U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

9/9/2009
STATE: OREGON

CLIENT: Wilson View Dairy Tract 313
ASSISTED BY: Pedersen
CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY

Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Milk Production in Pounds/Cow/Day= 70						Manure CF/D/AU	Annual	
				Nutrient Production								
				(lbs./day/1000 lb. Animal Unit)			(lbs./day)					
				N	P	K	N	P	K		Days Confined	Days Grazed
MILKER (Holstein)	150	1,100	165.0	0.70	0.12	0.32	115.50	19.83	53.10	1.70	157	208
Totals/Averages-	150	1,100	165.0	0.70	0.12	0.32	115.5	19.8	53.1	1.7		

GRAZING PERIOD

Type of Animal	Percent of Month and Number of Animals Grazing												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AU-YR.
MILKER (Holstein)	85%	0%	0%	0%	0%	85%	85%	85%	85%	85%	85%	85%	
	150	150	150	150	150	150	150	150	150	150	150	150	1,122
													0
													0
													0
													0
													0
													0
													0
													0
Total AUM's Available>	0	0	0	0	0	0	0	0	0	0	0	0	0
Total AUM's Needed>>>	140	0	0	0	0	140	140	140	140	140	140	140	1,122
Total AUM's>>>>>>>>>>	-140	0	0	0	0	-140	-140	-140	-140	-140	-140	-140	-1,122

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CLIENT: Wilson View Dairy Tract 313

ASSISTED BY: Pedersen CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

Type of Animal	Type of Bedding Facility	Bedding Material	Unit Weight Lbs/CF	Amount Needed Lbs/Day/AU	Volume CF/Day/AU	Total Volume CF/Day	Total Weight Lbs/Day
MILKER (Holstein)	Free Stall	Chopped Straw	**7.00**	**2.70**	**0.39**	64	446

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	Separation Factor %	Volume of Solids Separated CF/Day	Volume of Solids in Liquids CF/Day	Volume of Manure in Liquids CF/Day	Volume of Manure in Solids CF/Day	Accumulated Sludge in Storage CF/Day	Density of Separated Solids Lbs/CF	Weight of Separated Solids Lbs/Day
MILKER (Holstein)	Dry Scrape System	**25%**	86	259	211	70	121	**36**	3,103
Total Solids>>>			86	259	211	70	121		3,103

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

CLIENT: **Wilson View Dairy Tract 313**

ASSISTED BY: **Pedersen**

CHECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

	Runoff in Cubic Feet					Manure									
	Roof Area Square Feet	Paved Slab Area Square Feet	Unpaved Lot Area Square Feet	Silage Pit Surface Area, SF	Facility Water Use	Solids	Liquids	Bedding		Solids Separated		Solids in Liquids		Total Solids	Total Liquids
Month	0	0	0	0	Cubic Feet	Cubic Feet	Cubic Feet	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Cubic Feet
October	0	0	0	0	5,839	166	1,141	296	2,072	401	14,430	1,202	43,290	401	8,022
November	0	0	0	0	5,651	1,071	7,364	1,909	13,365	2,586	93,097	7,758	279,290	2,586	19,946
December	0	0	0	0	5,839	1,106	7,610	1,973	13,811	2,672	96,200	8,017	288,600	2,672	20,393
January	0	0	0	0	5,839	1,106	7,610	1,973	13,811	2,672	96,200	8,017	288,600	2,672	20,39
February	0	0	0	0	5,274	999	6,873	1,782	12,474	2,414	86,890	7,241	260,671	2,414	19,052
March	0	0	0	0	5,839	166	1,141	296	2,072	401	14,430	1,202	43,290	401	8,022
April	0	0	0	0	5,651	161	1,105	286	2,005	388	13,965	1,164	41,894	388	7,795
May	0	0	0	0	5,839	166	1,141	296	2,072	401	14,430	1,202	43,290	401	8,022
June	0	0	0	0	5,651	161	1,105	286	2,005	388	13,965	1,164	41,894	388	7,795
July	0	0	0	0	5,839	166	1,141	296	2,072	401	14,430	1,202	43,290	401	8,022
August	0	0	0	0	5,839	166	1,141	296	2,072	401	14,430	1,202	43,290	401	8,022
September	0	0	0	0	5,651	161	1,105	286	2,005	388	13,965	1,164	41,894	388	7,795
Annual	**0**	**0**	**0**	**0**	**68,755**	**5,594**	**38,478**	**9,976**	**69,832**	**13,512**	**486,431**	**40,536**	**1,459,292**	**13,512**	**143,283**

DAILY NUTRIENT PRODUCTION

	Pounds/Day of Nutrients from **LIQUIDS**			Pounds/Day of Nutrients from **SOLIDS**			Pounds/Day of Nutrients from **GRAZING**		
Type of Animal	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
MILKER (Holstein)	86.63	34.08	47.99	28.88	11.36	16.00	115.50	45.44	63.98
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CLIENT: **Wilson View Dairy Tract 313**
ASSISTED BY: **Pedersen** CHECKED BY: **0**

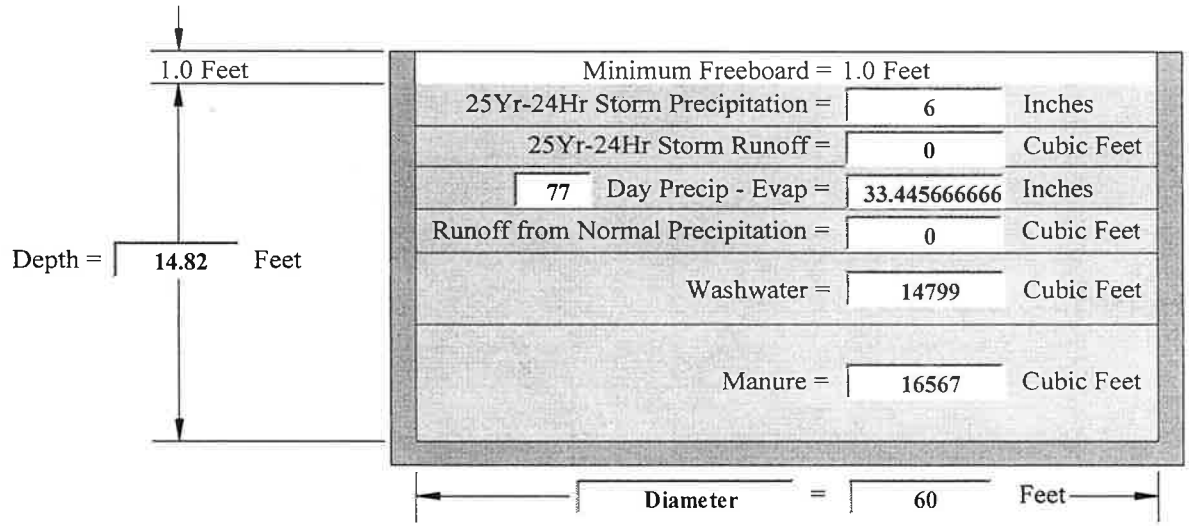
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

TANK

Tank Parameters	Value
Storage Period, Days=	77
Tank Diameter, Feet=	60
Existing Storage, Cubic Feet=	19,277
Surface Area of Existing Storage, SF=	
25 Year-24 Hour Storm Runoff, CF=	0
Volume Needed, Cubic Feet=	61,184
Design Volume, Cubic Feet=	41,881
Is Tank Covered?	NO
Tank Dimensions?	Circular

MONTHLY INFLOWS INTO TANK

Month	Number of days	Rain-Evap on Tank CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Manure CF	Solids CF	Waste to Store CF
October	31	1,352	0	0	5,839	981	1,202	8,022
November	30	3,052	0	0	5,651	6,326	7,758	19,735
December	31	3,142	0	0	5,839	6,537	8,017	20,393
January	31	2,970	0	0	5,839	6,537	8,017	20,393
February	28	2,357	0	0	5,274	5,904	7,241	18,420
March	31	2,035	0	0	5,839	981	1,202	8,022
April	30	1,156	0	0	5,651	949	1,164	7,764
May	31	382	0	0	5,839	981	1,202	8,022
June	30	2	0	0	5,651	949	1,164	7,764
July	31	-535	0	0	5,839	981	1,202	8,022
August	31	-495	0	0	5,839	981	1,202	8,022
September	30	268	0	0	5,651	949	1,164	7,764
Annual	365	15,687	0	0	68,755	33,054	40,536	142,344



CLIENT: **Wilson View Dairy Tract 313**
ASSISTED BY: **Pedersen**

HECKED BY: 0

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply **13,512** cubic feet of solids generated from the operation it will take approximately **27** trips annually. Based on applying NITROGEN, N
at agronomic rate use the application depths, travel lengths, and loads per acre listed below for each crop.

Field Number	Acres	Crop	Tractor Spreader Capacity Bushels	Tractor Spreader Capacity CF	Spread Width Feet	NITROGEN, N Concentration in Storage Facility PPM	NITROGEN, N Concentration in Storage Facility Lbs/Ton	Pounds of Nutrients to be Applied	Number of Applications Needed to meet Crop Demand	Tons per Acre of Solids to Apply	Travel Length per Load Needed in Feet	Loads per Acre	Assumed Solids Density lbs/CF
T313 1,2,3,4	38.8	Perennial Hay/Pasture(High Intensity)	400	498	15	6,979	13.96	384	1.00	45.2	576	5	36
5,6,7,8	38	Perennial Hay/Pasture(High Intensity)	400	498	15	6,979	13.96	384	1.00	45.2	576	5	36

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply **1,182,073** gallons of liquids generated from the operation it will take approximately **66** hours of pumping annually. Based on applying NITROGEN, N
at agronomic rate use the application depths, set times, and travel rates listed below for each crop.

Field Number	Acres	Crop	Sprinkler Flowrate GPM	Wetted Diameter Feet	Portion of Wetted Diameter Receiving Liquids	NITROGEN, N Concentration in Storage Facility PPM	NITROGEN, N Concentration in Storage Facility Lbs/1000Gal	Pounds of Nutrients to be Applied	Number of Applications Needed to meet Crop Demand	Inches of Liquids to Apply	Application Rate in Inches/Hour	Set Time Needed in Hours	Travel Rate Needed in Feet/Minute
T313 1,2,3,4	38.8	Perennial Hay/Pasture(High Intensity)	300	250	1/2 Circle	1,101	9.19	384	1.00	2.36	1.45	4.00	0.82
5,6,7,8	38	Perennial Hay/Pasture(High Intensity)	300	250	1/2 Circle	1,101	9.19	384	1.00	2.36	1.45	4.00	0.82

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ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation / Type of Storage Facility	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
	Dairy	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Tank (Uncovered)	13,578	5,342	7,522	**70%**	**85%**	**85%**	9,505	4,540	6,394
Solids	Solids Storage Facility (Roofed)	4,526	1,781	2,507	**75%**	**90%**	**90%**	3,395	1,603	2,257
Grazing	NONE	24,053	9,462	13,324	**100%**	**100%**	**100%**	24,053	9,462	13,324

NUTRIENTS AVAILABLE AFTER APPLICATION

Nutrient Source	Type of Application System	Pounds of Nutrients Available			Percent Nutrients Retained After Application			Pounds of Nutrients Retained After Application		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Sprinkling	9,505	4,540	6,394	**75%**	**100%**	**100%**	7,129	4,540	6,394
Solids	Broadcast (Incorporated 7 or more days after application)	3,395	1,603	2,257	**70%**	**100%**	**100%**	2,376	1,603	2,257
Grazing	Grazing	24,053	9,462	13,324	**85%**	**100%**	**100%**	20,445	9,462	13,324

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location / Soil Drainage Class	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
	Coast	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Well Drained	7,129	4,540	6,394	**87%**	**100%**	**100%**	6,202	4,540	6,394
Solids	Well Drained	2,376	1,603	2,257	**87%**	**100%**	**100%**	2,067	1,603	2,257
Grazing	Well Drained	20,445	9,462	13,324	**87%**	**100%**	**100%**	17,787	9,462	13,324
							TOTAL-	***26,056***	***15,605***	***21,974***

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON NITROGEN, N

Field Number	Acres	Crop	LIQUIDS Percent to be Applied	LIQUIDS Pounds of Nutrients to be Applied	LIQUIDS Acres Needed for Utilization of Nutrients	SOLIDS Percent to be Applied	SOLIDS Pounds of Nutrients to be Applied	SOLIDS Acres Needed for Utilization of Nutrients	GRAZING Percent to be Applied	GRAZING Pounds of Nutrients to be Applied	GRAZING Acres Needed for Utilization of Nutrients
T313 1,2,3,4	38.8	Perennial Hay/Pasture(High Intensity)	**51%**	3,133	8	**51%**	1,044	3	**51%**	8,986	23
5,6,7,8	38.0	Perennial Hay/Pasture(High Intensity)	**49%**	3,069	8	**49%**	1,023	3	**49%**	8,801	23
			0%	0		0%	0		0%	0	
TOTALS-	**76.8**		**100%**	**6,202**	**16**	100%	**2,067**	**5**	100%	**17,787**	**46**

repre	report	company	sampler	grower	crop	testdate	fieldno	depth	ph	smp	ss	om	p	k	ca	mg	n03	nh4	s	b	zn	mn	cu	fe	tb
S	916	WILSON VIEW DAIRY		T 313 F 1-4		9/3/2009	1	0-6"	5.5	5.2			24	987	7.2	4.1	30	40							13.8
S	916	WILSON VIEW DAIRY				9/3/2009	EAST SIDE	0-6"	5.9	6.2			39	1587	21.3	7.6	280	42							33
S	916	WILSON VIEW DAIRY				9/3/2009	HARVEY 4 + 6	0-6"	5.8	5.8			39	800	20.3	7.2	55	24							29.5
S	916	WILSON VIEW DAIRY				9/3/2009	HARVEY 5 + 6	0-6"	6	5.9			54	1588	21.8	10	98	31							35.9
S	916	WILSON VIEW DAIRY				9/3/2009	HARVEY 11 + 12	0-6"	5.7	5.3			12	717	10	6.4	108	36							18.2
S	916	WILSON VIEW DAIRY				9/3/2009	WEST SIDE	0-6"	6	5.9			29	1275	18.7	8	57	38							30

October 2001

PHOSPHORUS INDEX WORKSHEET – **WESTERN** OREGON

Producer: Wilson View Dairy | County: Tillamook | Tract No. 313 | Field No(s). 1-4 | Date: 09/03/2009

Soil Map Unit(s): 90A Yachats very fine sand Loam, 0-3% slopes | Soil Test P: 39 ppm | Lab. Method: Weak Bray | Sample Depth: 0-6 inches

Crop Rotation: Pasture | Nutrient Application Method(s) Manure Tank Wagon, and Manure Spreader

Planner: Pedersen | Notes: _____

		PHOSPHORUS LOSS RATING					Weighted Rating Value	
TRANSPORT FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	**Current**	**Planned**
Soil Erosion – tons/ac/yr (RUSLE)	1.50	< 1 (0)	1 – 3 (1.5)	4 – 6 (3.0)	7 – 15 (6.0)	> 15 (12.0)	0	0
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation (0)	Application rate < infiltration rate OR No visible runoff at field borders (0.75)	Application rate = infiltration rate OR Little to no visible runoff at field borders (1.5)	Application rate > infiltration rate OR Visible runoff at field borders (3.0)	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present. (6.0)	0.75	0.75
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	0	0
Flooding Frequency Class	0.75	None or very rare (0)	Rare (0.75)	Occasional (1.5)	Frequent (3.0)	Very Frequent (6.0)	3.0	3.0
Distance to Perennial Surface Waters / Buffer Widths	0.75	> 500 feet OR buffer > 30 ft. wide (or meets NRCS standards) next to surface waters (0)	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters (0.75)	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters (1.5)	100 – 199 feet AND buffer < 10 ft. wide next to surface waters (3.0)	< 100 feet AND No buffer next to surface waters (6.0)	0	0
Subsurface Drainage	0.50	No Tile Drains (0)	Tile drains present Soil Test P (Bray P1) < 60 ppm (0.5)	Tile drains present Soil Test P (Bray P1) 61 - 140 ppm (1.0)	Tile drains present Soil Test P (Bray P1) 141- 190 ppm (2.0)	Tile drains present Soil Test P (Bray P1) > 190 ppm (4.0)	0	0
						Transport Factors Subtotal (TFS)	3.75	3.75

PHOSPHORUS INDEX WORKSHEET – **WESTERN** OREGON

Producer: Wilson View Dairy County: Tillamook Tract No. 313 Field No(s). 1-4 Date: 09/03/2009

Soil Map Unit(s): 74A Nehalem silt loam 0-3% slopes Soil Test P: 39 ppm Lab. Method: Weak Bray Sample Depth: 0-6 inches

Crop Rotation: Pasture Nutrient Application Method(s) Manure Tank Wagon, and Manure Spreader

Planner: Pedersen Notes: _____

		PHOSPHORUS LOSS RATING					Weighted Rating Value	
TRANSPORT FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	**Current**	**Planned**
Soil Erosion – tons/ac/yr (RUSLE)	1.50	< 1 (0)	1 – 3 (1.5)	4 – 6 (3.0)	7 – 15 (6.0)	> 15 (12.0)	0	0
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation (0)	Application rate < infiltration rate OR No visible runoff at field borders (0.75)	Application rate = infiltration rate OR Little to no visible runoff at field borders (1.5)	Application rate > infiltration rate OR Visible runoff at field borders (3.0)	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present. (6.0)	0.75	0.75
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	1.0	1.0
Flooding Frequency Class	0.75	None or very rare (0)	Rare (0.75)	Occasional (1.5)	Frequent (3.0)	Very Frequent (6.0)	1.5	1.5
Distance to Perennial Surface Waters / Buffer Widths	0.75	> 500 feet OR buffer > 30 ft. wide (or meets NRCS standards) next to surface waters (0)	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters (0.75)	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters (1.5)	100 – 199 feet AND buffer < 10 ft. wide next to surface waters (3.0)	< 100 feet AND No buffer next to surface waters (6.0)	0	0
Subsurface Drainage	0.50	No Tile Drains (0)	Tile drains present Soil Test P (Bray P1) < 60 ppm (0.5)	Tile drains present Soil Test P (Bray P1) 61 - 140 ppm (1.0)	Tile drains present Soil Test P (Bray P1) 141- 190 ppm (2.0)	Tile drains present Soil Test P (Bray P1) > 190 ppm (4.0)	0	0
						Transport Factors Subtotal (TFS)	3.25	3.25

DATE: September 03, 2009
REPORT: S 916 M
CLIENT: WILSON VIEW DAIRY
GROWER:
SAMPLED:

COPY

AGRI-CHECK, INC.
Agricultural Testing Laboratory
323 Sixth St. - P.O. Box 1350
Umatilla, OR 97882
800-537-1128 * 541-922-4894

SOIL ANALYSIS REPORT

Lab No.	Depth Foot	pH	S.Salt mmhos	O. M. %	P ppm	K ppm	Ca meq	Mg meq	NITROGEN NO3 #/A	NITROGEN NH4 #/A	S ppm	B ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	CEC meq	Na meq	Total Bases	Base Sat. %	SMP Buf.pH	MOISTURE Total %	MOISTURE Avail. Inches	TKN %	Cl ppm
FIELD: 1																									
2692	0-6"	5.5			24	987	7.2	4.1	30	40									13.8		5.2				
FIELD: EAST SIDE																									
2693	0-6"	5.9			39	1587	21.3	7.6	280	42									33.0		6.2				
FIELD: HARVEY 4 + 6																									
2694	0-6"	5.8			39	800	20.3	7.2	55	24									29.5		5.8				
FIELD: HARVEY 5 + 6																									
2695	0-6"	6.0			54	1588	21.8	10.0	98	31									35.9		5.9				
FIELD: HARVEY 11 + 12																									
2696	0-6"	5.7			12	717	10.0	6.4	108	36									18.2		5.3				
FIELD: WEST SIDE																									
2697	0-6"	6.0			29	1275	18.7	8.0	57	38									30.0		5.9				

NOTE: East of Cascades Bicarb P & K extraction/SMP=1/4 SPM Buffer pH; West of Cascades Weak Bray P and Acetate K extractions.

repre	report	company	sampler	grower	crop	testdate	fieldno	depth	ph	smp	ss	om	p	k	ca	mg	n03	nh4	s	b	zn	mn	cu	fe	tb
S	916	WILSON VIEW DAIRY				9/3/2009	1	0-6"	5.5	5.2			24	987	7.2	4.1	30	40							13.8
S	916	WILSON VIEW DAIRY				9/3/2009	EAST SIDE	0-6"	5.9	6.2			39	1587	21.3	7.6	280	42							33
S	916	WILSON VIEW DAIRY				9/3/2009	HARVEY 4 + 6	0-6"	5.8	5.8			39	800	20.3	7.2	55	24							29.5
S	916	WILSON VIEW DAIRY				9/3/2009	HARVEY 5 + 6	0-6"	6	5.9			54	1588	21.8	10	98	31							35.9
S	916	WILSON VIEW DAIRY				9/3/2009	HARVEY 11 + 12	0-6"	5.7	5.3			12	717	10	6.4	108	36							18.2
S	916	WILSON VIEW DAIRY	T 313 F.5-8			9/3/2009	WEST SIDE	0-6"	6	5.9			29	1275	18.7	8	57	38							30

PHOSPHORUS INDEX WORKSHEET – **WESTERN** OREGON

Producer: Wilson View Dairy County: Tillamook Tract No. 313 Field No(s). 5-8 Date: 09/03/2009

Soil Map Unit(s): 74A Nehalem silt loam 0-3% slopes Soil Test P: 29 ppm Lab. Method: Weak Bray Sample Depth: 0-6 inches

Crop Rotation: Pasture Nutrient Application Method(s) Manure Tank Wagon, and Manure Spreader

Planner: Pedersen Notes: _____

		PHOSPHORUS LOSS RATING					Weighted Rating Value	
TRANSPORT FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	**Current**	**Planned**
Soil Erosion – tons/ac/yr (RUSLE)	1.50	< 1 (0)	1 – 3 (1.5)	4 – 6 (3.0)	7 – 15 (6.0)	> 15 (12.0)	0	0
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation (0)	Application rate < infiltration rate OR No visible runoff at field borders (0.75)	Application rate = infiltration rate OR Little to no visible runoff at field borders (1.5)	Application rate > infiltration rate OR Visible runoff at field borders (3.0)	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present. (6.0)	0.75	0.75
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	1.0	1.0
Flooding Frequency Class	0.75	None or very rare (0)	Rare (0.75)	Occasional (1.5)	Frequent (3.0)	Very Frequent (6.0)	1.5	1.5
Distance to Perennial Surface Waters / Buffer Widths	0.75	> 500 feet OR buffer > 30 ft. wide (or meets NRCS standards) next to surface waters (0)	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters (0.75)	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters (1.5)	100 – 199 feet AND buffer < 10 ft. wide next to surface waters (3.0)	< 100 feet AND No buffer next to surface waters (6.0)	0	0
Subsurface Drainage	0.50	No Tile Drains (0)	Tile drains present Soil Test P (Bray P1) < 60 ppm (0.5)	Tile drains present Soil Test P (Bray P1) 61 - 140 ppm (1.0)	Tile drains present Soil Test P (Bray P1) 141- 190 ppm (2.0)	Tile drains present Soil Test P (Bray P1) > 190 ppm (4.0)	0	0
						Transport Factors Subtotal (TFS)	3.25	3.25

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Producer:	Wilson View Dairy Tract 313	Tract(s): 313	Field(s): T313 1,2,3,4
Assisted by:	Pedersen	Date:	September 3, 2009

PURPOSE (Check all that apply)			
Budget and supply for plant production	x	Utilize manure/organic materials as a nutrient source	x
Minimize agricultural non-point source pollution (water quality)	x	Maintain or improve soil condition	x

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD
Perennial Hay/Pasture(High Intensity)	20

CURRENT SOIL TEST LEVELS (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC
NA	39	1587	5.9		

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD								
N (lbs/ac)		P_2O_5 (lbs/ac)		K_2O (lbs/ac)		LIME	Other	Other
Trial A	Trial B	Trial A	Trial B	Trial A	Trial B			
384		110		289		2-3 tons		

Table 2. Nutrient Sources

Credits			N		P_2O_5		K_2O	
			pounds per acre					
1. Nitrogen credits from previous legume crop			0					
2. Residual from long-term manure application			0					
3. Irrigation water			0		0		0	
4. Other (e.g., atmospheric deposition)			0		0		0	
5. Total Credits-			0		0		0	
Plant-Available Nutrients Applied to Field			N		P_2O_5		K_2O	
(Circle column that is landuser's decision)			Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5, above)			0	0	0	0	0	0
7. Fertilizer	Starter							
	Other	Commercial Fertilizer	45		0		0	
8. Manure / Organic Materials (Source-)		Dairy	339	0	203	0	286	0
9.		Subtotal (sum of lines 6, 7 and 8)	384	0	203	0	286	0
10.		Nutrients Recommended (from Table 1)	384	0	110	0	289	0
11.		Nutrient Status (subtract line 10 from line 9)	0	0	93	0	-3	0

If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.

PLANNED NUTRIENT APPLICATIONS						
Amount to be Applied (lb/ac)	N	384	P_2O_5	203	K_2O	286

Method, Form, and Timing of Application

The 1587ppm of potassium in the soil is excessive. High potassium levels in the soil may cause livestock health problems. Recommend forage tests to evaluate the potassium levels in the forage. The 39 ppm of phosphorus is medium. Recommend 45 lbs of nitrogen be applied per acre per year to achieve the 20 tons at 30% dry matter per acre per year. See attached letter from the Dairy Extension Agent. Manure should be applied in split applications. If manure is applied during wetter months, avoid applying manure to saturated soils, where manure runoff may occur, or during rainfall events.Apply 50 - 70 lbs. of nitrogen per acre per application. See attached Nutrient Management Specification Sheet, the Manure Distribution Sheet Section, for manure application rates per field. Recommend applying manure evenly over all the fields during the year. Recommend soil tests in late October to evaluate how well the biosolid application rate matches the nitrogen needs of the forage.

Don Josi
MAP 1000038
Tillamook

General Description

The Tannler Dairy consists of 130 Holstein cows and is located on 80 acres in Tillamook County. Currently, the operation is milking 112 and has 18 dry cows (171 A.U.). All the calves are sold at birth, and replacement animals are purchased back as needed. This is a pasture-based operation that utilizes grazing as its sole harvest method. The dairy has eight main pastures that serve as a base for the grazing program. Milk cows are typically grazed from April until the end of October depending on the weather, and the dry cows are typically confined all year long.

The total pasture land is comprised of 75 acres, this is also the area to be utilized for manure applications from collection during the storage period. There are 55 acres of Nehalem silt loam 0-3% slope, 14 acres of Nehalem silt loam with 3-7%, and the remaining 6 acres is Gardiner fine sandy loam 0-3% slope. The farm is bordered by the Wilson River on the East and Northeast sides, while Dougherty Slough borders to the South.

The operator will contain all waste water within the facilities, while diverting the clean water out of the system. The manure will be applied to the pasture lands via calibrated equipment to meet the expected nutrient uptake of the pasture grass. All barns are guttered with all clean water being drained to the slough.

Manure containment and Storage

The manure during the confinement period will be handled in one of two ways. The bulk (75%) of the manure will be scraped into a liquid reception tank. This will come from the main cow alleys and the holding pen scrapings. The remainder (25%) of the manure will be mixed with straw and shavings mostly from the dry cow alley and the feed bunks. This will bypass the liquid tank and be scraped into a dry stack.

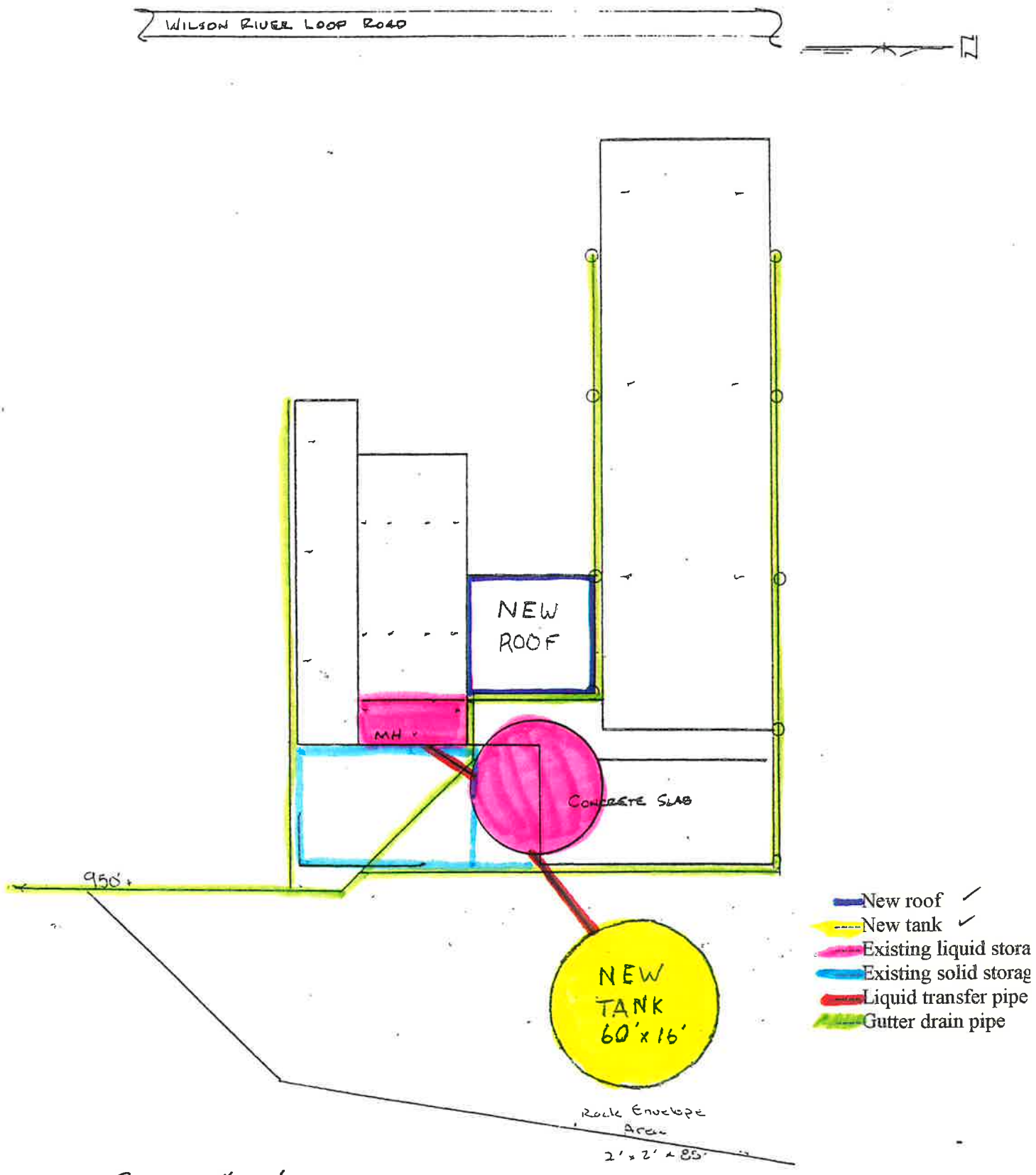
After construction, during the summer of 1998, the liquid storage will be 65,800 CF and is comprised of 3 individual tanks. The two existing tanks are (square 48' X 10' X 10') and (circular 48' X 10'). The third tank will be an above ground tank and will be installed in the next few months; it will be a (circular 60' X 16') tank adding 45,238 CF to the storage. There are plans in the future to possibly cover this tank should rainwater become a concern. The operator will also cover a section of an open slab between the barns this year (42' X 45"). Currently, this is contributing a considerable amount of rainwater to the storage system.

The dry storage (40' X 60' X 6') is covered and will contain 14,400 CF of solid manure. The operator will maintain these facilities (prevent unneeded water from

COMPUTATION SHEET
SCS-ENG-523 Rev. 5-80

U. S. DEPARTMENT OF AGRICULTURE
IL CONSERVATION SERVICE

STATE OREGON		PROJECT NEIL TANNLER		
BY STEVE R.	DATE 1-27-86	CHECKED BY	DATE	JOB NO.
SUBJECT DAIRY LAYOUT				SHEET 1 OF 1



SCALE 1"=50'

Wilson View Dairy
08/2009

BUSINESS NARRATIVE

This Comprehensive Nutrient Management Plan is developed for a 165-1,000 lb. animal unit dairy operation. There will normally be 150 lactating cows. The numbers may be lower, at any given day, month, or year. Culling rate, mortality, and economic condition may cause a decrease in the numbers. The lactating cows are normally confined for 157 days and on pasture for 208 days. The confinement days may vary depending on weather conditions, herd health, economics, and excessive forage production during the late fall, winter, and early spring. Livestock morality service is provided by the Tillamook County Creamery Association.

The leased operation consists of 76.8 acres of pastureland that receives manure applications. All but 10 acres are within the 100-year flood plain. The pastures are in good condition. The target yield is 20 tons at 30% dry matter per acre per year.

Manure is handled 75% liquids and 25% solids for the mature cows. The solid manure is transported and applied to the fields with a tractor and manure spreader. The liquid manure is transported and applied to the fields with a tractor and liquid manure tank wagon.

The liquid manure storage system consist of a 50' x 12' x 6' below ground liquid waste storage tank, a 48' x 10' below ground liquid waste storage tank, and a 60' x 16' above ground liquid waste storage tank. Liquid waste is transferred to the above ground liquid waste storage tank from the below ground liquid waste storage tanks by a manure pump and waste transfer pipe. The liquid manure tanks, in combination, can store the liquid waste generated by the 165-1,000 lb. animal units for 77 days. The solid manure produced at the milking operation is stored in a roofed 49' x 35' x 6' solid manure storage facility. The solid manure produced by the 165-1,000 lb. animal units can be stored for over 365 days. The manure storage days is based on the 30 year average precipitation at KTIL Radio Station in the City of Tillamook, Oregon. KTIL Radio Station is an official weather station.

The animal confinement buildings are guttered, down-spouted and outletted in an area free of manure. All conservation practices installed will be managed and maintained in accordance with the enclosed "CONSERVATION PRACTICE OPERATION AND MAINTENTANCE WORKSHEETS."

Soils where manure is applied are: Nehalem silt loam soil, 0 to 3 % slopes, Yachats very fine sandy loam, 0-3 % slopes, and Udifluents-Riverwash complex, 0-3 % slopes. The Nehalem, Yachats, and Udifluents-Riverwash soils are well drained.

Plan # 09098 Thanks Neil Tannler MK
MA ~~63498~~

I'm confused which Wilson View Dairy Plan

CAFO RECEIVED
-30-2009
KL

#994915

NRCS Natural Resources Conservation Service
TILLAMOOK SERVICE CENTER
6415 SIGNAL ST
TILLAMOOK, OR 97141-9622
5038422848 ext. 107

ROBERT A. PEDERSEN
CAFO PLANNER

Conservation Plan

WILSONVIEW DAIRY INC
2470 OLSON RD
TILLAMOOK, OR 97141

OBJECTIVE(S)

Develop and implement a comprehensive nutrient management plan, that when implemented, the operation will be in compliance with ODA's CAFO rules, regulations, and permit conditions.

Farmstead

Tract: 313

Comprehensive Nutrient Management Plan -

A comprehensive nutrient management plan consisting of structural and vegetative practices for the transferring, collecting, handling, storage and the application of animal waste in an environmental safe manner will be developed and implemented.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	9	2009		
Total:	1 no				

Manure Transfer

20 feet of 12 inch Class Code 125 PVC manure transfer pipe was installed between the 48' x 16' below ground liquid waste storage tank and the above ground liquid waste storage tank to gravity feed the manure back to the below ground liquid waste storage tank for transfer to the fields.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	8	1998	1 no	8/11/1998
Total:	1 no			1 no	

Manure Transfer

A concrete curb was installed to prevent manure runoff from the manure accumulation slab.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	11	1989	1 no	11/21/1989
Total:	1 no			1 no	

Waste Storage Facility
A 50' x 12' x 6' below ground liquid waste storage tank was installed. The 3,600 cubic foot liquid waste storage tank, in combination with the other below ground liquid waste storage tank and the above ground liquid waste storage tank, will store the liquid waste produced by the 165-1,000 lb. animal units for 77 days.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	7	1975	1 no	7/25/1975
Total:	1 no			1 no	

Waste Storage Facility
A 60' x 16' above ground manure tank was installed. The 45,216 cubic foot liquid waste storage tank, in combination with the other two below ground liquid waste storage tanks, will store the liquid waste produced by the 165-1,000 lb. animal units for 77 days.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	8	1998	1 no	8/11/1998
Total:	1 no			1 no	

Waste Storage Facility
An 8,880 square foot roof was installed over the manure accumulation area and the 48' x 10' below ground liquid waste storage tank on the east side of the animal confinement buildings.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	2	1989	1 no	2/15/1989
Total:	1 no			1 no	

Waste Storage Facility
An agitator/pump was installed in the 48' x 10' below ground liquid wastes storage tank for proper handling and managing the stored liquid manure.

Field	Planned Amount	Month	Year	Applied Amount	Date
F	1 no	10	1986	1 no	10/21/1986
Total:	1 no			1 no	

CERTIFICATION OF PARTICIPANTS

Wilsonview Dairy Inc. 9/8/09
WILSONVIEW DAIRY INC DATE
by: [signature] Sec.

