

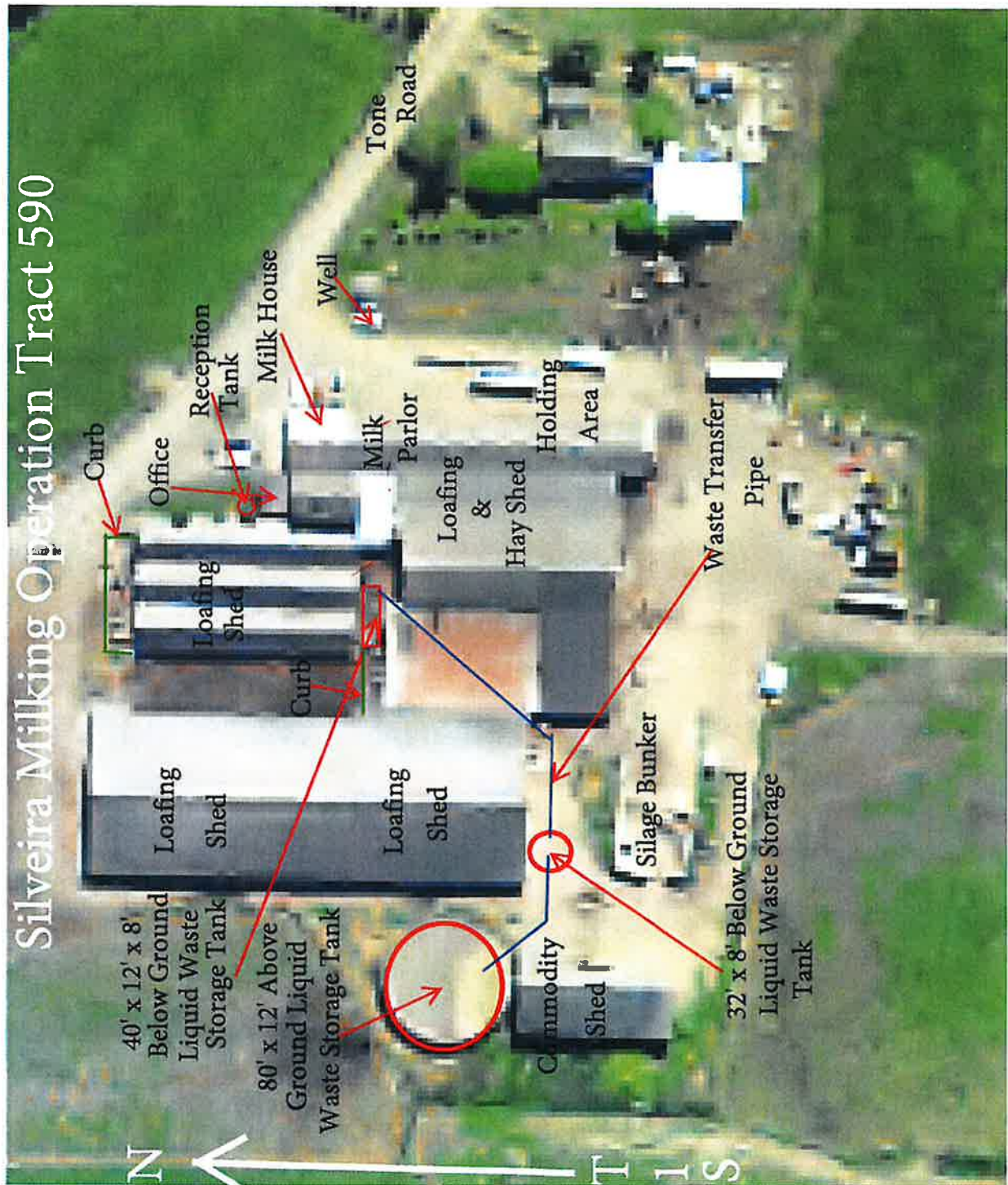
Silveira, Tony
MA# 1000053
AWMP# 15254
Rec'd 2/3/16

Need Signed
AWMP Agreement
Armando said he
will have Tony
Sign Agreement.

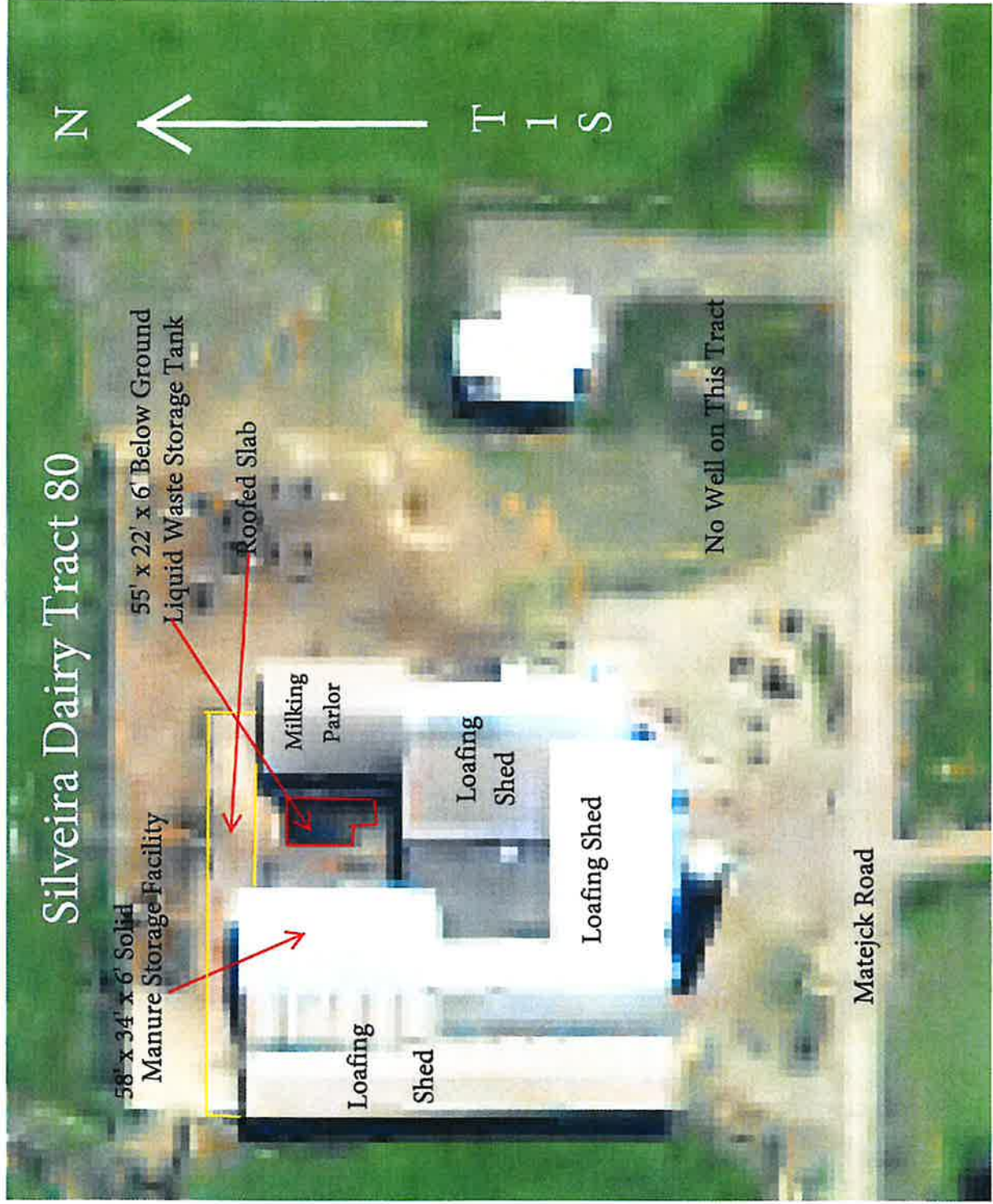
2/23/16

1	Site Maps
2	Land use Summaries & maps Soil Maps & Report
3	Business Narrative Comprehensive Nutrient management Plan Ops & Maint. Worksheets
4	Crops & Nutrient management Animal Waste Utilization - (ORAWM)
5	Emergency Response Plan Flood Frequency & Maps
6	Specification Worksheets
7	Soil tests, maps & ORAWM
8	References
9	
10	

Silveira Milking Operation Tract 590



Silveira Dairy Tract 80





Tillamook River

Fraser Road

N T I S

Loose Housing Barn B

82' x 12' x 2.5'

Dry Pack

Hay Barn

Dry Pack

55' x 12' x 4'
Solid Manure
Storage Facility

82' x 12' x 2.5'

17.2' x 78.5' x 1.5'
Dry Pack

50' x 98' x 1.5'
Dry Pack

Dry Pack 17' x 111' x 1.5'

Dry Pack 51' x 111' x 1.5'

Loose Housing Barn A

13' x 58' x 1.5'

