	+	0	ft ³ bedding	=	38,329	ft ³ manure/bedding
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2. Volume of lot runoff. Using data in Figures 21B-1, -2, -3a, and -3b, calculate the volume of runoff from exposed dirt lots, concrete lots, and unguttered roofs.

dirt lot, ft ²	x	rainfall, in	x	percent runoff /12	/	12	=	0	ft ³ runoff
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concrete, unguttered roofs, ft2	x	rainfall, in	x	percent runoff	/	12	=	17,926	ft ³ runoff
13,240	x	30.72	x	53%	/	12	=	17,926	

0	ft ³ dirt lot runoff	+	17,926	ft ³ concrete, roof runoff	=	17,926	ft ³ total runoff
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3. Depth of rainfall-evaporation. Using data from Figures 21B-3a, -3b, and -4, calculate the depth of R-E on the exposed surface of the manure storage facility.

$$\frac{(\text{rainfall, in} - \text{evaporation, in})}{12} = \text{ft R-E} \quad \times \text{Storage facilities sq ft} = \text{ft}^3$$

$$\frac{30.72 - 20.16}{12} = 0.880 \text{ ft R-E} \quad \times \quad 195,875 = 172,370$$

4. Sludge accumulation. Using data in Tables 21C-1 through 21C-10, calculate the volume of sludge accumulation

TS, lb/d/1,000 #	x	no. animals	x	average wt.	x	storage period, / 1,000	=	lbTS	x	SAR, ft ³ /lbTS	=	ft ³	
9.50	x	100	x	1,400	x	270 / 1,000	=	359,100	x	0.0729	=	26,178	
10.00	x	680	x	1,400	x	270 / 1,000	=	2,570,400	x	0.0729	=	187,382	
0.00	x	0	x	0	x	270 / 1,000	=	0	x	0	=	0	
											Total	213,561	
											Percent of manure produced in barns 1-8 going into lagoon	=	10%
											Total	21,356	

5. Treatment volume. Using data from Tables 21C-1 through 21C-9 and Figure 21B-5, calculate treatment volume (lagoons only).

VS, lb/d/1,000 #	x	no. animals	x	average wt. / 1,000	=	lb VS/d	/	lb VS/1,000 ft ³ /d	x	1,000	=	ft ³	
8.10	x	100	x	1,400 / 1,000	=	1,134	/	4.75	x	1,000	=	238,737	
8.50	x	680	x	1,400 / 1,000	=	8,092	/	4.75	x	1,000	=	1,703,579	
0.00	x	0	x	0 / 1,000	=	0	/	4.75	x	1,000	=	0	
											Total	1,942,316	
											Percent of manure produced in barns 1-8 going into lagoon	=	10%
											Total	194,232	

6. Volume/depth of 25 year, 24 hour storm. Using data in Figure 21B-6, calculate the depth of the 25-year, 24-hour storm on the manure storage facility surface and associated runoff from exposed lot and roof areas.

$$\text{Depth} = \frac{25\text{-yr, 24-hr storm, in}}{12} = \frac{5.5}{12} = 0.4583 \text{ ft}$$

$$\text{25-yr, 24-hr storm, ft} \times \text{exposed lot/roof area, ft}^2 = 0.4583 \times 209,115 = 95,844 \text{ ft}^3$$

7. Volume of washwater. Using water use data for the operation of estimating water use from similar operations, calculate the volume of washwater used during the selected storage period.

$$\text{Washwater use, gal/day} \times \text{storage period, days} / 7.48 = \frac{1,490 \times 270}{7.48} = 53,783 \text{ ft}^3$$

8. Total volume of manure storage facility. Sum the applicable volumes from Steps 1 through 7 above to obtain total manure storage facility volume.

manure/bedding	+	lot runoff	+	precip gain	+	sludge	+	treatment	+	25yr/24hr storm
38,329		17,926		172,370		21,356		194,232		95,844
	+	washwater	=	ft ³ total volume						
		53,783		421,471						

Westridge Dairy Lagoon 105

inside slope 2 to 1
length 775
width 125
depth 12

Usable Storage Capacity
422,938 ft³
3,163,788 gallons

depth	length	width	Per 1/2 foot		Cumulative	
			Feet ³	Gallons	Feet ³	Gallons
12.0	775	125	48,438	362,340	922,748	6,902,600
11.5	773	123	47,540	355,620	874,311	6,540,260
11.0	771	121	46,646	348,930	826,771	6,184,640
10.5	769	119	45,756	342,270	780,126	5,835,710
10.0	767	117	44,870	335,650	734,370	5,493,440
9.5	765	115	43,988	329,050	689,501	5,157,790
9.0	763	113	43,110	322,480	645,513	4,828,740
8.5	761	111	42,236	315,940	602,404	4,506,260
8.0	759	109	41,366	309,430	560,168	4,190,320
7.5	757	107	40,500	302,960	518,803	3,880,890
7.0	755	105	39,638	296,510	478,303	3,577,930
6.5	753	103	38,780	290,090	438,666	3,281,420
6.0	751	101	37,926	283,700	399,886	2,991,330
5.5	749	99	37,076	277,340	361,961	2,707,630
5.0	747	97	36,230	271,010	324,885	2,430,290
4.5	745	95	35,388	264,720	288,656	2,159,280
4.0	743	93	34,550	258,450	253,268	1,894,560
3.5	741	91	33,716	252,210	218,719	1,636,110
3.0	739	89	32,886	246,000	185,003	1,383,900
2.5	737	87	32,060	239,820	152,118	1,137,900
2.0	735	85	31,238	233,670	120,058	898,080
1.5	733	83	30,420	227,550	88,821	664,410
1.0	731	81	29,606	221,460	58,401	436,860
0.5	729	79	28,796	215,400	28,796	215,400
0.0	727	77	0	0	0	0

2' freeboard
188,378 ft³

24hr/25yr storm event
95,844 ft³

additional storage
194,312 ft³

270 days
manure & precip
228,626 ft³

treatment volume
194,232 ft³

sludge accumulation
21,356 ft³