R

CERTIFICATION OF:

CAFO PLANNER
[signature] 9/8/09
ROBERT A. PEDERSEN DATE

CONSERVATION DISTRICT
[signature] 9-8-09
TILLAMOOK SOIL & WATER CO DATE

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R - Designates Recurring Practices

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

WASTE STORAGE FACILITY
CODE 313

For: Landowner/Operator: Wilson View Dairy

Job Location: T 1S; R 9W; Sec 20

County Tillamook SWCD Tillamook County Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Tract 313

50' x 12' x 6' below ground liquid waste storage tank

48' x 10' below ground liquid waste storage tank

60' x 16' above ground liquid waste storage tank

Operation and Maintenance Items

A properly operated and maintained waste storage structure is an asset to your farm. This waste storage structure was designed and installed for temporary storage of animal wastes. The estimated life span of this installation is at least 10 years. If at any time this structure is taken out of service, the Natural Resources Division of the Oregon Department of Agriculture should be contacted for guidance in decommissioning the structure to avoid environmental concerns. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Do not allow equipment that exceeds the design loading to operate within 20 feet of the structure.

⇒ **WARNING: ENTERING AN UNVENTILATED TANK IS EXTEREMELY "HAZARDOUS" !** Do not allow human entry into the enclosed structure without safety equipment that includes ladders and breathing apparatus.

⇒ Continually maintain all pumps, agitators, piping, valves and all other electrical and mechanical equipment in good operating condition by following the manufacturer's recommendations.

⇒ Continually maintain grounding rods and wiring for all electrical equipment in good condition.

⇒ Facilities will be lowered sufficiently by November 1st to begin winter storage.

⇒ A one foot free board will be maintained to prevent spillage.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

MANURE TANK AGITATOR
CODE 634

Landowner/Operator: Wilson View Dairy

Job Location: T 1S; R 9W; Sec. 20

County Tillamook SWCD Tillamook Tract No. T-313

Prepared By: Pedersen Date 08/09

Operation and Maintenance Items

A properly operated and maintained manure tank agitator is an asset to your farm. The manure agitator was designed and installed to stir the liquid waste and keep the solids in suspension so solid manure will not buildup in the bottom of the tank and reduce the designed storage capacity. The estimated life span of this installation is at least 10 years. The life of the manure agitator can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Preventive maintenance will be in accordance with the manufacturer's recommendations.

⇒ Periodically examine the agitator for proper operation. Clean debris from the propeller, and promply replace any defective or damaged parts.

⇒ Remove the agitator from the manure tank and periodically clean and oil as needed to increase the life expectancy of the agitator.

⇒ Immediately repair any vandalism or livestock damage. Do not allow livestock near equipment during operation.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET
IRRIGATION WATER CONVEYANCE

HIGH-PRESSURE UNDERGROUND, PLASTIC PIPELINE
CODE 430-DD

Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W;Sec.20

County Tillamook SWCD Tillamook Tract No. T-313

Prepared By Pedersen Date 08/09

Waste Transfer Pipe

Operation and Maintenance Items

A properly operated and maintained waste transfer system is an asset to your farm. This waste transfer system was designed and installed for transferring liquid wastes from a below ground liquid storage facility to an above ground liquid waste storage facility. The estimated life span of this installation is at least 20 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Check to make sure all values and air vents are set at the proper operating condition so they may provide protection to the pipeline. Remove foreign materials and vegetation that can interfere with proper valve operation.

⇒ Pipeline will be flushed regularly to prevent clogging.

⇒ Leaks or broken sections will be replaced and/or repaired.

⇒ Maintain the designed depth of cover over the pipeline.

⇒ Limit traffic over the pipeline to designated sections that were designed for traffic loads.

⇒ Avoid travel over pipelines by tillage equipment when the soil is saturated.

⇒ Avoid any sub-soiling operation that may disturb the pipeline.

⇒ Maintain a vigorous growth of vegetative covering. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control height of vegetation.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET
MANURE TRANSFER

CODE 634

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W; Sec.20

County Tillamook SWCD Tillamook Farm/Tract No. T 313

Prepared By Pedersen Date 08/09

Concrete Curb

Operation and Maintenance Items

Properly operated and maintained curbs are an asset to the farm. A curb was designed and installed to control manure runoff and direct the manure towards a storage facility. Estimated life span of this installation is at least 10 years. Facility life can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require periodic maintenance and may require operational items to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Periodically check curb for proper operation. Repair or replace if needed.

⇒ Remove any foreign debris from the curb area.

⇒ Prevent manure from flowing over the curb.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

WASTE STORAGE FACILITY (SOLID MANURE STORAGE FACILITY) CODE 313

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W; Sec 20

County Tillamook SWCD Tillamook Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Tract 313

35' x 50' x 6'

Operation and Maintenance Items

A properly operated and maintained waste storage structure is an asset to your farm. This waste storage structure was designed and installed for temporary storage of animal wastes. The estimated life span of this installation is at least 10 years. If at any time a structure is taken out of service, the Natural Resources Division of the Oregon Department of Agriculture should be contacted for guidance in decommissioning the structure to avoid environmental concerns. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Do not allow equipment that exceeds the design loading to operate within 20 feet of the structure

⇒ Immediately repair any vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances.

⇒ Storage facility will be empty by November 1st to begin winter storage.

⇒ During de-watering of the structure, ensure that waste is spread at minimum rates in areas where crops are grown, spread waste no closer than 50 feet from open watercourses during the winter months and apply no manure within 35 feet of an open watercourse during the summer months. Avoid applying waste during heavy rainfall events.

⇒ Roofs of the solid manure storage facilities will be inspected annually.

⇒ All roof sections that are rusted and leaking will be repaired and/or replaced.

⇒ Loose roof sections on the solid manure storage facilities will be secured.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

WASTE STORAGE FACILITY (ROOF)
CODE 313

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W; Sec. 20

County Tillamook SWCD Tillamook Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Operation and Maintenance Items

A properly operated and maintained roof is an asset to your farm. These roofs were designed and installed for preventing manure runoff from manure accumulation areas. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Roof will be inspected weekly.

⇒ All roof sections that are rusted and leaking will be replaced or repaired to prevent rainwater from entering the liquid waste storage system.

⇒ Loose roof sections will be secured.

⇒ Broken trusses, beams, poles, gutters and downspouts will be repaired or replaced.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENCE WORKSHEET

UNDERGROUND OUTLETS
Code 620

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W;Sec. 20

County Tillamook SWCD Tillamook Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Gutter Outlet

Operation and Maintenance Items

Properly operated and maintained under ground outlet for the guttering system is an asset to the farm. This outlet was designed and installed to convey roof runoff in an underground pipeline to where it can be released without causing erosion. The estimated life span of this installation is at least 10 years. The life of the practice can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require periodic maintenance and may require operational items to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Check all above ground connections, rodent guards, inlets and outlets to make sure they are functioning properly.

⇒ Maintain design depth of cover on all pipelines.

⇒ Avoid operation of tillage and sub-soiling equipment that could damage any component of the gutter outlet system.

⇒ Remove all foreign debris that hinders the gutter system operation.

⇒ Limit traffic over pipeline to designated sections that were designated for traffic loads.

⇒ Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control growth.

⇒ Eradicate of otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

⇒ Immediately repair any vandalism, vehicular livestock damage.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

NUTRIENT MANAGEMENT
CODE 590

For: Landowner/Operator Wilson View Dairy

Job Location: T1S; R 9W; Sec.20

County Tillamook SWCD Tillamook Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Operation and Maintenance Items

Waste Utilization can provide economic and resource benefits if applied properly which are assets to the dairy operation. Proper waste utilization requires certain operational procedures to be followed and evaluated on an annual basis.

⇒ Manure application equipment is calibrated at least once per year to ensure uniform distribution and accurate application rates.

⇒ Records are maintained of manure applications.

⇒ Manure application equipment is cleaned up and residual material from the equipment is disposed of properly and in a place where surface runoff does not occur.

⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.

⇒ Unnecessary exposure to manure is avoided. Protective clothing is worn when necessary.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

SUBSURFACE DRAINAGE
CODE 606

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W; Sec.20

County Tillamook SWCD Tillamook Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Operation and Maintenance Items

Properly operated and maintain subsurface drainage system is an asset to the farm. The drainage system was designed and installed to remove excess subsurface water with a system of buried conduits.. The estimated life span of this installation is at least 10 years. The life of the practice can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require periodic maintenance and may require operational items to maintain satisfactory performance. A good operation and maintenance plan includes:

⇒ Maintain the designed depth of cover. All settlement or cracks in the soil should be investigated to determine the cause and immediately repaired.

⇒ Avoid travel by heavy equipment over drain-lines when the soil is saturated except at designated crossings. Avoid travel over pipelines by tillage equipment when the soil is saturated. Limit traffic to sections that were designed for traffic loads.

⇒ Remove all foreign debris and trash that hinders system operation.

⇒ Immediately remove any obstructions or blockage of, trash racks, drain inlets or drain outlets.

⇒ Maintain all outlets, rodent guards, inlets and access man-holes in good operating condition.

⇒ Eradicate or otherwise remove all rodents and/or burrowing animals that have or can potentially damage any part of the system. Immediately repair any damage caused by their activity.

⇒ Immediately repair any vandalism, vehicular or livestock damage to any outlets and appurtenances.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OPERATION AND MAINTENANCE WORKSHEET

USE EXCLUSION WORKSHEET

CODE 472

Landowner/Operator: Wilson View Dairy

Job Location: T 1S; R 9W; Sec. 20

County: Tillamook SWCD Tillamook Farm/Tract No. T-313

Prepared By Pedersen Date 08/09

Operation and Maintenance Items

A properly operated and maintained livestock exclusion practice will keep livestock out of the sloughs and open ditches and improve water quality. The estimated life span of the practices is 5 years. The life span can be assured and usually increased by developing and carrying out a good operation and maintenance program.

⇒ The fence barrier along the stream will be periodically inspected and remedial repairs will be performed as needed.

⇒ Immediately repair any vandalism, vehicular, or livestock damage to any earthfills, spillways, outlets or other appurtenance.

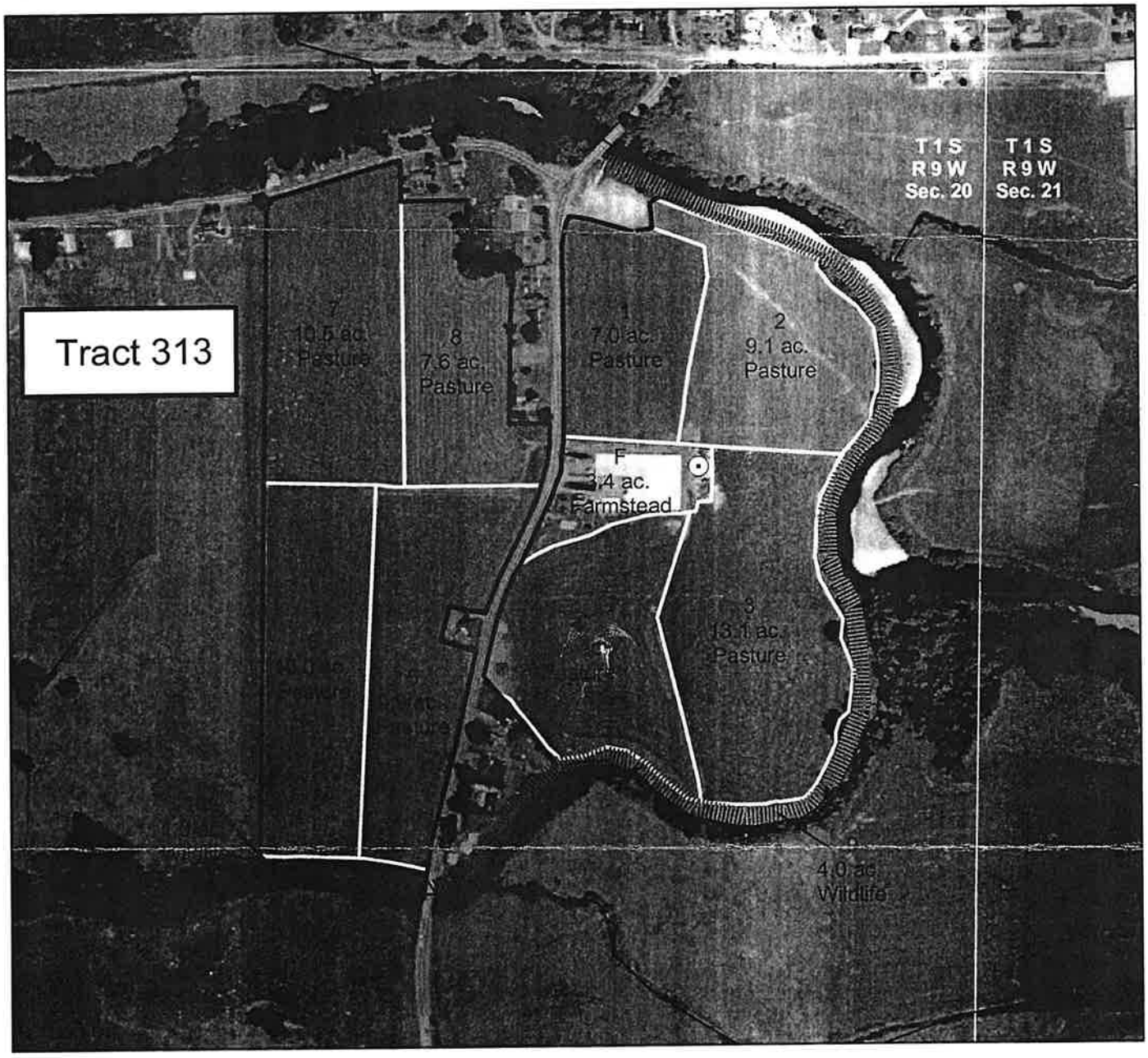
WILSONVIEW DAIRY INC
WI019

TILLAMOOK SERVICE CENTER
USDA - NRCS
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 85.2
Date: 8/24/2009

2009
Conservation Plan Map

Scale = 1:6,000



500 0 500 1,000 1,500 2,000 Feet

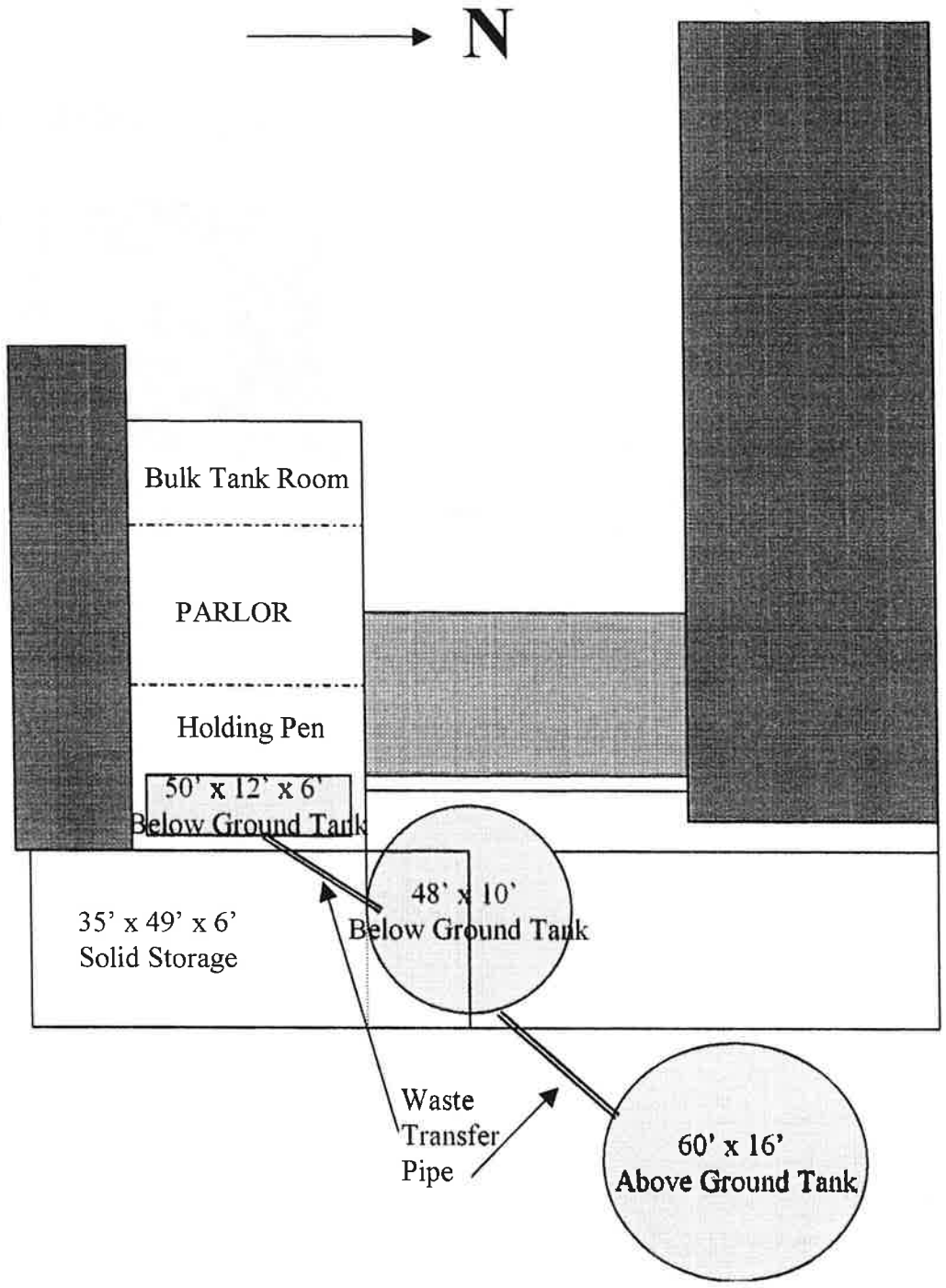
Legend

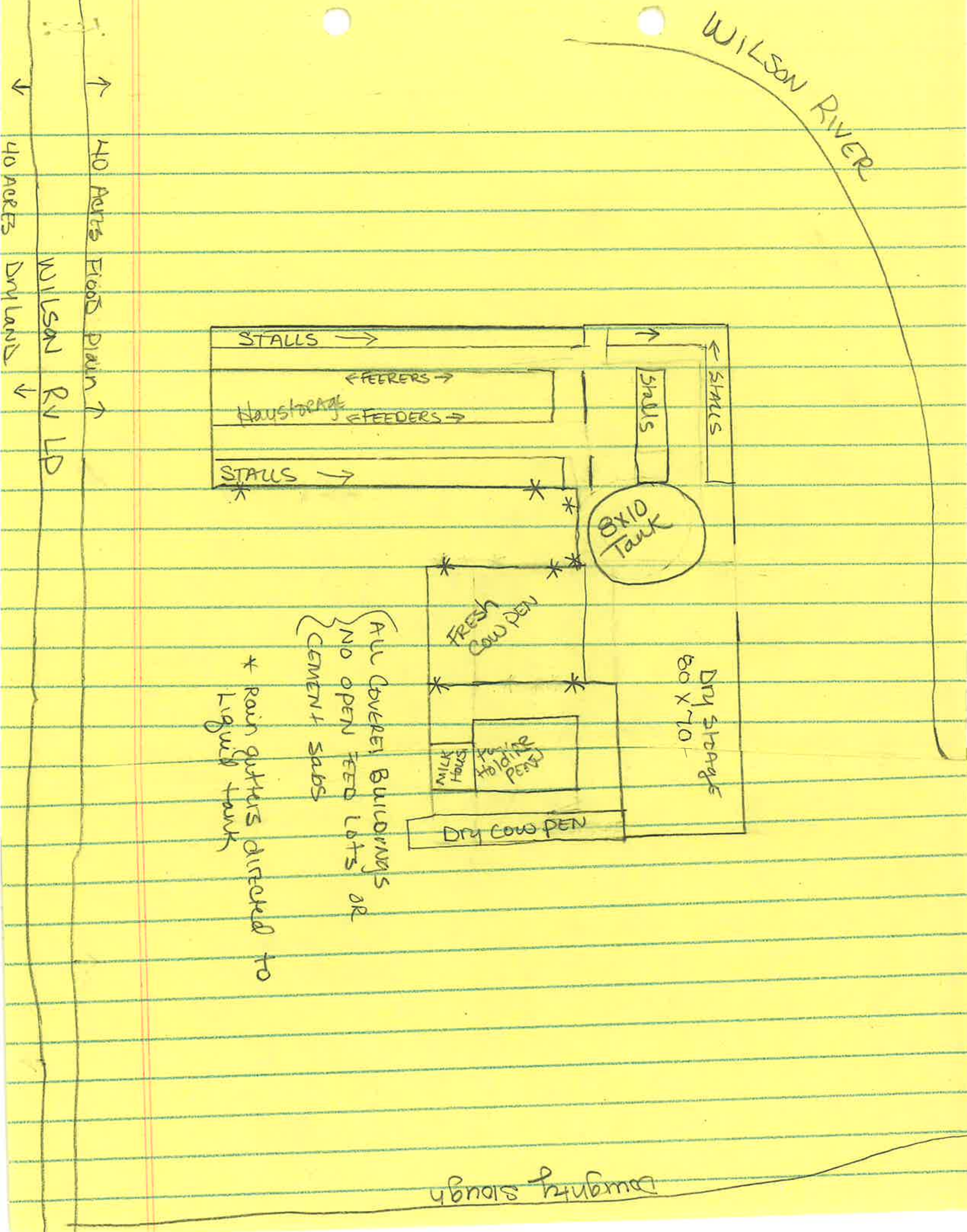
- Tract Boundaries 313
- 2009 Tract 313 Plan
- Public Land Survey
- Tank
- Dike
- Open Water Course

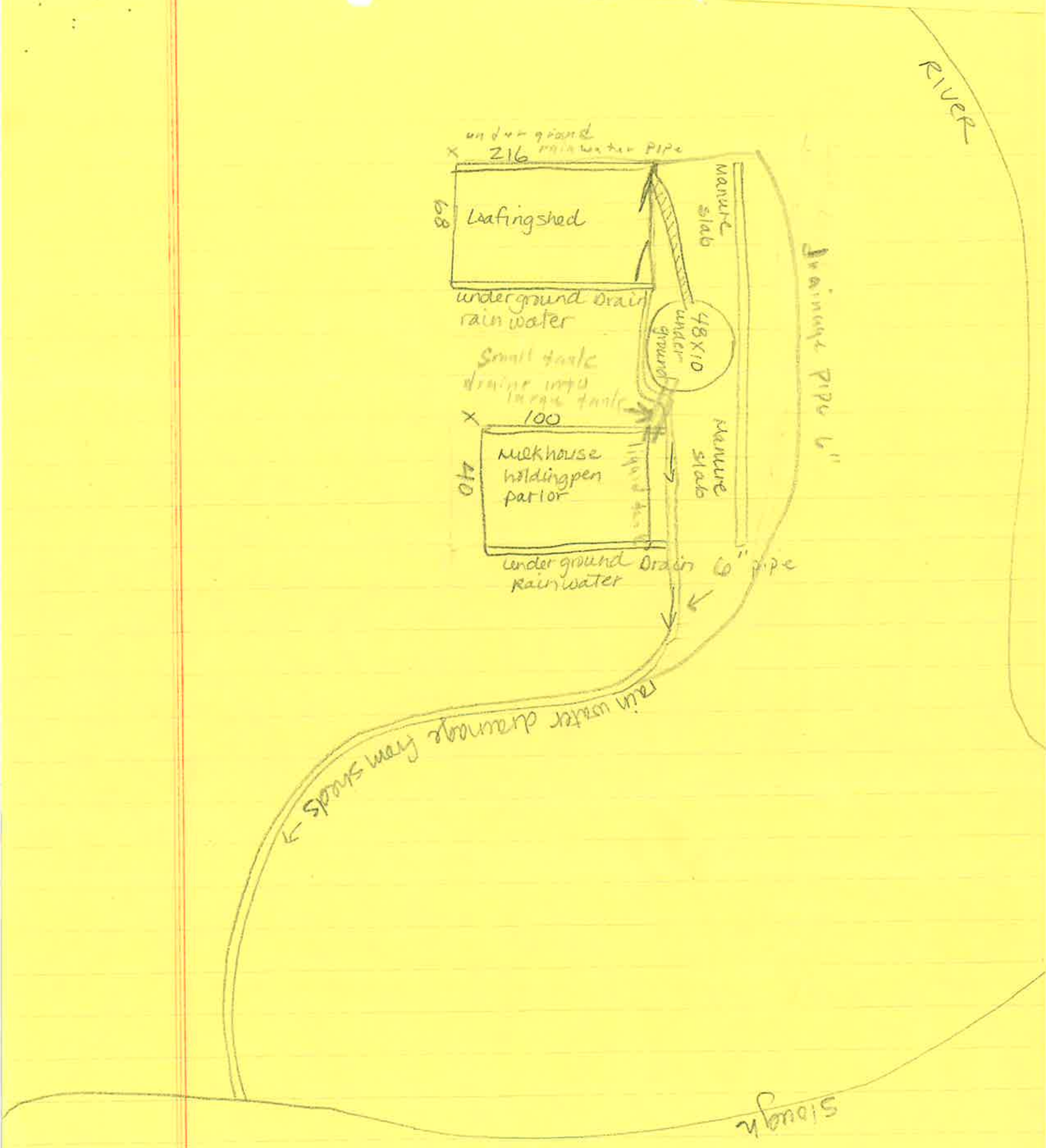
N

Tannler Dairy
Neil Tannler
Milking Operation (T-313)
2005 Site Map
*Map Not to Scale

* All buildings are guttered and down spouted



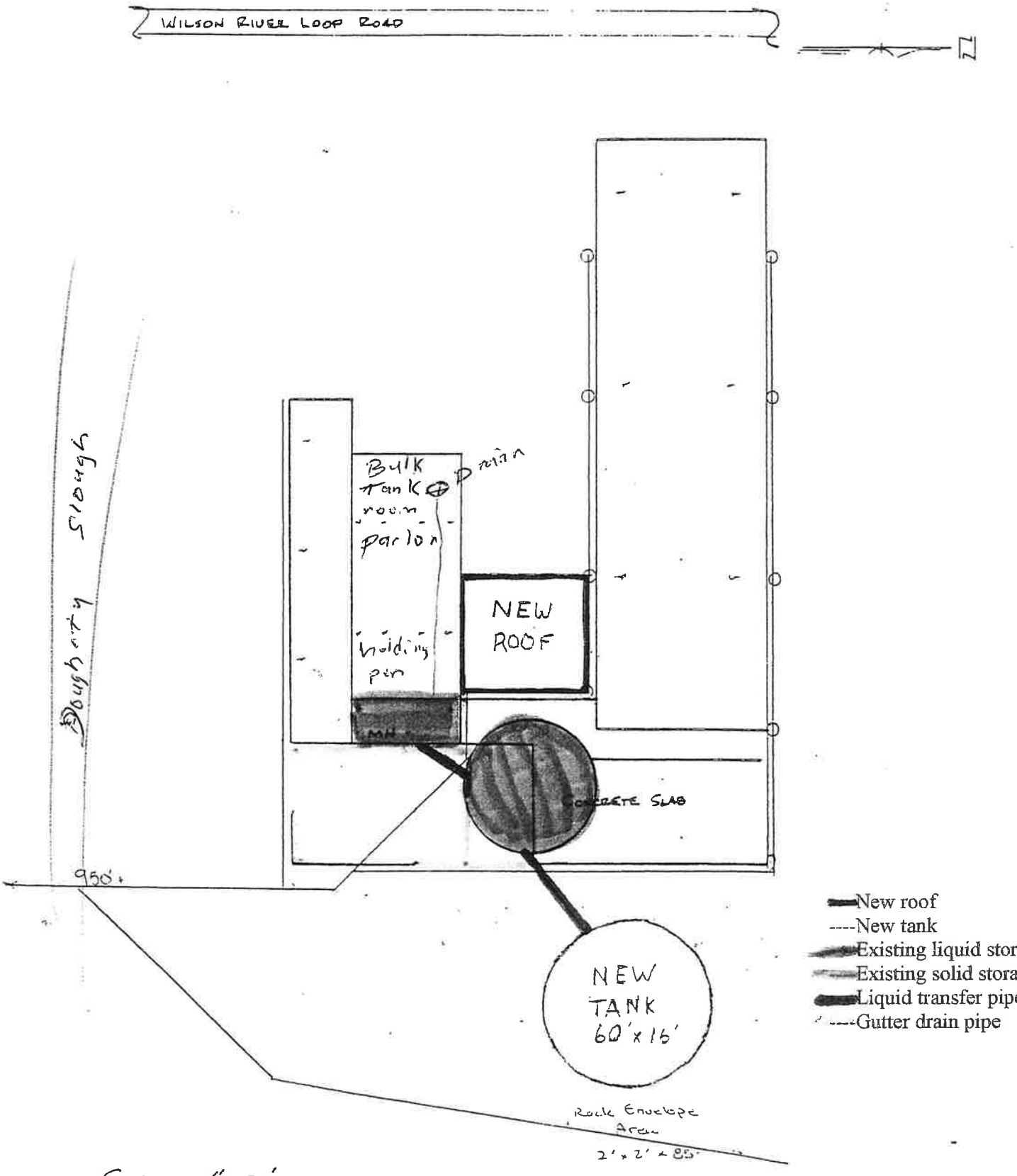

WILSON RIVER
40 Acres Flood Plain
WILSON RV LD
40 ACRES Dryland
STALLS
FEERERS
Haystorage
FEEDERS
STALLS
Stalls
STALLS
8X10 Tank
FRESH COW PEN
Dry storage 80 X 70
MILK House
Holding PEN
Dry COW PEN
All Covered Buildings No OPEN FEED LOTS OR CEMENT SLABS
* Rain gutters directed to Liquid tank
Doughty Slough


RIVER
under ground
216
rain water pipe
Manure slab
Leafingshed
68
underground Drain
rain water
48X10
under ground
Small tank
draine into
large tank
100
Milkhouse
holdingpen
parlor
40
Manure slab
Drainage Pipe 6"
underground Drain
Rainwater
6" pipe
rain water drainage from sheds
Slough

COMPUTATION SHEET
SCS-ENG-523 Rev. 5-60

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE OREGON		PROJECT NEIL TANNLER		
BY STEVE R.	DATE 1-27-86	CHECKED BY	DATE	JOB NO.
SUBJECT DAIRY LAYOUT				SHEET 1 OF 1



SCALE 1" = 50'

Tannler Dairy
735 Wilson RV Lp
Tillamook, OR 97141

#9808

April 16, 1998

ODA Natural Resorce Division
Attn: JOEL PALMER
635 Capital N.E.
Salem OR 97310

Dear Mr. Palmer

I am in the process of applying for a building permit to finish up my waste management plan. I am going to be putting an above ground 60 x 16 liquid storage tank, to allow for more storage days, and putting a roof over a cement pad to reroute rainwater away from underground liquid storage tank.

Enclosed you will find a copy of my dairy layout confined animal plan.

If you have any questions, please call me at 503.842.5341.

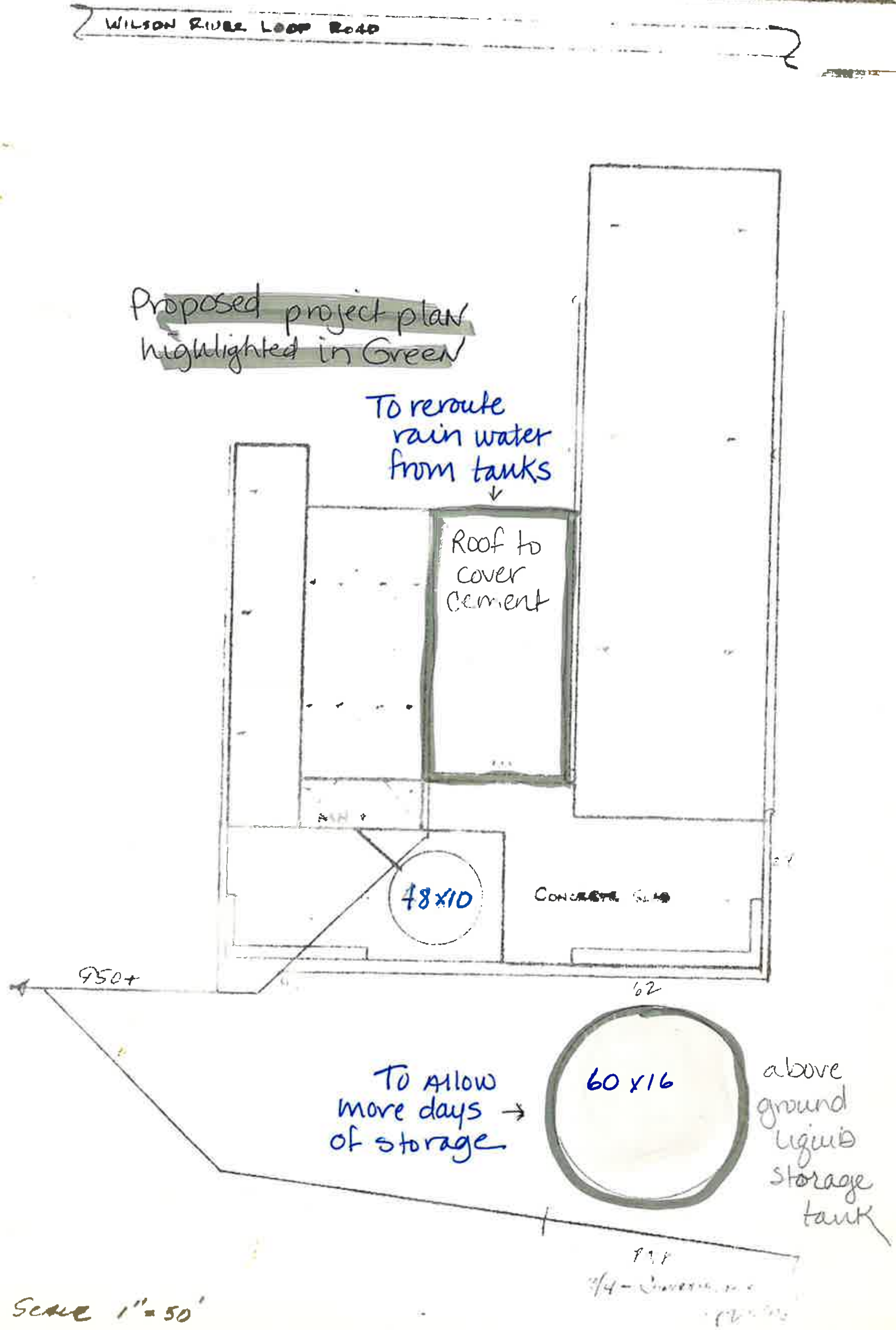
Thank you
neil a Tannler

Neil A. Tannler
735 Wilsson River Loop
Tillamook OR 97141

SCS-???-??? Rev. 5-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

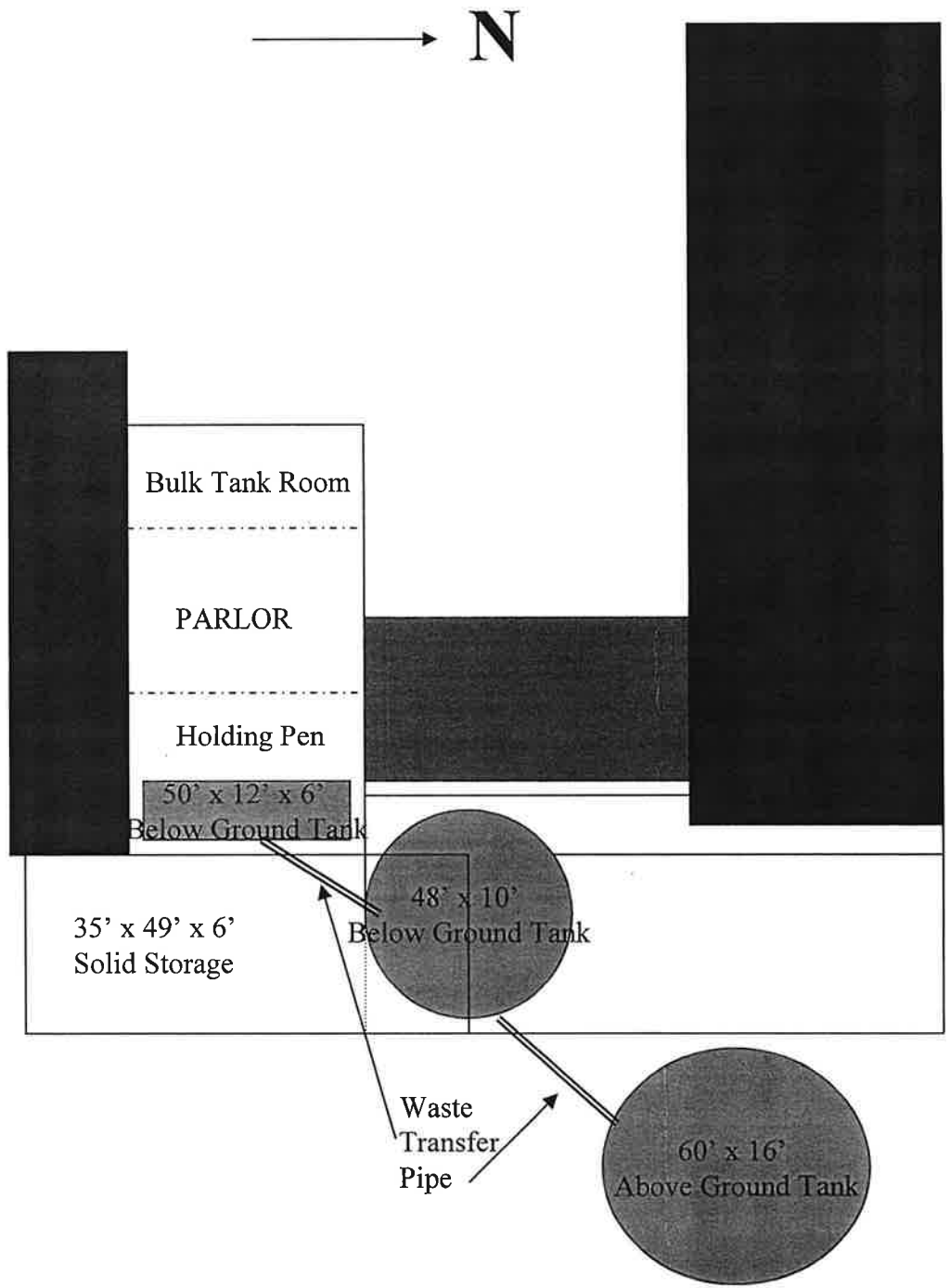
STATE: OREGON	PROJECT: NEIL TANNLER		
BY: STEVE R.	DATE: 1-27-86	CHECKED BY:	DATE:	JOB NO.:
SUBJECT: DAIRY LAYOUT			SHEET 1 OF 1