Silveira, Tony
Farmstead Map

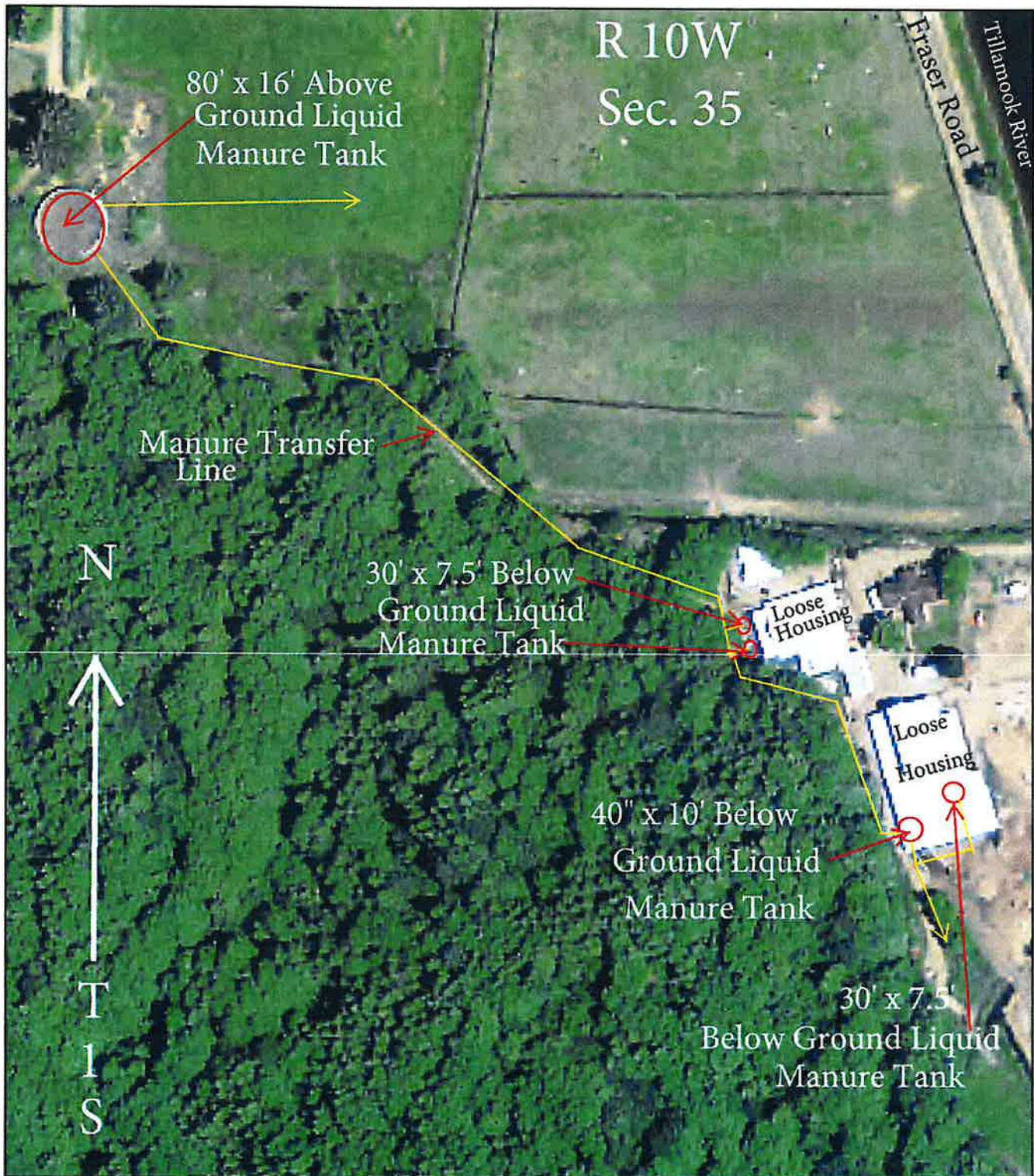
T-177

R 10W

Sec. 35

Customer(s): TONY M SILVEIRA
TRACT 177

Field Office: TILLAMOOK SERVICE CENTER



Tony Silveira
10/2015

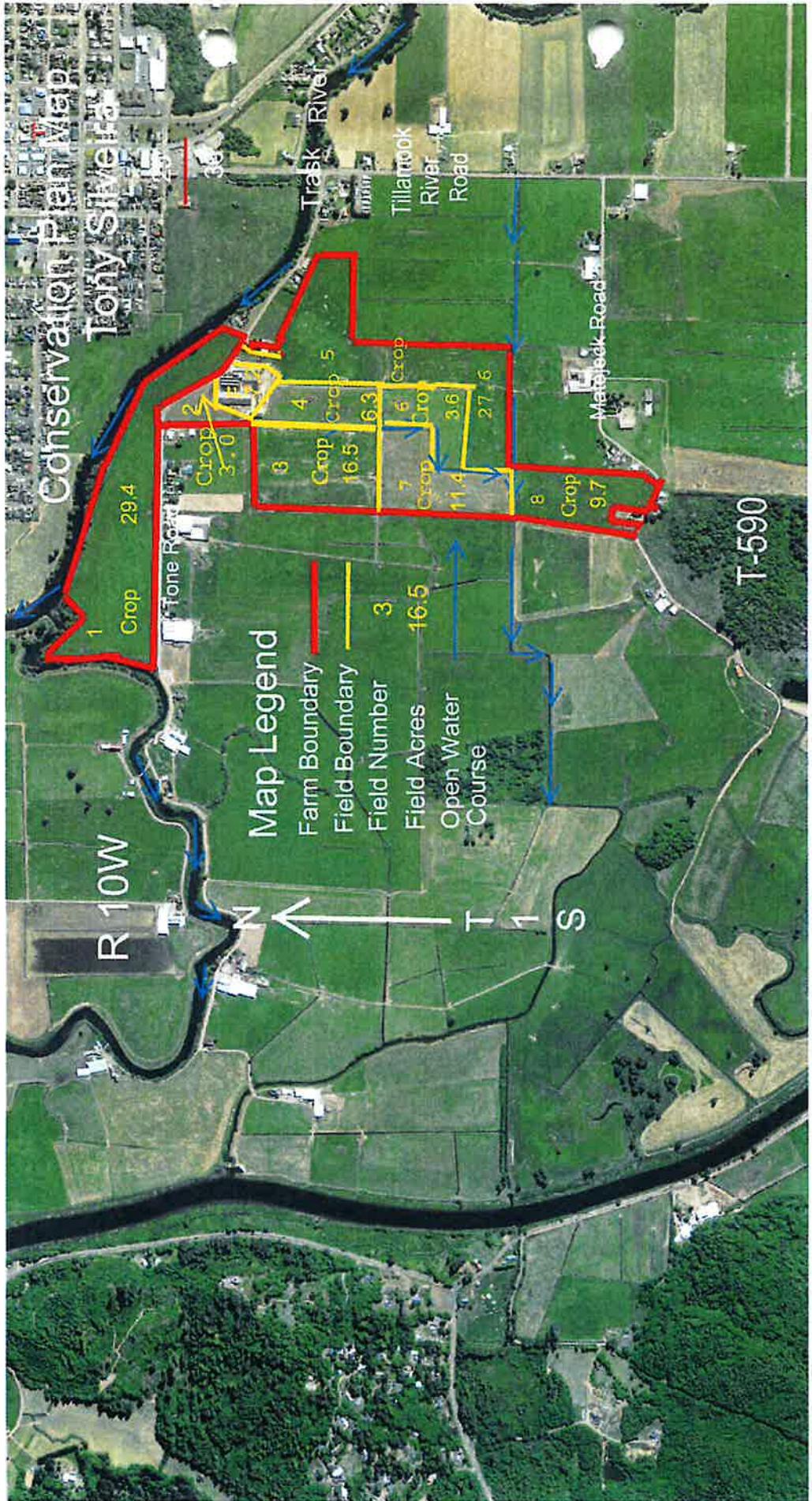
Land Use Summary

<u>Tract</u>	<u>Field</u>	<u>Land Use</u>	<u>Acres</u>
590	1	Crop (Corn/Grass Silage**)	29.4
	2	Crop (Corn/Grass Silage)	3.0
	3	Crop (Corn/Grass Silage)	16.5
	4	Crop (Corn/Grass Silage)	6.3
	5	Crop (Corn/Grass Silage)	27.6
	6	Crop (Corn/Grass Silage)	3.6
	7	Crop (Corn Grass Silage)	11.4
	8	Crop (Corn Grass Silage)	9.7
	F	Farmstead	7.2
		Total	114.7

Summary

Crop (Corn/Grass Silage)	107.5
Farmstead	7.2
Total	114.7

**** Grass silage mixtures may include wheat, oats or both**



Tony Silveira
10/2015

LAND USE SUMMARY

<u>Tract</u>	<u>Field No.</u>	<u>Land Use</u>	<u>Acres</u>
T-80	1	Crop (Corn/Grass Silage **	14.5
	2	Crop (Corn/Grass Silage)	6.8
	3	Crop (Corn/Grass Silage)	11.0
	4	Crop (Corn/Grass Silage)	47.3
	5	Crop (Corn/Grass Silage)	19.4
	6	Woodland	40.3
	F	Farmstead	3.0
		Total	142.3

SUMMARY

Crop (Corn/Grass Silage)	99.0
Woodland	40.3
Farmstead	3.0
Total	142.3

****Grass silage mixtures may include wheat, oats or both**

Tony Silveira Conservation Plan Map

R 10W

T-80

N

T I S

HWY 101

Trask River

Gienger Road

Matejck Road

Tillamook River Road

Tillamook River

Matejck Road

Map Legend

Farm Boundary

Field Boundary

Farmstead

Open Watercourse

Field Number

Field Acres

Filter Strip

Field Tie



Google

Land Use Summary

Name: Silveira, Tony

Date: Jul-14

<u>Tract</u>	<u>Field</u>	<u>Land Use</u>	<u>Acres</u>
177	1	Pasture	6.8
	2	Pasture	8.7
	3	Pasture	4.7
	4	Pasture	5.8
	5	Pasture	3.6
	6	Pasture	6.5
	7	Pasture	7.8
	8	Pasture	8.7
	9	Pasture	9.2
	10	Wildlife	0.9
	11	Wildlife	3.1
	12	Wildlife	0.4
	F	Farmstead	3.8
		Subtotal	70.0
<u>Summary</u>			
	Pasture		61.8
	Wildlife		4.4
	Farmstead		3.8
	Total		70.0

Tony Silveira

Tillamook County SWCD

Approximate Acres: 76.3

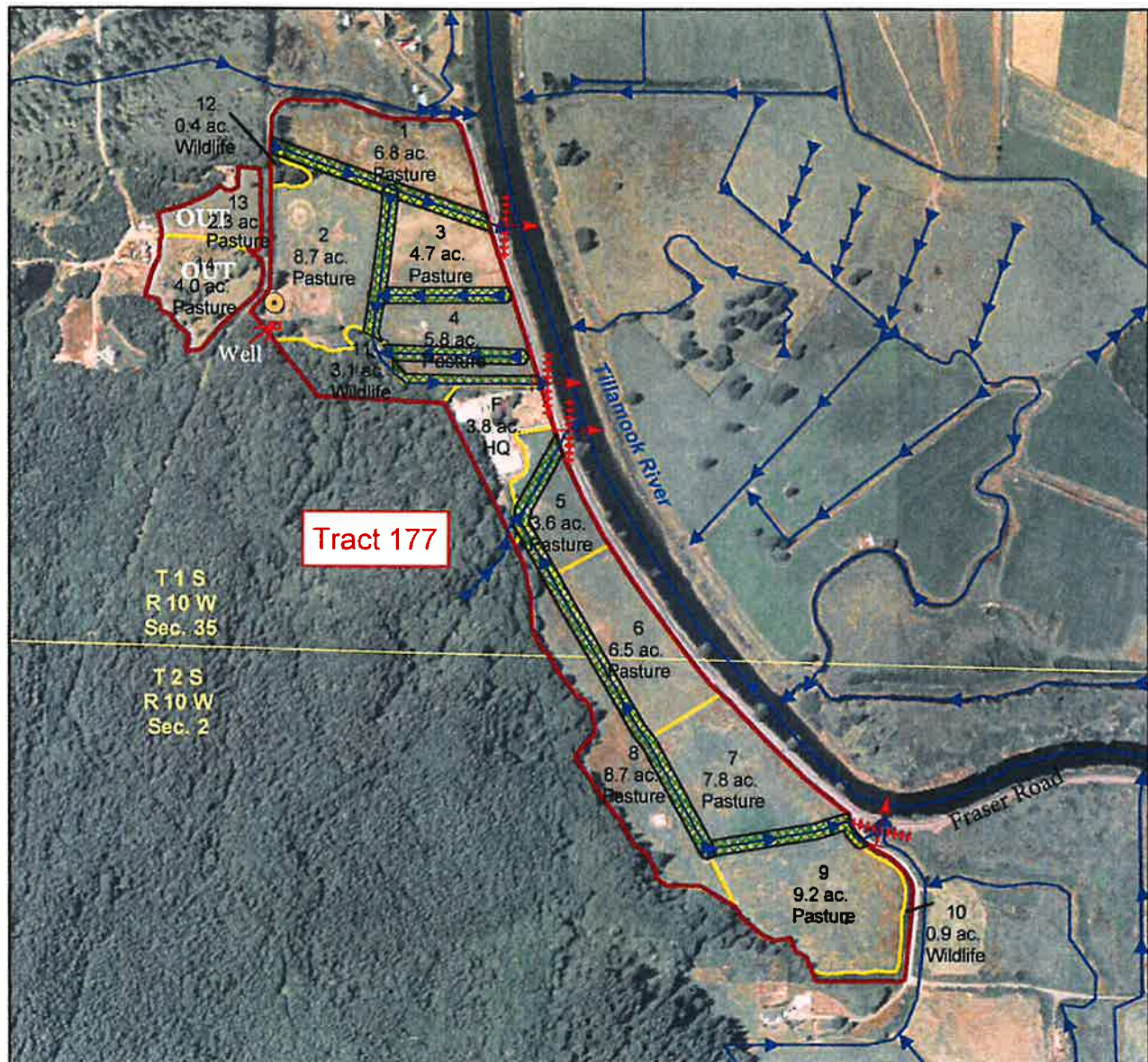
Date: 2/25/2009

TILLAMOOK SERVICE CENTER

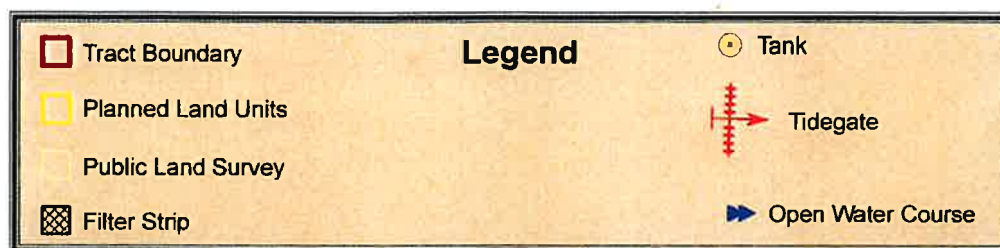
Tillamook County SWCD

TILLAMOOK COUNTY, OREGON

Conservation Plan Map



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

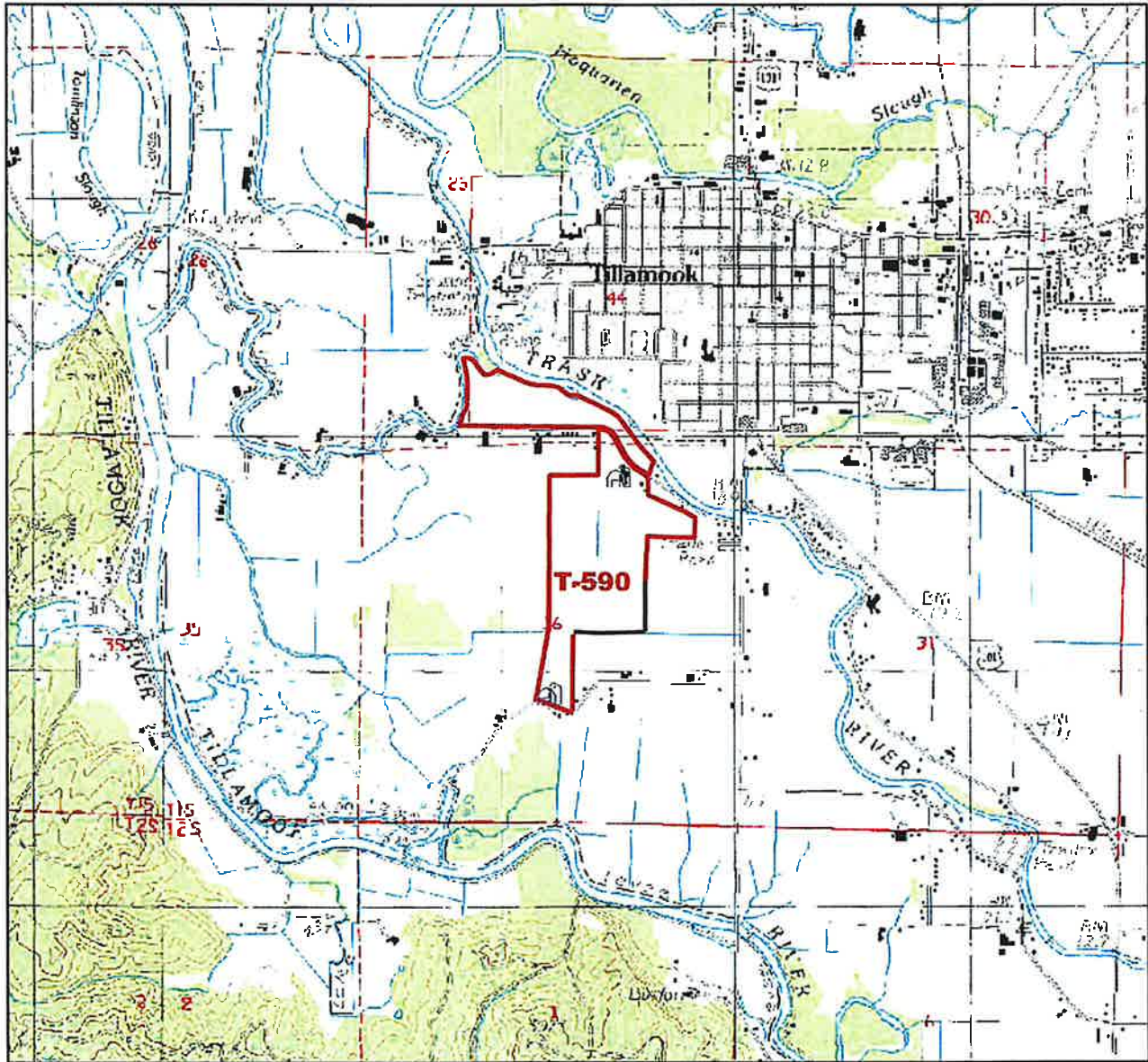


Silveira, Tony T-590
TI014

TILLAMOOK SERVICE CENTER
Tillamook County SWCD
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 107.5
Date: 11/20/2006

7.5 Min. Topo Map



1,500 0 1,500 3,000 4,500 6,000
Feet

Legend

 Tract Boundaries

 Farmstead Lat/Long (NAD83)
45° 26' 48.2" N; 123° 51' 53.5" W



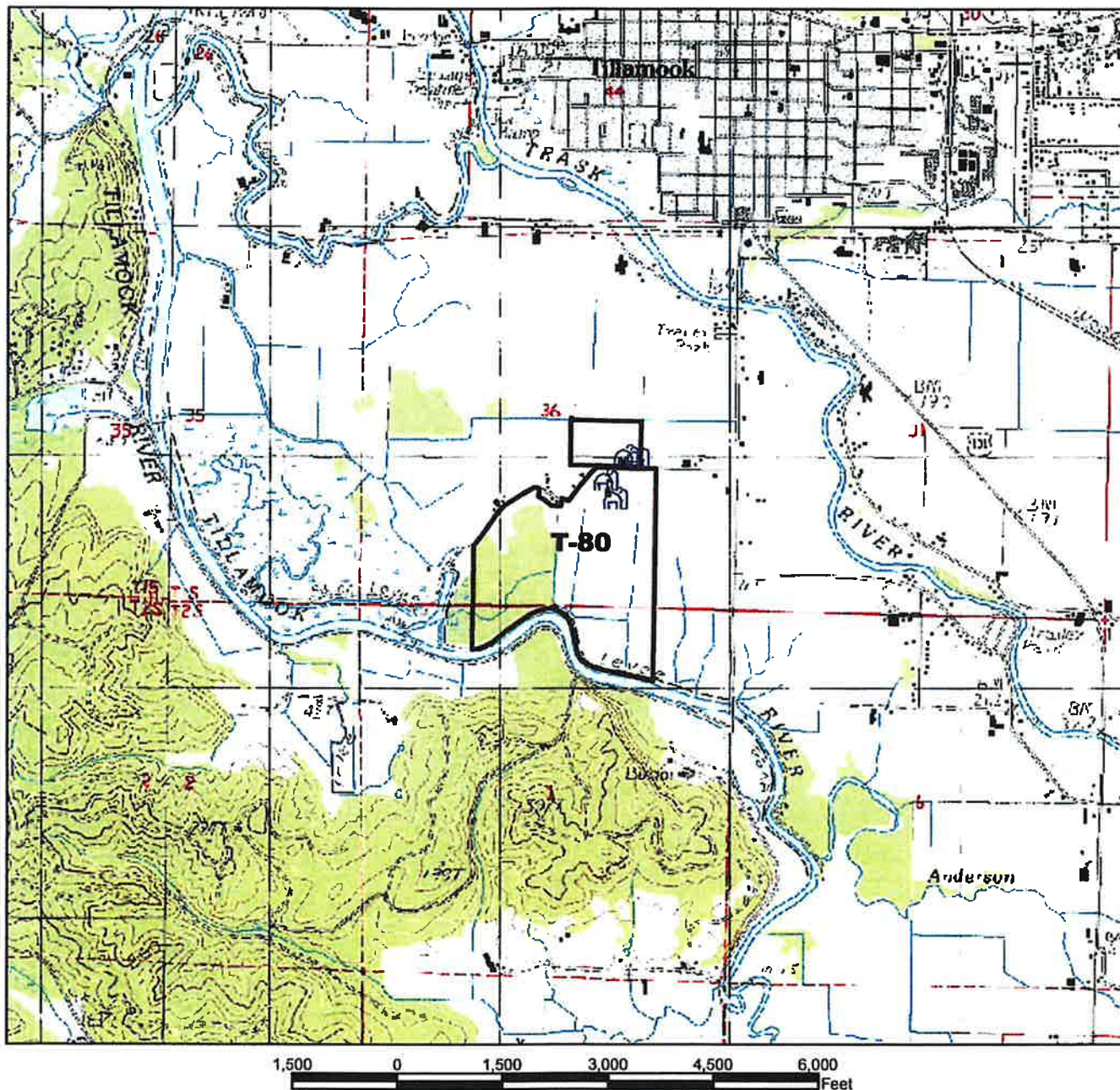
Silveira, Tony
TI080

- Tract 80

TILLAMOOK SERVICE CENTER
Tillamook County SWCD
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 160.1
Date: 11/29/2006

7.5 Min. Topo Map



Legend

□ Tract Boundaries



Farmstead Lat/Long (NAD83)
45° 26' 24.5" N; 123° 51' 3.3" W

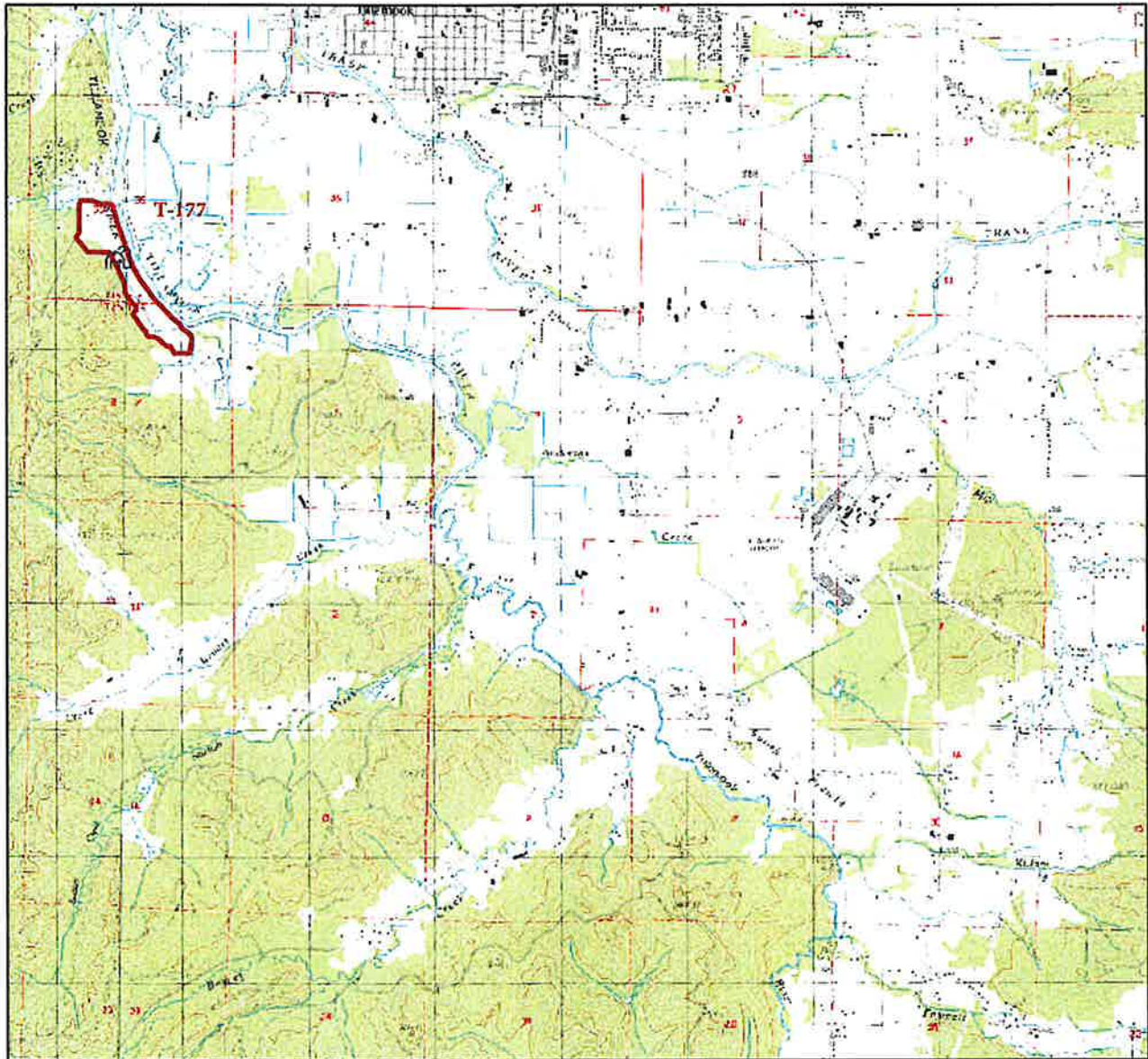


Silveira, Tony

TILLAMOOK SERVICE CENTER
TILLAMOOK COUNTY SWCD
TILLAMOOK COUNTY OREGON

Tillamook County SWCD
Approximate Acres: 70.0
Date: 2/18/2009

7.5 Min. Topo Map



5,000 0 5,000 10,000 15,000 20,000 Feet

Legend

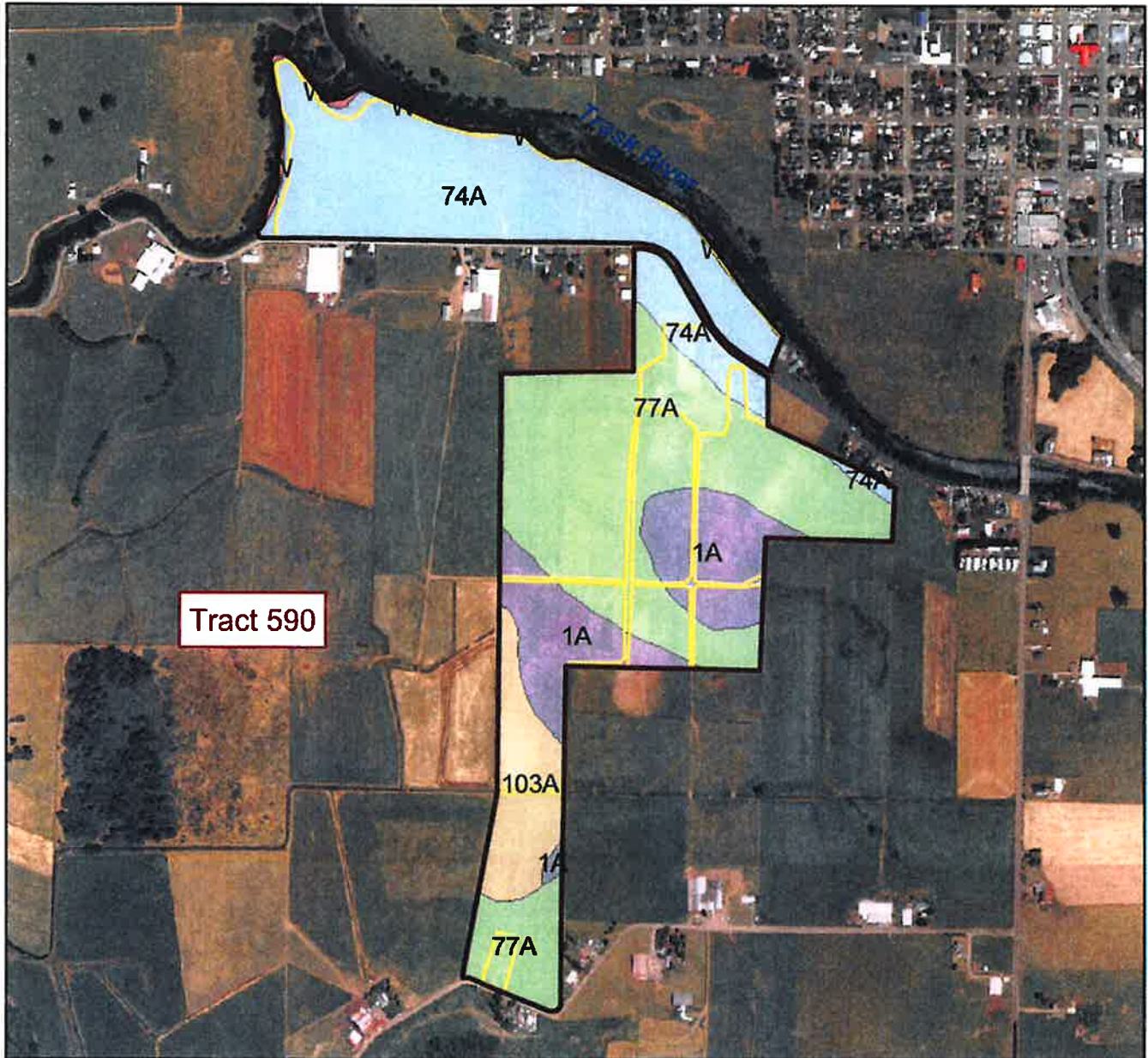
 Tract Boundary

 Farmstead Lat/Long (NAD83)
45 26' 14.9" N; 123 52' 37.5" W

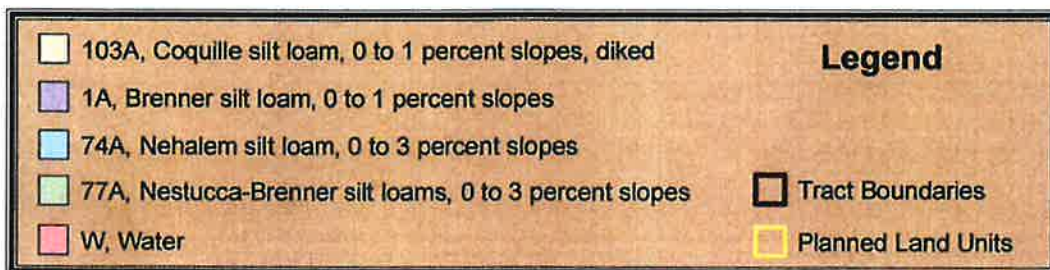


Tillamook County SWCD
Approximate Acres: 107.5
Date: 11/20/2006

Soils Map



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



Soils Inventory Report

Tue Dec 17 10:23:50 PST 2013

Silveira, Tony

Tract	Land Unit	Map Unit Symbol	Map Unit Name	Acres	Percent
590	1	W	Water	0.2	1%
590	1	74A	Nehalem silt loam, 0 to 3 percent slopes	29.1	99%
			Total:	29.3	
590	2	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	0.9	30%
590	2	74A	Nehalem silt loam, 0 to 3 percent slopes	2.1	70%
			Total:	3	
590	3	1A	Brenner silt loam, 0 to 1 percent slopes	0.8	5%
590	3	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	15.8	95%
			Total:	16.6	
590	4	1A	Brenner silt loam, 0 to 1 percent slopes	2.6	41%
590	4	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	3.7	59%
			Total:	6.3	
590	5	74A	Nehalem silt loam, 0 to 3 percent slopes	0.9	6%
590	5	1A	Brenner silt loam, 0 to 1 percent slopes	4	29%
590	5	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	9	65%
			Total:	13.9	
590	6	1A	Brenner silt loam, 0 to 1 percent slopes	1.7	47%
590	6	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1.9	53%
			Total:	3.6	
590	7	1A	Brenner silt loam, 0 to 1 percent slopes	1	33%
590	7	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	2	67%
			Total:	3	
590	8	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1.1	10%
590	8	103A	Coquille silt loam, 0 to 1 percent slopes, diked	4.1	36%
590	8	1A	Brenner silt loam, 0 to 1 percent slopes	6.2	54%
			Total:	11.4	
590	9	1A	Brenner silt loam, 0 to 1 percent slopes	0.4	4%
590	9	103A	Coquille silt loam, 0 to 1 percent slopes, diked	4.2	43%
590	9	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	5.1	53%
			Total:	9.7	
590	10	103A	Coquille silt loam, 0 to 1 percent slopes, diked	0.2	100%
			Total:	0.2	
590	11	W	Water	1	40%
590	11	74A	Nehalem silt loam, 0 to 3 percent slopes	1.5	60%
			Total:	2.5	
590	F	1A	Brenner silt loam, 0 to 1 percent slopes	0.8	11%
590	F	74A	Nehalem silt loam, 0 to 3 percent slopes	2.2	31%
590	F	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	4.1	58%
			Total:	7.1	
590	F2	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	0.8	100%
			Total:	0.8	

**Soil Description
Silveira, Tony— Tract 590
November, 2006**

Tillamook County, Oregon

Map unit:1A - Brenner silt loam, 0 to 1 percent slopes

Component: Brenner

Text kind/Category: Nontechnical description/GENSOIL

The Brenner component makes up 85 percent of the map unit. Slopes are 0 to 1 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 poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

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

Component: Nehalem

Text kind/Category: Nontechnical description/GENSOIL

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:77A - Nestucca-Brenner silt loams, 0 to 3 percent slopes

Component: Nestucca

Text kind/Category: Nontechnical description/GENSOIL

The Nestucca component makes up 50 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 poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 14 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Brenner

Text kind/Category: Nontechnical description/GENSOIL

The Brenner component makes up 40 percent of the map unit. Slopes are 0 to 1 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 poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

This report shows only the major soils in each map unit. Others may exist.

Soil Description Silveira, Tony – Tract 590

Tillamook County, Oregon

Map unit: 103A - Coquille silt loam, 0 to 1 percent slopes, diked

Component: Coquille, diked

Text kind/Category: Nontechnical description/GENSOIL

The Coquille, diked component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on tidal marshes. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, December. Organic matter content in the surface horizon is about 7 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: W - Water

Component: Water

Text kind/Category: Nontechnical description/GENSOIL

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

This report shows only the major soils in each map unit. Others may exist.