SCALE 1" = 50'

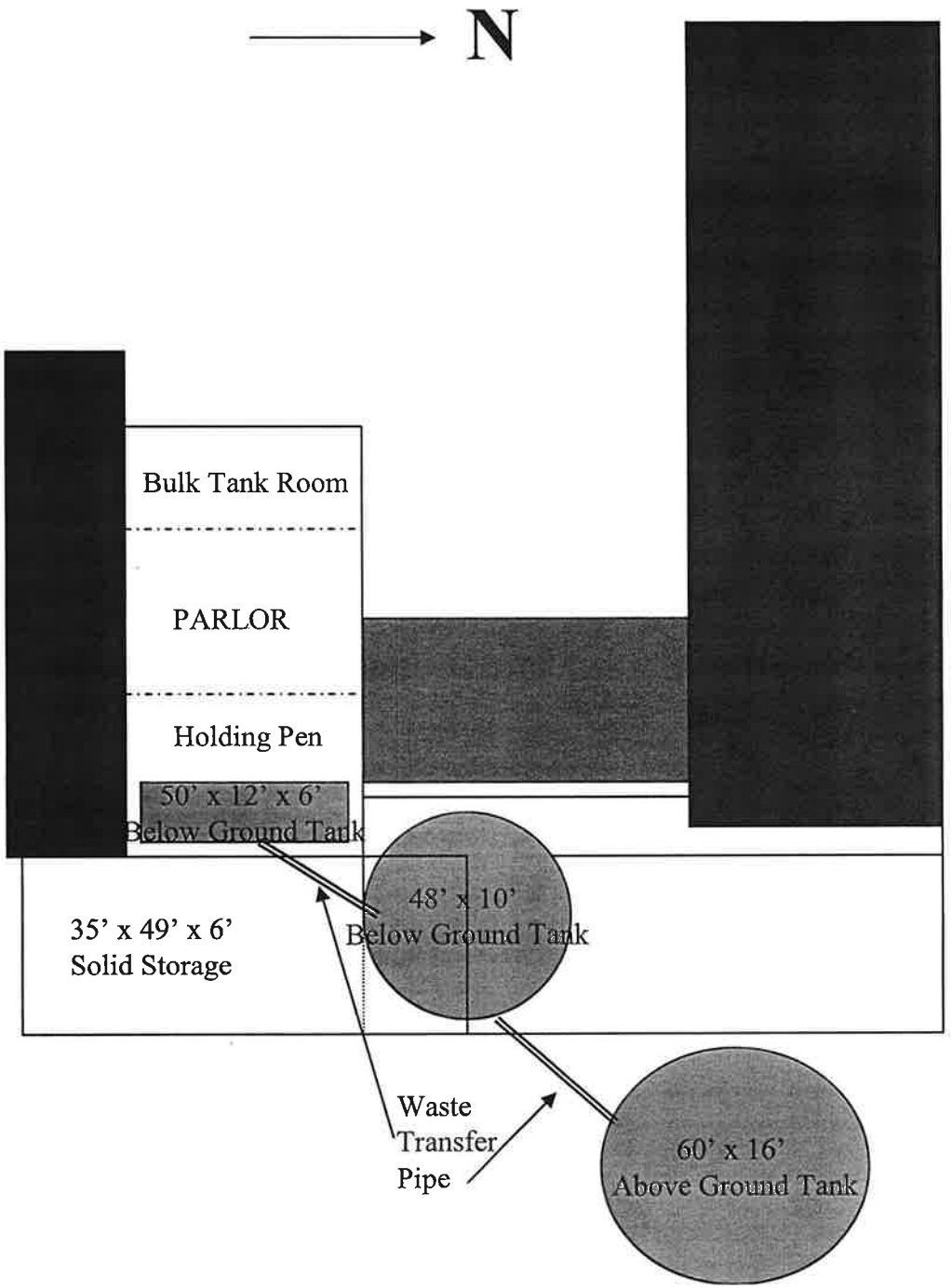
Wilson View Dairy
Milking Operation (T-313)
2005 Site Map
*Map Not to Scale

* All buildings are guttered and down spouted



Wilson View Dairy
Milking Operation (T-313)
2005 Site Map
*Map Not to Scale

* All buildings are guttered and down spouted



Wilson View Dairy
08/2009

LAND USE SUMMARY

Tract No.	Field No.	Land Use	Acres
313	1	Pasture (Irrigated)	7.0
	2	Pasture (Irrigated)	9.1
	3	Pasture (Irrigated)	13.1
	4	Pasture (Irrigated)	9.6
	5	Pasture (Irrigated)	9.9
	6	Pasture (Irrigated)	10.0
	7	Pasture (Irrigated)	10.5
	8	Pasture (Irrigated)	7.6
	9	Wildlife	4.0
	10	Wildlife	1.0
	F	Farmstead	3.4
		TOTAL	**85.2**

SUMMARY

Pasture		**76.8**
Wildlife		**5.0**
Farmstead		**3.4**
	Total	**85.2**

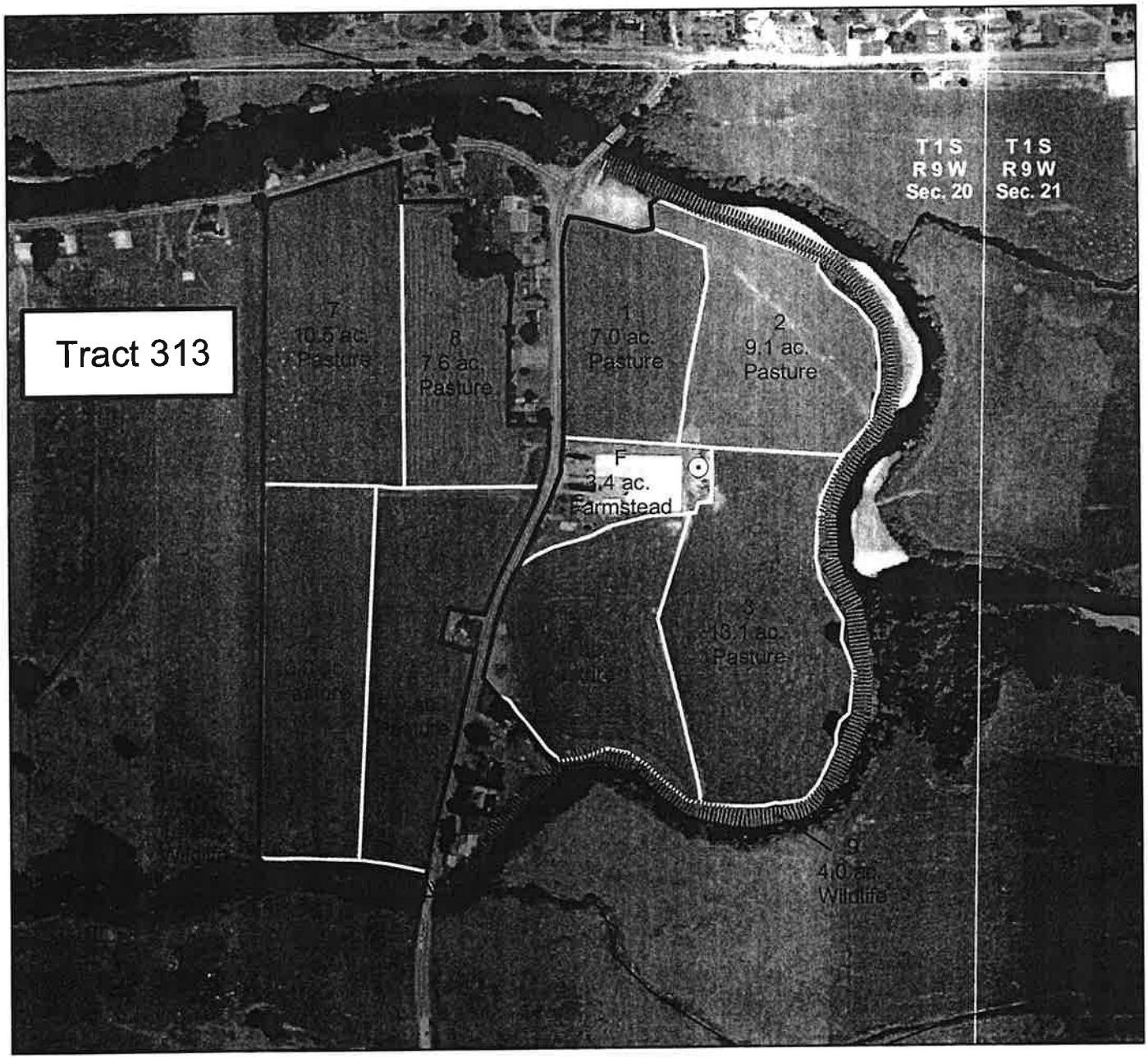
WILSONVIEW DAIRY INC
WI019

TILLAMOOK SERVICE CENTER
USDA - NRCS
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 85.2
Date: 8/24/2009

2009
Conservation Plan Map

Scale = 1:6,000



500 0 500 1,000 1,500 2,000 Feet

Legend

- Tract Boundaries 313
- 2009 Tract 313 Plan
- Public Land Survey
- Tank
- Dike
- Open Water Course

N

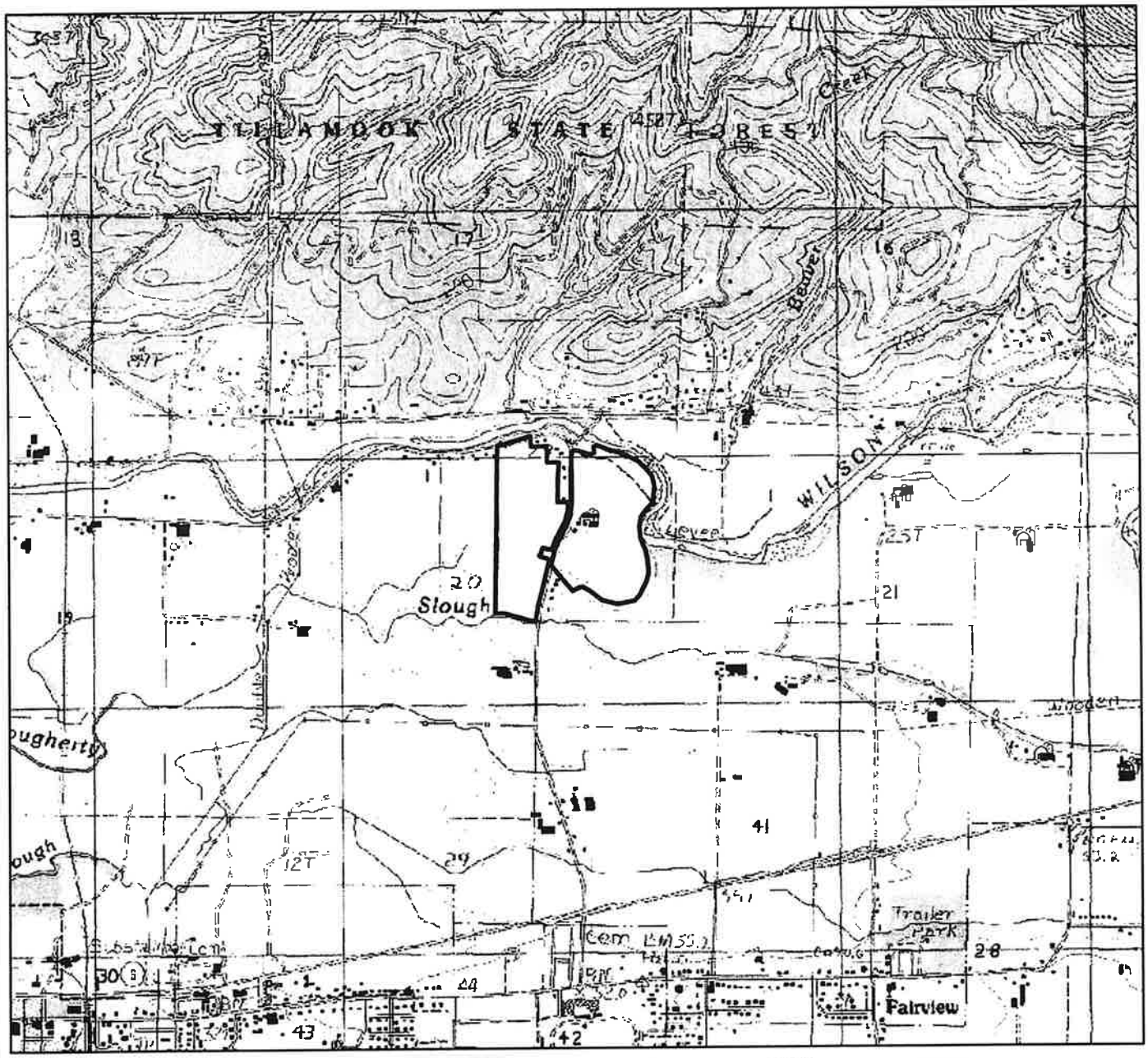
WILSONVIEW DAIRY INC
WI019

TILLAMOOK SERVICE CENTER
USDA - NRCS
TILLAMOOK COUNTY, OREGON

2009
Topo Map

Tillamook County SWCD
Approximate Acres: 85.2
Date: 8/24/2009

Scale = 1:24,000



Legend

Tract Boundaries 313

Farmstead Lat/Long (NAD83)
45 28' 27.5" N; 123 48' 26.2" W

Quad Name = Tillamook

8 dig. HUC = 17100203

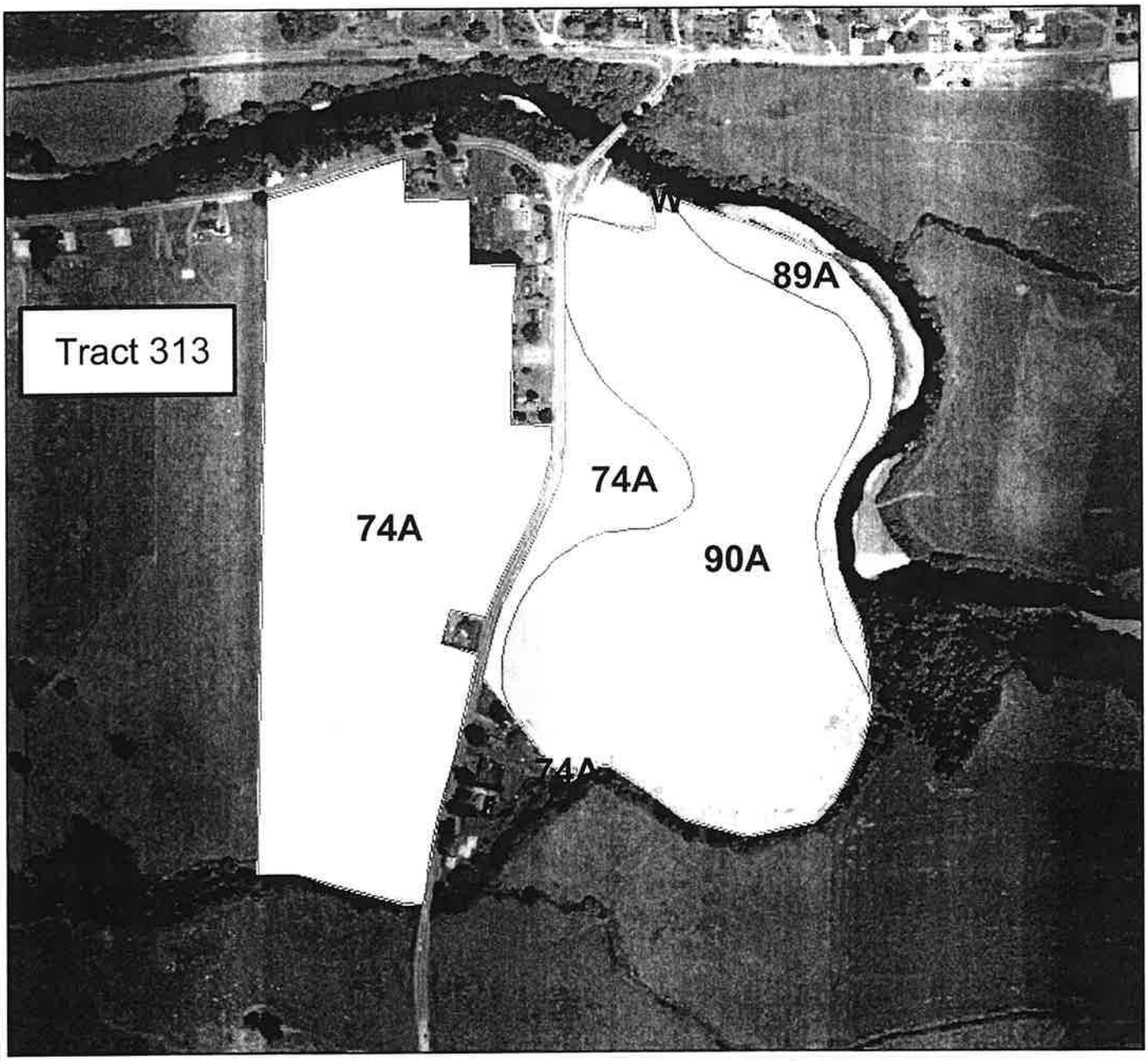
WILSONVIEW DAIRY INC
WI019

TILLAMOOK SERVICE CENTER
USDA - NRCS
TILLAMOOK COUNTY, OREGON

2009 Soils Map

Tillamook County SWCD
Approximate Acres: 85.2
Date: 8/24/2009

Scale = 1:6,000



500 0 500 1,000 1,500 2,000 Feet

Legend

- 74A, Nehalem silt loam, 0 to 3 percent slopes
- 89A, Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes
- 90A, Yachats very fine sandy loam, 0 to 3 percent slopes
- W, Water

2009 Tract 313 Plan

N

Soils Inventory Report

Wed Sep 9 09:58:02 PDT 2009

WILSONVIEW DAIRY INC

Tract	Land Unit	Map Unit Symbol	Map Unit Name	Acres	Percent
313	1	74A	Nehalem silt loam, 0 to 3 percent slopes	1.4	20%
313	1	90A	Yachats very fine sandy loam, 0 to 3 percent slopes	5.6	80%
			Total:	7	
313	2	W	Water	0	0%
313	2	89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	2	22%
313	2	90A	Yachats very fine sandy loam, 0 to 3 percent slopes	7.1	78%
			Total:	9.1	
313	3	89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	0.1	1%
313	3	90A	Yachats very fine sandy loam, 0 to 3 percent slopes	13.1	99%
			Total:	13.2	
313	4	74A	Nehalem silt loam, 0 to 3 percent slopes	0.7	7%
313	4	90A	Yachats very fine sandy loam, 0 to 3 percent slopes	8.8	93%
			Total:	9.5	
313	5	74A	Nehalem silt loam, 0 to 3 percent slopes	9.9	100%
			Total:	9.9	
313	6	74A	Nehalem silt loam, 0 to 3 percent slopes	10	100%
			Total:	10	
313	7	74A	Nehalem silt loam, 0 to 3 percent slopes	10.5	100%
			Total:	10.5	
313	8	74A	Nehalem silt loam, 0 to 3 percent slopes	7.6	100%
			Total:	7.6	
313	9	W	Water	0	0%
313	9	74A	Nehalem silt loam, 0 to 3 percent slopes	0	0%
313	9	89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	1.9	49%
313	9	90A	Yachats very fine sandy loam, 0 to 3 percent slopes	2	51%
			Total:	3.9	
313	10	74A	Nehalem silt loam, 0 to 3 percent slopes	0.9	100%
			Total:	0.9	
313	F	90A	Yachats very fine sandy loam, 0 to 3 percent slopes	0.4	12%
313	F	74A	Nehalem silt loam, 0 to 3 percent slopes	3	88%

Soil Description Report - Wilsonview Dairy - Tract 313

Tillamook County, Oregon

[Minor map unit components are excluded from this report]

Map unit: 74A - Nehalem silt loam, 0 to 3 percent slopes

Component: Nehalem (80%)

The Nehalem component makes up 80 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: 89A - Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes

Component: Udifluvents (40%)

The Udifluvents component makes up 40 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Riverwash (30%)

Generated brief soil descriptions are created for major soil components. The Riverwash is a miscellaneous area.

Component: Water (25%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map unit: 90A - Yachats very fine sandy loam, 0 to 3 percent slopes

Component: Yachats (85%)

The Yachats component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 7 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: W - Water

Component: Water (100%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Nonirrigated Capability Class - Wilsonview Dairy

Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Tillamook County, Oregon
Survey Area Version and Date: 1 - 09/21/2006

Map symbol	Map unit name	Rating
74A	Nehalem silt loam, 0 to 3 percent slopes	2
89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	4
90A	Yachats very fine sandy loam, 0 to 3 percent slopes	3
W	Water	

Nonirrigated Capability Class

Rating Options

Attribute Name: Nonirrigated Capability Class

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels – capability class, subclass, and unit. Only class and subclass are included in this dataset.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Tie-break Rule: Higher

Nonirrigated Capability Class

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Drainage Class - Wilsonview Dairy

Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Tillamook County, Oregon
Survey Area Version and Date: 1 - 09/21/2006

Map symbol	Map unit name	Rating
74A	Nehalem silt loam, 0 to 3 percent slopes	Well drained
89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	
90A	Yachats very fine sandy loam, 0 to 3 percent slopes	Well drained
W	Water	

Drainage Class

Rating Options

Attribute Name: Drainage Class

Drainage class (natural) refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized -- excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

To: Oregon Department of Agriculture

From: Don & Desi Josi

Re: Animal Waste Management Plan (AWMP) # 09098 for Wilsonview West Dairy/ Master Address 994915

Date: October 15, 2009

The nutrient management design and specification tables of my recent AWMP submission contained the wording "avoid applying manure to saturated soils, where manure runoff may occur, or during rainfall events."

I understand that Wilsonview West Dairy will fall under the condition, S2.C.4. of the CAFO NPDES General Permit #01-2009 which reads in part "Permittee is prohibited from applying manure, litter, or process waste water to saturated soils or during rainfall events that are expected to result in saturated soils or surface runoff."

Rather than rework the AWMP to strike the wording "avoid" in the nutrient management design and specification tables of my recent AWMP, I ask the department to accept this page as an amendment to plan number 09098 and my acknowledgement of condition S2.C.4. of the CAFO NPDES General Permit #01-2009 which reads in part "Permittee is prohibited from applying manure, litter, or process waste water to saturated soils or during rainfall events that are expected to result in saturated soils or surface runoff."

Don Josi Don Josi Date 10/15/09

Desi Josi Desi Josi Date 10/15/09

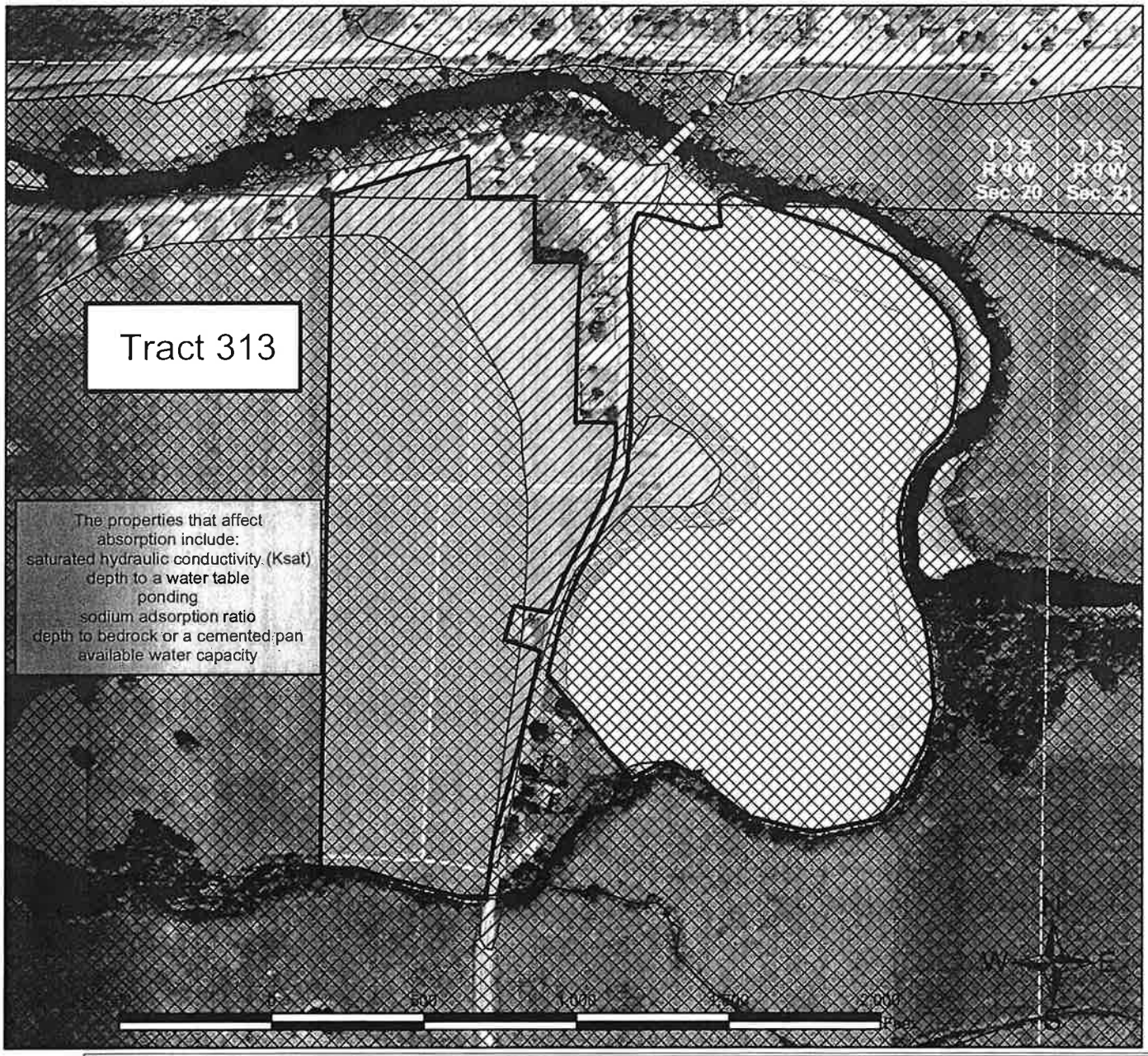
WILSONVIEW DAIRY INC
WI019

TILLAMOOK SERVICE CENTER
USDA - NRCS
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 85.2
Date: 8/24/2009

2009 Soil Suitability for Animal Waste Application

Scale = 1:6,000



Legend

- Tract Boundaries 313
- 2009 Tract 313 Plan
- Public Land Survey
- Open Water Course

FEMA Classification

- Sensitive Manure Application Area (100 Yr. Flood Plain)
- Winter Manure Application Area (Outside 500 Yr. Flood)
- 500 Yr. Flood Plain
- Undetermined Flood Plain

Animal Waste Suitability

- Not Rated
- Somewhat Limited
- Very Limited

Flooding Frequency Class

Rating Options

Attribute Name: Flooding Frequency Class

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Flooding frequency class is the number of times flooding occurs over a period of time and is expressed as a class. Flooding Frequency Classes are based on the interpretation of soil properties and other evidence gathered during soil survey field work.

The classes are:

NONE: Flooding is not probable, near 0 percent chance of flooding in any year or less than 1 time in 500 years.

VERY RARE: Flooding is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year).

RARE: Flooding is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year).

OCCASIONAL: Flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year).

FREQUENT: Flooding is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year).

VERY FREQUENT: Flooding is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

Month Range: January to December

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Tie-break Rule: More Frequent

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

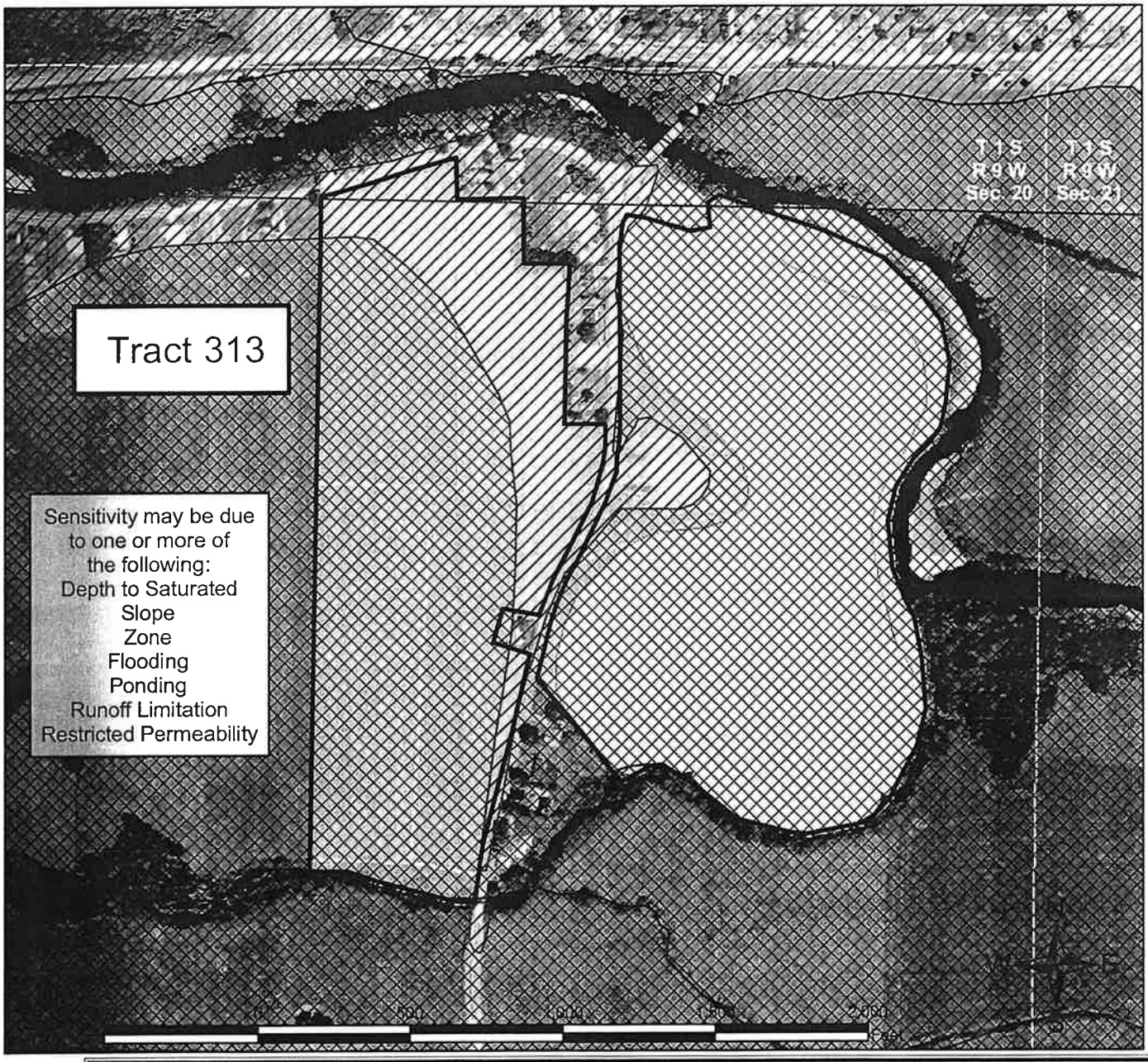
WILSONVIEW DAIRY INC
WI019

TILLAMOOK SERVICE CENTER
USDA - NRCS
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 85.2
Date: 8/24/2009

2009
Flood Boundary Map

Scale = 1:6,000



Legend

- Tract Boundaries 313
- 2009 Tract 313 Plan
- Public Land Survey
- Open Water Course

FEMA Classification

- Sensitive Manure Application Area (100 Yr. Flood Plain)
- Winter Manure Application Area (Outside 500 Yr. Flood)
- 500 Yr. Flood Plain
- Undetermined Flood Plain

Flood Frequency Classification

- Frequent
- None
- Occasional

EMERGENCY RESPONSE PLAN

Emergency Contact Information

Farm Name	
Address	
Farm Phone	
Permit #	
DIRECTIONS TO FARM	
Emergency Phone Numbers:	
Alan Wachlin home	
Alan Wachlin cell	
FIRE or AMBULANCE	**911**

If a Discharge Occurs a Written Report is to be made by Owner or Operator to Oregon Department of Agriculture within 5 Days that contains the following information:

a. A description and cause of the discharge.
b. The period of discharge including exact dates, times and duration of discharge.
c. An estimate of discharge volume.
d. Name or location of receiving water.
e. Corrective steps taken, if appropriate, to reduce, eliminate or prevent reoccurrence of the discharge.

Natural Resources Conservation Service, Oregon February 2002

WASTE UTILIZATION SPECIFICATION SHEET

DESIGN APPROVAL:

Practice Code NO.	PRACTICE	LEAD DISCIPLINE	CONTROLLING FACTOR	UNITS	JOB CLASS				
					I	II	III	IV	V
633	Waste Utilization	BCSD-Agron & CED-EE	Area	Acres	20	40	80	180	All

This practice is classified as Job Class IV

Design Approved by:/s/ Robert A. Pedersen Date: 9/8/09

Job title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The Client acknowledges that:

a. They have received a copy of the specification and understand the contents and requirements.

b. The following information must be provided to NRCS by the client before this practice can be certified as applied:
   - ☐ Waste application records which include the date, crop, type of waste applied, and amount of waste applied.
   - ☐ Calibration records for waste application equipment.
   - ☐ Analysis of nutrient concentrations in solid and liquid wastes.

c. It shall be the responsibility of the client to obtain all necessary permits and/or rights, and to comply with all ordinances and laws pertaining to the application of this practice.

Accepted by:/s/ Date: 9/8/09

CERTIFICATION:

I have completed a review of the information provided by the client and certify this practice has been applied.

Certification by:/s/ Date:

Job title:

Manure Nutrient Distribution

Wilson View Dairy

Date: 08/2009

			Grazing		Solids			Liquids (Spreader)			Liquids (Pumping)			
Tract	Field #	Grazing Cycles /YR	# N supplied by grazing/ field/yr	# of N supplied by grazing/ ac/yr	Loads of solid/yr	# of N per field/yr solids	# of N per from solids	Loads of Liquids/yr	# of N per field/yr liquid	# of N per ac/yr from liquid	Hours of Pumping	# of N per field/yr liquid	# of N per ac/yr from liquid	Total # of N per ac/yr
313	1	10	1637	**234**	2	190	**27**	26	571	**82**	0	0	**0**	342
313	2	10	2128	**234**	3	247	**27**	34	742	**82**	0	0	**0**	342
313	3	10	3063	**234**	5	356	**27**	48	1068	**82**	0	0	**0**	342
313	4	10	2244	**234**	3	261	**27**	35	783	**82**	0	0	**0**	342
313	5	10	2271	**229**	3	264	**27**	36	792	**80**	0	0	**0**	336
313	6	10	2294	**229**	3	267	**27**	36	800	**80**	0	0	**0**	336
313	7	10	2408	**229**	4	280	**27**	38	840	**80**	0	0	**0**	336
313	8	10	1743	**229**	3	203	**27**	28	608	**80**	0	0	**0**	336
	Totals		17787		27	2067		281	6202		0	0		

NOTE: For Farm Summary of all tracts you must highlight desired cell ranges go to Edit/Copy then click on the Summary Tab and click on Edit/Paste Special/ and under Paste select values/OK

Records are maintained of manure and or/or commmercial fertilizer applications.

Nutrient management plans are reviewed annually and adjustments are made as needed.

Manure is not applied within 35 feet of an open watercourse.

Manure and Food Processing Wastes - Wilsonview Dairy

Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Tillamook County, Oregon
Survey Area Version and Date: 1 - 09/21/2006

Map symbol	Map unit name	Rating	Component name and % composition Rating reasons
74A	Nehalem silt loam, 0 to 3 percent slopes	Somewhat limited	Nehalem 80% Flooding Too acid
89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	Not rated	Riverwash 30% Water 25% Fluvaquents 5%
90A	Yachats very fine sandy loam, 0 to 3 percent slopes	Very limited	Yachats 85% Flooding Leaching Too acid
W	Water	Not rated	Water 100%

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Waste Utilization

Conservation Practice Jobsheet

633 OR-JS

Natural Resources Conservation Service, Oregon **February 2002**

Client Wilson View Dairy Date 08/2009

Definition

Waste Utilization is the beneficial use of agricultural wastes such as manure and wastewater or other organic residues.

Purpose

The ultimate purpose of waste utilization is to insure the proper use of agricultural wastes while protecting soil, water, air, plant, and animal resources. Agricultural wastes can be used to provide nutrients for crops, forage, and fiber production and forest products. Agricultural waste also can be used as an amendment to improve or maintain soil structure, provide feedstuff for livestock, or provide a source of energy. The focus of this job sheet will be the use of agricultural wastes to provide fertility for crops, forage, and fiber production and forest products; and to supply organic material to the soil.

Where used

Waste utilization is used where agricultural wastes (primarily animal manure and polluted runoff from livestock and poultry operations) are generated and collected as part of a resource management system. Wastes can be used as a source of fertility on cropland and pastureland, and occasionally on forest land or rangeland. Use of the Soil Condition Index (SCI) can be used to determine the effects of organic material on soil quality.

Conservation Management Systems

Waste utilization is generally one of several components of a resource management system used to manage manure and polluted water from livestock and poultry operations. Where the wastes are used to supply the fertility needs of crop and pasture, waste utilization is done as part of an overall resource management plan for the enterprise.