Nonirrigated Capability Class - Siveira Tract 590
Tony

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
1A	Brenner silt loam, 0 to 1 percent slopes	4
74A	Nehalem silt loam, 0 to 3 percent slopes	2
77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	3
103A	Coquille silt loam, 0 to 1 percent slopes, diked	4
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 - Silveira, Tony **Tract 590**

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
1A	Brenner silt loam, 0 to 1 percent slopes	Poorly drained
74A	Nehalem silt loam, 0 to 3 percent slopes	Well drained
77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	Somewhat poorly drained
103A	Coquille silt loam, 0 to 1 percent slopes, diked	Very poorly 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.

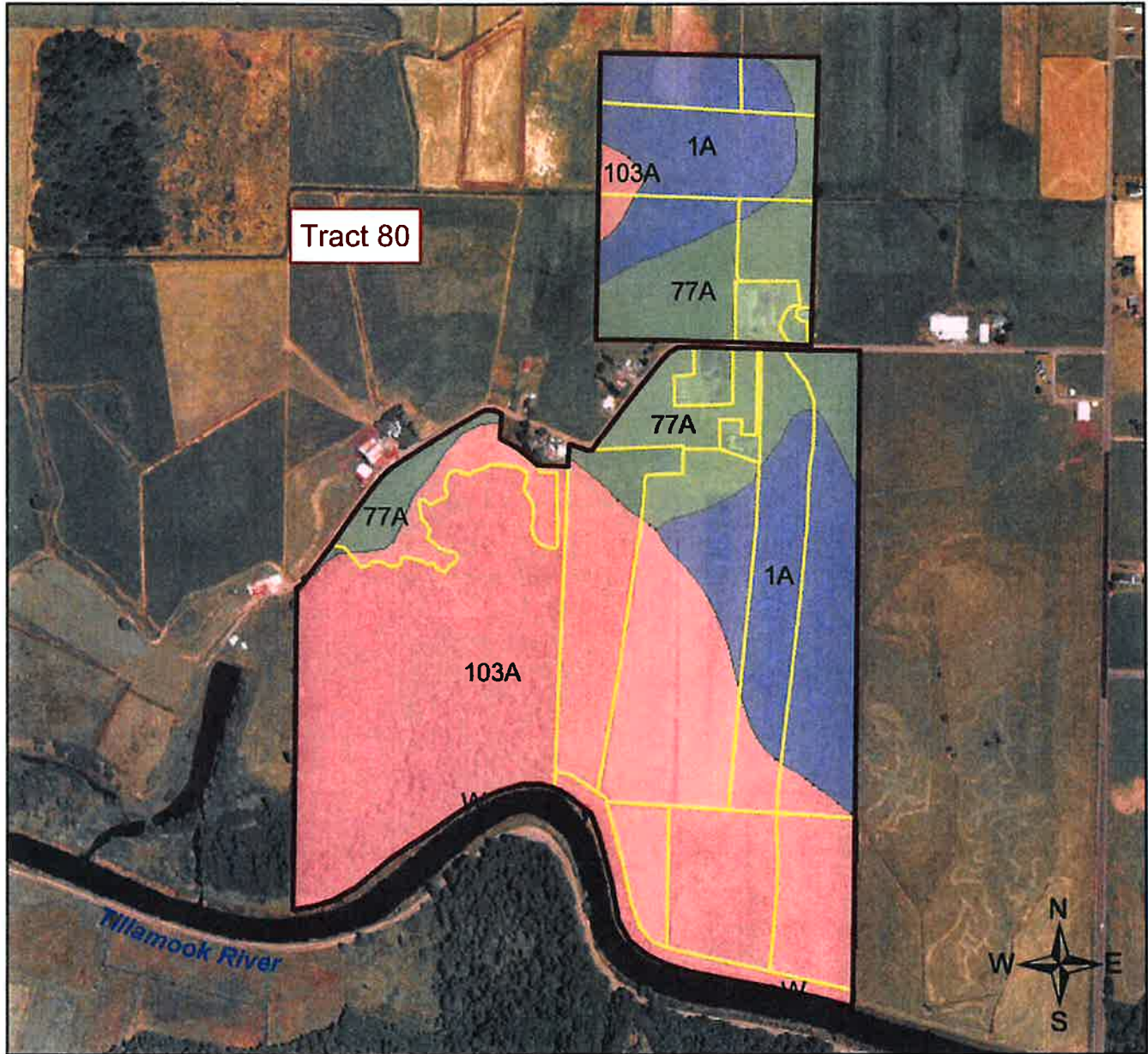
Silveira, Tony
T1080

- Tract 80

TILLAMOOK SERVICE CENTER
Tillamook County SWCD
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 160.1
Date: 11/29/2006

Soils Map



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

103A, Coquille silt loam, 0 to 1 percent slopes, diked

1A, Brenner silt loam, 0 to 1 percent slopes

77A, Nestucca-Brenner silt loams, 0 to 3 percent slopes

W, Water

Legend

Tract Boundaries

Planned Land Units

Soils Inventory Report Tract 80

Tue Dec 17 10:15:11 PST 2013

Silveira, Tony

Tract	Land Unit	Map Unit Symbol	Map Unit Name	Acres	Percent
80	1	1A	Brenner silt loam, 0 to 1 percent slopes	3.6	100%
			Total:	3.6	
80	2	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1	48%
80	2	1A	Brenner silt loam, 0 to 1 percent slopes	1.1	52%
			Total:	2.1	
80	3	103A	Coquille silt loam, 0 to 1 percent slopes, diked	0.9	10%
80	3	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1.1	12%
80	3	1A	Brenner silt loam, 0 to 1 percent slopes	7.4	79%
			Total:	9.4	
80	4	1A	Brenner silt loam, 0 to 1 percent slopes	0.2	6%
80	4	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	3.4	94%
			Total:	3.6	
80	5	103A	Coquille silt loam, 0 to 1 percent slopes, diked	0.5	5%
80	5	1A	Brenner silt loam, 0 to 1 percent slopes	3.2	33%
80	5	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	6.1	62%
			Total:	9.8	
80	6	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	4.3	100%
			Total:	4.3	
80	7	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	2	18%
80	7	103A	Coquille silt loam, 0 to 1 percent slopes, diked	9	82%
			Total:	11	
80	8	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	2.6	13%
80	8	1A	Brenner silt loam, 0 to 1 percent slopes	4.5	22%
80	8	103A	Coquille silt loam, 0 to 1 percent slopes, diked	13.5	66%
			Total:	20.6	
80	9	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1.7	15%
80	9	103A	Coquille silt loam, 0 to 1 percent slopes, diked	1.8	16%
80	9	1A	Brenner silt loam, 0 to 1 percent slopes	7.6	68%
			Total:	11.1	
80	10	103A	Coquille silt loam, 0 to 1 percent slopes, diked	1.1	8%
80	10	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	2.5	18%
80	10	1A	Brenner silt loam, 0 to 1 percent slopes	10.1	74%
			Total:	13.7	
80	11	103A	Coquille silt loam, 0 to 1 percent slopes, diked	6.4	100%
			Total:	6.4	
80	12	103A	Coquille silt loam, 0 to 1 percent slopes, diked	7.9	100%
			Total:	7.9	
80	13	103A	Coquille silt loam, 0 to 1 percent slopes, diked	2.9	100%
			Total:	2.9	
80	14	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	2.7	40%
80	14	103A	Coquille silt loam, 0 to 1 percent slopes, diked	4.1	60%
			Total:	6.8	
80	15	W	Water	0	0%

80	15	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	0.1	0%
80	15	103A	Coquille silt loam, 0 to 1 percent slopes, diked	40.1	100%
			Total:	40.2	
80	16	W	Water	0.1	3%
80	16	103A	Coquille silt loam, 0 to 1 percent slopes, diked	3.2	97%
			Total:	3.3	
80	F	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1.6	100%
			Total:	1.6	
80	F2	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	0.1	100%
			Total:	0.1	
80	F3	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	1.4	100%
			Total:	1.4	
80	F4	77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	0.7	100%
			Total:	0.7	

**Soil Description
Silveira, Tony – Tract 80
November, 2006**

Tillamook County, Oregon

Map unit: 1A - Brenner silt loam, 0 to 1 percent slopes

Component: Brenner

Text kind/Category: Nontechnical description/GENSOIL

The Brenner component makes up 85 percent of the map unit. Slopes are 0 to 1 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 poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: 77A - Nestucca-Brenner silt loams, 0 to 3 percent slopes

Component: Nestucca

Text kind/Category: Nontechnical description/GENSOIL

The Nestucca component makes up 50 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 poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 14 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Brenner

Text kind/Category: Nontechnical description/GENSOIL

The Brenner component makes up 40 percent of the map unit. Slopes are 0 to 1 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 poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: 103A - Coquille silt loam, 0 to 1 percent slopes, diked

Component: Coquille, diked

Text kind/Category: Nontechnical description/GENSOIL

The Coquille, diked component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on tidal marshes. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, December. Organic matter content in the surface horizon is about 7 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil meets hydric criteria.

This report shows only the major soils in each map unit. Others may exist.

Component Text

Tillamook County, Oregon

Map unit: W - Water

Component: Water

Text kind/Category: Nontechnical description/GENSOIL

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

This report shows only the major soils in each map unit. Others may exist.

Tabular Data Version: 1
Tabular Data Version Date: 09/21/2006

Page 2 of 2

Nonirrigated Capability Class - Silveira, Tony Tract 80

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
1A	Brenner silt loam, 0 to 1 percent slopes	4
77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	3
103A	Coquille silt loam, 0 to 1 percent slopes, diked	4
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 - Silveira, Tony - Tract 80

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
1A	Brenner silt loam, 0 to 1 percent slopes	Poorly drained
77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	Somewhat poorly drained
103A	Coquille silt loam, 0 to 1 percent slopes, diked	Very poorly 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

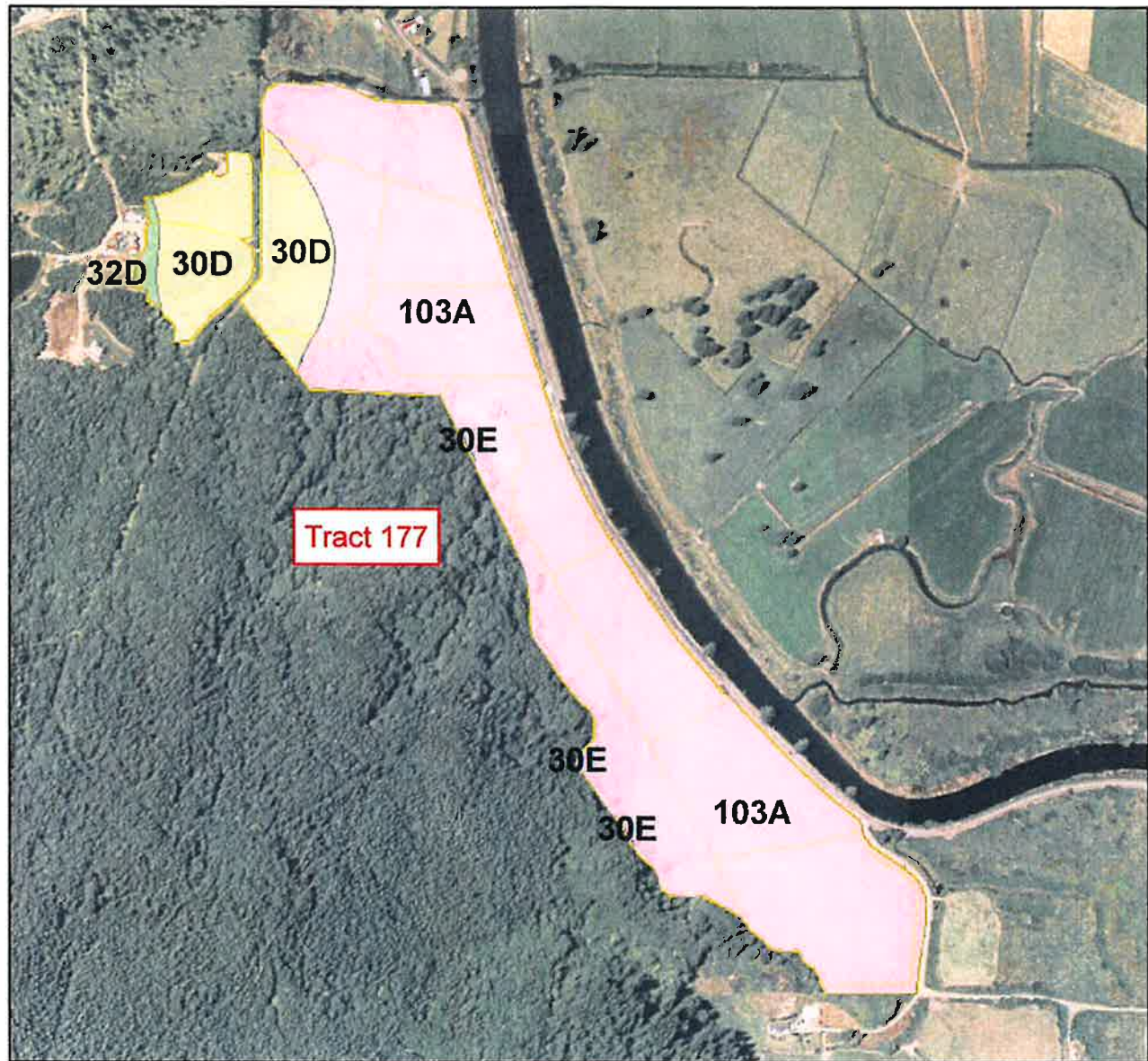
The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Silveira, Tony

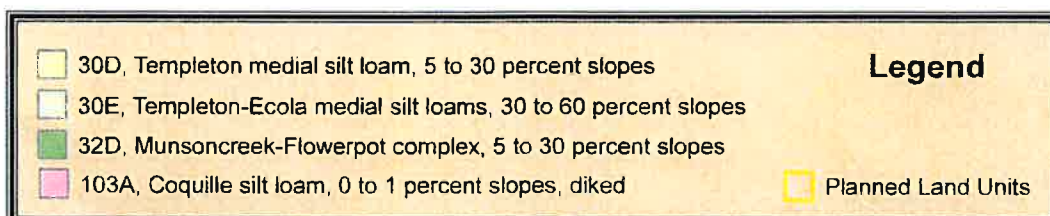
TILLAMOOK SERVICE CENTER
TILLAMOOK COUNTY SWCD
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 76.3
Date: 2/25/2009