Waste Utilization Planning

Waste utilization components of the conservation plan will contain the following information:

- field map and soil map
- crop rotation or sequence
- results of soil, water, plant, and organic material samples analyses
- expected yield
- sources of nutrients to be applied
- nutrient budget, including credits of nutrients available
- recommended nutrient rates, form, timing, and method of application
- location of designated sensitive areas
- guidelines for operation and maintenance

Waste utilization is most effective when used with other conservation practices such as cover crop, residue management, conservation buffers, irrigation water management, nutrient management, pest management, and conservation crop rotation.

Natural Resources Conservation Service, Oregon

WASTE UTILIZATION WORKSHEET

Spreader Equipment Calibration

(Using Bucket, Pan or Tarp)

Name:_____ Date:_____

Operator:_____ Spreader ID:_____

Perform the following operations to calibrate the solids spreader equipment:

- ✓ Place buckets, pans, or tarps in the application area to collect the applied or spread waste material.
- ✓ Spread waste material over the application area using the spreading pattern normally used in the field. Make sure the spreader is traveling at the speed it typically travels over the collection area. Record engine rpm and gear settings used.
- ✓ Collect and weigh the waste material and calculate the average application rate. Use this worksheet to record the weights and calculations.

Note: Use Tarps instead of buckets or pans when using dry stack manure or separated solids as the variability in the weight will be less.

Data and Calculations:

Steps	ID of Bucket, Pan or Tarp					
	A	B	C	D	E	F
1. Date of calibration test-						
2. Engine RPM during spreading -						
3. Gear selected during spreading -						
4. Weight of empty bucket (lb) =						
5. Weight of bucket with waste (lb) =						
6. Weight of Waste (lb) - line 5 – line 4 =						
7. Collection Area (sq ft) - Area of the top of the bucket, pan or tarp used to collect the waste =						
8. Waste Applied (lb/sq ft) - line 6 ÷ line 7 =						
9. Covert to tons per acre - line 8 x 21.78 =						
10. Average Application Rate (tons per acre)- Sum of values in cells A9 through F9 divided by the total number of calibrations completed =						

Additional Notes:

WASTE UTILIZATION WORKSHEET

Tank Equipment Calibration

(Using a Full Tank Load)

Name:_____ Date:_____

Operator:_____ Spreader ID:_____

Perform the following operations to calibrate the tank equipment:

- ✓ Determine the maximum capacity of the tank equipment from the manufacturer's maintenance manual or the owners manual for the equipment.
- ✓ Fill the tank and reduce the volume of the tank by the appropriate amount if the tank is not filled to its maximum capacity. Normally a tank spreader is only filled to about 80 percent of its maximum capacity and therefore the maximum rated capacity of the tank should be multiplied by 0.8 to reflect the volume of the loaded tank during the calibration exercise.
- ✓ Spread the loaded tank on the field using consistent speed and settings to cover the field uniformly. Try to spread in a rectangular pattern so the area calculation will be simple. Record engine rpm and gear settings used.

Data and Calculations:

Steps	ID of Calibration Test					
	A	B	C	D	E	F
1. Date of calibration test-						
2. Engine RPM during spreading-						
3. Gear selected during spreading-						
4. Maximum rated capacity of tank (gallons) =						
5. Volume of filled tank (gallons)- Line 4 x ____ % of tank filled ÷ 100% =						
6. Length of spreading area (ft) =						
7. Width of spreading area (ft) =						
8. Area spread (sq ft)- line 6 x line 7 =						
9. Waste applied (gal/sq ft)- line 5 ÷ line 8 =						
10. Convert to gallons per acre - Line 9 x 43,560 =						
11. Average Application Rate (gallons per acre) – Sum of values in cells A10 through F10 divided by the total number of calibrations completed =						

Additional Notes:

Natural Resources Conservation Service, Oregon

WASTE UTILIZATION WORKSHEET

Nitrogen Based Waste Application

Name:_____ Date:_____

Example:

Corn silage is being grown and the recommended nutrient application from the nutrient budget worksheet is 200 pounds of nitrogen(N) per acre. A traveling big gun sprinkler will be used to make 1 application of liquids from a non-agitated waste storage pond and a tractor spreader will be used to make 1 application of solids from a dry stacking facility that will not be incorporated into the field.

Waste application rates and amounts:

Steps	Example		Your Calculations			
	Liquid	Solids	Liquid	Solids	Liquid	Solids
1. Type of waste-	Dairy	Dairy				
2. Crop receiving waste-	Corn Silage	Corn Silage				
3. Desired nitrogen application rate, lb/acre-	100	100				
4. Nutrient concentrations in storage from laboratory analysis or from Table 1-1: **Nitrogen (N)-**	lb/1000 gal 4	lb/ton 9	lb/1000 gal	lb/ton	lb/1000 gal	lb/ton
Phosphorus (P_2O_5)-	1	4				
Potassium (K_2O)-	6	19				
5. Plant availability of nitrogen from Table 1-1 in percent-	100 %	100 %	%	%	%	%
6. Nitrogen retained, in percent, after application from Table 1-2-	75 %	70 %	%	%	%	%
7. Calculate nitrogen availability- line 4 N x line 5 x line 6 ÷ 10,000=	lb/1000 gal 3	lb/ton 6.3	lb/1000 gal	lb/ton	lb/1000 gal	lb/ton
8. Determine nitrogen application rate from the nutrient application charts: **Nitrogen (N)-**	Inches/acre 1.75	tons/acre 17	inches/acre	tons/acre	inches/acre	tons/acre
9. Determine the amount of phosphorus and potassium applied from nutrient concentration data on line 4 and nutrient application charts: **Phosphorus (P_2O_5)-**	lb/acre 50	lb/acre 70	lb/acre	lb/acre	lb/acre	lb/acre
Potassium (K_2O)-	250	300				
10. Total Nutrients Applied, lb/acre: **Nitrogen (N)-** (Sum of liquids and solids from line 3)	200 lb/acre		lb/acre		lb/acre	
Phosphorus (P_2O_5)- (Sum of liquids and solids from line 9)	120 lb/acre		lb/acre		lb/acre	
Potassium (K_2O)- (Sum of liquids and solids from line 9)	550 lb/acre		lb/acre		lb/acre	

WASTE UTILIZATION WORKSHEET

Table 1-1
Typical Manure Nutrient Concentrations for Different Handling Systems

The table below shows typical values of the nutrient content of manure from different animal waste handling systems. You can use them as a rough estimate of the nutrient content of your manure. Because manure nutrient content varies widely among farms and even over time on the same farm, it is recommended to test your manure to get realistic nutrient content numbers for your farm. Refer to Oregon State University Extension Publication PNW 505, "Which test is best?" for more information on manure testing.

Typical nutrient content, solids content, density, and nitrogen availability of animal manure at the time of application:

Solids from:	Nitrogen N (lb/Ton)[2]	Phosphorus P_2O_5 (lb/Ton)[2]	Potassium K_2O (lb/Ton)[2]	Solids (Percent)	Bulk Density (lb/cubic yard)	Nitrogen Availability (Percent)[1]
Broiler with litter	73	64	66	70	900	40-70
Laying Hen	37	57	47	40	1400	40-70
Sheep	18	9	35	28	1400	25-50
Horse	9	6	16	37	1400	0-20
Beef	12	6	17	23	1400	20-40
Dairy:						
Dry Stack	9	4	19	35	1400	20-40
Separated Solids	5	2	3	19	1100	0-20
Liquids from:	**Nitrogen N (lb/1,000gal)**	**Phosphorus P_2O_5 (lb/1,000gal)**	**Potassium K_2O (lb/1,000gal)**	**Solids (Percent)**	**Density (lb/gal)**	**Nitrogen Availability (Percent)[1]**
Dairy:						
Holding Tank	21	14	24	8	9.2	75-85
Pond, no agitation	4	1	6	<1	8.4	85-95
Pond, agitated	12	7	18	4	9.0	80-90

[1] Nitrogen available in the first growing season after application. For a field that has received manure annually for 4 years or more, consider 100% of the nitrogen available.

[2] Manure is at the moisture content typically found in storage.

Table 1-2
Typical Nutrient Availability After Application

Typical nutrient content of animal manure retained after application:

Application Method	Percent of original nutrient content of manure retained after application		
	N	P_2O_5	K_2O
Injection	95%	100%	100%
Sprinkling	75%	100%	100%
Broadcast (Incorporated 1 day after application)	90%	100%	100%
Broadcast (Incorporated 4 days after application)	80%	100%	100%
Broadcast (Incorporated 7 or more days after application)	70%	100%	100%

Natural Resources Conservation Service, Oregon

WASTE UTILIZATION WORKSHEET

Waste Application Record

Name:_____ Field ID:_____

Crop:_____ Acres:_____ Seeding Date:_____

Date	Crop Stage	**Waste Type** Liquids **(L)**, Solids **(S)**, Separated Solids **(SS)**, Etc.	**Amount Applied** (Loads, Inches, Tons, Hours of Operation, Etc.)	Notes

Estimating Soil Moisture by Feel and Appearance

Irrigation Water Management (IWM) is applying water according to crop needs in an amount that can be stored in the plant root zone of the soil.

The "feel and appearance method" is one of several irrigation scheduling methods used in IWM. It is a way of monitoring soil moisture to determine when to irrigate and how much water to apply. Applying too much water causes excessive runoff and/or deep percolation. As a result, valuable water is lost along with nutrients and chemicals, which may leach into the ground water.

The feel and appearance of soil vary with texture and moisture content. Soil moisture conditions can be estimated, with experience, to an accuracy of about 5 percent. Soil moisture is typically sampled in I-foot increments to the root depth of the crop at three or more sites per field. It is best to vary the number of sample sites and depths according to crop, field size, soil texture, and soil stratification. For each sample the "feel and appearance method" involves:

1. Obtaining a soil sample at the selected depth using a probe, auger, or shovel;
2. Squeezing the soil sample firmly in your hand several times to form an irregularly shaped "ball";
3. Squeezing the soil sample out of your hand between thumb and forefinger to form a ribbon;
4. Observing soil texture, ability to ribbon, firmness and surface roughness of ball, water glistening, loose soil particles, soil/water staining on fingers, and soil color. [Note: A very weak ball will disintegrate with one bounce of the hand. A weak ball disintegrates with two to three bounces;
5. Comparing observations with photographs and/or charts to estimate percent water available and the inches depleted below field capacity.

Example:

Sample Depth	Zone	USDA Texture	AWC*for Zone	Soil Moisture Delpetion**	Percent Depletion
6"	0-12"	sandy loam	1.4"	1.0"	70
18"	12-24"	sandy loam	1.4"	.8"	55
30"	24-36"	loam	2.0"	.8"	40
42"	36-48"	loam	2.0" / 6.8"	.5" / 3.1"	25

Result: A 3.1" net irrigation will refill the root zone.
** Available Water Capacity*
*** Determined by "feel and appearance method"*

Available Water Capacity (AWC) is the portion of water in a soil that can be readily absorbed by plant roots of most crops.

Soil Moisture Deficit (SMD) or Depletion is the amount of water required to raise the soil-water content of the crop root zone to field capacity.

Appearance of sandy clay loam, loam, and silt loam soils at various soil moisture conditions.

Available WaterCapacity 1.5-2.1 inches/foot

Percent Available: Currently available soil moisture as a percent of available water capacity.

In/ft. Depleted: Inches of water currently needed to refill a foot of soil to field capacity.

0-25 percent available
2.1-1.1 in./ft. depleted

Dry, soil aggregations break away easily, no staining on fingers, clods crumble with applied pressure. (Not pictured)

25-50 percent available
1.6-0.8 in./ft. depleted

Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away.

50-75 percent available
1.1-0.4 in./ft. depleted

Moist, forms a ball, very light staining on fingers, darkened color, pliable, forms a weak ribbon between the thumb and forefinger.

75-100 percent available
0.5-0.0 in/ft. depleted

Wet, forms a ball with well-defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger.

100 percent available
0.0 in/ft. depleted (field capacity)

Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. (Not pictured)

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

PRESCRIBED GRAZING SPECIFICATION SHEET

CODE 528

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W; Sec 20

County Tillamook SWCD Tillamook County Farm/Tract No T-313

Field No.: T-313 Fields 1-8

Prepared By Pedersen Date 08/09

⇒ Purpose:

⇒ Improve or maintain the health and vigor of the forage stand.

⇒ Maintain and improve water quality.

⇒ Maintain or improve animal health and productivity.

⇒ Attain grazing and management efficiency to promote economic stability.

Specifications:

⇒ Pastures are managed to assure at least 20 tons at 30% dry matter is produced per acre per year.

⇒ Pastures are reestablished when forage yields fall below 12 tons of dry matter per acre per year.

⇒ A rotational grazing system is used. A 21-day re-growth period is used during the normal years. During low rainfall years, the re-growth period varies between 30 to 35 days.

⇒ Noxious weeds such as Tansy Ragwort and Canada Thistle are controlled in accordance with an Integrated Pesticide Management Plan.

⇒ Pastures are clipped and dragged at least twice during the growing season.

⇒ Manure and commercial fertilizer applications are based on soil tests. Soil tests will be taken at least every 3 years. Nitrogen applications will not exceed 384 lbs. of nitrogen per acre per year unless soil tests and forage production justifies higher application rates.

⇒ Manure is applied to pastures in accordance with the enclosed Waste Utilization Conservation Practice and Nutrient Management Specification Sheets.

⇒ Spring grazing is delayed until the grasses have at least 6 inches of growth and the soil is firm.

⇒ Pastures are not grazed below 2 inches any time during the growing season.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

FORAGE HARVEST MANAGEMENT SPECIFICATION SHEET

CODE 511

For: Landowner/Operator Wilson View Dairy

Job Location: T 1S; R 9W; Sec 20

County Tillamook SWCD Tillamook County Farm/Tract No T-313

Field No.: T-313 Fields 1-8

Prepared By Pedersen Date 08/09

⇒ Purpose:

⇒ Improve or maintain the health and vigor of the forage stand.

⇒ Maintain and improve water quality.

⇒ Maintain or improve animal health and productivity.

⇒ Attain management efficiency to promote economic stability.

Specifications:

⇒ Hayland fields are managed to assure at least 20 tons at 30% dry matter is produced per acre per year.

⇒ Hayland Fields are reestablished when forage yields fall below 4 tons of dry matter per acre per year.

⇒ Harvesting newly seeded fields are delayed until the grasses have at least 8 inches of growth and are firmly rooted.

⇒ Harvesting established stands are delayed until grasses have at least 6 inches of growth and ground is firm.

⇒ Grasses are not cut if the grass height is less than 2 inches.

⇒ Harvesting is not done when the fields are saturated or ponded.

⇒ Noxious weeds such as Tansy Ragwort and Canada Thistle are controlled in accordance with an Integrated Pesticide Management Plan.

⇒ Manure and commercial fertilizer applications are based on soil tests. Soil tests will be taken at least every 3 years. Nitrogen applications will not exceed 384lbs. of nitrogen per acre per year unless soil tests and forage production justifies higher application rates.

⇒ Forage Tissue Tests will be taken at least twice during the growing season.

SOIL AND MANURE SAMPLING INSTRUCTIONS FOR ANIMAL WASTE MANAGEMENT SYSTEMS

SOIL SAMPLES Job Sheet 5

Spring Soil Samples

- Spring soil samples are to be collected the last 2 weeks of March or the first 2 weeks in April when soils are not saturated.
- Soil samples are to be collected on fields that have not received manure applications within the last 30 days.
- Collect several samples (about 10 one-fourth cup samples) of soils from just below the thin sod layer to a depth of 6 to 9 inches and add to bucket.
- Mix the samples in the bucket and remove about 1 cup from the mixture and place into a sample bag.
- The bag should be labeled with ;
  farm or operator name
  sample date
  field and tract (see NRCS plan map)
  sample depth (0 to 9 inches)
  soil type if determined
- Keep soil sample cool (small cooler with some ice) in the field until sample can be put in refrigerator or into freezer. Soil can be stored in refrigerator for up to 1 week or can be stored in a freezer for longer periods.
- Ship samples to lab (see shipping instructions below).

Fall Soil Samples

- Fall soil samples are to be collected during the last 2 weeks in September or the first 2 weeks in October on soils that are not saturated.
- Soil samples are to be collected on fields that have received normal manure applications during the current year.
- Sample soils and ship as outlined in the spring soil sample section above.

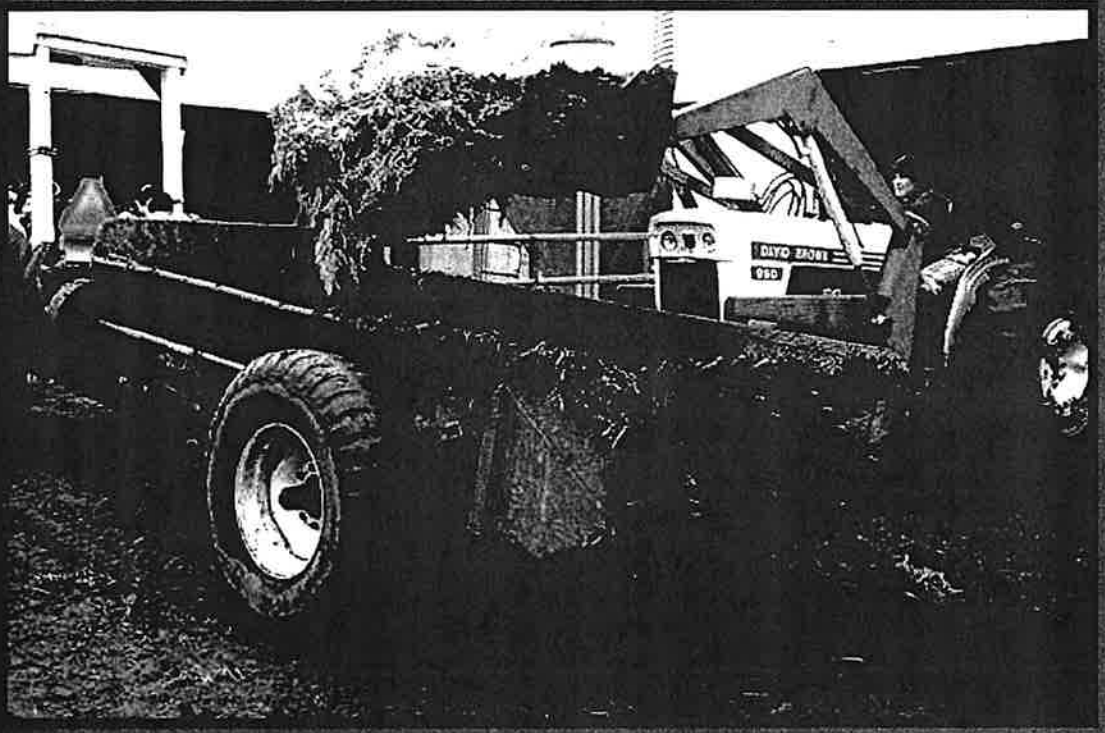
MANURE SAMPLES

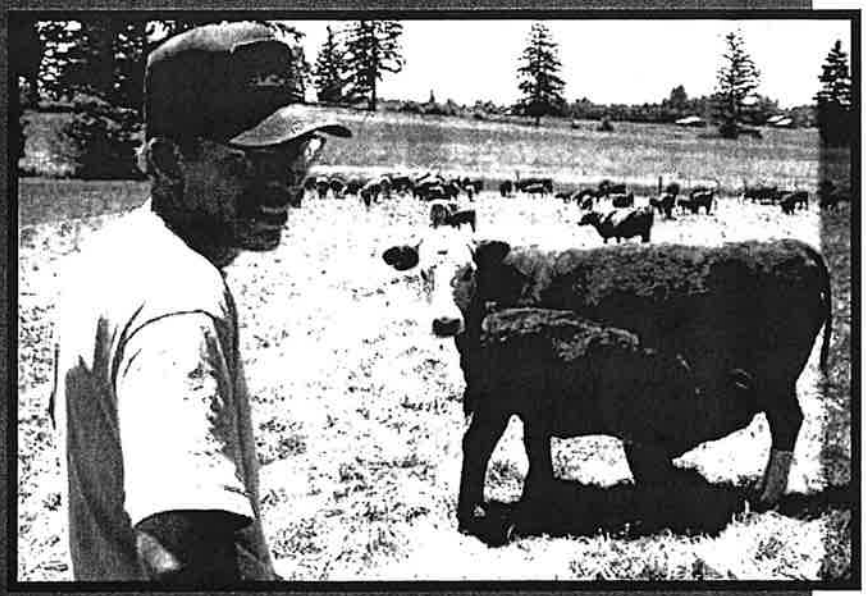
Liquid Manure Samples

- Liquid manure samples should be sampled after agitating the storage facility for the first application made in the spring (March-April) and for the last application in the fall (September-October).
- Put a bucket in the path of the gun or carefully take bucket sample of liquid manure from the liquid manure tank wagon .
- Fill a sample bottle with some of the liquid manure from the bucket and keep cool while in the field. (you can put the sample in a small cooler with some ice)
- Label the sample with the farm or operator name, date, and liquid manure sample.
- Freeze the sample until ready to ship to the lab.

EM 8954-E • January 2008

Estimating Plant-available Nitrogen from Manure





Oregon State University | Extension Service

Nutrient management plans for crops require estimates of plant-available nitrogen (PAN) provided by application of manure or compost. Recent developments have stimulated interest in utilizing manure nitrogen (N) as a resource. These factors include the following:

- Increased cost of N fertilizers
- Increased value of PAN from manure on farms using certified organic methods to produce crops or animal products
- Greater concern for the environmental effects of ammonia and nitrate loss
- Development of manure application equipment that can reduce ammonia loss (increase retention of PAN)
- Federal cost-share programs (usually administered by the Natural Resources Conservation Service) that pay producers to adopt practices that reduce N loss to the environment
- Efforts to reduce phosphorus buildup in manure-fertilized soils (when manure N is used more efficiently, the manure application rate to meet P needs can be reduced)

How to Use This Publication

This publication focuses on how to estimate PAN provided by manure. We do not address management of other nutrients or other aspects of manure management, such as manure sampling, calibration of application equipment, record-keeping, or post-application monitoring. See "For More Information" (page 19) for resources on these topics.

This publication is primarily designed for use by planners (agricultural professionals that assist farmers with nutrient management). We focus primarily on cropping systems west of the Cascades in Oregon and Washington.

This publication has two main parts:

1. Worksheet for calculating available nutrients supplied by manure application
2. Management practices that increase crop N utilization

The Worksheet can be used to do the following:

- Determine the manure application rate needed to supply a target amount of PAN
- Estimate the dollar value of PAN from the current year's manure application
- Estimate the value of additional PAN retained by immediate tillage or direct application (injection, banding, etc.)
- Assess the balance between PAN, P, and K supplied by manure
- Get a rough, long-term (10-year) estimate of PAN availability from manure
- Evaluate management options to increase crop N utilization

Management practices discussed in the second section of this publication can help farmers reduce N loss to the environment (water and air) and may provide economic benefit to some farmers.

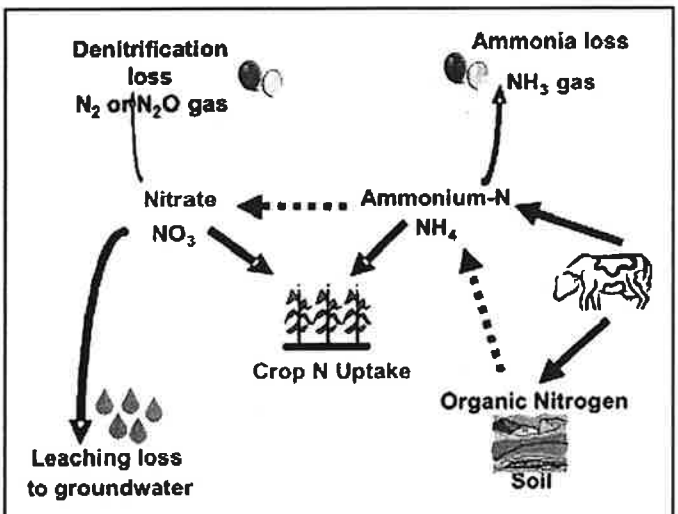


Figure 1. Where does manure N go? It can be taken up by the crop (green arrows) or lost to air or water (blue arrows). Organic N in the soil is converted to different forms by microbial activity (dotted arrows).

Nitrogen Forms and Cycling

The goal of N management is to efficiently deliver plant-available N (PAN) to a crop by maximizing crop utilization and minimizing losses to the environment. Plant roots take up nitrate and ammonium-N. Major losses of N to the environment occur when ammonia gas (NH_3) is lost to the air or nitrate (NO_3) is leached to groundwater. Losses of N via denitrification as N_2 or N_2O gas can be important under some conditions, but are generally small enough to be ignored in estimating PAN from manure.

Manures that contain mostly ammonium-N contain much PAN that is subject to volatilization (loss to the atmosphere) shortly after manure application. Manures that contain mostly organic N release much

Ask the laboratory to perform these analyses:

1. **Nitrogen:** total N and ammonium-N (NH_4-N). For compost only, also request an analysis for nitrate-N (NO_3-N). Other manures contain insignificant amounts of NO_3-N. To obtain an accurate value for manure NH_4-N, make sure the laboratory determines NH_4-N on a fresh sample (not a dried sample). Most of the manure NH_4-N is lost when samples are oven-dried.
2. **Phosphate and potash:** total P and total K. You will need analyses of P_2O_5 and K_2O for the Worksheet. Some labs report values in these units. If the lab reports only P, multiply P x 2.29 to calculate P_2O_5. If the lab reports only K, multiply by 1.2 to calculate K_2O.
3. **Manure dry matter (DM) or total solids.** The laboratory determines this value by oven-drying manure. This value enables you to express manure nutrient content on a dry weight or wet weight basis. Also, if manure analyses using wet weight fluctuate over time, manure DM can be used to determine whether the variation is due to changes in moisture or changes in nutrient content.

Manure N Availability Values

The worksheet estimates plant-available N (PAN) as:

PAN = NH_4-N retained after application
+ N mineralized from manure organic N in soil

The amount of manure NH_4-N retained is determined within the first week after application. In contrast, PAN is released from mineralization of manure organic N over a much longer period (Figure 2, page 7).

Estimating PAN from manure NH4-N

Under some conditions, ammonium (NH_4) is readily transformed to ammonia (NH_3) and is lost as a gas (Figure 1, page 3). Nitrogen lost as ammonia reduces PAN supplied by manure.

Management practices affect the amount of ammonium-N retained after manure application (Table 1):

- **Time to manure incorporation.** The sooner manure is incorporated into soil, the more ammonium-N is retained. After manure is in contact with soil, it is held as non-volatile ammonium-N (NH_4-N).
- **Manure dry matter (DM).** When manure is not incorporated or injected, the proportion of dry matter in manure determines the amount of ammonium-N retained. Solid manures remain on the soil surface, where most of the NH_4-N is lost to the atmosphere. Lagoon water, on the other hand, infiltrates soil rapidly, retaining almost all of its manure NH_4-N. With slurries, some of the NH_4-N infiltrates into the soil, and some remains with manure solids on the soil surface. The thicker the slurry, the less ammonium-N is retained.

  Composting. The pH value of finished compost is near 7 (usually 6.5 to 7.5). At pH values below 7.5, N remains in the ammonium form and is not subject to loss as ammonia gas.

Table 1 estimates the amount of ammonium-N retained after field application. To use this table, you will need information on:

- Manure dry matter
- Method of application
- Number of days before manure is incorporated

To use Table 1, find the column representing the kind of manure (lagoon water, slurry, solid, or compost) you will apply. Use the "lagoon water" column for water pumped from secondary lagoons, even if the dry matter content is above 1 percent. Use the "thick slurry" column if manure has greater than 5 percent dry matter, but can still be pumped as a liquid. Use the "solid" or "solid poultry" column for manures that are applied with a solid manure spreader. Use the "compost" column for well-composted materials that have an earthy odor with no discernable ammonia odor. If you smell ammonia in a material sold as compost, use the "solid" manure column in Table 1.

Next, find the "time to incorporation" (left column in Table 1) that best describes the typical time elapsed between manure application and tillage. Because ammonia is lost rapidly after application, immediate shallow incorporation often conserves NH_4-N more effectively than more intensive tillage the next day. When manure is broadcast, subsequent application of a half-inch of water via sprinkler irrigation or rainfall is considered as effective as tillage for moving NH_4-N into soil (provided the soil is not saturated).

If you use a directed application method (injection or banding), choose one of the application options at the bottom of Table 1. See "Conserve NH_4-N at application" (page 13) for additional information on directed incorporation methods.

Estimating PAN from mineralization of manure organic N

PAN is released from manure organic N through microbial activity in soil in a process called mineralization. This process is more rapid in soils that are warm and moist, and it is slower in soils that are cold or dry. Table 2 estimates the fraction of manure organic N that is released as PAN by mineralization.

Organic N mineralizes most rapidly during the first months after manure application. With time, the manure N mineralization rate slows. Figure 2 shows cumulative N mineralization for a variety of manures. The amount of N mineralized during the first year is strongly affected by the composition of manure (see "How Manure Composition Affects N Mineralization"). Mineralization rates for residual organic N (1 or more years after application) from many manures and composts are similar. However, it takes much longer for all of the manure organic N to mineralize from compost than from other manures.

The Worksheet (pages 11–12) tracks PAN from manure organic N over a 10-year period (Table 2). For the current year and for 1, 2, and 3 years ago, annual mineralization estimates are given. Long-term mineralization (4 to 9 years ago) is estimated at 2 percent per year and summed over the number of years (years manure applied x 0.02 per year). Table 3 shows examples of estimated N mineralization for manure (page 8) applied 4 to 9 years ago.

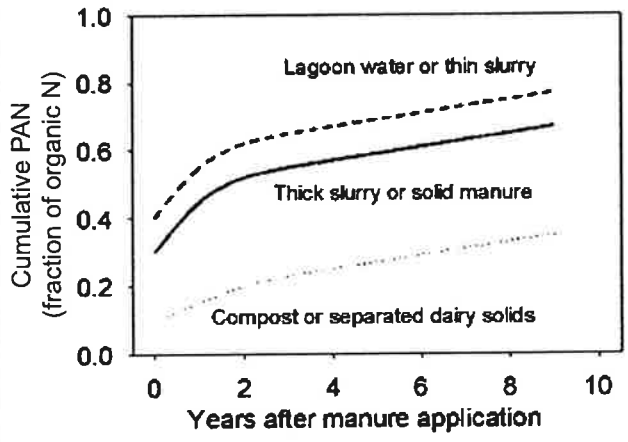


Figure 2. Cumulative PAN supplied by manure organic N, using the mineralization factors presented in Table 2. For this example, manure was applied in Year 0, with no subsequent manure applications. Slow release of PAN from mineralization continues beyond the 10-year period shown in the graph.

How Manure Composition Affects N Mineralization

The rate of mineralization in soil depends upon the "digestibility" of manure organic matter and its carbon:nitrogen (C:N) ratio. Separation of whole manure into liquids and solids segregates coarse and fine manure particles that have different organic composition and different mineralization rates. Fine particles in manure contain organic compounds with low C:N ratios (high protein) and are rapidly decomposed in soil. Coarse particles have higher C:N ratios (lower protein) and are more slowly decomposed in soil.

Because thin slurry and lagoon water contain the finest organic particles, these materials have the most rapid N mineralization rate. Thick slurry and solid manures contain a mixture of fine and coarse particles, so they have a lower N mineralization rate.

Solids separated from liquid manure by a mechanical separator (separated dairy solids) contain mostly coarse particles (bedding plus undigested feed). These solids have a unique pattern of mineralization over time in soil. Separated solids typically have negative N mineralization rates (PAN in soil decreases) for 4 to 8 weeks after application. After that, PAN is mineralized very slowly. Cumulative PAN from separated solids is much lower than for other fresh manures. The timing and amount of PAN release from horse manure is similar to that from separated dairy solids.

Separation of solids from liquid manure by gravity separation (settling basin or evaporation basin) does not change PAN, because the fine organic particles in the manure are recovered from the basin.

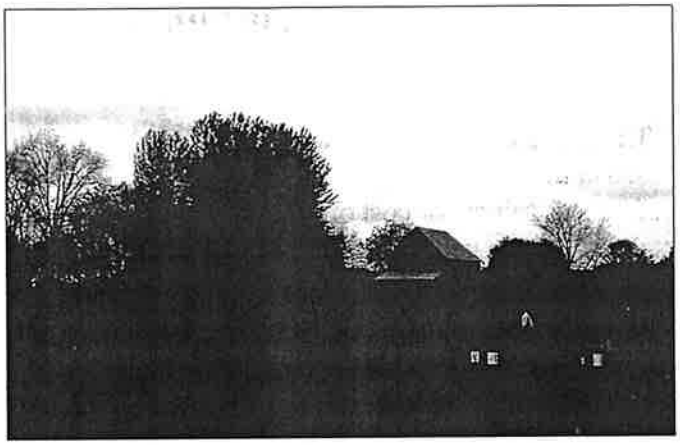
Composting manure reduces manure volume by 50 percent or more. During composting, some of the manure N is lost as ammonia gas, and some is transformed to more stable organic compounds. Compost organic matter decomposes very slowly in soil. Cumulative PAN for compost organic matter is similar to that of separated dairy solids.

Fresh poultry manure or broiler litter contains some organic N in the form of uric acid (similar to urea). In soil, uric acid is converted to PAN in 1 to 2 weeks. Most broiler litter sold as "compost" in western Oregon contains uric acid and behaves more like fresh litter than compost in terms of N availability. If you can smell ammonia in broiler litter, it probably is not thoroughly composted. Dry-stacking of broiler litter does not provide adequate moisture for composting.

Step 2. Calculate manure N applied.

Instructions

- Enter the manure application rate planned for this year and this year's manure organic N analysis.
- Enter manure application rate and organic N analyses for manure applied in previous years.



Example input data (Step 2)

This year's manure application:
Rate = 20,000 gal/acre
Manure organic N applied in previous years:

	Example	Example	Your information	Your information
	Manure application rate	Manure organic N analysis[a]	Manure application rate	Manure organic N analysis
Year	(units/acre)	(lb/unit)	(units/acre)	(lb/unit)
1 year ago	25,000 gal/acre	9 lb/1,000 gal		
2 years ago	15,000 gal/acre	5 lb/1,000 gal		
3 years ago	10,000 gal/acre	7 lb/1,000 gal		
4 to 9 years ago	15,000 gal/acre	6 lb/1,000 gal		

[a]Estimate from past manure analyses. Organic N = total N - NH_4-N.

Step 3. Estimate plant-available N (PAN) supplied by manure.

Instructions

Enter appropriate fractions for NH_4-N retention (Table 1, page 6) and fraction of organic N mineralized (Table 2, page 6).

Example input data (Step 3)

- Method of manure application: surface broadcast (splash plate)
- Time to incorporation by tillage or by 0.5 inch overhead sprinkler application: no incorporation within 7 days
- Fraction NH4-N retained at application (Table 1) = 0.55
- Fraction of organic N mineralized (Table 2)

Fraction of NH_4-N retained at application	
Example	**Your information**
0.55	

	Fraction of organic N mineralized	
Year	**Example**	**Your information**
This year	0.40	
1 year ago	0.15	
2 years ago	0.07	
3 years ago	0.03	
4 to 9 years ago (application every year)	0.02 per year x every year (6 years) = 0.12	

Worksheet: Estimating plant-available N from manure

Input cells are yellow.
Calculations are done for you in green boxes. (These cells contain equations.)
Final results for total PAN, P_2O_5, and K_2O are highlighted in blue text.

Note: The yellow cells contain example data. Replace the information in these cells with your own data. Before entering your data in the yellow cells, we recommend entering "0" in all yellow cells (to make sure you don't accidentally use the "example" data).

Note: We recommend turning off the following options in Acrobat Reader:
- Show border hover color for fields
- Auto-complete

To turn off these options, choose Preferences from the Edit menu (PC) or File menu (Mac). In the Preferences dialog box, chose Forms from the left-hand menu. Then make sure the buttons for these options are clicked OFF.

Step 1. Enter manure data

Instructions: Choose the manure application units that will be used througout this worksheet.

	Your information	Example
Kind of manure	thin dairy slurry	Thin dairy slurry

Choose manure application unit

Is wet manure measured in :

- ○ ton (solid or semisolid manure)?
- ◉ 1000 gallons (slurry or liquid)?
- ○ acre-inches (lagoon or holding pond effluent)?

Instructions: Enter "as-is" or "wet weight" manure analysis. If units are "lb nutrient/1000 gal," enter only "lb nutrient" in the boxes below.

This year's manure analysis
Nitrogen (N), lb/unit

	Your values	Example
Total N	10	10 lb/1000 gal
NH_4-N	6	6
Organic N	4	4

This year's manure analysis
Phosphate (P_2O_5) and potash (K_2O), lb/unit

	Your values	Example
P_2O_5	7	7 lb/1000 gal
K_2O	16	16

This year's manure analysis
Manure solids and moisture

Fraction	Your values	Example
Solids or DM	0.03	0.03
Moisture	0.97	0.97
Total	1.00	1.00

Step 2. Calculate manure N applied.

Instructions: Enter manure application rate for this year. Use application units chosen in Step 1.

	Your value units/acre	Example
Application rate selected	20	20,000 gallons

Instructions: Enter manure rate and manure analysis for 1–9 years ago.