Soils Map



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



Soils Inventory Report

Fri Jul 11 09:48:22 PDT 2014

Silveira, Tony

Tract	Land Unit	Map Unit Symbol	Map Unit Name	Acres	Percent
177	1	30D	Templeton medial silt loam, 5 to 30 percent slopes	0	0%
177	1	103A	Coquille silt loam, 0 to 1 percent slopes, diked	6.9	100%
			Total:	6.9	
177	2	103A	Coquille silt loam, 0 to 1 percent slopes, diked	4	46%
177	2	30D	Templeton medial silt loam, 5 to 30 percent slopes	4.7	54%
			Total:	8.7	
177	3	103A	Coquille silt loam, 0 to 1 percent slopes, diked	4.7	100%
			Total:	4.7	
177	4	103A	Coquille silt loam, 0 to 1 percent slopes, diked	5.8	100%
			Total:	5.8	
177	5	103A	Coquille silt loam, 0 to 1 percent slopes, diked	3.6	100%
			Total:	3.6	
177	6	103A	Coquille silt loam, 0 to 1 percent slopes, diked	6.5	100%
			Total:	6.5	
177	7	103A	Coquille silt loam, 0 to 1 percent slopes, diked	7.8	100%
			Total:	7.8	
177	8	30E	Templeton-Ecola medial silt loams, 30 to 60 percent slopes	0	0%
177	8	103A	Coquille silt loam, 0 to 1 percent slopes, diked	8.7	100%
			Total:	8.7	
177	9	103A	Coquille silt loam, 0 to 1 percent slopes, diked	9.2	100%
			Total:	9.2	
177	10	30E	Templeton-Ecola medial silt loams, 30 to 60 percent slopes	0	0%
177	10	103A	Coquille silt loam, 0 to 1 percent slopes, diked	0.9	100%
			Total:	0.9	
177	11	30D	Templeton medial silt loam, 5 to 30 percent slopes	0.4	13%
177	11	103A	Coquille silt loam, 0 to 1 percent slopes, diked	2.6	87%
			Total:	3	
177	12	103A	Coquille silt loam, 0 to 1 percent slopes, diked	0	0%
177	12	30D	Templeton medial silt loam, 5 to 30 percent slopes	0.4	100%
			Total:	0.4	

177	13	32D	Munsoncreek-Flowerpot complex, 5 to 30 percent slopes	0.1	4%
177	13	30D	Templeton medial silt loam, 5 to 30 percent slopes	2.2	96%
			Total:	2.3	
177	14	32D	Munsoncreek-Flowerpot complex, 5 to 30 percent slopes	0.5	12%
177	14	30D	Templeton medial silt loam, 5 to 30 percent slopes	3.5	88%
			Total:	4	
177	F	30E	Templeton-Ecola medial silt loams, 30 to 60 percent slopes	0	0%
177	F	103A	Coquille silt loam, 0 to 1 percent slopes, diked	3.7	100%
			Total:	3.7	
5000	1	119B	Typic Fulvudands complex, 0 to 7 percent slopes	0.1	0%
5000	1	170B	Logsdan-Nehalem silt loams, 0 to 5 percent slopes	1	3%
5000	1	33D	Tolovana medial silt loam, 5 to 30 percent slopes	6	20%
5000	1	191B	Siletz-Euchre medial silt loams, 0 to 7 percent slopes	10.3	34%
5000	1	45B	Hebo silty clay loam, 0 to 5 percent slopes	13	43%
			Total:	30.4	

Soil Description Report - Silveira, Tony

Tillamook County, Oregon

[Minor map unit components are excluded from this report]

Map unit: 30D - Templeton medial silt loam, 5 to 30 percent slopes

Component: Templeton (85%)

The Templeton component makes up 85 percent of the map unit. Slopes are 5 to 30 percent. This component is on benches, ridges. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 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 very high. Shrink-swell potential is low. This soil is not 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 75 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: 30E - Templeton-Ecola medial silt loams, 30 to 60 percent slopes

Component: Templeton (60%)

The Templeton component makes up 60 percent of the map unit. Slopes are 30 to 60 percent. This component is on hillslopes, mountain slopes. The parent material consists of colluvium derived from sedimentary rock. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 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 very high. Shrink-swell potential is low. This soil is not 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 75 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Ecola (20%)

The Ecola component makes up 20 percent of the map unit. Slopes are 30 to 60 percent. This component is on hillslopes, mountain slopes. The parent material consists of colluvium derived from sedimentary rock. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 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 not 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 75 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: 32D - Munsoncreek-Flowerpot complex, 5 to 30 percent slopes

Component: Munsoncreek (65%)

The Munsoncreek component makes up 65 percent of the map unit. Slopes are 5 to 30 percent. This component is on benches, ridges. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 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 moderate. This soil is not 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 75 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Flowerpot (20%)

The Flowerpot component makes up 20 percent of the map unit. Slopes are 5 to 30 percent. This component is on benches, ridges. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 14 inches during January, February. Organic matter content in the surface horizon is about 75 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: 33D - Tolovana medial silt loam, 5 to 30 percent slopes

Component: Tolovana (85%)

The Tolovana component makes up 85 percent of the map unit. Slopes are 5 to 30 percent. This component is on hills. 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

Map Unit Description

Tillamook County, Oregon

Map unit: 33D - Tolovana medial silt loam, 5 to 30 percent slopes

Component: Tolovana (85%)

moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is moderate. This soil is not 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 75 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: 45B - Hebo silty clay loam, 0 to 5 percent slopes

Component: Hebo (80%)

The Hebo component makes up 80 percent of the map unit. Slopes are 0 to 5 percent. This component is on terraces. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is very low. Shrink-swell potential is high. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 4e. This soil meets hydric criteria.

Map unit: 103A - Coquille silt loam, 0 to 1 percent slopes, diked

Component: Coquille, diked (85%)

The Coquille, diked component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on tidal marshes. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, December. Organic matter content in the surface horizon is about 7 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: 119B - Typic Fulvudands complex, 0 to 7 percent slopes

Component: Typic Fulvudands, flood plain (45%)

The Typic Fulvudands, flood plain component makes up 45 percent of the map unit. Slopes are 0 to 7 percent. This component is on flood plains. The parent material consists of alluvium derived from igneous rock. Depth to a root restrictive layer, strongly contrasting textural stratification, is 12 to 20 inches. The natural drainage class is moderately 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 occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 26 inches during January, February, March, April, May, June, October, November, December. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Typic Fulvudands, terrace (30%)

The Typic Fulvudands, terrace component makes up 30 percent of the map unit. Slopes are 0 to 7 percent. This component is on stream terraces. The parent material consists of alluvium derived from igneous rock. Depth to a root restrictive layer, strongly contrasting textural stratification, is 30 to 50 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 very high. Shrink-swell potential is low. This soil is not 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 75 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: 170B - Logsden-Nehalem silt loams, 0 to 5 percent slopes

Component: Logsden (50%)

The Logsden component makes up 50 percent of the map unit. Slopes are 0 to 5 percent. This component is on stream terraces. 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 very low. Shrink-swell potential is moderate. This soil is rarely 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 2e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit Description

Tillamook County, Oregon

Map unit: 170B - Logsden-Nehalem silt loams, 0 to 5 percent slopes

Component: Nehalem, occasional (40%)

The Nehalem, occasional component makes up 40 percent of the map unit. Slopes are 0 to 5 percent. This component is on flood plains. 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 2e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: 191B - Siletz-Euchre medial silt loams, 0 to 7 percent slopes

Component: Siletz (40%)

The Siletz component makes up 40 percent of the map unit. Slopes are 0 to 7 percent. This component is on stream terraces. Depth to a root restrictive layer, strongly contrasting textural stratification, is 40 to 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 very high. Shrink-swell potential is low. This soil is not 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 15 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Euchre (35%)

The Euchre component makes up 35 percent of the map unit. Slopes are 0 to 7 percent. This component is on stream terraces. Depth to a root restrictive layer, strongly contrasting textural stratification, is 36 to 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 14 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 12 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria.

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 Silveira, Tony

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
30D	Templeton medial silt loam, 5 to 30 percent slopes	6
30E	Templeton-Ecola medial silt loams, 30 to 60 percent slopes	6
32D	Munsoncreek-Flowerpot complex, 5 to 30 percent slopes	6
33D	Tolovana medial silt loam, 5 to 30 percent slopes	6
45B	Hebo silty clay loam, 0 to 5 percent slopes	4
103A	Coquille silt loam, 0 to 1 percent slopes, diked	4
119B	Typic Fulvudands complex, 0 to 7 percent slopes	4
170B	Logsdan-Nehalem silt loams, 0 to 5 percent slopes	2
191B	Slitz-Euchre medial silt loams, 0 to 7 percent slopes	2

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- Silveira, Tony

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
30D	Templeton medial silt loam, 5 to 30 percent slopes	Well drained
30E	Templeton-Ecola medial silt loams, 30 to 60 percent slopes	Well drained
32D	Munsoncreek-Flowerpot complex, 5 to 30 percent slopes	Well drained
33D	Tolovana medial silt loam, 5 to 30 percent slopes	Well drained
45B	Hebo silty clay loam, 0 to 5 percent slopes	Poorly drained
103A	Coquille silt loam, 0 to 1 percent slopes, diked	Very poorly drained
119B	Typic Fulvudands complex, 0 to 7 percent slopes	Moderately well drained
170B	Logsdon-Nehalem silt loams, 0 to 5 percent slopes	Well drained
191B	Siletz-Euchre medial silt loams, 0 to 7 percent slopes	Well drained

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 nonsol 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.

BUSINESS NARRATIVE

This Animal Waste Management Plan is for 862-1,000 lb. animal units. It is for 440 lactating Jerseys, 110 lactating Holsteins, 80 dry cows, 250 heifers, and 300 calves. The number of livestock may be lower, at times, due to culling rates, economic conditions, and/or livestock health. The lactating cows, dry cows, and heifers are confined throughout the year. The calves are normally confined for 181 days and on pasture for 184 days. The confinement days for the calves may vary from day to day, week to week, month to month and year to year. The variation is due to livestock health, economic conditions, weather conditions, and excessive forage produced during late fall, winter, and early spring. Livestock mortality service is provided by Tillamook County Creamery Association.

The operation consists of three owned Tracts. The lactating cows are housed at Tract 590. Tract 80 is the dry cow and heifer operation. Tract 177 is the calve operation.

There are 107.5 acres in Tract 590 (milking operation) that receive manure applications. There is 39 acres that occasionally flood and 68.5 acres that frequently flood. Liquid manure is applied with a pump, buried manure mainline, and a manure gun traveler. Solid manure produced at Tract 80 is applied with a tractor and manure spreader on Tract 590 forage producing fields. At Tract 590 emergency winter manure applications will be on Field 1 that occasionally floods. See the enclosed Flood Boundary Map for the emergency winter manure application areas. The Liquid manure produced at Tract 590 is run through a separator. All solid manure produced at Tract 590 is recycled as bedding. No solids from Tract 590 are applied to the fields. Based on the Oregon Animal Waste Management Design Aid (ORAWM) 47% of the nutrients produced will not be applied to the fields. This 47% represents 12,706 lbs. of nitrogen, 9,972 lbs. of phosphorus (P2O5), and 15,932 lbs. of potassium (K2O).

Tract 590 and 80 fields are double cropped. Those fields that are used to grow corn silage will be established to an adapted grass species as soon as the corn silage is removed. The grass forage mixture may contain wheat, oats, or both. All fields that receive manure applications in Tract 590 are within the 100-year flood plain. The target yield for the corn silage is 18 to 22 tons at 30% dry matter per acre per year. The target yield for the ryegrass silage crop forage is 20 tons at 30% dry matter per acre per year. Soil tests will be taken in the early spring to determine the rate of manure or commercial fertilizer application for the corn silage. The forage producing fields are in good condition. To achieve a 20 ton yield for the grass silage the agronomic rate is 300 lbs. of nitrogen per acre per year. To produce 18 to 22 tons of silage corn at 30% dry matter per acre the agronomic rate for nitrogen is 135 lbs. to 165 lbs. per acre

At Tract 590 (milking operation) the manure is handled 70% liquids and 30% solids. There are three liquid waste storage tanks and a waste collection tank at Tract 590. The

size of the two below ground liquid waste storage tanks are: 40' x 12' x 8' and 32' x 8'. The waste collection tank holds 134 cubic feet of milk house and parlor waste. The collection tank and below ground tank wastes are pumped to the above ground liquid waste storage tank. The above ground tank is 80' x 12'.

Liquid waste storage tanks at Tract 177 are used to store liquid waste produced at Tract 590, Tract 80 if needed, and solid manure leachate from the solid manure storage at Tract 177. Manure from Tracts 590 and 80 is transported to the liquid waste storage system by either a commercial manure hauler that uses a truck and tank wagon or by using either a 2,000 gallon or a 2,500 gallon tank wagon and a tractor. The liquid waste storage tanks at Tract 177 are four below ground liquid manure tanks and one above ground liquid waste storage tank. The below ground tanks are: 35' x 7.5', 40' x 10', 30' x 7.5', and 30' x 7.5'. The above ground liquid waste storage tank is 80' x 16'. The manure from the below ground liquid waste storage tanks is, pumped through a buried manure mainline to the above ground liquid waste storage tank. In combination, these six below ground liquid waste storage tanks, the waste collection tank, and the two above ground liquid waste storage tanks can store the liquid waste produced by the 862-1,000 lb. animal units at Tract 590, 80, and manure leachate from the solid manure produced at Tract 177 for 122 days. The 84' x 40' x 12' solid manure store is used to store T-590 separated manure. The facility can store the separated solid waste from 539-1,000 lb. animal units for 255 days.

Tract 80(dry cow/heifer operation) has 99.0 acres that receive manure applications. Liquid manure is applied from both Tract 590 and 80 by a pump, buried manure mainline and a manure gun traveler or a manure tank wagon. The solid manure is applied with a tractor and manure spreader. All fields that receive manure applications in T-80 are within the 100-year floodplain. Tract 80 field 2 is used for winter emergency manure applications. Refer to the enclosed Flood Boundary Map for Tract 80.

Tract 80 fields used to produce corn silage will be planted to an adapted grass species identified in the enclosed Cover Crop Specification Sheet when the corn silage is removed. Wheat, oats, or both may be included in the ryegrass mixture. The target yield for the ryegrass fields is 20 tons at 30% dry matter per acre per year. To achieve a 20 ton yield for the grass silage the agronomic rate is 300 lbs. of nitrogen per acre per year. The corn silage target yield is 18 to 22 tons at 30% dry matter per acre per year. Soil tests will be taken in the early spring for those fields that will be planted to corn silage to determine manure and commercial fertilizer application rates. For the pasture fields at Tract 177, soil tests will be taken at least every five years to evaluate the manure and/or commercial fertilizer application rates. Soil tests are recommend following the removal of the corn silage to evaluate the rate of manure application to the grass silage fields.

The manure that is produced by the dry cow and heifers at Tract 80 is handled 40% liquids and 60% solids. The below ground liquid manure storage tank is 55' x 22' x 6'. It will store the liquid manure produced by the 226-1,000 lb. animal units for 61 days. The solid manure storage facility is 58' x 34' x 6'. It will store the solid manure produced by the 226-1,000 lb. animals for 142 days.