Ammonium-N applied this year

Manure rate (units/ac)	NH_4-N analysis (lb/unit)	NH_4-N applied (lb/acre)
20,000 gal x 6 lb/1000 gal =		120
20	6	120

From manure analysis (this year):
6 lb NH_4-N per 1000 gallons

Organic N applied this year

Manure rate (units/ac)	Organic-N analysis (lb/unit)	Organic-N applied (lb/acre)
20,000 gal x 4 lb/1000 gal =		80
20	4	80

From manure analysis (this year):
4 lb organic N/1000 gal

Organic N applied in previous years

Year	Manure rate (units/ac)	Organic N analysis (lb/unit)	Organic N residual (lb/acre)
1 year ago	25,000 gal x 25	9 lb/1000 gal = 9	225
2 years ago	15,000 gal x 15	5 lb/1000 gal = 5	75
3 years ago	10,000 gal x 10	7 lb/1000 gal = 7	70
4 to 9 years ago	15,000 gal x 15	6 lb/1000 gal = 6	90

Manure organic N analysis (lb/1000 gal):
9 (1 year ago), 5 (2 year ago), 7 (3 year ago)
Estimated manure organic N 4 to 9 years ago = 6 lb/1000 gal

Management to Increase Crop N Utilization

Conserve manure NH_4-N at application

Directed application methods reduce exposure of slurry to the atmosphere, which reduces ammonia loss. When properly done, directed application increases NH_4-N retention, reduces odor, decreases the risk of manure runoff from the field, and allows for greater manure application uniformity. Directed application methods do not require a separate tractor trip across the field for slurry incorporation. Directed application methods (Figures 3 and 4) include:

- Injection below the soil surface
- Surface banding; placement of slurry in a line (band) on the soil surface
- Surface banding with partial incorporation of slurry into soil with a tillage implement

Many equipment configurations are available. Slurry is supplied to tractor-mounted application equipment through a drag hose or from a tanker. Many directed application methods are suitable for use with no-till or reduced tillage cropping systems.

Because surface banding does not completely cover slurry with soil, it does not increase NH_4-N retention as much as does injection (Table 1). However, surface banding methods require less power, are faster, and cause less damage to established grass than injection. An excellent discussion of advantages and limitations of various directed application systems (with photos) is provided in *Advanced Silage Corn Management* (Bittman and Kowelenko, 2004).

Equipment alternatives are discussed below and illustrated in Figures 3 and 4.

Preplant or side-dress for row crops (Figure 3). With this kind of equipment, one injection slot is made for each crop row. Options include:

- Deep injection (4 to 8 inches) into soil with a hose mounted on a knife or chisel (Figure 3a).

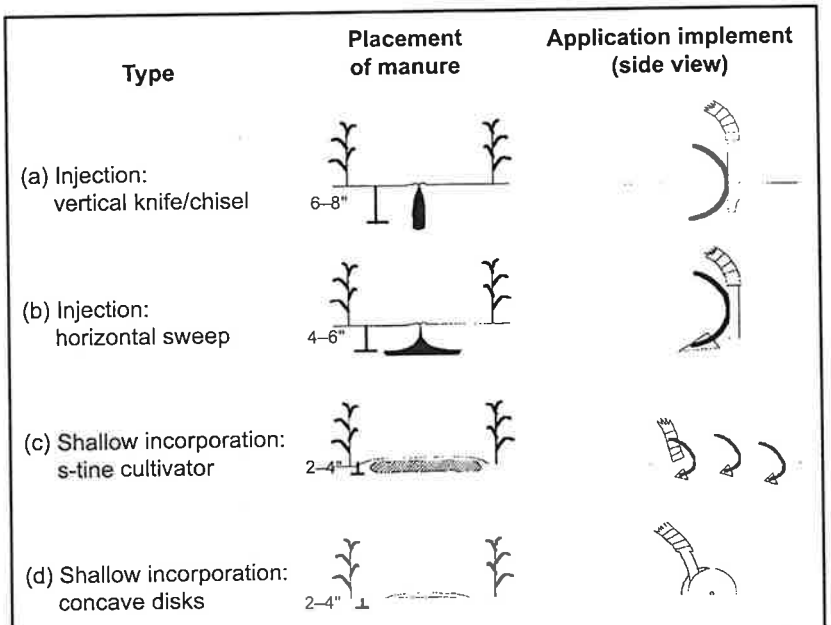


Figure 3. Directed application methods for row crops. Source: Jokela, W.E. and D. Côté. 1994. In NRAES-79. Natural Resource, Agriculture, and Engineering Service (NRAES), Ithaca, NY. www.nraes.org

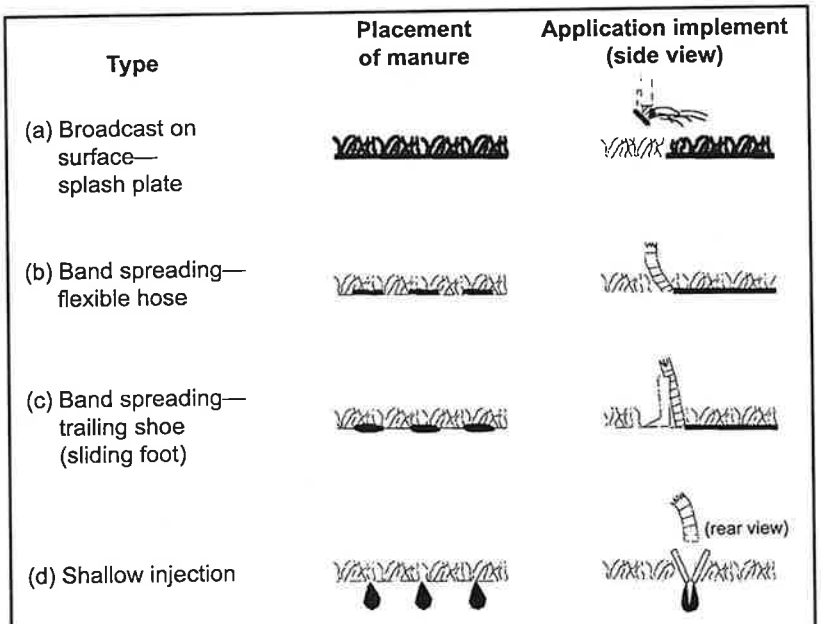


Figure 4. Directed application methods (b, c, d) for grasses or cereal crops vs. traditional broadcast manure application (a). Source: Jokela, W.E. and D. Côté. 1994. In NRAES-79. Natural Resource, Agriculture, and Engineering Service (NRAES), Ithaca, NY. www.nraes.org

Table 4. Effect of the timing of manure application on crop N utilization for crops grown west of the Cascades.[a] Best utilization of manure N = "high."

	Manure application date				
	March	April–June	July	August	September–February[b]
Crop	Crop N uptake utilization of first-year PAN[c, d]				
Corn for silage	Medium	High	Medium	Low	Very low
Grass pasture or grass for silage	High	High	High	Medium	Medium
Cereal or grass winter cover crop	High	Medium (April), very low (May–June)			Low
Grass seed crop	High	Medium (April), very low (May–June)	Medium (postharvest)	Medium	Medium
Summer annual forage crop (e.g., sudangrass)	Medium	High	High	Medium	Very low

[a] Excludes mechanically separated dairy solids and composts. These materials have "medium" or "high" crop N utilization because they release PAN slowly and in small amounts.

[b] September–February applications are not recommended where significant surface runoff is expected.

[c] PAN = First-year plant-available N from manure application.

[d] PAN utilization estimate given assumes that manure application rate is adequate, but not excessive, and that manure application does not cause significant damage to soil (compaction) or crop (smothering).

Take advantage of increased soil N mineralization rates

Repeated manure applications gradually increase the amount of PAN supplied from mineralization of residual organic N (manure organic N applied 1 or more years ago). This process is part of "soil building." The annual quantity of N mineralized from manured soils (in the absence of current-season manure application) typically is 1.5–2 times greater than from unmanured soils with similar soil and crop management regimes. This boost in soil N mineralization is accounted for in the Worksheet (pages 11–12) as "PAN from residual organic N."

Studies of soil biota (soil animals, nematodes, fungi, bacteria, etc.) show adaptation to repeated manure application. Biota communities adapted to manured soil typically have greater capacity to break down organic N compounds in manure that generally are resistant to decomposition. The proliferation of soil biota in manured soils also often improves soil tilth, which can increase root growth and crop N utilization. These changes in soil biota and tilth also contribute to "residual" manure effects (increasing PAN supply for the crop).

The rate of PAN release from residual organic N (1 or more years after manure application) is strongly affected by soil moisture and soil temperature, but it is not affected much by the kind of manure or compost applied the previous year. With irrigation, N mineralization rates are 2 to 4 times faster during the summer than during the cool season (October–March). Because soil is moist but not frozen for most of the winter at sites west of the Cascades, a small, but significant, amount of N mineralizes between October and March.

To take full advantage of PAN from soil organic matter mineralization, the field must have vegetative cover during the October–March period. Otherwise, nitrate-N released via mineralization during this period is likely to be lost by leaching. On fields with a history of frequent manure application, perennial grass growth typically continues for several weeks longer in the fall, and begins earlier in the spring, than on unmanured fields (even if manure was not reapplied in the early spring). The most significant long-term impact of manure application is evident in early spring (February and March) grass growth.

Crop rotation strongly affects PAN release from residual organic N. When rotating from perennial

Should denitrification loss estimates be included in N budgets for manure utilization?

The denitrification process (Figure 1, page 3) requires:

- Anaerobic soil conditions (lack of oxygen)
- Microbial activity
- Soil nitrogen in the nitrate form

Research conducted west of the Cascades has demonstrated that N loss via denitrification is typically less than 10 percent of N applied. Nitrate-N loss in the fall and winter is caused mainly by leaching. In spring, denitrification is limited by low concentrations of soil nitrate. In western Oregon and Washington, denitrification loss is not necessarily related to soil drainage class because seasonal high water tables usually occur in winter and spring when soil nitrate-N is low (e.g., it has already been leached out).

Because the amount of PAN lost by denitrification is generally small relative to other processes that affect PAN (timing and rate of manure application, NH_4-N retained at application, organic-N mineralized, nitrate-N leached) it is ignored in the Worksheet.

What can be done to conserve N on a whole-farm basis?

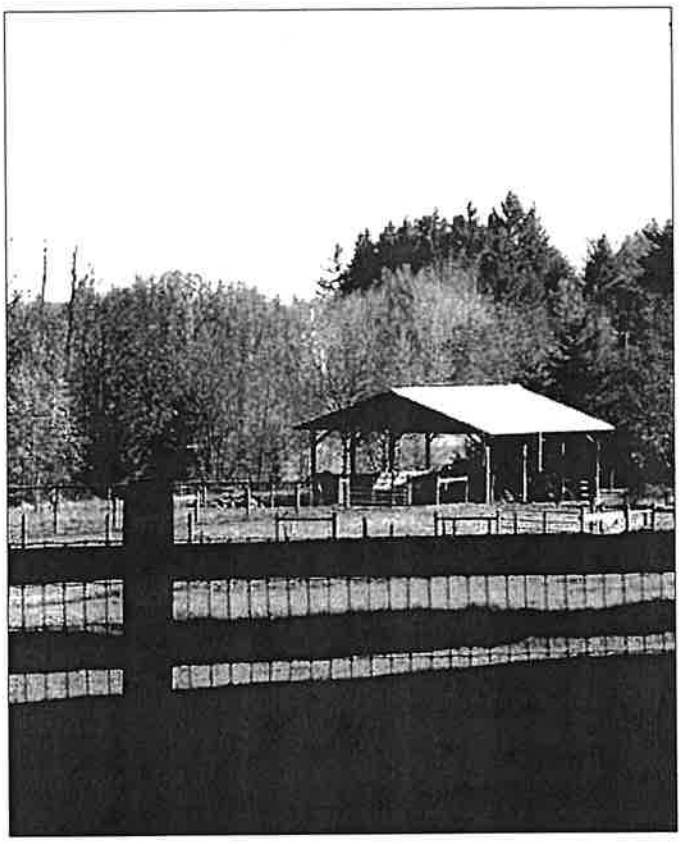
Much of the N lost from manure occurs prior to field application. An N-efficient whole-farm system includes:

- Feeding practices that maximize animal utilization of N
- Minimizing N loss in the barn
- Minimizing N loss in manure storage

Resources for improving whole-farm N utilization are available from the Livestock Poultry Environmental Stewardship program at: www.lpes.org

If manure is applied in fall, does it count as manure applied "this year" in the Worksheet?

The Worksheet allows you to define a "year" any way you wish. If you apply manure in the fall to perennial grasses, you may want to begin your "manure application year" after the last forage cut in the fall, since this manure N will be utilized by grass the following spring.



For crops other than perennial grasses, it is best to avoid fall application of manure because crop N utilization is low (Table 4, page 15). Most of the first-year PAN is lost from manure applied in the fall when crop N utilization is "low" or "very low" (Table 4).

Is the Worksheet a nitrogen budget or nitrogen recommendation?

The Worksheet provided in this publication is **not** a complete nitrogen budget or recommendation. The Worksheet focuses only on N supplied by manure application. A nitrogen recommendation considers other factors, including:

- N uptake/removal by crops
- N supplied from other sources (irrigation water, fertilizer, legumes)
- Typical mineralization rate for soil organic matter (unmanured soil)

For More Information

OSU Extension publications

Manure management

Bary, A.I., C.G. Cogger, and D.M. Sullivan. 2000. *Fertilizing with Manure*. PNW 533.

Downing T., D. Sullivan, J. Hart, and M. Gamroth. 2007. *Manure Application Rates for Forage Production*. EM 8585-E.

Laboratories

Hart, J. 2006. *Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis*. EM 8677.

Tracking nutrients on the farm

Downing, T. 2000. *Calculating Dairy Manure Nutrient Application Rates*. EM 8768.

Gamroth, M., T. Downing, and P. French. 2006. *Feed Management: A Tool for Balancing Nutrients on Dairies and Other Livestock Operations*. EM 8913-E.

Marx, E.S., N.W. Christensen, J. Hart, M. Gangwer, C.G. Cogger, and A.I. Bary. 1997. *Nutrient Management for Dairy Production: The Pre-sidedress Soil Nitrate Test (PSNT) for Western Oregon and Western Washington*. EM 8650.

Sullivan, D.M. and C.G. Cogger. 2003. *Post-harvest Soil Nitrate Testing for Manured Cropping Systems West of the Cascades*. EM 8832.

Sullivan, D.M., C.G. Cogger, and A.I. Bary. 1997. *Date, Rate, and Place: the Field Book for Dairy Manure Applicators*. PNW 506.

Sullivan, D.M and R.G. Stevens. 2003. *Agricultural Phosphorus Management Using the Oregon/ Washington Phosphorus Indexes*. EM 8848-E.

Additional Extension publications on manure and nutrient management are available at http://extension.oregonstate.edu/catalog/

Other resources

On-Farm quick tests for manure

Chadwick, D.R., S.K.E. Brookman, J. Williams, K.A. Smith, B.J. Chambers, I.M. Scotford, and T.R. Cumby. 2004. On-Farm Quick Tests for Manure. In: *Advanced Silage Corn Management*. http://www.farmwest.com

Manure application methods to reduce ammonia loss

Bittman, S. and C.G. Kowalenko, eds. 2004. *Advanced Silage Corn Management: a Production Guide for Coastal British Columbia and the Pacific Northwest*. Pacific Field Corn Association, Agassiz, BC.

Effects of weather and direct application methods on ammonia loss

An online calculator, Ammonia Loss from Applied Slurry Manure, is available at www.farmwest.com

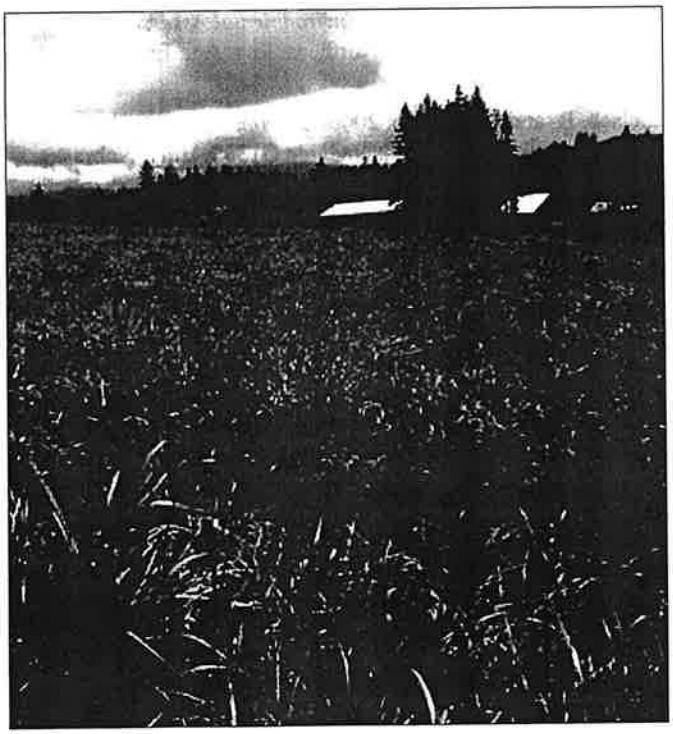
Organic fertilizer calculator

Andrews, N. and J. Foster. 2007. *Organic Fertilizer Calculator: A Tool for Comparing the Cost, Nutrient Value, and Nitrogen Availability of Organic Materials*. Oregon State University Extension Service publication EM 8936-E, available at http://smallfarms.oregonstate.edu/organic-fertilizer-calculator

Whole-farm nutrient management

Livestock and Poultry Environmental Stewardship Curriculum, available at http://www.lpes.org

National Livestock and Poultry Environmental Learning Center, available online at http://lpe.unl.edu



PAN from manures and composts in multiyear field studies

Bittman, S., C.G. Kowalenko, T. Forge, D.E. Hunt, F. Bounaix, and N. Patni. 2007. Agronomic effects of multi-year surface banding of dairy slurry on grass. Bioresource Tech. 98:3249–3258.

Cogger, C.G., A.I. Bary, S.C. Fransen, and D.M. Sullivan. 2001. Seven years of biosolids vs. inorganic nitrogen applications to tall fescue. J. Environ. Qual 30:2188–2194.

Sullivan, D.M., A.I. Bary, T.J. Nartea, E.A. Myrhe, C.G. Cogger, and S.C. Fransen. 2003. Nitrogen availability seven years after a high-rate food waste compost application. Compost Sci. Util. 11(3):265–275.

Sullivan, D.M., A.I. Bary, D.R. Thomas, S.C. Fransen, and C.G. Cogger. 2002. Food waste compost effects on fertilizer nitrogen efficiency, available nitrogen, and tall fescue yield. Soil Sci. Soc. Am. J. 66:154–161.

Sullivan, D.M., C.G. Cogger, A.I. Bary, and S.C. Fransen. 2000. Timing of dairy manure applications to perennial grass on well-drained and poorly drained soils. J. Soil Water Cons. 55:147–152.

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Post-harvest Soil Nitrate Testing

for Manured Cropping Systems West of the Cascades

D.M. Sullivan and C.G. Cogger

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What's in this publication?

This publication describes the use of post-harvest soil nitrate testing as a tool for assessment of nitrogen (N) management in manured cropping systems west of the Cascade Mountains in Oregon, Washington, and south coastal British Columbia.

The first section of this publication gives general information on the test and is designed for use by growers and dairy operators. This section gives a brief introduction to soil sampling, but does not provide all of the technical details. The focus is on how to use the post-harvest test to improve nutrient management. This section describes:

- What the post-harvest test measures
- How to collect soil samples
- Units used in soil nitrate testing
- How to interpret soil nitrate test results for grass and silage corn crops

In addition, background information explains the rationale for the test:

- How to use the post-harvest test as a management tool (page 3)
- Crop and soil response to excess plant-available N (page 4)

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How to use the post-harvest test as a management tool

Sampling depth and timing are critical. Interpretation tables for this test apply only to samples taken to a 12-inch depth. Surface soil (0 to 12 inches) typically contains the highest nitrate-N levels and requires the least time and effort for sample collection. Samples must be taken before heavy fall rains move nitrate below the 12-inch depth. The target sampling period generally is August 15 to October 15.

To get the most value from this test, it is important to understand:

- How the test fits into an overall nutrient management program
- Limitations to interpretation of test results
- How *not* to use the test

Using the test as part of a nutrient management program

The post-harvest test is but one measure of success in nutrient management. Post-harvest nitrate test data should be assessed in the context of the current N management plan and records of manure application. Successful N management involves a number of components, including:

- Assessing crop N needs
- Planning manure application to meet crop N needs
- Applying manure according to the plan
- Recording manure application amount and estimated plant-available N amount
- Measuring crop yield and N content
- Monitoring success of the plan

All components of the nutrient management system should be evaluated together.

Limitations to test results

Interpretive values for post-harvest soil nitrate are:

- Calibrated only for high-rainfall portions of the Pacific Northwest (west of the Cascades). Extrapolation to other environments is not recommended.
- Provided only for corn silage and grass hay/silage crops. Field research has been used as the basis for interpretive levels for these crops. Applicable research data are not available for other crops to determine post-harvest nitrate-N levels associated with good crop and nutrient management practices. However, the test may be used for relative comparisons among fields planted to another crop (e.g., comparisons among grass pasture fields).
- Based on the assumption that summer irrigation is less than, or close to, evapotranspiration to ensure that significant nitrate leaching does not occur before the fall test.
- Designed for fields with a history of applied manure (more than 3 consecutive years of regular manure application). Lower post-harvest soil nitrate test values are attainable where only fertilizer N is used, or where manure is applied infrequently.
- Based on good management of the crop and normal yields. Crop moisture stress, insect damage, or plant disease will reduce crop yield and crop uptake of nitrogen, thus increasing post-harvest soil nitrate test levels.

How *not* to use the post-harvest test

The test will *not*:

- Detect a shortage of plant-available nitrogen for crop production. Continual mineralization of nitrogen (conversion of organic N forms to plant-available N forms in the soil) can provide enough plant-available nitrogen for a crop without accumulation of nitrate-N in soil.
- Determine the source(s) of excess plant-available N. Sources of N may include manure slurry, lagoon water, fertilizer, soil organic matter, or previous crop residues.
- Predict crop response to fall manure or N fertilizer applications. The test does not predict the amount of plant-available N that will be mineralized from soil organic matter or crop residues in the fall.

Table 1.—Average calendar date when cumulative rainfall (after September 1) reaches 5 inches west of the Cascades.[a]

Cumulative rainfall after Sept. 1	Calendar date to reach specified cumulative rainfall							
	Medford (OR)	Salem (OR)	Tillamook (OR)	Coupeville (WA)	Centralia (WA)	Lynden (WA) Abbotsford (BC)	Agassiz (BC)	Comox (BC)
(inches)								
3	10 Nov	20 Oct	26 Sep	31 Oct	8 Oct	1 Oct	26 Sep	10 Oct
5	29 Nov	1 Nov	8 Oct	24 Nov	23 Oct	15 Oct	9 Oct	25 Oct
7	16 Dec	13 Nov	18 Oct	15 Dec	4 Nov	27 Oct	19 Oct	6 Nov

[a]Average daily precipitation data for many other locations is available at: Western Regional Climate Center (http://wrcc.dri.edu) or Environment Canada (http://www.msc-smc.ec.gc.ca/climate/climate_normals/index_e.cfm).

3 inches of cumulative fall rainfall. The starting date for calculating cumulative fall rainfall is September 1. Include inches of irrigation water applied after September 1 in your estimate of cumulative rainfall.

Table 1 shows the average calendar date when cumulative fall rainfall (after September 1) reaches 5 inches at a variety of locations. For most locations, sampling prior to October 15 is acceptable in an average year. In high rainfall areas (coastal areas and the Cascade foothills), plan to sample earlier. A late October sampling date usually is acceptable in lower rainfall areas of southern Oregon, the Puget Sound islands, Olympic Peninsula, or Vancouver Island.

Units used in soil nitrate testing

In this publication, interpretation of a post-harvest soil nitrate test (Tables 3 and 4) is based on units of parts per million (ppm). Some labs report soil test nitrate-N in units of lb/acre by assuming a standard value for soil bulk density. If the lab reports nitrate-N results in pounds per acre, ask them to provide a conversion factor to express data in units of ppm. The conversion factor assumed by laboratories usually is between 3 and 4, because 1 acre-foot of dry soil usually weighs about 3.5 million pounds (3.5 lb per acre-foot = 1 ppm).

Table 2.—Units used to report soil nitrate analyses.

Name	Interpretation	Equivalent units
nitrate-N or NO_3-N	N present in the nitrate form, soil dry weight basis	mg/kg or ppm (dry weight basis)

Interpreting soil nitrate test results

Data quality and variability

The first step in evaluating your soil nitrate data is to verify data quality. Determine whether the sample collection method, timing of sample collection, sample preservation, and laboratory analysis methods are acceptable. Reject data that did not result from reasonable protocols. For example, Tables 3 and 4 should not be used for soil samples collected in November after heavy fall rains.

Make sure that you understand the units used to report test results. See Table 2 for an explanation of units found in soil test reports.

Table 3.—Silage corn. Suggested interpretation for post-harvest soil nitrate-N (0- to 12-inch depth).[a]

If post-harvest nitrate-N is less than 20 ppm (less than approximately 70 lb N per acre)

- Continue present N management.

If post-harvest nitrate-N is 20 to 45 ppm (approximately 70 to 160 lb N per acre)

- Reduce or eliminate sidedress N fertilizer application. Use the pre-sidedress nitrate test (PSNT). Apply sidedress N only when PSNT indicates a need.
- Reduce lagoon water application after August 1.
- Keep records to document crop yield, dry matter, and crop N removal. Total applied manure-N + fertilizer-N should be less than 125 percent of documented crop N removal.
- Reduce manure application on fields where corn follows grass sod plow-down.
- Plan to reduce manure-N application by 10 to 25 percent.
- Improve whole farm N balance.

If post-harvest nitrate-N is greater than 45 ppm (greater than approximately 160 lb N per acre)

- Apply only starter N (20 to 40 lb N/acre at planting).
- Plan not to sidedress N fertilizer in June. Apply sidedress N only when PSNT indicates a need.
- Eliminate lagoon water application after August 1.
- Keep records to document crop yield, dry matter, and crop N removal. Apply manure N at a rate less than or equal to crop N removal (approximately 200 lb total N per acre).
- Eliminate manure application on a few fields or a few strips within a field next year to determine the contribution of mineralized N vs. current-season application of manure.
- Plan to reduce manure-N application by 25 to 40 percent.
- Consult experts to improve whole farm nutrient balance.

[a]The post-harvest test values listed above are for the *end* of a growing season. Management changes (if needed) should be implemented in future years. Interpretive values assume near-optimum crop yields. If yield is below average, improve agronomic practices to increase crop yield and crop N uptake.

Detailed suggestions for soil sampling and planning

Collecting, preserving, and analyzing the soil sample

Tools for field sampling

Collect a sample that is representative of the entire sampling depth. For example, a representative sample for a 0- to 12-inch depth has the same amount of soil from the soil surface (0 to 6 inches) and from the bottom of the sampling depth (6 to 12 inches).

Always use a tool specifically designed for soil sampling. Don't use a shovel, because the samples won't be uniform with depth. Tools for soil sampling often are called soil probes or augers. There are several kinds available.

Push probes are tubes that you push into the soil. They have a T-shaped handle attached to a cylindrical tube (about 1 inch diameter) with a beveled tip. The tube collects a cylinder, or "core," of soil. Push probes work well in soft, uncompacted soils.

Hammer probes are designed for hard or compacted soils. They have a sliding weight (hammer) instead of a T-handle to drive the probe into soil.

Soil test consultants often use hydraulic probes mounted on a tractor or pickup to sample soils. These reduce the time and effort of sampling in hard soils. Gravelly and rocky soils are difficult to sample. A hydraulic probe with a rotating auger can sample some gravelly soils.

A mud auger or bucket auger is the best tool for hand-sampling at sites that are difficult to sample with push probes. Use an auger for compacted, muddy, rocky, or dry soils. Augers can be purchased from several manufacturers. A 2- to 4-inch diameter mud auger (open-sided) works best for most situations because it is easy to remove the sample from the bucket. Use a larger diameter auger for soils with large rocks. Augers sample a 4- to 6-inch depth. You will need to take several bites from the same hole to sample to 12-inch depth. You will collect a larger sample volume, about 5 to 10 times that collected with a push tube. Because of the extra effort required for auger sampling, use this method only if other sampling methods are difficult or impossible.

Field sampling protocol

Plan ahead. Use field maps and soil maps to divide the farm into different management units. A management unit is usually a field, but you may want to subdivide a large field if sections can be managed separately for nutrient application. The simplest approach is to collect a composite sample from the entire management unit. You may choose to restrict sampling to the dominant soil type if the management unit has soils that differ markedly in visual appearance (soil color, texture, organic matter).

Alternatively, you can restrict your sampling to a representative area (usually about an acre in size) within the management unit. Choosing a representative area within the field where manure application rate, timing, and uniformity are well documented is essential. If you use the "representative area" sampling approach, record the sampling location using a GPS receiver or record the distance from a fixed location (e.g., fenceline).

Avoid large buffer zones that are sometimes present adjacent to water bodies or roads, especially with big gun manure applicators. Avoid small atypical areas such as:

- Swales
- Very rocky or shallow soil (less than 12 inches deep)
- Site of an old manure pile or a feeding, watering, or resting area for livestock
- Abandoned field roads
- Field edges

Find out how the lab reports soil test data. Standard units for soil nitrate-N are parts per million (ppm, Table 2). If you aren't familiar with the lab, it's a good idea to obtain a copy of a sample laboratory report.

Because you will use sample results to compare post-harvest soil nitrate across years, laboratory consistency over time is a major issue. A standard reference sample (soil sample with known concentration of nitrate) can help you assess laboratory variability. Consider submitting a standard reference sample (approximately 50 to 100 g dry weight) with a nitrate-N concentration of 20 to 45 ppm with each batch of soil samples. Keep track of test results for the standard reference sample over time. If you note a major error in the nitrate concentration reported for the standard reference sample, then the test data is questionable.

Standard reference samples are available from the North American Proficiency Testing Program (see "For more information," page 15). Standard reference samples must be dried, ground, and thoroughly mixed.

We do not recommend that you split a field sample to check laboratory consistency. The one-time nature of such comparisons, the uncertainty of obtaining a homogeneous sample, and the uncertainty of sample preservation in-transit to the lab limit the interpretation of split-sample data.

Developing a sampling plan

Nutrient management plans can be voluntary, required by regulatory agencies, or a part of an agreement with a conservation planning agency (e.g., Natural Resources Conservation Service or conservation district). If your nutrient management plan is not voluntary, consult the agency that supervises your nutrient management plan to determine whether they have specific requirements for how often fields must/should be sampled. Suggestions given here for sampling frequency are general in nature and are not intended to serve as policy for any agency.

Representative fields for long-term monitoring

Representative fields are fields that you sample every year to track trends in sample values over time. Select fields that represent typical management practices. Criteria that can be used to choose representative fields include: (1) records or estimates of annual manure application rate, (2) number of years of continuous manure application, (3) soil test values for P and K. On dairies where P and K fertilizers are not routinely applied, soil test values above 75 ppm P (Bray P1 method) and 400 ppm K (ammonium acetate method) usually reflect substantial manure application in the past.

Sample the representative fields every year to assess trends over time. If you grow corn silage and perennial grass forage, plan to sample at least four grass fields and four corn fields each year. At a small dairy (fewer than four fields), sample all fields each year.

Other fields

Periodically, you will need to evaluate the fields not designated as "representative" fields. Consider sampling all fields every 3 years. Compare whole farm soil data to representative field data.

If you have only a few fields with elevated soil test N, then focus management on those fields. If all fields on the farm give similar test data, then focus your N management efforts at the whole farm level. If representative fields consistently have test values of less than 15 ppm (grass) or less than 20 ppm (corn) over a 3-year period, and all other fields sampled have similar test values, consider reducing the number of post-harvest soil nitrate tests.

What other soil tests can be used to provide information to guide N management for corn?

Soil nitrate testing in spring and early summer can assist with N management for silage corn. Test soil ammonium + nitrate-N several weeks after a spring manure application to track early-season N availability. Test soil nitrate when corn is at the four- to six-leaf stage (pre-sidedress nitrate test, PSNT) to determine the need for sidedress N application to corn.

How much variability should I expect in post-harvest nitrate-N test values for the same grass field sampled between August 15 and October 15?

It all depends on weather, soil biology, and crop management. A good stand of actively growing grass can maintain nitrate-N concentrations of less than 15 ppm throughout the post-harvest sampling period. Where soil is dry in late summer, increased N availability may occur for 2 or 3 weeks following the first heavy rain. It may be useful to take several soil nitrate tests from the same field in the fall to document changes in nitrate concentration with time. Soil nitrate values given in the interpretive table in this publication are for typical precipitation and sampling date.

Ammonium-N is plant-available. Why doesn't the post-harvest test include ammonium-N analysis?

Post-harvest ammonium-N analyses cost money, and they do not yield reliable interpretive information. Ammonium-N does not accumulate in soils supplied with an excess of plant-available N. It is rapidly converted to nitrate. Soil samples taken at least 30 days after manure application usually have negligible ammonium-N concentrations unless soil has remained dry.

Drying of soils after sampling releases ammonium-N from microbial biomass. Most dried soils have 2 to 20 ppm ammonium-N that is caused by the soil drying process. Dry soil ammonium-N concentrations are poorly correlated with other indices of N availability in controlled experiments.

Should post-harvest nitrate tests be used for fields with organic soils?

Other methods should be used to assess the success of nutrient management plans on organic soils. Goals for post-harvest nitrate-N of less than 20 ppm are difficult if not impossible to attain on organic soils, which contain more than 20 percent organic matter. These soils formed as organic matter accumulated under natural poorly drained conditions. Soil organic matter decomposition and N mineralization processes are greatly accelerated under typical farming practices such as artificial drainage and tillage.

Should I measure or estimate soil bulk density to estimate post-harvest nitrate-N in units of pounds per acre?

The variation in bulk densities among soils typically is less than the variation associated with soil nitrate sampling and testing. Interpretive information in this publication is based on units of parts per million (ppm; mg per kg dry soil). You can approximate soil nitrate-N in the surface foot of soil by assuming typical bulk density (ppm x 3.5 = lb/acre). This conversion factor is based on the weight of 1 acre-foot of soil at a bulk density of 1.3 g cm^3 (1 acre-foot = 3.5 million lb). Organic soils (more than 20 percent organic matter) have lower bulk density (0.6 to 0.8 g cm^3).

What is whole farm nutrient management?

The goals of whole farm management are: (1) to move toward a balance of nutrient imports and exports, and (2) to utilize nutrients on the farm at agronomic rates that minimize nutrient losses to the environment. Managing nutrients at the whole farm level requires knowledge of the major nutrient imports, major nutrient exports, crop

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Many OSU Extension Service publications, as well as additional gardening information, may be viewed or downloaded from the Web (http://eesc.oregonstate.edu).

Copies of many of our publications and videos also are available from OSU Extension and Experiment Station Communications. For prices and ordering information, visit our online catalog (http://eesc.oregonstate.edu) or contact us by fax (541-737-0817), e-mail (puborders@oregonstate.edu), or phone (541-737-2513).

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Soil Test Interpretation Guide

E.S. Marx, J. Hart, and R.G. Stevens

Regular soil testing is an important element in nutrient management. You can use soil tests as a diagnostic tool or to identify trends through time. To obtain meaningful test results, you must sample soil correctly, at the same time each year, and you must maintain records. For more information, see EC 628, *How to take a soil sample. . .and why (*see "For more information," page 7).

Soil testing laboratories use different test methods, which may influence results and sufficiency ranges. Therefore, the sufficiency ranges in this publication are accurate only for the test methods listed.

Soil tests used to evaluate fertility measure the soil nutrients that are expected to become plant-available. They do not measure total amounts of nutrients in the soil. Measurements of total nutrient content are not useful indicators of sufficiency for plant growth, because only a small portion of the nutrients are plant-available.

Adequate soil nutrient levels vary depending on plant species. Similarly, plant tolerance of excessive nutrient levels, nutrient imbalances, or less-than-optimum growing conditions varies. If excessive nutrient levels exist, review management to determine the cause.

Nutrient concentrations vary with soil depth. Depth of sampling, therefore, affects test results. To determine the proper sampling depth, you must consider the purpose of the soil test. To estimate nutrient availability for a crop prior to planting, sample soil to the depth where most root activity will occur. Shallow sampling sometimes is used to evaluate surface conditions in perennial crops where fertilizers have been applied to the soil surface. Deep sampling may be necessary to diagnose problems in orchards.

Soil test values do not vary greatly from year to year. Drastic changes in test values may indicate an unrepresentative soil sample or a laboratory error. When in doubt, submit a new sample or ask the lab to repeat the analysis.

This publication provides general guidelines for interpreting soil test results. Fertilizer guides for many individual crops are available from your county office of the OSU Extension Service or Washington State University Cooperative Extension, or from Extension and Experiment Station Communications, Oregon State University (see "For more information").

Nitrogen (N)

Plant-available nitrogen (nitrate and ammonium)

Plant-available forms of nitrogen are nitrate (NO_3^--N) and ammonium (NH_4^+-N). Soil concentrations of NO_3^--N and NH_4^+-N depend on biological activity, and therefore fluctuate with changes in conditions such as temperature and moisture. Nitrate is easily leached from the soil with high rainfall or excessive irrigation. Soil tests can determine NO_3^--N and NH_4^+-N concentrations at the time of sampling, but do not reflect future conditions.

When you collect samples for nitrogen testing, keep them cold, or dry them immediately to prevent NO_3^--N and NH_4^+-N concentrations from changing.

E.S. Marx, former research assistant in soil science, and John Hart, Extension soil scientist, Oregon State University;
and Bob Stevens, Extension soil scientist, Washington State University.

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Cations

Of the three primary cations (potassium, calcium, and magnesium), potassium requires the most management attention. Few crops have responded to calcium and magnesium in the Pacific Northwest.

If extremely high levels of a single cation exist, plant deficiencies of other cations may occur due to competition for plant uptake.

The soil test ranges in Tables 3, 4, and 5 are for the ammonium acetate extraction method. If a sodium bicarbonate ($NaHCO_3$) extraction is used, test values may be slightly lower.

Potassium (K)

Excessive soil potassium levels can result in elevated K levels in grass forage crops, which may be detrimental to animal health.

Table 3.—Extractable potassium (K).

	K
low	<150 ppm* <0.4 meq/100 g soil
medium	150–250 ppm 0.4–0.6 meq/100 g soil
high	250–800 ppm 0.6–2.0 meq/100 g soil
excessive	>800 ppm >2.0 meq/100 g soil

*See Table 13 (page 7) for conversions from ppm to meq/100 g soil.