There are 61.8 acres in Tract 177(calf operation) that receives manure applications. The adjacent county road is built on a dike along the Tillamook River. Tide-gates have been installed at the pasture open ditch outlets. The fields frequently flood during high tides. Emergency winter manure application will be in the areas designated as occasional. Refer to the enclosed Flood Boundary Map for Tract 177.

The target yield for Tract 177 pasture fields is 17 tons at 30% dry matter per acre per year. To achieve a 17 ton yield for the grass pastures, the agronomic rate for nitrogen is 245 lbs. per acre per year.

Liquid waste is transported from Tract 590 and stored in Tract 177 liquid waste storage tanks. Liquid manure is applied to Tract 177 pasture fields with a pump, buried manure mainline, and a manure gun traveler. A manure tank wagon may be used at times. The solid manure is applied with a tractor and manure spreader.

At Tract 177 manure will be managed 100% solids. The operation is a loose housing operation. The solid manure produced remains in the two barns at the operation. Barn A has 200 calves housed. There is 21,827 cubic feet of available solid manure storage in Barn A. This available storage can store the solid manure produced by the 65/1,000 lb. animal units for 130 days. Barn B houses 100 calves. There is 7,560 cubic feet of available solid manure storage in Barn B. This available storage can store the solid manure produced by the 33-1,000 lb. animal units for 156 days. Chopped straw is periodically placed in the loose housing facilities. The below ground liquid waste storage facilities will catch any leachate that might come from the solid manure areas.

If any manure is exported from any of the three operations, records are kept on the amount, type, date the liquid and/or the solid manure was export from which operation. Manure storage days are based on the 30-year average annual precipitation recorded at KTIL Radio Station in the City of Tillamook. All conservation practices installed will be managed and maintained in accordance with the enclosed "OPERATION AND MAINTENANCE WORKSHEETS."

Best management practices used to divert clean water away from the animal confinement area includes roofing manure accumulation slabs. These practices prevent manure run off from manure accumulation areas and/or the addition of rainwater to the liquid waste storage system that decrease the available liquid waste storage. Gutters, downspouts, and outlets have been installed on the animal confinement buildings to divert clean water away from animal confinement buildings or manure accumulation areas and outletted in an area free of manure. Waste storage facilities have been installed to store manure until soil and climatic conditions are favorable for manure application. A bedding maker or manure separator is used to process the solid manure into fiber to use for bedding to lower the nutrients that are applied to the fields. Buried waste transfer pipes and pumps have been installed to transfer liquid waste to liquid waste storage facilities /or to the fields for application. Filter strips adjacent to open watercourse are used to prevent manure runoff from fields into open water courses.

Soils where manure is applied are: Brenner silt loam, 0-1% slopes, Coquille silt loam, 0-1% slopes, diked, Nehalem silt loam, 0-3% slopes, Nestucca-Brenner silt loams, 0-3% slopes, Nestucca silt loam, 0-3% slopes and Templeton medial silt loam, 5-30% slopes. The Brenner soil is poorly drained. The Coquille diked soil is very poorly drained. The Nehalem and Templeton soils are well drained. The Nestucca-Brenner and Nestucca silt loam soils are somewhat poorly drained.

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: **Silveira, Tony**

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Farmstead T-590

F	1	x	x
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Waste Storage Facility

A 80' x 12' above ground liquid waste storage tank was installed. The 60,288 cubic foot above ground liquid waste storage tank, in combination with the two below ground liquid waste storage tanks, the four below ground liquid waste storage tanks at Tract 177, and the above ground liquid waste at T-177 will store the liquid waste produced by the 862-1,000 lb. animal units for 122 days.

F	1	x	x
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Waste Storage Facility

A 32' x 8' below ground liquid waste storage tank was installed. The 6,430 cubic foot liquid waste storage tank, in combination with the other below ground liquid waste tank, the above ground waste storage tank, and the four below ground liquid waste storage tanks and the above ground liquid waste storage tanks at T-177 will store the liquid waste produced by the 862-1,000 lb. animal units for 122 days.

F	1	x	x
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Waste Storage Facility

A 40' x 12' x 8' below ground liquid waste storage tank was installed. The 3,840 cubic foot liquid waste storage tank, in combination with the other below ground liquid waste storage tank, the above ground waste storage tank and the four below ground liquid waste storage tanks and the above ground waste storage tank at T-177 will store the liquid waste produced by the 862-1,000 lb. animal units for 122 days.

F	1	x	x
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Waste Storage Facility

A 40' x 84' x 12' solid manure storage facility was installed. The facility is used as commodity shed where separated manure produced for bedding is stored. The facility can store the separated manure for 255 days.

F	1	x	x
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Waste Storage Facility

A 384 cubic foot liquid waste reception tank was installed to collect and transfer milk house and parlor waste to the above ground liquid waste storage tank.

F	1	x	x
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Manure Transfer

390 feet of 5 inch PVC Class Code 125 manure transfer pipe was installed from the below ground liquid waste storage tank to the above ground liquid waste storage tank.

F	2	x	x
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Manure Transfer

A pump/agitator was installed in the two below ground liquid waste storage tanks to agitate the manure in the below ground liquid waste storage tanks and transfer the liquid waste to the above ground liquid waste storage tank.

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: Silveira, Tony

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Farmstead T-590

F	1	x	x
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Waste Storage Facility

A 80' x 12' above ground liquid waste storage tank was installed. The 60,288 cubic foot above ground liquid waste storage tank, in combination with the two below ground liquid waste storage tanks, the four below ground liquid waste storage tanks at Tract 177, and the above ground liquid waste at T-177 will store the liquid waste produced by the 539-1,000 lb. animal units at T-590, the milking operation, for 133 days.

F	1	x	x
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Waste Storage Facility

A 32' x 8' below ground liquid waste storage tank was installed. The 6,430 cubic foot liquid waste storage tank, in combination with the other below ground liquid waste tank, the above ground waste storage tank, and the four below ground liquid waste storage tanks and the above ground liquid waste storage tanks at T-177 will store the liquid waste produced by the 539-1,000 lb. animal units for 133 days.

F	1	x	x
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Waste Storage Facility

A 40' x 12' x 8' below ground liquid waste storage tank was installed. The 3,840 cubic foot liquid waste storage tank, in combination with the other below ground liquid waste storage tank, the above ground waste storage tank and the four below ground liquid waste storage tanks and the above ground waste storage tank at T-177 will store the liquid waste produced by the 539-1,000 lb. animal units for 133 days.

F	1	x	x
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Waste Storage Facility

A 40' x 84' x 12' solid manure storage facility was installed. The facility is used as commodity shed where separated manure produced for bedding is stored. The facility can store the separated manure for 255 days.

F	1	x	x
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Waste Storage Facility

A 384 cubic foot liquid waste reception tank was installed to collect and transfer milk house and parlor waste to the above ground liquid waste storage tank.

F	1	x	x
---	---	---	---

Manure Transfer

390 feet of 5 inch PVC Class Code 125 manure transfer pipe was installed from the below ground liquid waste storage tank to the above ground liquid waste storage tank.

F	2	x	x
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Manure Transfer

A pump/agitator was installed in the two below ground liquid waste storage tanks to agitate the manure in the below ground liquid waste storage tanks and transfer the liquid waste to the above ground liquid waste storage tank

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: **Silveira, Tony**

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Farmstead T-590

F	1	x	x
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Manure Transfer

A pump was installed in the above ground liquid waste storage tank to transfer the liquid waste to the fields for application.

F	1	x	x
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Manure Transfer

An agitator was installed in the above ground liquid waste storage tank to stir the manure for application and prevent solid manure buildup in the tank.

F	1	x	x
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Manure Transfer

261 feet of concrete curbs were installed on the manure accumulation slabs to prevent manure runoff.

F	1	x	x
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Manure Transfer

1,850 feet of buried manure mainline was installed to transfer liquid manure from the above ground liquid waste storage tank to the fields for application.

F	1	x	x
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Manure Transfer

A manure gun traveler is used to apply liquid manure to the fields.

Farmstead 80

F	1	x	x
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Waste Storage Facility

A 58' x 34' x 6' solid manure storage facility was installed. The 11,832 cubic foot solid manure storage facility will store the solid manure produced by the 226-1,000 lb. animal units for 142 days.

F	1	x	x
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Waste Storage Facility

A 55' x 22' x 6' below ground liquid waste storage tank was installed. The 7,260 cubic foot liquid waste storage tank will store the liquid manure produced by the 226-1,000 lb. animal units for 61 days.

F	4	x	x
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Waste Storage Facility

Four roofs were installed over the manure accumulation areas. The roofs were: 59' x 10'; 47' x 76'; 2' x 59'; 30.5' x 54'.

F	1	x	x
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Manure Transfer

A pump was installed in the below ground liquid waste storage tank to transfer liquid waste to the fields.

F	1	x	x
---	---	---	---

Manure Transfer

Concrete curbs were installed around the manure accumulation slabs to prevent manure runoff.

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: **Silveira, Tony**

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Farmstead T-80

F	1	x	x
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Roof Runoff Structure

1040 feet of gutters and downspouts were installed on the animal confinement building.

Farmstead T-177

F	2	x	x
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Waste Storage Facilities

Two 35' x 7.5' below ground liquid manure storage tanks were installed at Barn B. The 10,596 cubic foot liquid manure store system, in combination with the other two liquid manure storage system at Barn A, the above ground liquid manure storage tank, the two below ground liquid waste storage tanks, the waste collection tank, and the above ground liquid waste storage tank at T-590 will store the liquid waste produced by the 862-1,000 lb. animal units for 122 days.

F	2	x	x
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Waste Storage Facilities

A 35' x 7.5' and a 40' x 10' below ground liquid manure tanks were installed at Barn A. The 19,772 cubic foot liquid manure storage system, in combination with the other two liquid manure storage system at Barn B, the above ground liquid manure storage tank, the two below ground liquid waste storage tanks, the waste collection tank, and the above ground liquid waste storage tank at T-590 will store the liquid waste produced by the 862-1,000 lb. animal units for 122 days.

F	1	x	x
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Waste Storage Facility

An 80' x 16' above ground liquid waste storage tank was installed. The 80,384 cubic foot liquid waste storage tank, in combination with the two below ground liquid manure tanks at Barn B and the two below ground liquid waste storage tanks at Barn A, the above ground liquid waste storage tank, the two below ground liquid waste storage tanks, the waste collection tank, and the above ground liquid waste store tank at T-590, will store the liquid waste produced by the 862-1,000 lb. animal units for 122 days.

F	2,200 ft	x	x
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Waste Transfer Pipe

A 5 inch manure transfer pipe has been installed to transfer liquid waste from the below ground liquid waste storage tank system to the above ground liquid waste storage tank.

F	1	x	x
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Pump

A pump was installed in the above ground liquid waste storage tank to transfer the liquid manure to the fields.

F	1	x	x
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Pump/Agitator

A pump/agitator was installed in the below ground liquid waste storage tank to transfer the liquid waste from the below ground liquid waste storage tank to the above ground liquid waste storage tank.

F	1	x	x
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Roofs

4,287 square feet of roof was installed over the below ground liquid waste storage tank and the manure accumulation slab at Barn A.

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: **Silveira, Tony**

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Farmstead T-177

F	1	x	x
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Gutters and Downspouts

278 feet of gutters and downspouts were installed on the animal confinement buildings.

F	950 ft	x	x
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Underground Outlet

A six inch underground outlet was installed to outlet the gutters in an area free of manure.

F	1	x	x
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Curbs

Concrete curbs were installed to prevent manure runoff from the livestock confinement and manure accumulation areas.

F	1	x	x
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Buried Manure Mainline

2,385 feet of buried manure mainline was installed to transfer liquid manure from the above ground liquid waste storage tank to the fields in a non-polluting manner.

Crop T-590

1-8	107.5 ac	x	
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Forage Harvest Management

When grass forage is harvested it will be in accordance with the enclosed Forage Harvest Specification Sheet. When corn silage is harvested it will be in accordance with the enclosed Cover Crop Specification Sheet.

1-8	107.5 ac	x	
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Nutrient Management

Liquid and solid manure will be used for forage production. Soil manure tests will be used to determine rates of manure application. Nutrient management will be implemented in accordance with the enclosed Nutrient Management Specification Sheet.

1-8	107.5 ac	x	
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Waste Utilization

Solid and liquid waste will be applied to the cropland in accordance with the enclosed Waste Utilization Specification Sheet.

3,5,7,8	3,600 ft	x	x
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Surface Drainage, Main or Lateral

The existing open ditches will be maintained.

3,4,5,6,7,8	2.4 ac	x	
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Filter Strip

A grass filter strip adjacent to the open watercourses will be established and maintained as part of the animal confinement operation water quality plan to prevent agricultural waste from entering the open watercourses. The filter strip will be managed and maintained in accordance with the enclosed Filter Strip Specification Sheet.

Crop T-80

1,4	11,839 ft	x	x
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Surface Drainage, Main or Lateral

The existing open ditches will be maintained.

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: **Silveira, Tony**

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Crop T-80

1,4	16.2 ac	x	
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Filter Strip

A grass filter strip adjacent to the open watercourses will be established and maintained as part of the animal confinement operation water quality plan to prevent agricultural waste from entering the open watercourses. The filter strip will be managed and maintained in accordance with the enclosed Filter Strip Specification Sheet.

1-5	99.0 ac	x	
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Forage Harvest Management

When grass forage is harvested it will be in accordance with the enclosed Forage Harvest Specification Sheet. When corn silage is harvested it will be in accordance with the enclosed Cover Crop Specification Sheet.

1-5	99.0 ac	x	
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Nutrient Management

Solid and liquid manure will be used for forage production. Soil and manure tests will be used to determine rates of manure applications. Nutrient management will be implemented in accordance with the enclosed Nutrient Management Specification Sheet.

1-5	99.0 ac	x	
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Waste Utilization

Solid and liquid manure will be applied to the cropland in accordance with the enclosed Waste Utilization Specification Sheet.

Pasture T-177

1-9	61.8 ac	x	
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Prescribed Grazing

Pastures will be managed in accordance with the enclosed Prescribed Grazing Specification Sheet.

1-9	61.8 ac	x	
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Nutrient Management

Digested effluent from the Port of Tillamook will be used for forage production. production. Soil and digested effluent tests will be used to determine rates of application. Nutrient management will be implemented in accordance with the enclosed Nutrient Management Specification Sheet.

1-9	61.8	x	
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Waste Utilization

Solid and liquid manure will be applied to the cropland in accordance with the enclosed Waste Utilization Specification Sheet.

1-9	6.8 ac	x	
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Filter Strip

A grass filter strip adjacent to the open watercourses will be established and maintained as part of the animal confinement operation water quality plan to prevent agricultural waste from entering the open watercourse. The filter strip will be managed and maintained in accordance with the enclosed Filter Strip Specification Sheet.

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

Cooperator: **Silveira, Tony**

Date:

Field No.	Amount	Planned	Applied
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LAND USE AND PRACTICE

Pasture T-177

1-9	5,552 ft	x	x
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Surface Drainage, Main or Lateral
The existing open ditches will be maintained.

1,4,5,9	4	x	x
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Tidegates
Tide have been installed to prevent salt water intrusion onto the fields.

3	1	x	x
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Culvert
A culvert was installed in the open ditches to provide a crossing for livestock and prevent manure from entering the open water courses.

CERTIFICATION OF PARTICIPANTS

[Signature]

11-4-2015
DATE

CERTIFICATION OF:

[Signature]
Robert A. Pedersen
CAFO PLANNER

Date 11/4/2015

CONSERVATION DISTRICT

[Signature] 11/4/15
TILLAMOOK COUNTY SWCD DATE

TILLAMOOK COUNTY SOIL AND WATER CONSERVATION DISTRICT:

Conservation

Development

Self Government

**Tillamook County Soil and Water Conservation District is an Equal Opportunity
Provider and Employer**

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
OPERATION AND MAINTENANCE WORKSHEET

WASTE STORAGE FACILITY

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec 35, 36

County Tillamook SWCD Tillamook Farm/Tract No. T-590, 80, 177

Prepared By Pedersen Date 10/15

Tract-590

80' X 12' Above Ground Liquid Waste Storage Tank

40' x 12' x 8' Below Ground Liquid Waste Storage Tank

32' x 8' Below Ground Liquid Waste Storage Tank

134 cubic foot waste collection tank for the milk house and parlor wastes.

Tract- 80

55' x 22' x 6' Below Ground Liquid Waste Storage Tank

Tract 177

80' x 16' Above Ground Liquid Waste Storage Tank

35' x 7.5' Below Ground Liquid Waste Storage Tank

40' x 10' Below Ground Liquid Waste Storage Tank

30' x 7.5' Below Ground Liquid Waste Storage Tank

30' x 7.5' Below Ground Liquid Waste Storage Tank

Operation and Maintenance Items

A properly operated and maintained waste storage structure is an asset to your farm. These waste storage structures were designed and installed for temporary storage of animal wastes and/or effluent from the Port of Tillamook methane digester. 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 by November 1st to begin winter storage.
- ⇒ A one foot free board will be maintained on the above ground liquid waste storage tanks to prevent spillage.
- ⇒ The waste storage facility will be inspected at least annually.
- ⇒ Perform daily inspections of water lines, including drinking water or cooling water lines. Repair leaking lines immediately to prevent excessive water from entering the storage system.
- ⇒ Immediately repair any vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances.
- ⇒ Pump out the facility within the first two years following construction to check for structural damage. If damage is noted, immediately seek a qualified engineer to assess the situation. Thereafter, it should be pumped out at least every five years to check for damages, remove gravel, rocks, sand, wire and other debris to maintain storage capacity.
- ⇒ Immediately remove all foreign debris within the structure that may cause damage to pumps and agitator.
- ⇒ During de-watering of the structure, ensure that waste is spread at minimum rates in areas where crops are grown. When spread manure adjacent to open watercourses, the enclosed Filter Strip Specification Sheet will be followed. Avoid applying waste during heavy rainfall events.
- ⇒ Dead animals will not be disposed of in the liquid waste storage facility.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
OPERATION AND MAINTENANCE WORKSHEET

MANURE TANK AGITATOR

Landowner/Operator: Silveira, Tony

Job Location: T 2S; R 10W; Sec. 36

County Tillamook SWCD Tillamook

Tract No. T-590

Prepared By: Pedersen Date 10/15

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 promptly 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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

MANURE TANK AGITATOR/PUMP

Landowner/Operator: Silveira, Tony

Job Location: T 1; R 10W; Sec. 35, 36

County Tillamook SWCD Tillamook

Tract No. T-590,177

Prepared By: Pedersen Date 10/15

Operation and Maintenance Items

A properly operated and maintained manure tank agitator/pump is an asset to your farm. The manure agitator/pump 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 and transfer the manure to a tank wagon or to the fields. 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 promptly 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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

MANURE PUMP

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W. Sec. 35, 36

County Tillamook SWCD Tillamook

Tract No. T-590, 80, 177

Prepared By: Pedersen Date 10/15

Operation and Maintenance Items

A properly operated and maintained manure pump is an asset to your farm. The manure pump was designed to transfer the liquid waste to the pasture and hay lands for application. The estimated life span of this installation is at least 10 years. The life of the manure pump 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 pump for proper operation. Clean debris from the propeller, and promptly replace any defective or damaged parts.
- ⇒ Periodically clean and oil as needed to increase the life expectancy of the pump.
- ⇒ Immediately repair any vandalism or livestock damage. Do not allow livestock near equipment during operation.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

MANURE SEPARATOR AND/OR BEDDING MAKER

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 36

County Tillamook SWCD Tillamook

Tract No. T-590

Prepared By: Pedersen Date 10/15

Operation and Maintenance Items

A properly operated and maintained manure separator or bedding maker is an asset to your farm. The manure separator was designed and installed to remove solid manure from the liquid manure storage facility 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 separator 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 separator for proper operation. Clean debris from the separator, and promptly replace any defective or damaged parts.
- ⇒ Periodically clean and oil as needed to increase the life expectancy of the separator.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

**WASTE TRANSFER PIPE
HIGH-PRESSURE UNDERGROUND, PLASTIC PIPELINE**

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 35, 36

County Tillamook SWCD Tillamook

Tract No. T-590, 177

Prepared By: Pedersen

Date 10/15

• **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 valves 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.
- ⇒ Non-buried pipelines will be inspected weekly to assure there is no leaks that is causing waste spillage. Leaks will be repaired immediately.

⇒ **Eradicate or otherwise remove all rodents or burrowing animals that can potentially damage or displace the pipe. Immediately repair any damages caused by their activity.**

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

WASTE STORAGE FACILITY (SOLID MANURE STORAGE FACILITY)

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec 36

County Tillamook SWCD Tillamook

Farm/Tract No. T-590, 80

Prepared By Pedersen Date 10/15

Tract 590

84' x 40' x 12' Solid Manure Storage Facility

Tract 80

58' x 34' x 6' Solid Manure Storage Facility

Tract 177

51' x 111' x 1.5' Dry Pack Facility Barn A
17' x 111' x 1.5' Dry Pack Facility Barn A
13' x 58' x 1.5' Dry Pack Facility Barn A
50' x 98' x 1.5' Dry Pack Facility Barn A
17.2' x 78.5' x 1.5' Dry Pack Facility Barn A

82' x 12' x 2.5' Dry Pack Facility Barn B
55' x 12' x 4.0' Dry Pack Facility Barn B
82' x 12' x 2.5' Dry Pack Facility Barn B

Operation and Maintenance Items

A properly operated and maintained waste storage structure is an asset to your farm. These waste storage structures were designed and installed for temporary storage of solid manure. 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 ready 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. When spread manure adjacent to open watercourses, the enclosed Filter Strip Specification Sheet will be followed. 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.
- ⇒ Broken trusses, beams, poles, gutters and downspouts will be repaired or replaced on the solid waste storage facilities.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

MANURE SEPARATOR AND/OR BEDDING MAKER

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 36

County Tillamook SWCD Tillamook

Tract No. T-590

Prepared By: Pedersen Date 10/15

Operation and Maintenance Items

A properly operated and maintained manure separator or bedding maker is an asset to your farm. The manure separator was designed and installed to remove solid manure from the liquid manure storage facility 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 separator 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 separator for proper operation. Clean debris from the separator, and promptly replace any defective or damaged parts.
- ⇒ Periodically clean and oil as needed to increase the life expectancy of the separator.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

CURB

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec 35, 36

County Tillamook SWCD Tillamook

Farm/Tract No. T 590, 80, 177

Prepared By Pedersen Date 10/15

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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

ROOF

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec. 35, 36

County Tillamook SWCD Tillamook

Farm/Tract No. T-590, 80, 177

Prepared By Pedersen

Date 10/15

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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

GUTTERS & DOWNSPOUTS

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 9W; Sec. 35, 36

County Tillamook SWCD Tillamook

Farm/Tract No. T 590, 80, 177

Prepared By Pedersen Date 10/15

Gutters and Downspouts

Operation and Maintenance Items

Properly operated and maintained roof runoff facilities are an asset to the farm. Roof runoff facilities were designed and installed to control roof runoff. 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:

- ⇒ Perform weekly inspections of gutters, downspouts and above ground pipelines, and appurtenances for proper operation. Repair or replace if needed.
- ⇒ Periodically remove debris from gutters, downspouts and outlet facilities.
- ⇒ Protect downspouts from damage by livestock and equipment. Repair or replace damaged components as needed.
- ⇒ Keep gutters, downspouts, conveyance pipelines and ditches and appurtenances in good operating condition.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
OPERATION AND MAINTENANCE WORKSHEET
UNDERGROUND OUTLETS

For: Landowner/Operator Silveira, Tony

Job Location: T1S R 10W Sec 35, 36

County Tillamook SWCD Tillamook

Farm/Tract No. 590, 80, 177

Prepared By Pedersen Date 10/15

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 or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.
- ⇒ Immediately repair any vandalism, vehicular livestock damage.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

**MANURE GUN TRAVELER
CODE 634**

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 25, 35, 36 T 2S; R 10W; Sec. 1, 2

County Tillamook SWCD Tillamook

Tract No. T-590, 80, 177

Prepared By: Pedersen Date 10/15

Operation and Maintenance Items

A properly operated and maintained manure gun traveler is an asset to your farm. The manure gun was designed and must be operated to apply manure to the fields in a non-polluting matter. The estimated life span of this installation is at least 10 years. The life of the manure gun 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.
- ⇒ Liquids will be drained from the manure gun during freezing weather.
- ⇒ Nozzle will be checked periodically.
- ⇒ Worn nozzles will be replaced.
- ⇒ Manure gun traveler will be calibrated at least once a year.
- ⇒ Physically examine the manure gun for proper operation.
- ⇒ Immediately repair any vandalism or livestock damage. Do not allow livestock near equipment during operation.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

**BURIED MANURE MAINLINE
HIGH-PRESSURE UNDERGROUND, PLASTIC PIPELINE**

Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec. 25, 35, 36, T 2S; R 10W; Sec. 2

County Tillamook SWCD Tillamook

Tract No. T-590, 80, 177

Prepared By Pedersen Date 10/15

Buried Manure Mainline

Operation and Maintenance Items

A properly operated and maintained waste application system is an asset to your farm. This waste application system was designed and installed for applying liquid wastes to the pasture and hayland fields. 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 valves 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.
- ⇒ 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.
- ⇒ Eradicate or otherwise remove all rodents or burrowing animals that can potentially damage or displace the pipe. Immediately repair any damages caused by their activity.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
OPERATION AND MAINTENANCE WORKSHEET
WATERING FACILITY

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec 35 & T 2S; R 10W; Sec. 2

County Tillamook

SWCD Tillamook

Farm/Tract No. T-177

Prepared By Pedersen

Date 10/15

Operation and Maintenance Items

Properly operated and maintained water troughs and tanks are an asset to the farm. This practice was designed and installed to provide a source of water to the grazing units so livestock do not need access to open watercourse for drinking water. Practice will prevent pollution and prevent streambank erosion and riparian habitat damage due to livestock access. 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, valves, gates, rodent guards, inlets and outlets to make sure they are functioning properly. Check troughs and tanks for leaks or cracks and repair or replace.
- ⇒ Make certain the area adjacent to the trough is well protected with gravel, paving, or good cover. Be sure that the outlet pipe has a free outlet and is not causing any serious erosion problems.
- ⇒ Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodical mowing may also be needed to control growth.
- ⇒ Check periodically to see if debris has fallen into the troughs and tanks which may restrict inflow or planned function of the outflow system.
- ⇒ Clean the entire system periodically and remove moss, algae growth, and/or sludge. Chemicals such as copper sulfate and chlorine can be used to prevent moss and algae growth. Local rules and regulations are to be followed when using chemicals to make sure they are safe for animals.
- ⇒ Maintain, when necessary, coverings and insulation to prevent damage by freezing.
- ⇒ Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.
- ⇒ Immediately repair any vandalism, vehicular, or livestock damage to inlets, outlets, valves, and other appurtenances.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
OPERATION AND MAINTENANCE WORKSHEET
PIPELINE

For: Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec.35 & T 2S; R 10W; Sec. 2

County Tillamook SWCD Tillamook

Farm/Tract No. T-177

Prepared By Pedersen

Date 10/15

Operation and Maintenance Items

Properly operated and maintained pipeline is an asset to the farm. This pipeline was designed and installed to provide a source of water to the grazing units so livestock do not need access to open watercourse for drinking water. Practice will prevent pollution and prevent streambank erosion and riparian habitat damage due to livestock access. 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 to make sure all valves and air vents are set at the proper operating conditions so they provide protection to the pipeline.
- ⇒ Maintain the design depth of cover over the pipeline. Limit traffic over the pipeline to designated sections that were designed for traffic loads.
- ⇒ Maintain vigorous growth of vegetation coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodically mowing may also be needed to control vegetative height.
- ⇒ Remove all foreign debris that hinders system application.
- ⇒ Drain the system and components in areas that are subject to freezing.
- ⇒ Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.
- ⇒ Immediately repair any vandalism, vehicular, or livestock damage to inlets, outlets, valves, and other appurtenances.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
OPERATION AND MAINTENANCE WORKSHEET
STRUCTURE FOR WATER CONTROL - CULVERT

Land Owner/Operator Silveira, Tony

Job Location T 1S; R 10W; Sec. 35; T 2S; R 10W; Sec. 2

County Tillamook SWCD Tillamook County Farm/Tract No. T-177

Prepared By Pedersen Date 10/15

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained culvert is an asset to the farm. The structure was designed and installed to control water flows, discharge and direction of flow. Estimated life span of this installation is at least 10 years. The life of the structure 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 also require operational items to maintain satisfactory performance. A good operation and maintenance program includes:

- ⇒ Remove accumulated soil and debris and any blockage that restricts capacity.
- ⇒ Repair any cracks or breaks. If settlement is present, investigate the cause and design repairs accordingly.
- ⇒ Prevent access to components subject to damage by livestock.
- ⇒ Check culvert for settlement, alignment or rusted out sections. Repair any vandalism, vehicular, or livestock damage.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

SURFACE DRAINAGE MAIN OR LATERAL

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec.35,36 2S; R 10W, Sec. 1,2

County Tillamook SWCD Tillamook County

Farm/Tract No. T-590, 80, 177

Prepared By Pedersen Date 10/15

Operation and Maintenance Items

Properly operated and maintain drainage system is an asset to the farm. The drainage system was installed to remove excess surface and subsurface water. 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 cross-section and gradient by controlling channel erosion and bank sloughing.
- ⇒ Control the growth of undesirable vegetative materials by use of herbicides and/or mowing.
- ⇒ Remove all foreign debris and trash that hinders system operation.
- ⇒ Install and maintain fences to prevent livestock access when adjacent fields are used for pasture.
- ⇒ 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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

STRUCTURE FOR WATER CONTROL (Tidegate)

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec 35 & T 2S; R 10W; Sec 2

County Tillamook SWCD Tillamook Farm/Tract No. T-177

Prepared By Pedersen Date 10/15

Operation and Maintenance Items

A properly operated and maintained Tide Gate for water control is an asset to the farm. This design and installation is to provide directional control of the water. The estimated life span of this installation is at least 10 years. The life of this structure can be assured and usually increased by developing and carrying out a good operation and maintenance program.