Calcium (Ca)

Calcium deficiencies usually are found only on very acid soils. They can be corrected by liming with calcium carbonate ($CaCO_3$).

Table 4.—Extractable calcium (Ca).

	Ca
low	<1,000 ppm* <5 meq/100 g soil
medium	1,000–2,000 ppm 5–10 meq/100 g soil
high	>2,000 ppm >10 meq/100 g soil

*See Table 13 (page 7) for conversions from ppm to meq/100 g soil.

Magnesium (Mg)

Magnesium deficiencies on acid soils can be corrected by liming with dolomitic lime.

Magnesium toxicity can occur on serpentine soils in southwest Oregon.

Table 5.—Extractable magnesium (Mg).

	Mg
low	<60 ppm* <0.5 meq/100 g soil
medium	60–180 ppm 0.5–1.5 meq/100 g soil
high	>180 ppm > 1.5 meq/100 g soil

*See Table 13 (page 7) for conversions from ppm to meq/100 g soil.

Sulfate-sulfur (SO_4^{2-}-S)

Plants absorb sulfur in the sulfate (SO_4^{2-}-S) form. In high rainfall areas west of the Cascades, SO_4^{2-} is readily leached, and soil test data are not well correlated with plant growth. In arid regions east of the Cascades, soil test information may be useful. Also, irrigation water may contain significant amounts of sulfate-sulfur. Plant analysis often is useful for diagnosing sulfur deficiency.

Table 6.—Sulfate-sulfur, east of the Cascades.

	SO_4^{2-}-S (ppm)
low	<2
medium	2–10
sufficient	>10

Micronutrients

Deficiencies of micronutrients other than boron and zinc are uncommon. Availability of most micronutrients is largely pH-dependent; availability decreases as pH increases (except for molybdenum, which becomes more available as pH increases). Deficiencies rarely occur in soils with pH below 6.5.

Soil testing for micronutrients other than boron and zinc is recommended only when a deficiency is suspected. If you suspect a micronutrient deficiency, plant tissue testing may be a better diagnostic tool than soil testing.

pH, lime requirement (LR)

Soil pH is a measure of soil acidity. Most crops grow best if the soil pH is between 6.0 and 7.5.

Table 9.—Soil pH ranges.

	pH
strongly acid	below 5.1
moderately acid	5.2–6.0
slightly acid	6.1–6.5
neutral	6.6–7.3
moderately alkaline	7.4–8.4
strongly alkaline	above 8.5

Soil pH can be increased by liming. The soil pH test indicates *if* lime is needed. The lime requirement test determines *how much* lime is needed. Accurate lime recommendations cannot be made without performing an SMP or similar test.

SMP* lime requirement test

The SMP lime requirement test is used to estimate the amount of lime required to raise the pH of 6 inches of soil. The SMP test is performed by mixing soil with a buffered pH 7.5 solution and determining the pH of the mixture. During the reaction, the soil's reserve acidity lowers the pH of the SMP solution. Soils with low SMP values have high reserve acidity and high lime requirements.

Some soils may have a low pH (<5.3) and a fairly high SMP buffer value (>6.2). This condition can be caused by the application of fertilizer. In this case, the low pH value is temporary, and the pH of the soil will increase as the fertilizer completes its reaction with the soil.

Sandy soils also may have a low pH and high SMP buffer value. This condition occurs because sandy soils have low amounts of reserve acidity due to low cation exchange capacity (CEC). In such cases, a light application of lime (1 to 2 t/a) should suffice to neutralize soil acidity.

Table 10 is used to determine the amount of lime required, based on the SMP test, to raise soil pH to a desired level. The target pH is determined by the crop to be grown and possibly by other factors.

*SMP stands for Shoemaker, MacLean, and Pratt—the people who developed the test.

Without an SMP or similar test, there is no way to know how much lime is required to adjust soil pH to a desired level. Accurate lime recommendations cannot be made solely on the basis of soil pH.

Table 10.—SMP lime requirement—field scale.

SMP buffer	Tons/acre of 100-score lime needed to raise pH of surface 6 inches of soil to the following pH's			
	5.3	5.6	6.0	6.4
6.7	—	—	—	—
6.6	—	—	—	1.1
6.5	—	—	1.0	1.7
6.4	—	—	1.1	2.2
6.3	—	—	1.5	2.7
6.2	—	1.0	2.0	3.2
6.1	—	1.4	2.4	3.7
6.0	1.0	1.7	2.9	4.2
5.9	1.4	2.1	3.3	4.7
5.8	1.7	2.5	3.7	5.3
5.7	2.0	2.8	4.2	5.8
5.6	2.3	3.2	4.6	6.3
5.5	2.6	3.6	5.1	6.8
5.4	2.9	3.9	5.5	7.3
5.3	3.2	4.3	6.0	7.8
5.2	3.6	4.7	6.4	8.3
5.1	3.9	5.0	6.9	8.9
5.0	4.2	5.4	7.3	9.4
4.9	4.5	5.8	7.7	9.9
4.8	4.8	6.2	8.2	10.4

Example: If the "SMP buffer" value is 5.9, the amount of lime needed to raise the pH to 6.0 is 3.3 tons of 100-score lime/acre.

Table 11.—SMP lime requirement—gardens.

If the SMP lime requirement test is	Apply this amount of lime (lb/1,000 ft²)
5.4 or below	250
5.5–6.0	150–250
6.0–6.5	100–150
above 6.5	0

Some plants, such as blueberries, rhododendrons, azaleas, and cranberries, grow best in acid soils. Fertilizers such as ammonium sulfate can help maintain acidic conditions.

For more information

Hart, J. *Analytical Laboratories Serving Oregon*, FG 74 (Oregon State University, Corvallis, reprinted 1997). No charge

Hart, J. *How to take a soil sample. . .and why,* EC 628 (Oregon State University, Corvallis, revised 1995). No charge

Marx, E.S., N.W. Christensen, J. Hart, M. Gangwer, C.G. Cogger, and A.I. Bary, *The Pre-sidedress Soil Nitrate Test (PSNT) for Western Oregon and Western Washington*, EM 8650 (Oregon State University, Corvallis, reprinted 1997). 75¢

Fertilizer guides for individual crops are available. Request our catalog to see a complete listing.

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To order the publications listed above, send the publication's complete title and series number, along with a check or money order for the amount listed, to:

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Fax: 541-737-0817

If you would like additional copies of this publication, *Soil Test Interpretation Guide*, EC 1478, send $1.50 per copy to the above address.

You may order up to six no-charge publications without charge. If you request seven or more no-charge publications, include 25 cents for each publication beyond six.

We offer discounts on orders of 100 or more copies of a single title. Please call 541-737-2513 for price quotes.

Table 13.—Conversions.

To convert column 1 into column 2, *divide* by	**Column 1**	**Column 2**	**To convert column 2 into column 1, *multiply* by**
390	ppm K	meq K/100 g soil	390
200	ppm Ca	meq Ca/100 g soil	200
121	ppm Mg	meq Mg/100 g soil	121
230	ppm Na	meq Na/100 g soil	230
1	meq/100 g soil	cmol/kg soil	1
2*	lb/acre (7 inch depth)	ppm	2*
3.65*	lb/acre (1 foot depth)	ppm	3.65*
43.56	lb/acre	lb/1,000 sq ft	43.56
43,560	square feet	acres	43,560
2.471	acres	hectares	2.471

*These values vary with soil bulk density.

EM 8585-E • Revised July 2007

NUTRIENT MANAGEMENT
FOR DAIRY PRODUCTION

Manure application rates for forage production

T. Downing, D. Sullivan, J. Hart, and M. Gamroth

Most dairies can supply all the nitrogen, phosphorus, potassium, and other nutrients needed for forage production by applying manure to forage crops. As a manager, your goal is to match nutrient supply with crop needs by deciding when and how much manure to apply.

This publication explains how to estimate the amount of manure to apply for forage production. To do so, you need:

- A current manure analysis for your dairy (see *Dairy Manure as a Fertilizer Source*, EM 8586)
- A list of forage crops to be produced
- A soil test for phosphorus and potassium from each field where manure will be applied

Applying too much manure leads to several problems. First, plants take up excess amounts of nutrients such as potassium. High-potassium grass forages can lead to health problems, especially in dry cows. Second, excess manure can add nutrients and microorganisms to runoff or surface water, and can provide nitrogen that can leach into groundwater.

Application rates in this publication are based on soil tests and growing conditions in western Oregon.

Manure analysis

Analyzing manure is critical to determining the correct application rate. If you don't test your dairy's manure, you can only guess its nutrient value.

Manure testing in western Oregon has shown more variation among dairies than within one dairy. Develop a manure nutrient history for your dairy by testing manure two or three times a year for 2 or 3 years. These records will help you manage nutrient resources.

Have manure analyzed for total nitrogen (N), ammonium nitrogen (NH_4-N), phosphorus (P), and potassium (K). Laboratories often perform these as a standard analysis package.

Call your county office of the OSU Extension Service or your local USDA Natural Resources Conservation Service office for sampling directions. *Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis* (EM 8677) lists laboratories that test manure.

Crop nitrogen requirements

Nitrogen (N) typically is the limiting nutrient for crop production on dairies. Table 1, page 3, shows the estimated nitrogen removal rate (or uptake) for average yields of the most common forage crops grown on dairies. Values in the upper part of the table are on a dry matter (DM) basis; in the lower part, as-harvested values are adjusted for moisture. For example, 1 ton of forage dry matter is equivalent to 4 tons of harvested forage if the silage is 25 percent DM. When discussing nutrient removal, you need to know whether you are dealing with as-harvested or dry-matter values so that you can interpret values correctly.

Troy Downing, Extension agriculture faculty (dairy), Tillamook County; Dan Sullivan, Extension soil scientist; John Hart, Extension soil scientist; and Mike Gamroth, Extension dairy specialist; all of Oregon State University. This publication replaces EC 1094, *Calculating the Fertilizer Value of Manure from Livestock Operations*.

Oregon State University | Extension Service

Table 1.—Nitrogen, phosphorus, and potassium removal of common perennial and annual forage crops.

Crop (dry matter)	Cuttings (no.)	DM[1] (%)	CP[1] (%)	N (lb/t)	P (lb/t)	K (lb/t)	DM (t/a)	N used (lb/a)
Red clover	1	100	18	58	8	48	4	232
Alfalfa hay	3	100	20	64	8	42	5	320
Perennial grass (low intensity)	1–2	100	10	32	6	38	4	128
Perennial grass (medium to low intensity)	2–3	100	12	38	6	38	4.5	171
Perennial grass (medium intensity)	4–5	100	15	48	7	38	5	240
Perennial grass (medium to high intensity)	5–6	100	18	58	8	40	6	348
Perennial grass (high intensity)	6–8	100	20	64	8	40	7	448
Annual ryegrass	1	100	12	38	6	38	4	152
Annual ryegrass	2	100	15	48	7	40	5	240
Corn silage	1	100	8	25	4	20	8	200
Small grains (boot stage)	2	100	12	38	5	32	5	190
Small grains (soft dough)	1	100	8	25	5	30	4	100
Crop (as harvested)	**Cuttings (no.)**	**DM[1] (%)**	**CP[1] (%)**	**N (lb/t)**	**P (lb/t)**	**K (lb/t)**	**AH[1] (t/a)**	**N used (lb/a)**
Red clover	1	25	5	14	2	12	16	232
Alfalfa	3	30	6	19	2	12	16	320
Perennial grass (low intensity)	1–2	30	3	10	2	11	13	128
Perennial grass (medium to low intensity)	2–3	30	4	11	2	11	15	171
Perennial grass (medium intensity)	4–5	30	5	14	2.1	11	17	240
Perennial grass (medium to high intensity)	5–6	30	5	17	2.4	12	20	348
Perennial grass (high intensity)	6–8	30	6	19	2.4	12	23	448
Annual ryegrass	1	30	4	11	1.8	11	13	152
Annual ryegrass	2	25	4	12	1.8	10	20	240
Corn silage	1	25	2	6.7	1	5	30	200
Small grains (boot stage)	2	30	4	11	1.5	10	16	190
Small grains (soft dough)	1	30	2	8	1.5	9	13	100

[1]DM=dry matter; CP=crude protein; AH=as harvested

where manure has been applied unless the applications were light and a high yield of grass hay was removed. A manure application that meets crop N needs usually supplies sufficient amounts of P and K. Manure contains as much, if not more, K than N. For more information, see *Dairy Manure as a Fertilizer Source* (EM 8586).

In fact, fields that have received manure for a decade or more often have high soil test values for P and K. Fields with soil test K above 1,000 ppm can produce grass forage with a high K concentration. Dry cows fed grass forage containing more than 3 percent K may become seriously ill or die.

In some cases, a soil test shows excessive K, but N is needed. In this case, if another area is available for manure application, apply manure there and buy N fertilizer for the area that has excess K.

Contact your county office of the OSU Extension Service for additional information.

Soil and plant tissue testing for N

The tables and figures in this publication only estimate manure application rates. A soil test for nitrate nitrogen or a stalk nitrate test for silage corn can aid in adjusting manure application rates.

OREGON DEPARTMENT OF AGRICULTURE

CONFINED ANIMAL FEEDING OPERATION ANIMAL WASTE MANAGEMENT PLAN OR NUTRIENT MANAGEMENT PLAN AMENDMENT FORM

Rodds End Dairy
Confined Animal Feeding Operation

Rodds End
CAFO Operator's Name

135 Wilson River
Facility Street Address, City, State, Zip

503-457-8874
Phone Number

Tillamook 97141

Submitted to the Oregon Dept. Of Agriculture are the following modifications to Animal Waste Management Plan (AWMP)/Nutrient Management Plan (NMP) # 09098.

I would like to apply the following modifications to this AWMP/NMP:

Animal Increase + 56 mature
± 80 Acres

Operator's Signature

2/23/21
Date

CONCLUSION: ✓ Approved _____ Denied

Inspector's Signature

Official Use:

MA#_____ Effective date: 2/23/21

Date copy sent to Operator:_____

United States Department of Agriculture

NRCS

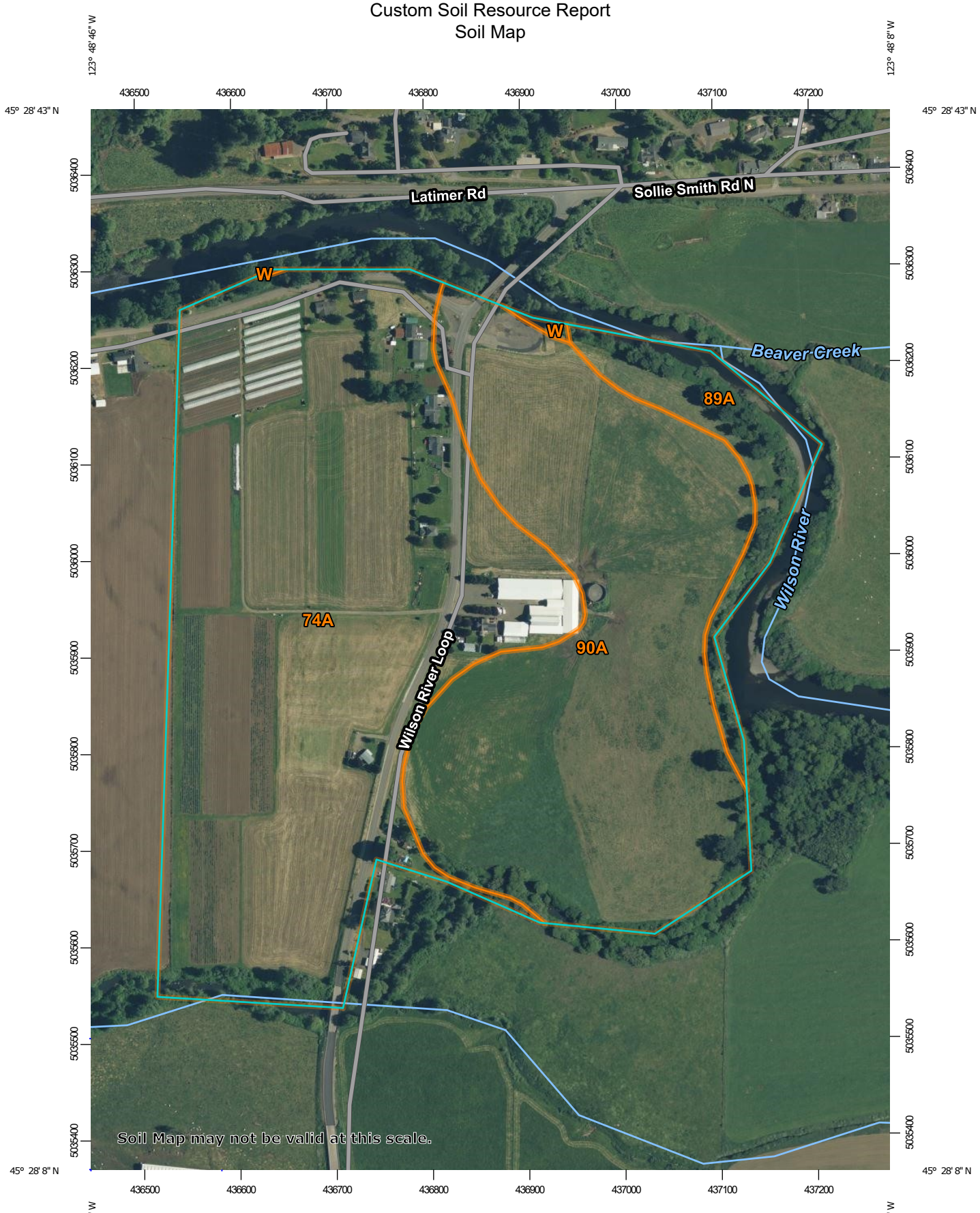
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Tillamook County, Oregon

February 3, 2021

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,350 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
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- Soil Map Unit Points

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- Clay Spot
- Closed Depression
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- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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- Streams and Canals

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- Interstate Highways
- US Routes
- Major Roads
- Local Roads

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- Aerial Photography

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The soil surveys that comprise your AOI were mapped at 1:24,000.

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Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Tillamook County, Oregon
Survey Area Data: Version 12, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 28, 2020—Jun 22, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
74A	Nehalem silt loam, 0 to 3 percent slopes	54.2	54.7%
89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	6.2	6.2%
90A	Yachats very fine sandy loam, 0 to 3 percent slopes	38.5	38.9%
W	Water	0.2	0.2%
Totals for Area of Interest		**99.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Tillamook County, Oregon

74A—Nehalem silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 27z5
Elevation: 10 to 200 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nehalem, occasional flooding, and similar soils: 80 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nehalem, Occasional Flooding

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 16 inches: silt loam
Bw - 16 to 48 inches: silt loam
BC - 48 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Forage suitability group: Well Drained <15% Slopes (G004AY014OR)
Other vegetative classification: Well Drained <15% Slopes (G004AY014OR), Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Minor Components

Brenner

Percent of map unit: 3 percent

Landform: Depressions on flood plains
Other vegetative classification: Poorly Drained (G004AY018OR)
Hydric soil rating: Yes

89A—Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2815
Elevation: 20 to 100 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Udifluvents and similar soils: 40 percent
Riverwash: 30 percent
Water: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udifluvents

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A - 0 to 7 inches: fine sandy loam
C1 - 7 to 38 inches: sandy loam
C2 - 38 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Other vegetative classification: Sitka spruce/wet non-forest (991)

Hydric soil rating: No

Description of Riverwash

Setting

Landform: Flood plains

Typical profile

- 0 to 60 inches: stratified sand to gravel

Properties and qualities

Slope: 0 to 3 percent
Depth to water table: About 0 to 24 inches
Frequency of flooding: FrequentNone

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

Minor Components

Fluvaquents

Percent of map unit: 5 percent
Landform: Depressions on flood plains
Hydric soil rating: Yes

90A—Yachats very fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2816
Elevation: 10 to 200 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Yachats and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yachats

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Ap - 0 to 9 inches: very fine sandy loam
A - 9 to 19 inches: loam
C1 - 19 to 39 inches: fine sandy loam
C2 - 39 to 54 inches: fine sandy loam
C3 - 54 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Forage suitability group: Well Drained <15% Slopes (G004AY014OR)
Other vegetative classification: Well Drained <15% Slopes (G004AY014OR), Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Minor Components

Brenner

Percent of map unit: 5 percent
Landform: Depressions on flood plains
Other vegetative classification: Poorly Drained (G004AY018OR)
Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

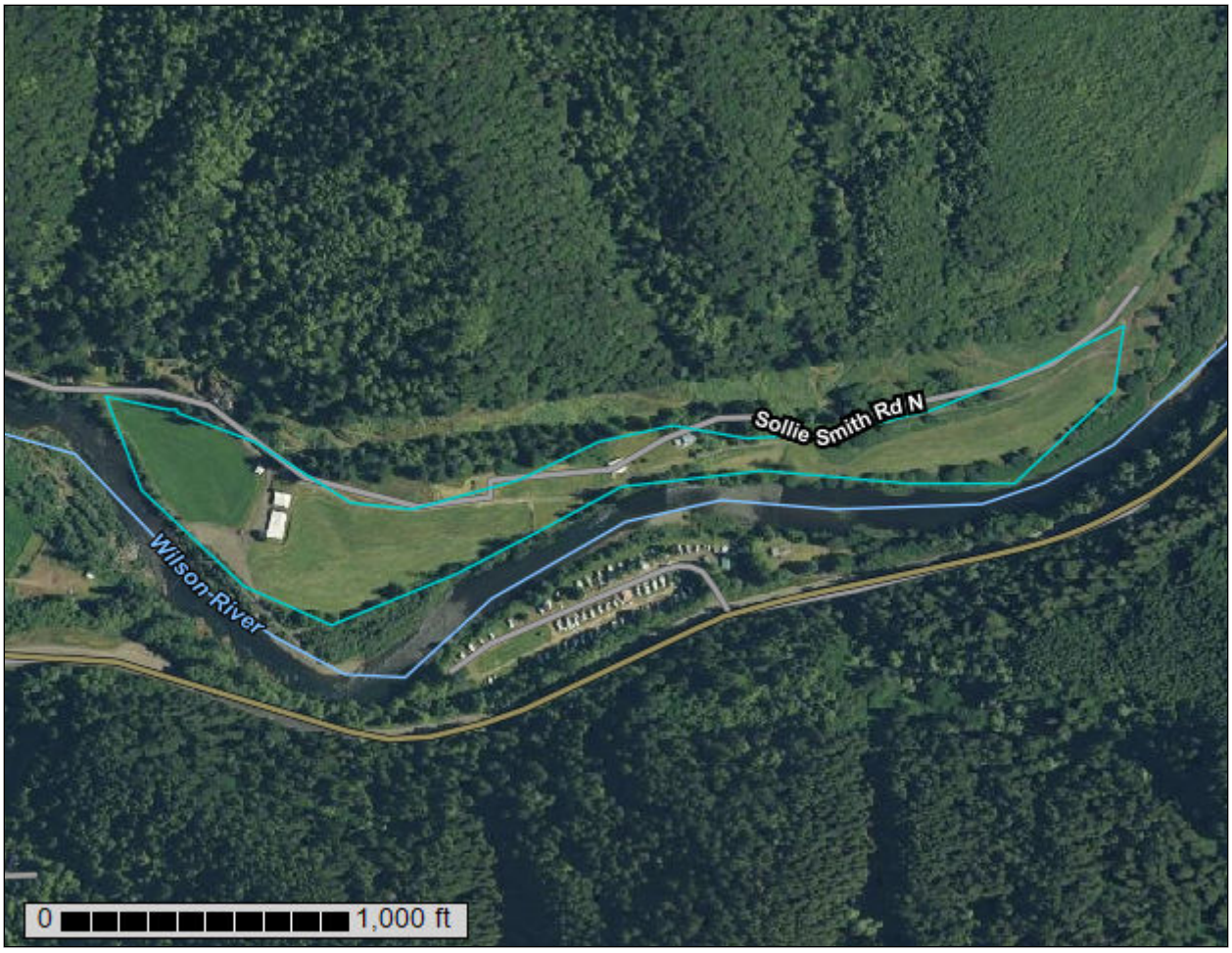
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

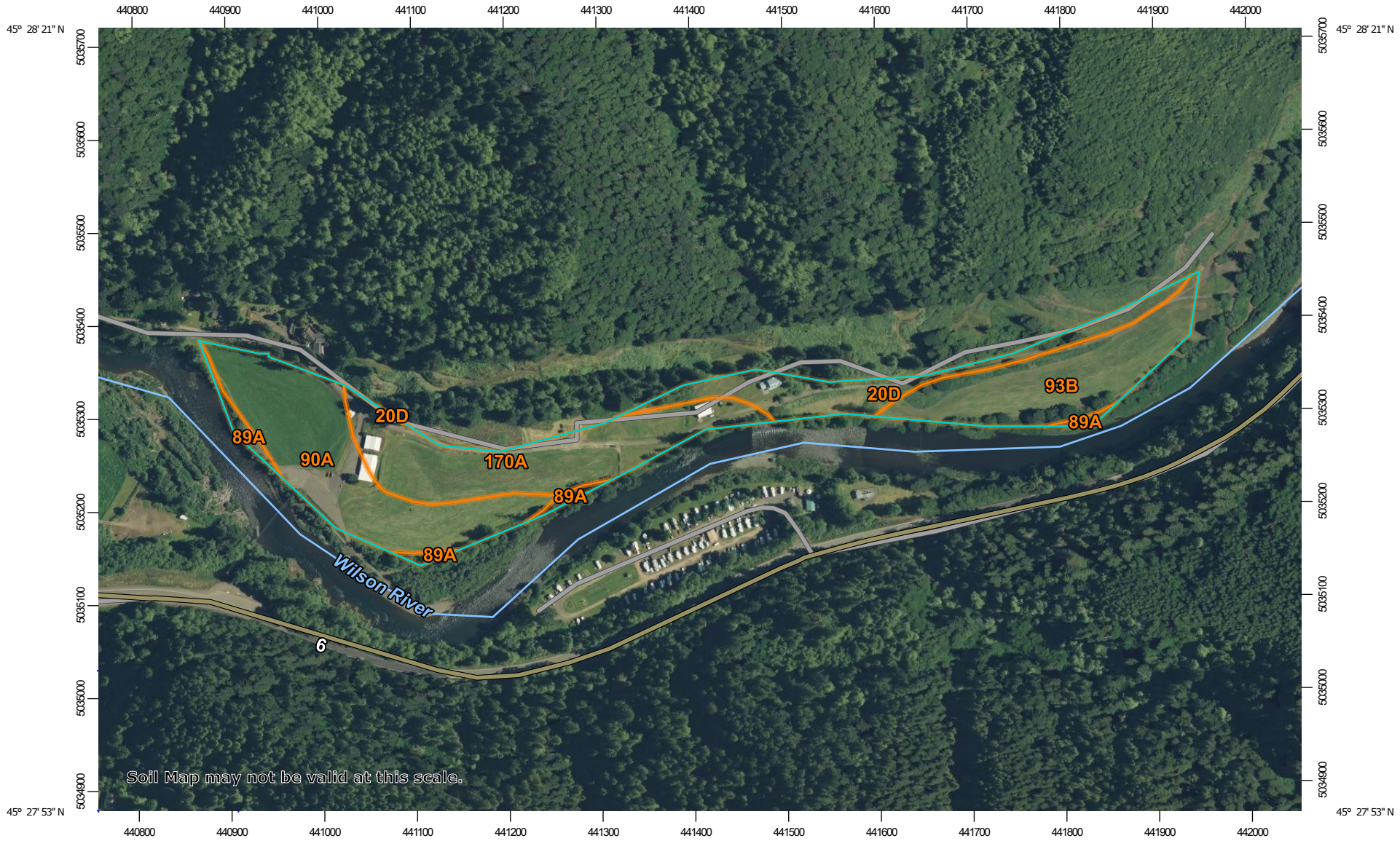
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Tillamook County, Oregon



February 3, 2021

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,930 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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- Sinkhole
- Slide or Slip
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The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
20D	Klootchie-Necanicum complex, 5 to 30 percent slopes	3.2	14.6%
89A	Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes	0.7	3.3%
90A	Yachats very fine sandy loam, 0 to 3 percent slopes	6.9	31.0%
93B	Gauldy complex, 0 to 5 percent slopes	5.1	23.2%
170A	Logsden silt loam, 0 to 3 percent slopes	6.1	27.8%
Totals for Area of Interest		**22.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Tillamook County, Oregon

20D—Klootchie-Necanicum complex, 5 to 30 percent slopes

Map Unit Setting

National map unit symbol: 27xq
Elevation: 50 to 1,800 feet
Mean annual precipitation: 80 to 110 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 120 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Klootchie and similar soils: 60 percent
Necanicum and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Klootchie

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Mountaintop, mountainbase
Down-slope shape: Concave
Across-slope shape: Concave, linear
Parent material: Colluvium and residuum derived from igneous rock and tuff

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A1 - 1 to 9 inches: medial silt loam
A2 - 9 to 19 inches: medial silt loam
Bw1 - 19 to 44 inches: medial silty clay loam
Bw2 - 44 to 68 inches: medial silty clay loam

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 19.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Other vegetative classification: Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Description of Necanicum

Setting

Landform: Mountain slopes

Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Mountaintop, mountainbase
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Colluvium derived from igneous rock and tuff

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A1 - 1 to 10 inches: very gravelly medial loam
A2 - 10 to 18 inches: very gravelly medial loam
Bw1 - 18 to 27 inches: very gravelly medial loam
Bw2 - 27 to 49 inches: extremely cobbly medial loam
Bw3 - 49 to 71 inches: extremely cobbly medial loam

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Other vegetative classification: Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

89A—Udifluvents-Riverwash-Water complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2815
Elevation: 20 to 100 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Udifluvents and similar soils: 40 percent
Riverwash: 30 percent
Water: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udifluvents

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A - 0 to 7 inches: fine sandy loam
C1 - 7 to 38 inches: sandy loam
C2 - 38 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Other vegetative classification: Sitka spruce/wet non-forest (991)
Hydric soil rating: No

Description of Riverwash

Setting

Landform: Flood plains

Typical profile

- 0 to 60 inches: stratified sand to gravel

Properties and qualities

Slope: 0 to 3 percent
Depth to water table: About 0 to 24 inches
Frequency of flooding: FrequentNone

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

Minor Components

Fluvaquents

Percent of map unit: 5 percent
Landform: Depressions on flood plains
Hydric soil rating: Yes

90A—Yachats very fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2816
Elevation: 10 to 200 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Yachats and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yachats

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Ap - 0 to 9 inches: very fine sandy loam
A - 9 to 19 inches: loam
C1 - 19 to 39 inches: fine sandy loam
C2 - 39 to 54 inches: fine sandy loam
C3 - 54 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Forage suitability group: Well Drained <15% Slopes (G004AY014OR)
Other vegetative classification: Well Drained <15% Slopes (G004AY014OR), Sitka spruce/salmonberry-wet (903)

Hydric soil rating: No

Minor Components

Brenner

Percent of map unit: 5 percent
Landform: Depressions on flood plains
Other vegetative classification: Poorly Drained (G004AY018OR)
Hydric soil rating: Yes

93B—Gauldy complex, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1jxw4
Elevation: 10 to 400 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gauldy, occasional flooding, and similar soils: 50 percent
Gauldy, rare flooding, and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gauldy, Occasional Flooding

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Ap - 0 to 10 inches: loam
Bw - 10 to 26 inches: gravelly loam
2C1 - 26 to 38 inches: extremely gravelly loamy coarse sand
2C2 - 38 to 55 inches: loamy fine sand
2C3 - 55 to 60 inches: extremely gravelly fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 30 inches to strongly contrasting textural stratification
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: OccasionalNone

Frequency of ponding: None
Available water capacity: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Forage suitability group: Somewhat Excessively Drained (G004AY012OR)
Other vegetative classification: Somewhat Excessively Drained (G004AY012OR), Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Description of Gauldy, Rare Flooding

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Ap - 0 to 10 inches: loam
Bw - 10 to 26 inches: gravelly loam
2C1 - 26 to 38 inches: extremely gravelly loamy coarse sand
2C2 - 38 to 55 inches: loamy fine sand
2C3 - 55 to 60 inches: extremely gravelly fine sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: 20 to 30 inches to strongly contrasting textural stratification
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water capacity: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Forage suitability group: Somewhat Excessively Drained (G004AY012OR)
Other vegetative classification: Somewhat Excessively Drained (G004AY012OR), Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Minor Components

Brenner

Percent of map unit: 10 percent
Landform: Stream terraces
Other vegetative classification: Poorly Drained (G004AY018OR)
Hydric soil rating: Yes

170A—Logsden silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 27zd
Elevation: 20 to 200 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Logsden and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Logsden

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Ap - 0 to 8 inches: silt loam
A - 8 to 17 inches: silt loam
Bw1 - 17 to 37 inches: silty clay loam
Bw2 - 37 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water capacity: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: B
Forage suitability group: Well Drained <15% Slopes (G004AY014OR)
Other vegetative classification: Well Drained <15% Slopes (G004AY014OR), Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Minor Components

Brenner

Percent of map unit: 2 percent
Landform: Depressions on flood plains
Other vegetative classification: Poorly Drained (G004AY018OR)
Hydric soil rating: Yes

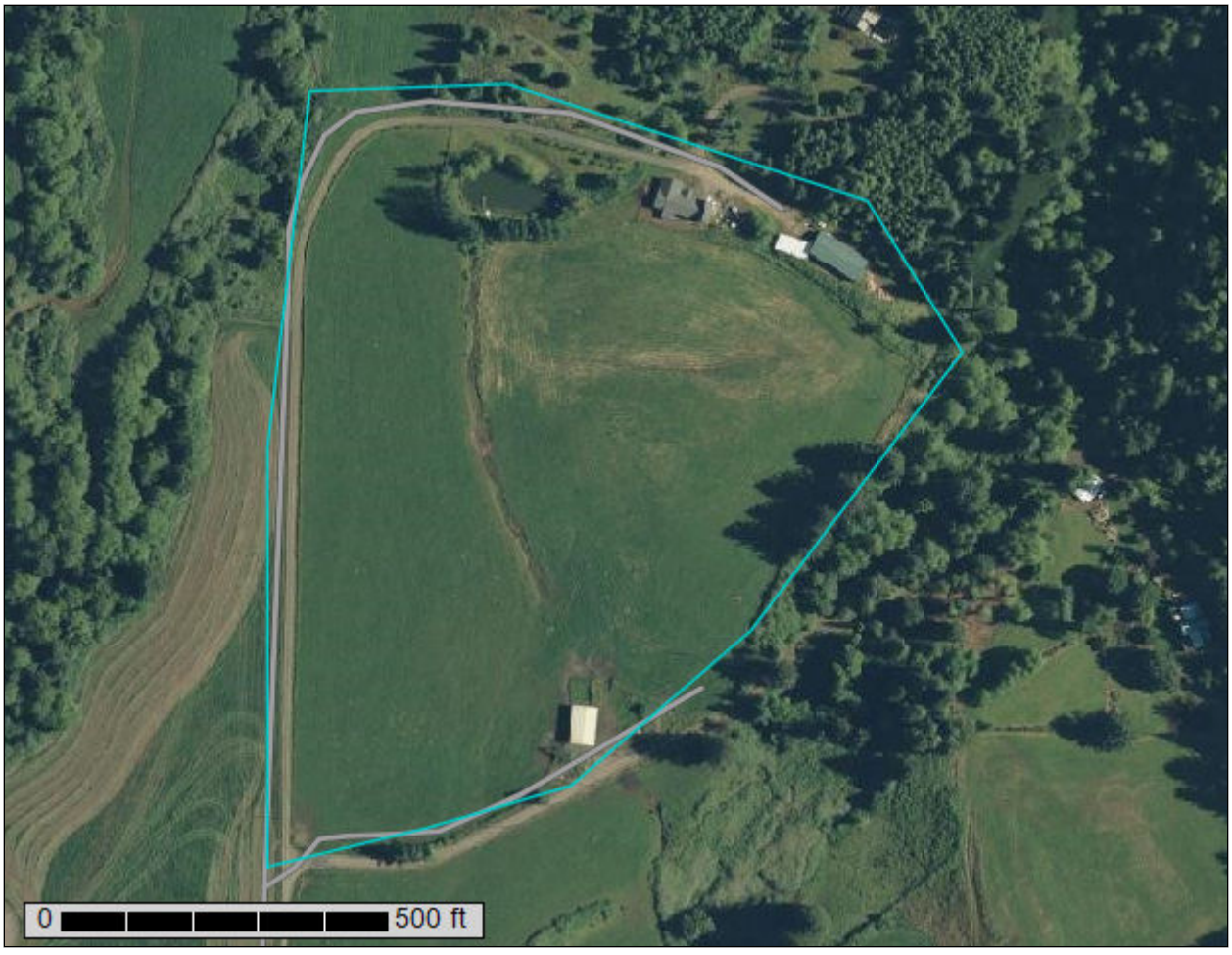
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

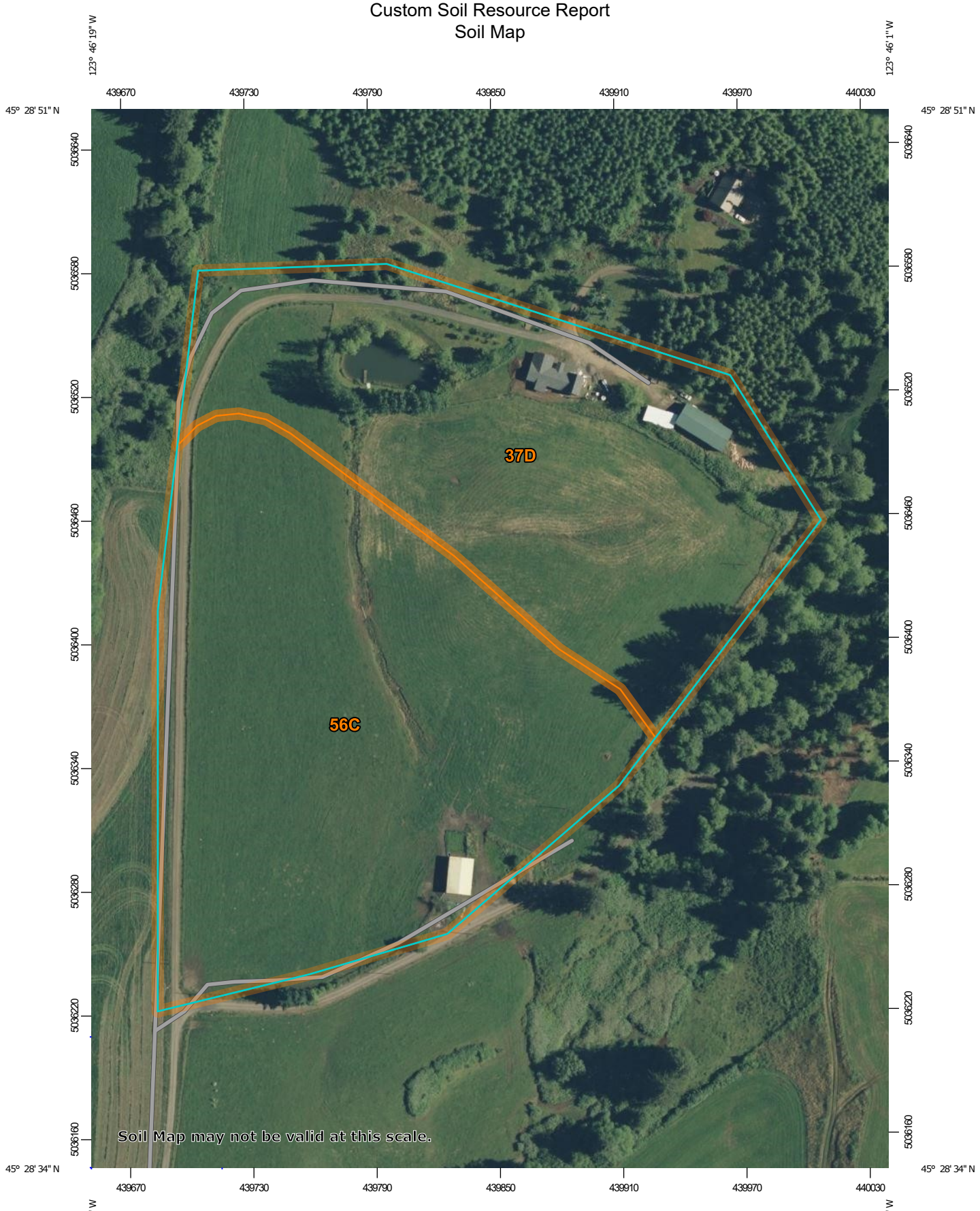
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Tillamook County, Oregon



February 3, 2021

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,500 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Tillamook County, Oregon
Survey Area Data: Version 12, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 28, 2020—Jun 22, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
37D	Templeton-Skipanon complex, 5 to 30 percent slopes	9.0	44.9%
56C	Wolfer medial silt loam, 3 to 15 percent slopes	11.1	55.1%
Totals for Area of Interest		**20.1**	**100.0%**

Map Unit Descriptions

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The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

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Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Tillamook County, Oregon

37D—Templeton-Skipanon complex, 5 to 30 percent slopes

Map Unit Setting

National map unit symbol: 27wb
Elevation: 50 to 1,500 feet
Mean annual precipitation: 80 to 110 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 120 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Templeton and similar soils: 45 percent
Skipanon and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Templeton

Setting

Landform: Hillslopes, mountain slopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Mountainbase, mountaintop, base slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Colluvium and residuum derived from sedimentary rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 15 inches: medial silt loam
Bw1 - 15 to 28 inches: silty clay loam
Bw2 - 28 to 43 inches: silty clay loam
Bw3 - 43 to 54 inches: silty clay loam
Bw4 - 54 to 59 inches: paragravelly silty clay loam
Cr - 59 to 69 inches: weathered bedrock

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 14.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Other vegetative classification: Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

Description of Skipanon

Setting

Landform: Hillslopes, mountain slopes
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Mountainbase, mountaintop, interfluve, base slope
Down-slope shape: Linear, concave
Across-slope shape: Convex, concave
Parent material: Mass movement deposits derived from a mixture of igneous and sedimentary rock types overlying sedimentary rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A1 - 2 to 7 inches: gravelly medial silt loam
A2 - 7 to 15 inches: gravelly silt loam
Bw1 - 15 to 29 inches: gravelly clay loam
Bw2 - 29 to 44 inches: gravelly clay loam
C - 44 to 62 inches: paragravelly clay loam

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Other vegetative classification: Sitka spruce/salmonberry-wet (903)
Hydric soil rating: No

56C—Wolfer medial silt loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: sws3
Elevation: 20 to 250 feet
Mean annual precipitation: 80 to 100 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 160 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wolfer and similar soils: 85 percent

Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wolfer

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium overlying sandy and gravelly alluvium derived from igneous rock

Typical profile

Ap - 0 to 8 inches: medial silt loam
A - 8 to 14 inches: medial silt loam
AB - 14 to 22 inches: medial silt loam
Bw - 22 to 35 inches: medial silty clay loam
2C - 35 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 24 to 36 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 12.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Forage suitability group: Well Drained <15% Slopes (G004AY014OR)
Other vegetative classification: Well Drained <15% Slopes (G004AY014OR), Sitka spruce/oxalis, swordfern-moist (902)
Hydric soil rating: No

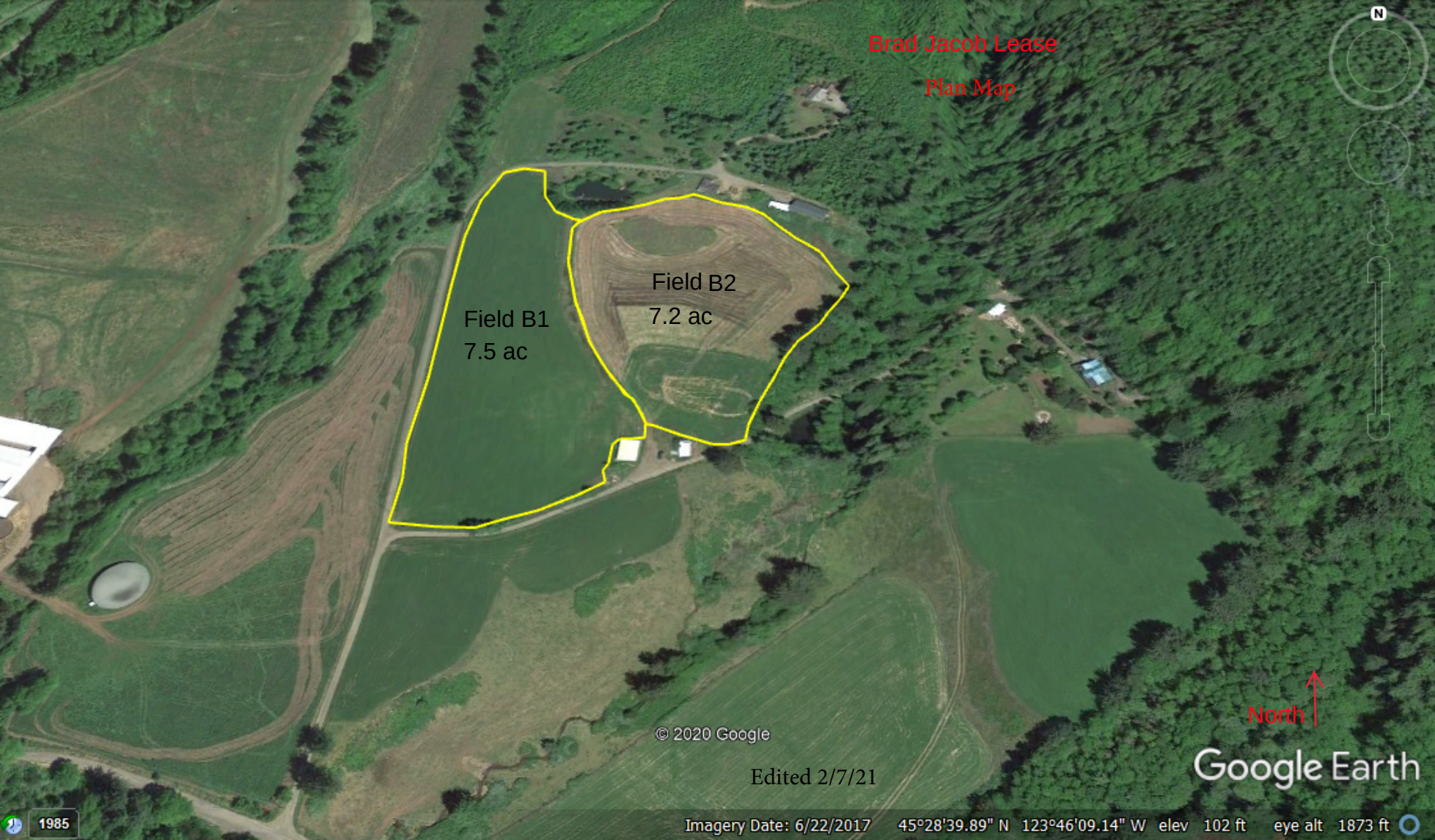
Minor Components

Hebo

Percent of map unit: 5 percent
Landform: Depressions on stream terraces
Other vegetative classification: Poorly Drained (G004AY018OR)
Hydric soil rating: Yes


Roads End Dairy
Plan Map
Field 7
9.6 ac
Field 8
7.6 ac
Field 1
7.5 ac
Field 2
8.6 ac
Field 9, 0.2 ac
Field 10, 0.2 ac
Field 11, 0.2 ac
Field 12, 0.1 ac
Field 13
2.6 ac
Farmstead
Field 6
10.1 ac
Field 5
9.4 ac
Field 4
9.7 ac
Field 3
13.4 ac
North
© 2020 Google
Google Earth
Edited 2/7/21
Imagery Date: 6/22/2017 45°28'24.55" N 123°48'25.98" W elev 24 ft eye alt 3500 ft


Gobel Lease
Plan Map
Field G1
3.3 ac
Field G3
4.7 ac
Field G2
6.0 ac
Edited 2/7/21
North
Google Earth
1985
Imagery Date: 6/22/2017 45°28'07.02" N 123°44'53.10" W elev 0 ft eye alt 3361 ft


Brad Jacob Lease
Plan Map
Field B1
7.5 ac
Field B2
7.2 ac
North
© 2020 Google
Edited 2/7/21
Google Earth
1985
Imagery Date: 6/22/2017 45°28'39.89" N 123°46'09.14" W elev 102 ft eye alt 1873 ft

DESIGN USE:

This design aid has been developed for planning animal waste management systems. The following NRCS Practice Standards for Oregon were used to develop the design aid;

(PC) 313, Waste Storage Facility
(PC) 590, Nutrient Management
(PC) 633, Waste Utilization

LIMITATIONS:

Job Approval Class for each practice are to be determined and appropriate reviews requested as needed. This design aid does not address the structural design of waste storage structures but provides storage volumes needed in accordance with (PC) 313, Waste Storage Facility design criteria. Additional documentation is needed to meet the requirements of (PC) 590, Nutrient Management and (PC) 633, Waste Utilization. This spreadsheet is a read only file and should be saved to a new filename before use.

WORKSHEET TABS:

ReadMe Spreadsheet documentation for all information regarding the use of this spreadsheet.

Inventory Start with this tab to inpute all of the inventory information for the client and their operation. The Animal Feeding Operation Inventory Worksheet in Agronomy Technical Note 20 can be used to record data collected in the field and/or from interviews with the client.

Production This worksheet will display monthly volumes of liquids and solids produced from the operation. Daily and monthly nutrient production from the operation are also displayed. The information displayed on this worksheet is for use in planning and is used for computations made in other worksheets. No inputs are required on this worksheet.

Storage The type of storage facility for solids and liquids can be selected and sized based on the number of days of storage desired using this worksheet.

Application This worksheet allows the user to determine the amounts of nutrients from liquid manure to be applied based on "Big Gun" travel rates and set times and for tank wagons based on travel length and spread width. The worksheet also allows the user to compute the amounts of nutrients from solid manure to be applied based on travel lengths and spread width of tractor spreader equipment.

Utilization This worksheet allows the user to determine the approximate amount of nutrients lost during storage, application, and denitrification. The worksheet also allows the user to determine what crops the manure is to be applied to and the amount of manure to apply based on the nutrient application desired. The worksheet also computes a nutrient balance based on available acres and crop uptake of nutrients.

Nutrient Budget This worksheet allows the user to document a nutrient budget based on soil test information and recommended nutrient application rates from fertilizer guidesheets and other nutrient management reference material.

SPWK10A-7 This worksheet allows the user to determine the recommended storage period to use when sizing waste storage facilities. The calculated storage period is based on the weather station data and crop data entered on the Inventory worksheet and the adjustment factors entered by the user.

INPUT & OUTPUT:

Input cells will be shaded gray with **red text/numbers**. Output cells will be formatted with **blue text/numbers** with white background. Cells where data is inserted, from a database, will be **black text/numbers** with white background. Cells will be formatted the same as input cells where cells contain data from a database that can be changed by the user. Errors will be indicated with red text that says **ERROR** on a white background.

QUESTIONS: Direct all questions regarding this design aid to your Basin Engineer. If the Basin Engineer is not available, contact the person who developed this design aid.

Developed by: Bruce D. Wilson, Professional Engineer, Keizer, Oregon
Version of spreadsheet: Version HR3.3 October 2007

REFERENCE MATERIAL:

In addition to the applicable NRCS Practice Codes listed under DESIGN USE and OTHER DESIGN RESOURCES;

NRCS National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook (AWMFH)

Manure application rates for forage production, EM8585, OSU Extension Service, July 2007

NRCS National Engineering Handbook, Part 652, Irrigation Guide

Practice Planning and Design Guide for practice standard 313, Waste Storage Facility.

Nutrient Management Jobsheet for practice standard 590, Nutrient Management.

If a cell contains a red triangle in the upper right corner, simply passing the cursor over the cell will reveal references used in the development of the worksheet. See Reference Material cell above for an example.

RESOURCE DATA:

A field visit is required to obtain physical information about the site and interview the landowner/operator. The Animal Feeding Operation Inventory Worksheet in Agronomy Technical Note 20 can be used to record data collected in the field and/or from interviews with the client. The use of some kind of photo base to make notes on is recommended.

Data to Collect:

>> Clients name, address, phone number, facsimile number, and email.
>> Type of operation(Dairy, Beef, Swine, Poultry, etc)
>> Description of livestock, number to utilize facility, average weight, dates confined, and dates animals grazed for current and planned operation. If the operation is a dairy then include the average daily milk production per cow in pounds.
>> Type of bedding &volume used per day.
>> Solids separation system planned and efficiency of system.
>> Dimensions of existing solids & liquid storage facilities.
>> Roofed and unroofed areas that contribute rainwater to storage facilities.
>> Roofed areas that are guttered or drain clean water away from storage facilities.
>> Clients desired solid and liquid storage time.
>> Water use that contributes gray water to storage facility, e.g. milkhouse washwater.
>> Planned location of storage facility.
>> Location of domestic wells, streams, lakes and other sensitive water bodies.
>> Climatic station to use to retrieve needed climatic data.
>> Topographic information from surveys or USGS Quadrangle maps or other maps or photos.
>> Geologic considerations which will effect the planned storage structure such as shallow bedrock, unsuitable soils, coarse gravel subsoil, slide areas, wetlands, sharp breaks in slope, floodplains, etc.
>> Property lines and ownership considerations that may effect location of planned facilities.

OTHER DESIGN RESOURCES:

For additional information on wastewater production from confined animal facilities and other manure management issues, refer to the Oregon State University Extension homepage for publications at http://extension.oregonstate.edu/catalog/.

Other computer programs and spreadsheet design aids that might assist you in developing specific design information for planned facilities can be found on the Oregon NRCS website at http://www.or.nrcs.usda.gov/technical/engineering/engineering.html. If you have not had training and/or experience with the use of computer programs and spreadsheet design aids, you should contact the appropriate NRCS basin or state office technical staff for assistance before attempting to use them.

Standard drawings and forms associated with the design of waste management systems can be found in the Oregon NRCS Standard Drawings and Forms Catalog and on the Oregon NRCS website at http://www.or.nrcs.usda.gov/technical/engineering/engineering.html. Use of standard drawings requires appropriate review of foundation and site conditions before they are used for a final design and should be approved by someone with appropriate job approval authority.

NRCS Standards and Specifications that are applicable to the development of agricultural waste management systems to address site specific resource problems can be found in conservation system guidesheets (CSG) which are located on the NRCS eFOTG website for Oregon at http://www.nrcs.usda.gov/technical/efotg/.

PRINT & PROTECTION:

Each individual spreadsheet (tab) within this Excel Design Aid is set to print with enough margin to fit on 8 1/2 x 11 paper. All pages are designed to print on HP Deskjet and Lazerjet printers. All worksheets are protected so the formulas and certain text cannot be edited. Contact the NRCS Oregon State Office with any requests for changes to the ORAWM Design Aid.

U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: Roads End Dairy
ASSISTED BY: Rebecca Rudd
CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY

Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Milk Production in Pounds/Cow/Day= 62						Manure CF/D/AU	Annual	
				Nutrient Production								
				(lbs./day/1000 lb. Animal Unit)			(lbs./day)					
				N	P	K	N	P	K		Days Confined	Days Grazed
MILKER (Holstein)	110	1,200	132.0	0.68	0.12	0.31	90.29	15.28	41.38	1.65	206	159
MILKER (DRY)	26	1,200	31.2	0.33	0.07	0.17	10.30	2.18	5.30	0.92	365	0
MILKER (Jersey)	56	950	53.2	0.81	0.14	0.47	43.02	7.20	24.77	1.84	206	159
MILKER (DRY)	14	950	13.3	0.33	0.07	0.17	4.39	0.93	2.26	0.92	365	0
Totals/Averages-	206	1,075	229.7	0.64	0.11	0.32	148.0	25.6	73.7	1.6		

GRAZING PERIOD

Type of Animal	Percent of Month and Number of Animals Grazing												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AU-YR.
MILKER (Holstein)	50%	0%	0%	0%	0%	50%	70%	70%	70%	70%	70%	70%	
	110	110	110	110	110	110	110	110	110	110	110	110	686
MILKER (DRY)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	26	26	26	26	26	26	26	26	26	26	26	26	0
MILKER (Jersey)	50%	0%	0%	0%	0%	50%	70%	70%	70%	70%	70%	70%	
	56	56	56	56	56	56	56	56	56	56	56	56	277
MILKER (DRY)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	14	14	14	14	14	14	14	14	14	14	14	14	0
													0
													0
													0
													0
													0
													0
Total AUM's Available>	0	0	0	0	0	0	0	0	0	0	0	0	0
Total AUM's Needed>>>	93	0	0	0	0	93	130	130	130	130	130	130	963
Total AUM's>>>>>>>>>>	-93	0	0	0	0	-93	-130	-130	-130	-130	-130	-130	-963

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: Roads End Dairy

ASSISTED BY: Rebecca Rudd CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION TILLAMOOK 1 W

Month	25Yr-24Hr	6.00	Lot Runoff Factors as a Percent of Monthly Precipitation	
	Monthly Average in Inches			
	Precipitation	Evaporation	Paved	Unpaved
October	7.16	1.42	50%	20%
November	13.71	0.75	60%	25%
December	13.94	0.60	60%	25%
January	13.09	0.48	60%	25%
February	10.79	0.78	50%	25%
March	9.90	1.26	45%	15%
April	6.81	1.90	40%	15%
May	4.84	3.22	40%	10%
June	3.41	3.40	35%	10%
July	1.64	3.91	30%	0%
August	1.42	3.52	40%	10%
September	3.68	2.54	45%	15%
Annual	90.39	23.78		

AREAS CONTRIBUTING RUNOFF TO LIQUID STORAGE FACILITY

Description of Runoff Area	Area in SF
Paved Lot Area >>> Is paved lot scraped daily? (Y/N) NO	0
Unpaved Lot Area >>	0
Roof Area >>>	0
Surface Area of Silage Storage Facility>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Does Silage Seepage Drain to Storage Facility? (Y/N) NO	0
Total Runoff Area Contributing to Liquid Storage Facility>>>>>>>>>>>>>>>>	0

WATER USE THAT ENTERS LIQUID STORAGE FACILITY

Type of Water Use	Number of Animals	Number of Washes per Day	Gallons of Water Used per Wash-Day	Total Water Use per Day, Gallons	Total Water Use per Day, Cubic Feet
Animal Washwater	150.0	2	0.03	9	1.2
Equipment Wash		2	675.00	1350	180.5
Flushwater		0	0.00	0	0.0
Miscellaneous		2	25.00	50	6.7
Total>>>				1409	188.4

CROP DATA

Field Number	Acres	Crop	Percent Dry Matter (DM)	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre: Nitrogen N	Phosphorous P2O5	Potassium K2O
Main 1,2,3,4	39.2	Perennial Hay/Pasture(High Intensity)	30%	Ton	20.00	384	110	289
Main 5,8	17.0	Perennial Hay/Pasture(High Intensity)	30%	Ton	20.00	384	110	289
Main 6,7,9,10,11,12	20.4	Perennial Hay/Pasture(Med Intensity)	30%	Ton	15.00	216	72	206
B1,B2	14.7	Perennial Hay/Pasture(High Intensity)	30%	Ton	20.00	384	110	289
G1,G2,G3	14.0	Perennial Hay/Pasture(High Intensity)	30%	Ton	20.00	384	110	289

U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: Roads End Dairy

ASSISTED BY: Rebecca Rudd

CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

Type of Animal	Type of Bedding Facility	Bedding Material	Unit Weight Lbs/CF	Amount Needed Lbs/Day/AU	Volume CF/Day/AU	Total Volume CF/Day	Total Weight Lbs/Day
MILKER (Holstein)	Free Stall	Sawdust	12.00	3.10	0.26	34	409
MILKER (DRY)	Loose Housing	Sawdust	12.00	12.40	1.03	32	387
MILKER (Jersey)	Free Stall	Sawdust	12.00	3.10	0.26	14	165
MILKER (DRY)	Loose Housing	Sawdust	12.00	12.40	1.03	14	165

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	Separation Factor %	Volume of Solids Separated CF/Day	Volume of Solids in Liquids CF/Day	Volume of Manure in Liquids CF/Day	Volume of Manure in Solids CF/Day	Accumulated Sludge in Storage CF/Day	Density of Separated Solids Lbs/CF	Weight of Separated Solids Lbs/Day
MILKER (Holstein)	Dry Scrape System	25%	63	189	163	54	93	36	2,263
MILKER (DRY)	Dry Scrape System	25%	15	46	22	7	6	36	548
MILKER (Jersey)	Dry Scrape System	25%	28	84	74	25	64	36	1,006
MILKER (DRY)	Dry Scrape System	25%	6	19	9	3	2	36	234
Total Solids>>			113	338	267	89	165		4,051

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

Month	Runoff in Cubic Feet: Roof Area Square Feet 0	Paved Slab Area Square Feet 0	Unpaved Lot Area Square Feet 0	Silage Pit Surface Area, SF 0	Facility Water Use Cubic Feet	Manure Solids Cubic Feet	Manure Liquids Cubic Feet	Bedding Cubic Feet	Bedding Pounds	Solids Separated Cubic Feet	Solids Separated Pounds	Solids in Liquids Cubic Feet	Solids in Liquids Pounds	Total Solids Cubic Feet	Total Liquids Cubic Feet
October	0	0	0	0	5,839	767	5,390	2,167	26,005	2,081	74,918	6,243	224,754	2,081	16,700
November	0	0	0	0	5,651	1,342	9,347	2,815	33,778	3,376	121,533	10,128	364,600	3,376	24,063
December	0	0	0	0	5,839	1,387	9,659	2,909	34,904	3,488	125,584	10,465	376,753	3,488	24,589
January	0	0	0	0	5,839	1,387	9,659	2,909	34,904	3,488	125,584	10,465	376,753	3,488	24,589
February	0	0	0	0	5,274	1,252	8,724	2,627	31,526	3,151	113,431	9,453	340,293	3,151	23,011
March	0	0	0	0	5,839	767	5,390	2,167	26,005	2,081	74,918	6,243	224,754	2,081	16,700
April	0	0	0	0	5,651	502	3,564	1,810	21,721	1,469	52,888	4,407	158,665	1,469	13,210
May	0	0	0	0	5,839	519	3,683	1,870	22,445	1,518	54,651	4,554	163,954	1,518	13,545
June	0	0	0	0	5,651	502	3,564	1,810	21,721	1,469	52,888	4,407	158,665	1,469	13,210
July	0	0	0	0	5,839	519	3,683	1,870	22,445	1,518	54,651	4,554	163,954	1,518	13,545
August	0	0	0	0	5,839	519	3,683	1,870	22,445	1,518	54,651	4,554	163,954	1,518	13,545
September	0	0	0	0	5,651	502	3,564	1,810	21,721	1,469	52,888	4,407	158,665	1,469	13,210
Annual	**0**	**0**	**0**	**0**	**68,755**	**9,965**	**69,910**	**26,635**	**319,618**	**26,627**	**958,589**	**79,882**	**2,875,766**	**26,627**	**209,917**

DAILY NUTRIENT PRODUCTION

Type of Animal	Pounds/Day of Nutrients from **LIQUIDS** N	P_2O_5	K_2O	Pounds/Day of Nutrients from **SOLIDS** N	P_2O_5	K_2O	Pounds/Day of Nutrients from **GRAZING** N	P_2O_5	K_2O
MILKER (Holstein)	67.72	26.25	37.40	22.57	8.75	12.47	90.29	35.00	49.86
MILKER (DRY)	7.72	3.75	4.79	2.57	1.25	1.60	0.00	0.00	0.00
MILKER (Jersey)	32.26	12.37	22.38	10.75	4.12	7.46	43.02	16.49	29.84
MILKER (DRY)	3.29	1.60	2.04	1.10	0.53	0.68	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Pounds of Nutrients going OFF-FARM			Total Pounds of Nutrients from ALL SOURCES		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
October	1,891	764	1,139	630	255	380	2,066	798	1,235	0	0	0	4,588	1,817	2,753
November	3,330	1,319	1,998	1,110	440	666	0	0	0	0	0	0	4,440	1,759	2,665
December	3,441	1,363	2,065	1,147	454	688	0	0	0	0	0	0	4,588	1,817	2,753
January	3,441	1,363	2,065	1,147	454	688	0	0	0	0	0	0	4,588	1,817	2,753
February	3,108	1,231	1,865	1,036	410	622	0	0	0	0	0	0	4,144	1,641	2,487
March	1,891	764	1,139	630	255	380	2,066	798	1,235	0	0	0	4,588	1,817	2,753
April	1,230	508	743	410	169	248	2,799	1,081	1,674	0	0	0	4,440	1,759	2,665
May	1,271	525	768	424	175	256	2,893	1,117	1,730	0	0	0	4,588	1,817	2,753
June	1,230	508	743	410	169	248	2,799	1,081	1,674	0	0	0	4,440	1,759	2,665
July	1,271	525	768	424	175	256	2,893	1,117	1,730	0	0	0	4,588	1,817	2,753
August	1,271	525	768	424	175	256	2,893	1,117	1,730	0	0	0	4,588	1,817	2,753
September	1,230	508	743	410	169	248	2,799	1,081	1,674	0	0	0	4,440	1,759	2,665
Annual	**24,606**	**9,904**	**14,804**	**8,202**	**3,301**	**4,935**	**21,209**	**8,191**	**12,681**	**0**	**0**	**0**	**54,017**	**21,397**	**32,420**

U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd**
CHECKED BY: **0**

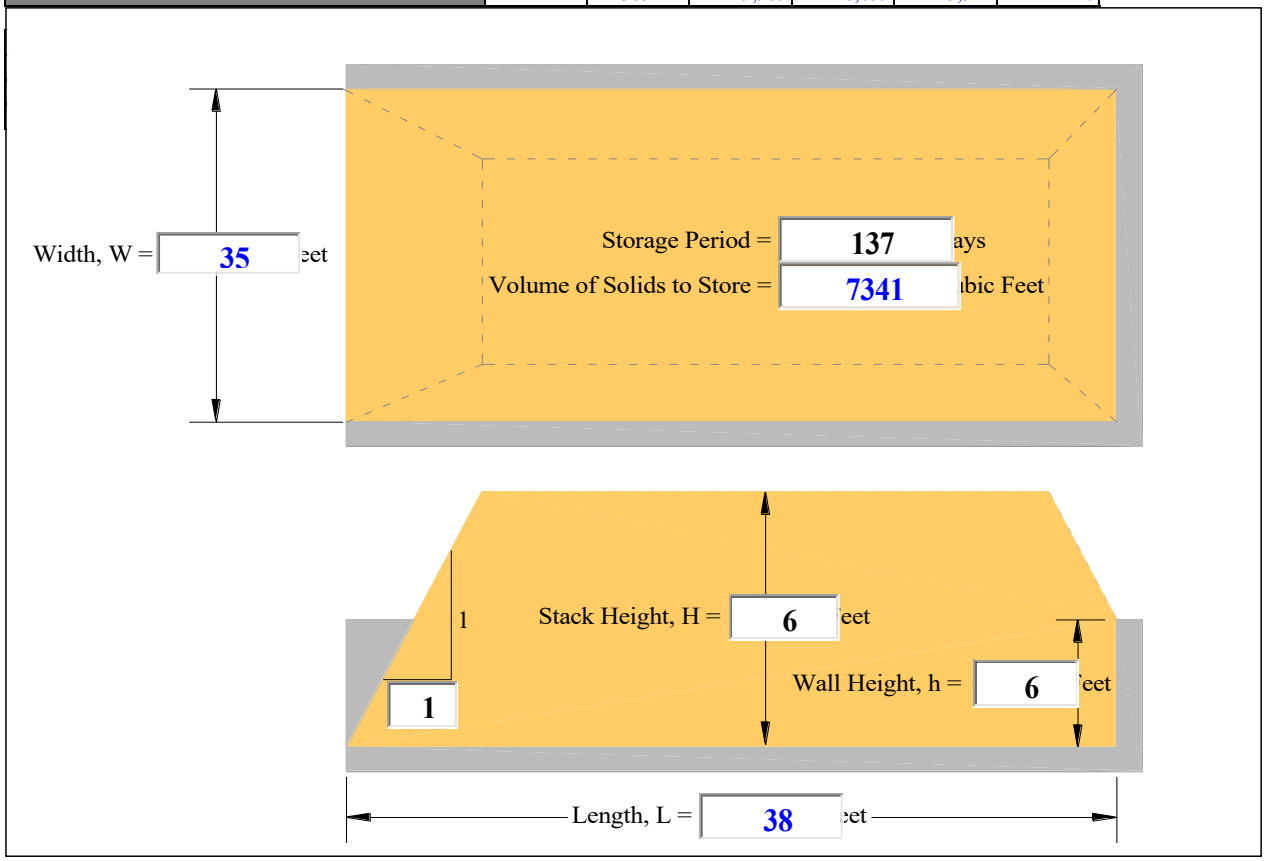
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY

Solids Storage Facility Parameters	Value
Storage Period, Days=	137
Stacking Width, W in Feet=	35
Stacking Height, H in Feet=	6.00
Wall Height, h in Feet=	6.00
Stack Side Slope (X:1)=	1.00
Existing Storage, Cubic Feet=	0
Surface Area of Existing Storage, SF=	0
25 Year-24 Hour Storm Runoff, CF=	0
Volume Needed, Cubic Feet=	7,341
Design Volume, Cubic Feet=	7,350
Is Facility Covered?	YES

MONTHLY SOLIDS VOLUME STACKED IN FACILITY

Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Normal Runoff CF
October	31	1539	542	1,041	0
November	30	2672	704	1,688	0
December	31	2761	727	1,744	0
January	31	2761	727	1,744	0
February	28	2494	657	1,575	0
March	31	1539	542	1,041	0
April	30	1017	453	735	0
May	31	1050	468	759	0
June	30	1017	453	735	0
July	31	1050	468	759	0
August	31	1050	468	759	0
September	30	1017	453	735	0
Annual	365	19,969	6,659	13,314	0



U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd**
CHECKED BY: **0**

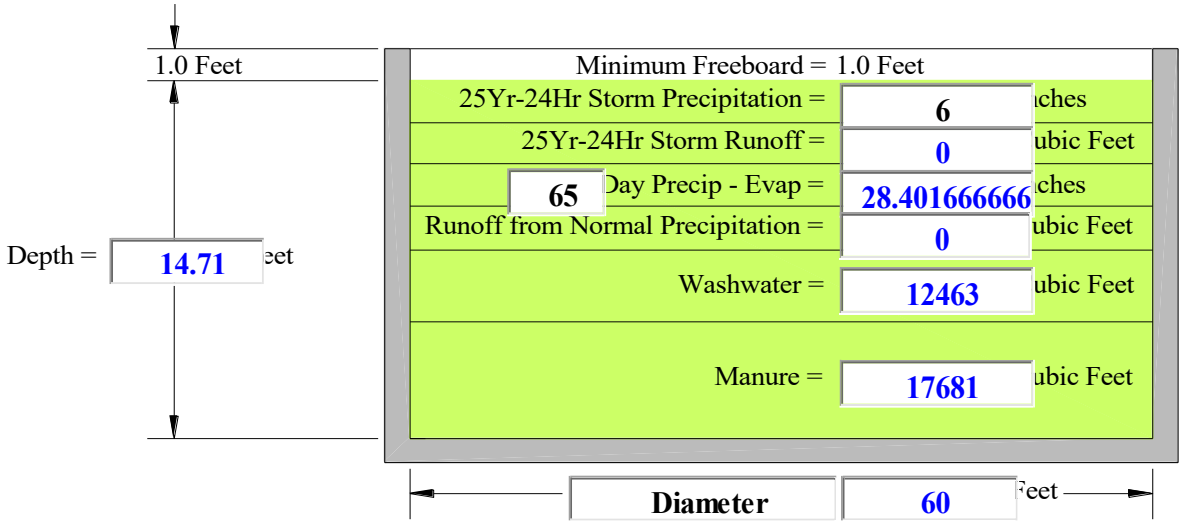
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

TANK

Tank Parameters	Value
Storage Period, Days=	65
Tank Diameter, Feet=	60
Existing Storage, Cubic Feet=	19,277
Surface Area of Existing Storage, SF=	
25 Year-24 Hour Storm Runoff, CF=	0
Volume Needed, Cubic Feet=	60,850
Design Volume, Cubic Feet=	41,570
Is Tank Covered?	NO
Tank Dimensions?	Circular

MONTHLY INFLOWS INTO TANK

Month	Number of days	Rain-Evap on Tank CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Manure CF	Solids CF	Waste to Store CF
October	31	1,352	0	0	5,839	4,618	6,243	16,700
November	30	3,052	0	0	5,651	8,017	10,128	23,796
December	31	3,142	0	0	5,839	8,284	10,465	24,589
January	31	2,970	0	0	5,839	8,284	10,465	24,589
February	28	2,357	0	0	5,274	7,482	9,453	22,209
March	31	2,035	0	0	5,839	4,618	6,243	16,700
April	30	1,156	0	0	5,651	3,050	4,407	13,108
May	31	382	0	0	5,839	3,151	4,554	13,545
June	30	2	0	0	5,651	3,050	4,407	13,108
July	31	-535	0	0	5,839	3,151	4,554	13,545
August	31	-495	0	0	5,839	3,151	4,554	13,545
September	30	268	0	0	5,651	3,050	4,407	13,108
Annual	365	15,687	0	0	68,755	59,906	79,882	208,543



U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd**
CHECKED BY: **0**

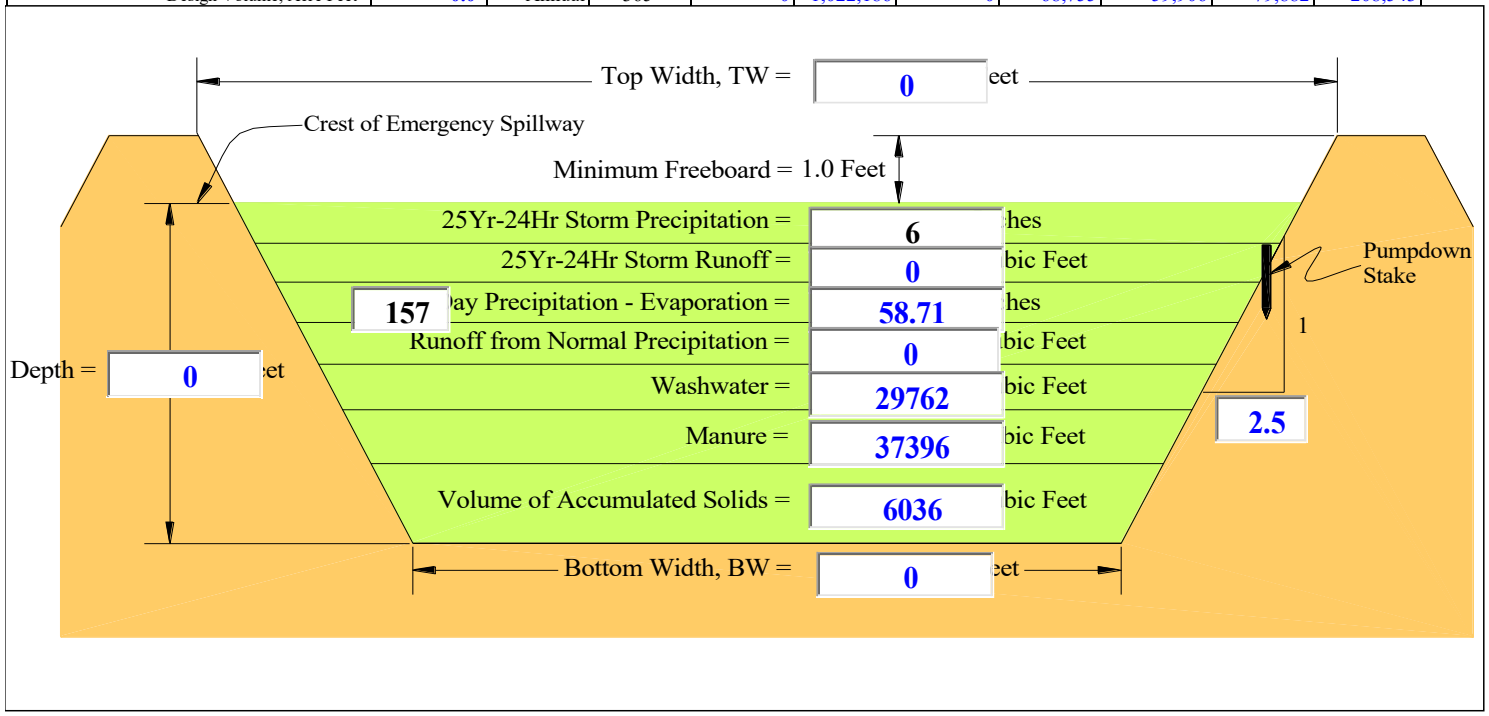
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

WASTE STORAGE POND

Pond Parameters	Value
Storage Period, Days=	157
Side Slope (X:1)=	2.50
Bottom Width, BW, Feet=	0
Bottom Length, BL, Feet=	0
Accumulated Solids Duration, Years=	0
Existing Storage, Acre Feet=	50.60
Surface Area of Existing Storage, SF=	184,150
Minimum Soil Liner Depth, Feet=	1.00
25 Year-24 Hour Storm Runoff, CF=	0
Top Width, TW, Feet=	0
Top Length, TL, Feet=	0
Volume Needed, Acre Feet=	25.6
Design Volume, Acre Feet=	0.0

MONTHLY INFLOWS INTO WASTE STORAGE POND

Month	Number of Days	Rain-Evap on Pond CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Manure CF	Solids CF	Waste to Store CF
October	31	0	88,085	0	5,839	4,618	6,243	16,700
November	30	0	198,882	0	5,651	8,017	10,128	23,796
December	31	0	204,713	0	5,839	8,284	10,465	24,589
January	31	0	193,511	0	5,839	8,284	10,465	24,589
February	28	0	153,612	0	5,274	7,482	9,453	22,209
March	31	0	132,588	0	5,839	4,618	6,243	16,700
April	30	0	75,348	0	5,651	3,050	4,407	13,108
May	31	0	24,860	0	5,839	3,151	4,554	13,545
June	30	0	153	0	5,651	3,050	4,407	13,108
July	31	0	-34,835	0	5,839	3,151	4,554	13,545
August	31	0	-32,226	0	5,839	3,151	4,554	13,545
September	30	0	17,494	0	5,651	3,050	4,407	13,108
Annual	365	0	1,022,186	0	68,755	59,906	79,882	208,543



U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version HRv3.3

STATE: OREGON

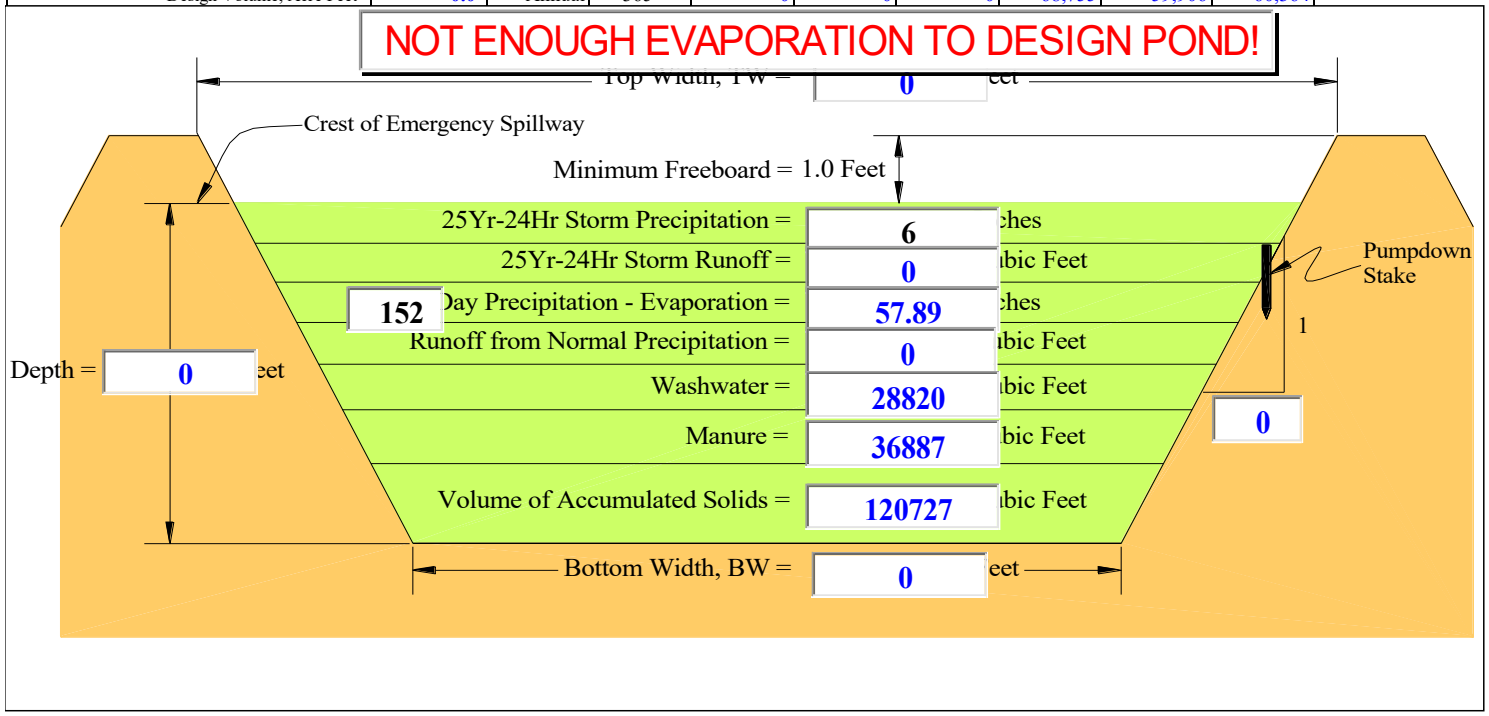
CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

EVAPORATION POND **MONTHLY INFLOWS INTO EVAPORATION POND**

Evaporation Pond Parameters	Value	Month	Number of Days	Rain-Evap on Pond CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Manure CF	Accum Solids CF
Storage Period, Days=	152	October	31	0	0	0	5,839	4,618	5,127
Side Slope (X:1)=	0.00	November	30	0	0	0	5,651	8,017	4,961
Bottom Width, BW, Feet=	0	December	31	0	0	0	5,839	8,284	5,127
Bottom Length, BL, Feet=	0	January	31	0	0	0	5,839	8,284	5,127
Accumulated Solids Duration, Years=	2	February	28	0	0	0	5,274	7,482	4,631
Existing Storage, Acre Feet=	0.00	March	31	0	0	0	5,839	4,618	5,127
Surface Area of Existing Storage, SF=	0	April	30	0	0	0	5,651	3,050	4,961
Minimum Soil Liner Depth, Feet=	1.00	May	31	0	0	0	5,839	3,151	5,127
25 Year-24 Hour Storm Runoff, CF=	0	June	30	0	0	0	5,651	3,050	4,961
Top Width, TW, Feet=	0	July	31	0	0	0	5,839	3,151	5,127
Top Length, TL, Feet=	0	August	31	0	0	0	5,839	3,151	5,127
Volume Needed, Acre Feet=	28.2	September	30	0	0	0	5,651	3,050	4,961
Design Volume, Acre Feet=	0.0	Annual	365	0	0	0	68,755	59,906	60,364

NOT ENOUGH EVAPORATION TO DESIGN POND!



CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** ЧECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply **26,627** cubic feet of solids generated from the operation it will take approximately **134** trips annually. Based on applying NITROGEN, N
at agronomic rate use the application depths, travel lengths, and loads per acre listed below for each crop.

Field Number	Acres	Crop	Tractor Spreader Capacity Bushels	Tractor Spreader Capacity CF	Spread Width Feet	NITROGEN, N Concentration in Storage Facility PPM	NITROGEN, N Concentration in Storage Facility Lbs/Ton	Pounds of Nutrients to be Applied	Number of Applications Needed to meet Crop Demand	Tons per Acre of Solids to Apply	Travel Length per Load Needed in Feet	Loads per Acre	Assumed Solids Density lbs/CF
Main 1,2,3,4	39.2	Perennial Hay/Pasture(High Intensity)	160	199	15	6,417	12.83	384	1.00	49.1	212	14	36
Main 5,8	17	Perennial Hay/Pasture(High Intensity)	160	199	15	6,417	12.83	384	1.00	49.1	212	14	36
Main 6,7,9,10,11,12	20.4	Perennial Hay/Pasture(Med Intensity)	160	199	15	6,417	12.83	216	1.00	27.6	376	8	36
B1,B2	14.7	Perennial Hay/Pasture(High Intensity)	160	199	15	6,417	12.83	384	1.00	49.1	212	14	36
G1,G2,G3	14	Perennial Hay/Pasture(High Intensity)	160	199	15	6,417	12.83	384	1.00	49.1	212	14	36

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply **1,677,240** gallons of liquids generated from the operation it will take approximately **93** hours of pumping annually. Based on applying NITROGEN, N
at agronomic rate use the application depths, set times, and travel rates listed below for each crop.

Field Number	Acres	Crop	Sprinkler Flowrate GPM	Wetted Diameter Feet	Portion of Wetted Diameter Receiving Liquids	NITROGEN, N Concentration in Storage Facility PPM	NITROGEN, N Concentration in Storage Facility Lbs/1000Gal	Pounds of Nutrients to be Applied	Number of Applications Needed to meet Crop Demand	Inches of Liquids to Apply	Application Rate in Inches/Hour	Set Time Needed in Hours	Travel Rate Needed in Feet/Minute
Main 1,2,3,4	39.2	Perennial Hay/Pasture(High Intensity)	300	250	3/4 Circle	1,231	10.27	384	1.00	2.11	0.97	3.58	0.91
Main 5,8	17	Perennial Hay/Pasture(High Intensity)	300	250	3/4 Circle	1,231	10.27	384	1.00	2.11	0.97	3.58	0.91
Main 6,7,9,10,11,12	20.4	Perennial Hay/Pasture(Med Intensity)	300	250	3/4 Circle	1,231	10.27	216	1.00	1.19	0.97	2.01	1.62
B1,B2	14.7	Perennial Hay/Pasture(High Intensity)	300	250	3/4 Circle	1,231	10.27	384	1.00	2.11	0.97	3.58	0.91
G1,G2,G3	14	Perennial Hay/Pasture(High Intensity)	300	250	3/4 Circle	1,231	10.27	384	1.00	2.11	0.97	3.58	0.91

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** ЧECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply **1,677,240** gallons of liquids generated from the operation it will take approximately **419** trips annually. Based on applying NITROGEN, N at agronomic rates use the application depths, travel lengths, and loads per acre listed below for each crop.

Field Number	Acres	Crop	Tank Wagon Capacity Gallons	Spread Width Feet	NITROGEN, N Concentration in Storage Facility PPM	NITROGEN, N Concentration in Storage Facility Lbs/1000Gal	Pounds of Nutrients to be Applied	Number of Applications Needed to meet Crop Demand	Inches of Liquids to Apply	Travel Length per Load Needed in Feet	Loads per Acre
Main 1,2,3,4	39.2	Perennial Hay/Pasture(High Intensity)	**4,000**	**15**	**1,231**	**10.27**	**384**	1.00	0.90	476	6.1
Main 5,8	17	Perennial Hay/Pasture(High Intensity)	**4,000**	**15**	**1,231**	**10.27**	**384**	1.00	0.90	476	6.1
Main 6,7,9,10,11,12	20.4	Perennial Hay/Pasture(Med Intensity)	**4,000**	**15**	**1,231**	**10.27**	**216**	1.00	0.51	846	3.4
B1,B2	14.7	Perennial Hay/Pasture(High Intensity)	**4,000**	**15**	**1,231**	**10.27**	**384**	1.00	0.90	476	6.1
G1,G2,G3	14	Perennial Hay/Pasture(High Intensity)	**4,000**	**15**	**1,231**	**10.27**	**384**	1.00	0.90	476	6.1

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

Storage Facility	Annual Volume Production	Units	Concentration of Nutrients in Storage N	P_2O_5	K_2O	Units
Tank (Uncovered)	1,677,240	Gallons	10.27	5.02	7.50	lbs/th Gal
Solids Storage Facility (Roofed)	240	Tons	12.83	6.20	9.27	lbs/Ton

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd**

CHECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation / Type of Storage Facility	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
	Dairy	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Tank (Uncovered)	24,606	9,904	14,804	**70%**	**85%**	**85%**	17,224	8,419	12,583
Solids	Solids Storage Facility (Roofed)	8,202	3,301	4,935	**75%**	**90%**	**90%**	6,151	2,971	4,441
Grazing	NONE	21,209	8,191	12,681	**100%**	**100%**	**100%**	21,209	8,191	12,681

NUTRIENTS AVAILABLE AFTER APPLICATION

Nutrient Source	Type of Application System	Pounds of Nutrients Available			Percent Nutrients Retained After Application			Pounds of Nutrients Retained After Application		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Sprinkling	17,224	8,419	12,583	**75%**	**100%**	**100%**	12,918	8,419	12,583
Solids	Broadcast (Incorporated 7 or more days after application)	6,151	2,971	4,441	**70%**	**100%**	**100%**	4,306	2,971	4,441
Grazing	Grazing	21,209	8,191	12,681	**85%**	**100%**	**100%**	18,028	8,191	12,681

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location: Coast / Soil Drainage Class	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Well Drained	12,918	8,419	12,583	**87%**	**100%**	**100%**	11,239	8,419	12,583
Solids	Well Drained	4,306	2,971	4,441	**87%**	**100%**	**100%**	3,746	2,971	4,441
Grazing	Well Drained	18,028	8,191	12,681	**87%**	**100%**	**100%**	15,684	8,191	12,681
							TOTAL-	***30,669***	***19,581***	***29,706***

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON NITROGEN, N

Field Number	Acres	Crop	LIQUIDS			SOLIDS			GRAZING		
			Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients
Main 1,2,3,4	39.2	Perennial Hay/Pasture(High Intensity)	**17%**	1,877	5	**41%**	1,524	4	**74%**	11,606	30
Main 5,8	17.0	Perennial Hay/Pasture(High Intensity)	**14%**	1,596	4	**18%**	661	2	**26%**	4,037	11
Main 6,7,9,10,11,1	20.4	Perennial Hay/Pasture(Med Intensity)	**15%**	1,686	8	**12%**	446	2	**0%**	0	0
B1,B2	14.7	Perennial Hay/Pasture(High Intensity)	**24%**	2,697	7	**15%**	571	1	**0%**	0	0
G1,G2,G3	14.0	Perennial Hay/Pasture(High Intensity)	**30%**	3,372	9	**15%**	544	1	**0%**	0	0
			0%	11		**0%**	0		**0%**	40	
TOTALS-	**105.3**		**100%**	**11,239**	**33**	**100%**	**3,746**	**11**	**100%**	**15,684**	**41**

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd**

CHECKED BY: **0**

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED - Nitrogen, N Lbs/Acre	NUTRIENTS APPLIED - Phosphorous, P_2O_5 Lbs/Acre	NUTRIENTS APPLIED - Potassium, K_2O Lbs/Acre	NUTRIENTS REMOVED - Nitrogen, N Lbs/Acre	NUTRIENTS REMOVED - Phosphorous, P_2O_5 Lbs/Acre	NUTRIENTS REMOVED - Potassium, K_2O Lbs/Acre	NUTRIENT BALANCE = Nitrogen, N Lbs/Acre	NUTRIENT BALANCE = Phosphorous, P_2O_5 Lbs/Acre	NUTRIENT BALANCE = Potassium, K_2O Lbs/Acre
Main 1,2,3,4	39.2	Perennial Hay/Pasture(High Intensity)	383	221	339	384	110	289	-1	111	50
Main 5,8	17.0	Perennial Hay/Pasture(High Intensity)	370	225	343	384	110	289	-14	115	54
Main 6,7,9,10,11,1	20.4	Perennial Hay/Pasture(Med Intensity)	105	79	118	216	72	206	-111	7	-88
B1,B2	14.7	Perennial Hay/Pasture(High Intensity)	222	168	252	384	110	289	-162	58	-38
G1,G2,G3	14.0	Perennial Hay/Pasture(High Intensity)	280	211	316	384	110	289	-104	101	27

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Producer:	Roads End Dairy	Tract(s): 313	Field(s): Main 1,2,3,4
Assisted by:	Rebecca Rudd	Date:	September 3, 2009

PURPOSE (Check all that apply)			
Budget and supply for plant production	x	Utilize manure/organic materials as a nutrient source	x
Minimize agricultural non-point source pollution (water quality)	x	Maintain or improve soil condition	x

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD
Perennial Hay/Pasture(High Intensity)	20

CURRENT SOIL TEST LEVELS (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC
NA	39	1587	5.9		

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD								
N (lbs/ac)		P_2O_5 (lbs/ac)		K_2O (lbs/ac)		LIME	Other	Other
Trial A	Trial B	Trial A	Trial B	Trial A	Trial B			
384		110		289		2-3 tons		

Table 2. Nutrient Sources

Credits			N	P_2O_5	K_2O
			pounds per acre		
1. Nitrogen credits from previous legume crop			0		
2. Residual from long-term manure application			0		
3. Irrigation water			0	0	0
4. Other (e.g., atmospheric deposition)			0	0	0
5. Total Credits-			0	0	0

Plant-Available Nutrients Applied to Field			N		P_2O_5		K_2O	
(Circle column that is landuser's decision)			Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5, above)			0	0	0	0	0	0
7. Fertilizer	Starter							
	Other	Commercial Fertilizer	45		0		0	
8. Manure / Organic Materials (Source-)		Dairy	383	0	221	0	339	0
9.		Subtotal (sum of lines 6, 7 and 8)	428	0	221	0	339	0
10.		Nutrients Recommended (from Table 1)	384	0	110	0	289	0
11.		Nutrient Status (subtract line 10 from line 9)	44	0	111	0	50	0

If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.

PLANNED NUTRIENT APPLICATIONS						
Amount to be Applied (lb/ac)	N	384	P_2O_5	203	K_2O	286

Method, Form, and Timing of Application

The 1587ppm of potassium in the soil is excessive. High potassium levels in the soil may cause livestock health problems. Recommend forage tests to evaluate the potassium levels in the forage. The 39 ppm of phosphorus is medium. Recommend 45 lbs of nitrogen be applied per acre per year to achieve the 20 tons at 30% dry matter per acre per year. See attached letter from the Dairy Extension Agent. Manure should be applied in split applications. If manure is applied during wetter months, avoid applying manure to saturated soils, where manure runoff may occur, or during rainfall events.Apply 50 - 70 lbs. of nitrogen per acre per application. See attached Nutrient Management Specification Sheet, the Manure Distribution Sheet Section, for manure application rates per field. Recommend applying manure evenly over all the fields during the year. Recommend soil tests in late October to evaluate how well the biosolid application rate matches the nitrogen needs of the forage. *** The Nutrient Budget tab will be updated after soil samples are taken March 2021.***

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Producer:	Roads End Dairy	Tract(s): 313	Field(s): Main 5,8
Assisted by:	Rebecca Rudd	Date:	September 3, 2009

PURPOSE (Check all that apply)			
Budget and supply for plant production	x	Utilize manure/organic materials as a nutrient source	x
Minimize agricultural non-point source pollution (water quality)	x	Maintain or improve soil condition	x

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD
Perennial Hay/Pasture(High Intensity)	20

CURRENT SOIL TEST LEVELS (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC
NA	29	1275	6		

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD									
N (lbs/ac)		P_2O_5 (lbs/ac)		K_2O (lbs/ac)		LIME	Other		Other
Trial A	Trial B	Trial A	Trial B	Trial A	Trial B				
384		110		289		3-4 tons			

Table 2. Nutrient Sources

Credits			N		P_2O_5		K_2O	
			pounds per acre					
1. Nitrogen credits from previous legume crop			0					
2. Residual from long-term manure application			0					
3. Irrigation water			0		0		0	
4. Other (e.g., atmospheric deposition)			0		0		0	
5. Total Credits-			0		0		0	
Plant-Available Nutrients Applied to Field			N		P_2O_5		K_2O	
(Circle column that is landuser's decision)			Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5, above)			0	0	0	0	0	0
7. Fertilizer	Starter							
	Other	Commercial Fertilizer	45		0		0	
8. Manure / Organic Materials (Source-)		Dairy	370	0	225	0	343	0
9.		Subtotal (sum of lines 6, 7 and 8)	415	0	225	0	343	0
10.		Nutrients Recommended (from Table 1)	384	0	110	0	289	0
11.		Nutrient Status (subtract line 10 from line 9)	31	0	115	0	54	0

If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.

PLANNED NUTRIENT APPLICATIONS						
Amount to be Applied (lb/ac)	N	384	P_2O_5	203	K_2O	286

Method, Form, and Timing of Application

The 1275 ppm of potassium in the soil is excessive. High potassium levels in the soil may cause livestock health problems. Recommend forage tests to evaluate the potassium levels in the forage. The 29 ppm of phosphorus is medium. Recommend 45 lbs of nitrogen be applied per acre per year to achieve the 20 tons at 30% dry matter per acre per year. See attached letter from the Dairy Extension Agent. Manure should be applied in split applications. If manure is applied during wetter months, avoid applying manure to saturated soils, where manure runoff may occur, or during rainfall events.Apply 50 - 70 lbs. of nitrogen per acre per application. See attached Nutrient Management Specification Sheet, the Manure Distribution Sheet Section, for manure application rates per field. Recommend applying manure evenly over all the fields during the year. Recommend soil tests in late October to evaluate how well the biosolid application rate matches the nitrogen needs of the forage. *** The Nutrient Budget tab will be updated after soil samples are taken March 2021.***

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Producer:	Roads End Dairy	Tract(s): 313	Field(s): Main 6,7,9,10,11,12
Assisted by:	Rebecca Rudd		Date: September 3, 2009

PURPOSE (Check all that apply)			
Budget and supply for plant production	x	Utilize manure/organic materials as a nutrient source	x
Minimize agricultural non-point source pollution (water quality)	x	Maintain or improve soil condition	x

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD
Perennial Hay/Pasture(Med Intensity)	15

CURRENT SOIL TEST LEVELS (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD								
N (lbs/ac)		P_2O_5 (lbs/ac)		K_2O (lbs/ac)		LIME	Other	Other
Trial A	Trial B	Trial A	Trial B	Trial A	Trial B			

Table 2. Nutrient Sources

Credits		N	P_2O_5	K_2O
		pounds per acre		
1. Nitrogen credits from previous legume crop				
2. Residual from long-term manure application				
3. Irrigation water				
4. Other (e.g., atmospheric deposition)				
5. Total Credits-		0	0	0

Plant-Available Nutrients Applied to Field		N		P_2O_5		K_2O	
(Circle column that is landuser's decision)		Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5, above)		0	0	0	0	0	0
7. Fertilizer	Starter						
	Other						
8. Manure / Organic Materials (Source-)		105	105	79	79	118	118
9. Subtotal (sum of lines 6, 7 and 8)		105	105	79	79	118	118
10. Nutrients Recommended (from Table 1)		0	0	0	0	0	0
11. Nutrient Status (subtract line 10 from line 9)		105	105	79	79	118	118

If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.

PLANNED NUTRIENT APPLICATIONS						
Amount to be Applied (lb/ac)	N		P_2O_5		K_2O	
Method, Form, and Timing of Application						
*** The Nutrient Budget tab will be updated after soil samples are taken March 2021.***						

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Producer:	Roads End Dairy	Tract(s): 313	Field(s): B1,B2
Assisted by:	Rebecca Rudd	Date:	September 3, 2009

PURPOSE (Check all that apply)			
Budget and supply for plant production	x	Utilize manure/organic materials as a nutrient source	x
Minimize agricultural non-point source pollution (water quality)	x	Maintain or improve soil condition	x

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD
Perennial Hay/Pasture(High Intensity)	20

CURRENT SOIL TEST LEVELS (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD								
N (lbs/ac)		P_2O_5 (lbs/ac)		K_2O (lbs/ac)		LIME	Other	Other
Trial A	Trial B	Trial A	Trial B	Trial A	Trial B			

Table 2. Nutrient Sources

Credits		N		P_2O_5		K_2O	
		pounds per acre					
1. Nitrogen credits from previous legume crop							
2. Residual from long-term manure application							
3. Irrigation water							
4. Other (e.g., atmospheric deposition)							
5. Total Credits-		0		0		0	
Plant-Available Nutrients Applied to Field		N		P_2O_5		K_2O	
(Circle column that is landuser's decision)		Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5, above)		0	0	0	0	0	0
7. Fertilizer	Starter						
	Other						
8. Manure / Organic Materials (Source-)		222	222	168	168	252	252
9.	Subtotal (sum of lines 6, 7 and 8)	222	222	168	168	252	252
10.	Nutrients Recommended (from Table 1)	0	0	0	0	0	0
11.	Nutrient Status (subtract line 10 from line 9)	222	222	168	168	252	252

If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.

PLANNED NUTRIENT APPLICATIONS						
Amount to be Applied (lb/ac)	N		P_2O_5		K_2O	
Method, Form, and Timing of Application						

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Producer:	Roads End Dairy	Tract(s): 313	Field(s): G1,G2,G3
Assisted by:	Rebecca Rudd	Date:	September 3, 2009

PURPOSE (Check all that apply)			
Budget and supply for plant production	x	Utilize manure/organic materials as a nutrient source	x
Minimize agricultural non-point source pollution (water quality)	x	Maintain or improve soil condition	x

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD
Perennial Hay/Pasture(High Intensity)	20

CURRENT SOIL TEST LEVELS (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD									
N (lbs/ac)		P_2O_5 (lbs/ac)		K_2O (lbs/ac)		LIME	Other		Other	
Trial A	Trial B	Trial A	Trial B	Trial A	Trial B					

Table 2. Nutrient Sources

Credits		N		P_2O_5		K_2O	
		pounds per acre					
1. Nitrogen credits from previous legume crop							
2. Residual from long-term manure application							
3. Irrigation water							
4. Other (e.g., atmospheric deposition)							
5. Total Credits-		0		0		0	
Plant-Available Nutrients Applied to Field		N		P_2O_5		K_2O	
(Circle column that is landuser's decision)		Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5, above)		0	0	0	0	0	0
7. Fertilizer	Starter						
	Other						
8. Manure / Organic Materials (Source-)		280	280	211	211	316	316
9.	Subtotal (sum of lines 6, 7 and 8)	280	280	211	211	316	316
10.	Nutrients Recommended (from Table 1)	0	0	0	0	0	0
11.	Nutrient Status (subtract line 10 from line 9)	280	280	211	211	316	316
If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.							
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.							

PLANNED NUTRIENT APPLICATIONS						
Amount to be Applied (lb/ac)	N		P_2O_5		K_2O	
Method, Form, and Timing of Application						

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

Worksheet OR10A-7--Waste storage period determination

Basic Storage Period, SPb = **274** **Days**

Enter average monthly Evapotranspiration(**ET**) from OSU Extension Publication 8530, Oregon Crop Water Use and Irrigation Requirements, and Precipitation(Ppt) Data from

Climatic Station- TILLAMOOK 1 W

Day of Year	MONTH	Crop ET, Inches	Accum ET, Inches	Ppt, Inches
1-31	January	0.18	0.18	13.09
32-59	February	0.36	0.54	10.79
60-90	March	0.75	1.29	9.90
91-120	April	2.64	3.93	6.81
121-151	May	3.74	7.67	4.84
152-181	June	3.66	11.33	3.41
182-212	July	3.98	15.31	1.64
213-243	August	3.39	18.70	1.42
244-273	September	2.87	21.57	3.68
274-304	October	2.01	23.58	7.16
305-334	November	0.90	24.48	13.71
335-365	December	0.43	24.91	13.94

a. Determine last day for the month of the year when 3/4 of Annual ET is exceeded-

3/4 of Annual ET = 0.75 x **24.91** = **18.68** Inches

L = Last Day for Month Accum ET exceeds 3/4 of Annual ET

L = **243** **Days**

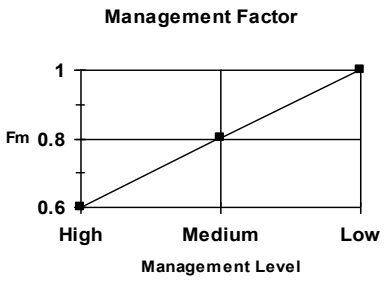
b. Determine first day for the month of the year when ET >= Ppt-

E = First Day of Month ET >= Ppt

E = **152** **Days**

c. **SPb =** 365 - (L - E) = 365 - (**243** - **152**)

Management Factor, Fm = **0.8**



Low Level, Fm = 1.0
...The operator does not utilize a waste management plan.
...Proper operation and maintenance may not be performed.

Medium Level, Fm = 0.8
...The operator utilizes an up-to-date waste management plan.
...Manure application equipment is calibrated for nutrient applications.
...Maintains adequate soil moisture for crop growth.
...Agronomic treatments which would maximize crop nutrient uptake are not fully utilized.
...Proper operation and maintenance is planned.

High Level, Fm = 0.6
…The operator utilizes an up-to-date waste management plan.
...Soil fertility testing is performed annually.
…Manure in storage is tested for nutrient concentrations.
...Records of time, rate and location of manure applications are maintained.
...Manure application equipment is calibrated for nutrient applications.
...Irrigation water management techniques are practiced.
...Crop nutrient uptake is maximized with appropriate agronomic treatments such as residue management, conservation crop rotation, crop variety selection, prescribed grazing, and pest management.
...Proper operation and maintenance is planned.

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

Worksheet OR10A-7--Waste storage period determination

Soils Factor: Fs_{LIQUID} = **0.90** Fs_{SOLID} = **0.70**

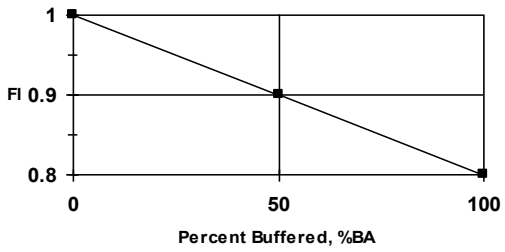
Soils must meet the following criteria for Fs to be less than 1.0-
... The average water holding capacity for the profile greater than 3.0 inches.
... A cation exchange capacity greater than 5 meq/100g of soil.
... Depth to a thin layer/cemented pan greater than 20 inches.
... Depth to high water table greater than 2 feet.
... A permeability greater than 0.06 inches/hr but less than 6 inches/hr.
... Cobbles less than 35% by weight in the surface layer.
... Stones and boulders less than 15% by weight in the surface layer.
... A pH greater than 5.0.
... Sodium Adsorption Ratio less than 13.
... Land slope less than 15%.

	Soils Factor (Fs)			
	Consistency of Waste			
HSG	Liquid	Slurry	Semi-Solid	Solid
A	1	0.95	0.9	0.8
B	0.8	0.75	0.7	0.6
C	0.9	0.85	0.8	0.7
D	1	1	0.95	0.85

HSG	Area	Fs_{LIQUID}	Wtd Fs_{LIQUID}	Fs_{SOLID}	Wtd Fs_{SOLID}
C	100	0.9	90.00	0.7	70.00
		Fs_{LIQUID} =	0.90	Fs_{SOLID} =	0.70

Location Factor: Fl = **1.00**

Location Factor



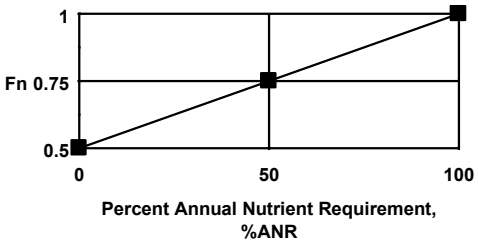
For an application area to be considered buffered there must be a 0 to 5 percent chance of flooding and the area must be at least 50 feet from water bodies, ground water sources(wells), and areas of concentrated flow. The percent buffered area(%BA) is determined by taking the total buffered area(TBA) and dividing it by the total land area(TLA) available for manure application.

$$\%BA = \frac{TBA}{TLA} \times 100\%$$

$$\%BA = \frac{0}{105} \times 100\% = 0\%$$

Nutrient Loading Factor: Fn = **1.00**

Nutrient Loading Factor



In order for the Nutrient Loading Factor, Fn to be less than 1, the Location Factor, Fl must be 0.95 or less.

The percent of annual nutrient requirement(%ANR) is determined by taking the total nutrients applied(TNA) annually and dividing it by the total nutrient requirements(TNR) of all of the crops grown.

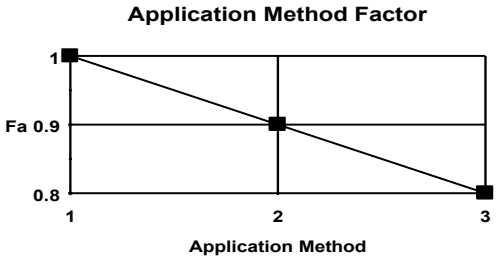
$$\%ANR = \frac{TNA}{TNR} \times 100\%$$

$$\%ANR = \frac{3{,}633}{3{,}627} \times 100\% = 100\%$$

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

Worksheet OR10A-7--Waste storage period determination

Application Method Factor: Fa_{LIQUID} = **0.90** Fa_{SOLID} = **1.00**



Method 1 - Surface applied solid manure, no incorporation.

Method 2 - Surface applied liquid manure, no incorporation.

Method 3 - Injection or immediate incorporation.

Adjusted Storage Period: ASP_{LIQUID} = 178 **Days** ASP_{SOLID} = 153 **Days**

ASP = SPb X Fm X Fs X Fl X Fn X Fa

ASP_{LIQUID} = 274 X 0.8 X 0.9 X 1 X 1 X 0.9

ASP_{SOLID} = 274 X 0.8 X 0.7 X 1 X 1 X 1

Adjusted earliest Day of Year for application, E_a = ASP - (365 - L)

$E_{a\ LIQUID}$ = 56

$E_{a\ SOLID}$ = 31

Storage Period: SP_{LIQUID} = 178 **Days** SP_{SOLID} = 154 **Days**

The storage period must span the seasonal flooding conditions and must also span frozen ground and snow conditions where the land slope exceeds 5% and a buffer strip of less than 100 feet exists next to open water courses that affect the application area-

a. Enter **L** from Sheet 1 and determine the Day of Year L_f when seasonal frozen ground, snow or flooding conditions are first anticipated for the application area-

L = 243 **Days** L_f = 305 **Days**

If L_f comes before L then $L_{sp} = L_f$

If L_f comes after L or there is no seasonal frozen ground, snow or flooding then L_{sp} = L

L_{sp} = 243 **Days**

b. Determine the Day of Year E_f when seasonal frozen ground, snow or flooded conditions are no longer anticipated for the application area-

E_f = 32 **Days**

If E_f comes after E_a then $E_{sp} = E_f$

If E_f comes before E_a or there is no seasonal frozen ground, snow or flooding then $E_{sp} = E_a$

$E_{sp\ LIQUID}$ = 56 **Days** $E_{sp\ SOLID}$ = 32 **Days**

c. SP_{LIQUID} = 365 - (Lsp - Esp LIQUID) = 178 Days

SP_{SOLID} = 365 - (L_{sp} - $E_{sp\ SOLID}$) = 154 Days

d. **Earliest date (E_{sp}) for manure application (month-day):**

$E_{sp\ LIQUID}$ = February 4

$E_{sp\ SOLID}$ = February 1

e. **Latest date (L_{sp}) for manure application (month-day) =** September 31

CLIENT: **Roads End Dairy**
ASSISTED BY: **Rebecca Rudd** CHECKED BY: **0**

Worksheet OR10A-7--Waste storage period determination

Day of Year Calendar

Day of month	Month Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	32	60	91	121	152	182	213	244	274	305	335
2	2	33	61	92	122	153	183	214	245	275	306	336
3	3	34	62	93	123	154	184	215	246	276	307	337
4	4	35	63	94	124	155	185	216	247	277	308	338
5	5	36	64	95	125	156	186	217	248	278	309	339
6	6	37	65	96	126	157	187	218	249	279	310	340
7	7	38	66	97	127	158	188	219	250	280	311	341
8	8	39	67	98	128	159	189	220	251	281	312	342
9	9	40	68	99	129	160	190	221	252	282	313	343
10	10	41	69	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12	12	43	71	102	132	163	193	224	255	285	316	346
13	13	44	72	103	133	164	194	225	256	286	317	347
14	14	45	73	104	134	165	195	226	257	287	318	348
15	15	46	74	105	135	166	196	227	258	288	319	349
16	16	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19	19	50	78	109	139	170	200	231	262	292	323	353
20	20	51	79	110	140	171	201	232	263	293	324	354
21	21	52	80	111	141	172	202	233	264	294	325	355
22	22	53	81	112	142	173	203	234	265	295	326	356
23	23	54	82	113	143	174	204	235	266	296	327	357
24	24	55	83	114	144	175	205	236	267	297	328	358
25	25	56	84	115	145	176	206	237	268	298	329	359
26	26	57	85	116	146	177	207	238	269	299	330	360
27	27	58	86	117	147	178	208	239	270	300	331	361
28	28	59	87	118	148	179	209	240	271	301	332	362
29	29		88	119	149	180	210	241	272	302	333	363
30	30		89	120	150	181	211	242	273	303	334	364
31	31		90		151		212	243		304		365