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

- ⇒ Structures will be inspected annually.
- ⇒ Rip Rap around the outlet will be replaced as needed
- ⇒ Gates will be kept free of debris.
- ⇒ Worn bushings and other parts will be replaced.
- ⇒ Rodents will be controlled.
- ⇒ Repair any cracks or breaks. If settlement is present, investigate the cause and design repairs accordingly.
- ⇒ Repair any vandalism, vehicular, or livestock damage.

NOTE: Replacement of gates in the future should consider "Fish friendly" aluminum types.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

NUTRIENT MANAGEMENT

For: Landowner/Operator Silveira, Tony

Job Location : T 1S; R 10W; Sec. 25, 35, 36 T 2S; R 10W; Sec. 1,2

County Tillamook SWCD Tillamook Farm/Tract No. T-590, 80, 177

Prepared By Pedersen Date 10/15

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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

WASTE UTILIZATION

For: Landowner/Operator Silveira, Tony

Job Location: T 1S; R 10W; Sec. 25, 35, 36 T 2S; R 10W; Sec. 1, 2

County Tillamook SWCD Tillamook

Farm/Tract No. T-590, 80, 177

Prepared By Pedersen Date 10/15

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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

PRESCRIBED GRAZING

For: Landowner/Operator Silveira, Tony

Job Location: T1S; R 10W; Sec.35 T 2S; R 10W; Sec. 2;

County Tillamook SWCD Tillamook Farm/Tract No. T-177

Prepared By Pedersen Date 10/15

Operation and Maintenance Items

Prescribed Grazing can provide economic and resource benefits if applied properly which are assets to the heifer operation. Proper Prescribed Grazing requires certain operational procedures to be followed and evaluated on an annual basis.

- ⇒ Pastures are reestablished when forage production falls below planned yield threshold.
- ⇒ A rotational grazing system is used to maintain plant vigor.
- ⇒ Pastures are clipped and dragged during the growing season to maintain plant vigor and spread the livestock droppings to prevent grass from becoming rank.
- ⇒ Manure and commercial fertilizer applied in accordance with soil and forage tests.
- ⇒ Pasture weeds are controlled.
- ⇒ Pasture grasses are not grazed below 2 inches during the growing season
- ⇒ Livestock are removed when the soils become wet in the fall.

TILAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

FORAGE HARVEST MANAGEMENT

For: Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 25, 36 T 2S; R 10W; Sec. 1 T 1S; R 9W; Sec. 31

County Tillamook SWCD Tillamook

Farm/Tract No. T-590, 80

Prepared By Pedersen

Date 07/14

Operation and Maintenance Items

Forage Harvest Management can provide economic and resource benefits. If applied properly, is an assets to the dairy operation. Forage Harvest Management requires certain operational procedures to be followed and evaluated on an annual basis.

- ⇒ When corns is grown for silage, refer to the enclosed Cover Crop Specification Sheet for guidance.
- ⇒ Before forage harvest, clear fields of debris that could damage machinery, or if ingested by livestock, lead to sickness (for example, hardware disease) or death.
- ⇒ Monitor weather conditions and take action accordingly before and after cutting to optimize forage wilting or cutting time to preserve feed quality and prevent forage swaths or windrows from smothering underlying plants.
- ⇒ Inspect and repair harvesting equipment following manufacturer's preventive maintenance procedures.
- ⇒ All shields shall be in place during machine operation to prevent injury or death. Shut off machinery before working or unplugging moving parts.
- ⇒ Select equipment sizes and capabilities that will in a timely and economically feasible manner handle the acreage normally harvested.
- ⇒ Operate all forage harvesting equipment at the optimum setting and speeds to minimize loss of leaves.
- ⇒ Set shear-plate on forage chopper to the proper theoretical cut for the crop being harvested. Keep knives well sharpened. Do not use re-cutters or screens unless forage moisture levels fall below recommended levels for optimum chopping action.
- ⇒ Regardless of silage/haylage storage method, ensure good compaction and an air-tight seal to exclude oxygen and mold formation.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

OPERATION AND MAINTENANCE WORKSHEET

FILTER STRIP

For: Landowner/Operator Silveira, Tony

Job Location: T1S; R 10W; Sec. 35, 36; T 2S; R 10W Sec. 1, 2

County Tillamook SWCD Tillamook Farm/Tract No. T-590, 80, 177

Prepared By Pedersen Date 07/14

Operation and Maintenance Items

A properly operated and maintained vegetated filter strip is an asset to your farm. This vegetative filter strip was designed and installed to remove sediment and pollutants from runoff. The estimated life span of this practice is at least 10 years. The life of this practice 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 maintenance and may also require operation items to maintain satisfactory performance. Some recommendations to assist you develop a good operation and maintenance program:

- ⇒ Maintain vigorous growth of vegetative covering. This includes reseeding, commercial fertilization and application of herbicides when necessary. Periodic mowing or grazing may also be needed to control height.
- ⇒ Where the filter strip is used to trap nutrients, periodic grazing or mechanical harvesting and removal of vegetation is needed.
- ⇒ Remove all foreign debris that hinders system operation.
- ⇒ Limit the traffic and do not use as a roadway.
- ⇒ Limit livestock usage to vegetative growth periods when they will not damage vegetative root system or compact the soil.
- ⇒ Immediately repair any vandalism, vehicular, or livestock damage.
- ⇒ Eradicate or remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Nutrient Uptake Rates for Silage Corn, Grass Silage, and Pastures

Nutrient uptake rates are based on the Oregon Animal Waste Management Design Aid (ORAWM) Utilization Program. See enclosed ORAWM Animal Waste Management System Application and Utilization Sheets for Nitrogen, Phosphorus, and Potassium. Attached to the ORAWM sheets are the Nutrient Distribution Charts for the manure application rates for Nitrogen, Phosphorus and Potassium per field by grazing, solid manure and liquid waste application to Tract 590, 80 and 177 fields. Tract 177 is used for older calve pasture. Tract 590 and 80 is used to produce corn and grass silage. Tract 590 and Tract 80 fields are double cropped when corn is grown. Grass is planted following the corn silage removal. Grass mixture planted in Tract 590 and 80 may include wheat, oats and or both. Based on the enclosed Phosphorus index for the pasture, grass and silage crop Tracts, since no soil test Site Variability Class is High or Very High (See enclosed Phosphorus Index Worksheet-Wester Oregon), Nitrogen is used to determine the Nutrient Distribution for the pastures, corn, and grass silage crops. The Phosphorus and Potassium application are based on the Nitrogen application rates.

1. Perennial Pasture Crop for Tract 177 fields: The target yields is 17 tons at 30% dry matter per acre per year. 245 lbs. of nitrogen per acre per year is the agronomic rate to achieve the target yield. It is estimated that 213 lbs. of nitrogen per acre year will be available for application.
2. Ryegrass Haylage (Silage) Crop with wheat, oats or both in the grass silage mixture for Tract 590 and 80 fields: Wheat target yield is 13 tons at 30% dry matter per acre per year for Tract 590 and 80 fields. To achieve the 13 ton target yield for the wheat, 161 lbs. of nitrogen per acre per year is needed. Oat target yield is 13 tons at 30% dry matter per acre per year. To achieve the 13 ton target yield for oats, 125 lbs. of nitrogen per acre is needed. 300 lbs. of nitrogen per acre per year is the agronomic rate to achieve 20 tons of ryegrass silage per acre per year. It is estimated 249 to 260 lbs. of nitrogen per acre will be available for the ryegrass planted with the wheat, oats, or both.
3. Corn silage target yield for Tract 590 and 80 fields is 18.0 to 22 ton at 30% dry matter per acre. The nitrogen application rate to achieve 18 tons of corn silage at 30% dry matter per acre is 135 lbs. of nitrogen per acre. The nitrogen application rate to achieve 22 tons of corn silage at 30% dry matter per acre is 166 lbs. of nitrogen per acre.
4. Refer to the enclosed Nitrogen, Phosphorus, and Potassium Distribution Charts for a corn silage crop for potential Tract 590 and 80 corn producing fields for 18 and 22 tons per acre. Also refer to the enclosed Nitrogen, Phosphorus, and Potassium Distribution Charts for Tract 177 pasture fields.

5. Example on using the Distribution Charts: Corn silage crop is grown on Tract 590; field 1 followed by rye grass silage crop. The corn silage crop's target yield is 22 tons at 30% dry matter per acre. The rye grass silage crop's target yield is 20 tons per acre per year. To achieve the 22 tons at 30% dry matter per acre for the corn silage, 165 lbs. of nitrogen is required at the time corn is planted. 300 lbs. of nitrogen per acre per year is required per acre per year to achieve the grass silage target yield of 20 tons per acre per year. However; there is not enough manure available to supply 300 lbs. of nitrogen per acre per year. It is estimated that 249 lbs. to 260 lbs. of nitrogen will be available through manure application to the ryegrass haylage crop.
6. Recommend a soil test prior to planting corn to evaluate the amount of nitrogen required to achieve 18 to 22 tons of corn per acre. When the corn silage is removed, a soil tests to evaluate the nutrients available for rye grass silage production is recommended.

**Tillamook County
Soil and Water Conservation District**

NUTRIENT MANAGEMENT SPECIFICATION SHEET

Landowner/Operator Tony Silveira

Job Location: T 1S; R 10W; Sec. 25,36,35 T 2S; R 10W; Sec. 1, 2

County: Tillamook SWCD Tillamook Farm/Tract No. T-590, 80, 177

Field No. T- 590 Fields: 1-8 T-80 Field 1-5 T-177 Fields 1-9

Prepared By: Pedersen

Date: 08/15

⇒ Purpose:

- ⇒ To budget and supply nutrients for plant production.
- ⇒ To properly utilize manure and organic by-products as a plant nutrient source.
- ⇒ To minimize agricultural non-point source pollution of surface and ground water resources.
- ⇒ To maintain or improve the physical, chemical and biological condition of soil.

Specifications:

- ⇒ Manure is applied to the surface of permanent pastures in accordance with the enclosed Waste Utilization Specification Sheet.
- ⇒ A target yield of 20 tons at 30% dry matter per acre per year is the planned yield to utilize the nitrogen in the manure and/or commercial applied fertilizer for all fields in T-590 and T-80 The target yield is 17 tons at 30% dry matter per acre per year for T-177 fields.
- ⇒ Manure and commercial fertilizer is applied in accordance with soil tests.
- ⇒ Manure and/or commercial fertilizer is applied in split applications.
- ⇒ Soil tests are taken at least every 5 years.
- ⇒ Manure test are taken at least every 3 years. Samples will be collected from the equipment that applies the manure and wastewater to the fields.
- ⇒ No more than 348 lbs. of nitrogen is applied per acre per year in accordance the ORAWM Animal Waste System Utilization unless soil, manure, and forage tests justifies higher rates.

Manure Application Equipment to be used:

835-1,000 lb. animal units

Manure Gun Traveler will be used to apply manure to T-590 and 80 fields.

A tractor and manure spreader will be used to apply solid manure to T-80 and 177 fields.

Some solid manure produced from the separator at T-590 will be recycled as bedding at the operation.

One acre-inch = 27,154 gallons

DESIGN APPROVAL:

Design approved by: /s/ Robert A. Pedersen

Date: 11/4/2015

Job Title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The client acknowledges that:

- a. They have received a copy of this specification and under-stands the contents and requirements.
- b. The following information must be provided NRCS by the client before this practice can be certified as applied:
 - ☒ Nutrient management application records including soil, water, plant and organic by-product test results.
 - ☒ Documentation showing amount, rate, form and application method of nutrient applied
 - ☒ Annual review of nutrient management including adjustments made.
- 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.
- d. Maintain records of nutrient application as required by state and local regulations.

Accepted by: /s/ [Signature]

Date: 11-4-2015

CERTIFICATION;

I have completed a review of the nutrient management and the specification's application and certify this practice has been applied.

Certification by: /s/ _____

Date: _____

Job Title: _____

Manure (Nitrogen) Nutrient Distribution for Corn Crop. (Target Yield 22 tons)

Field #	Grazing cycle s/year	# of N by Livestock	# of N supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of N per field/yr solids	#of N per acre from solids	Gallons of liquid manure per field per year	#of N per field/year from liquid manure	#of N per acre per year from liquid manure	Total # of N per acre/year
Tract 590										
1.	0	0	0	7,606	1,085	37	262,577	3,768	128	165
2.	0	0	0	780	111	37	26,923	386	129	166
3.	0	0	0	3,839	547	33	147,259	2,174	132	165
4.	0	0	0	1,468	209	33	56,292	831	132	165
5.	0	0	0	6,433	918	33	246,783	3,642	132	165
6.	0	0	0	979	140	39	32,874	454	126	165
7.	0	0	0	3,093	441	39	103,802	1,434	126	165
8.	0	0	0	2,637	376	39	88,491	1,223	126	165
Subtotal		0	0	26,835	3,827		965,001	13,912		
Tract 80										
1	0	0	0	3,354	478	33	128,667	1,920	132	165
2	0	0	0	1,570	224	33	63,562	893	131	164
3	0	0	0	2,551	364	33	103,287	1,451	132	165
4	0	0	0	10,973	1,565	33	444,319	6,242	132	165
5	0			5,031	718	37	160,834	2,493	128	165
Subtotal		0	0	23,479	3,349		900,669	12,999		
Totals				50,314	7,176		1,865,670	26,911		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/29/2015

CLIENT: Silveira, Tony Tracts 590,80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply 167,717 cubic feet of solids generated from the operation it will take approximately 378 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		Spread Width Feet	NITROGEN, N in Storage Facility		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
			Bushels	CF		PPM	Libs/Ton						
T590 1,2	32.4	Com, Silage(AH)	357	444	15	7,075	14,15	165	1.00	20.8	1115	3	36
3,4,5	50.4	Com, Silage(AH)	357	444	15	7,075	14,15	165	1.00	20.8	1115	3	36
6,7,8	24.7	Com, Silage(AH)	357	444	15	7,075	14,15	165	1.00	20.8	1115	3	36
T80 1	14.5	Com, Silage(AH)	357	444	15	7,075	14,15	165	1.00	20.8	1115	3	36
2,3,4	65.1	Com, Silage(AH)	357	444	15	7,075	14,15	165	1.00	20.8	1115	3	36
5	19.4	Com, Silage(AH)	357	444	15	7,075	14,15	165	1.00	20.8	1115	3	36

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 3,216,672 gallons of liquids generated from the operation it will take approximately 179 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		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	
						PPM	Lbs/1000Gal							
T590 1,2	32.4	Com, Silage(AH)	300	250	1/2 Circle	▼	2,866	23.92	165	1.00	0.42	1.45	0.72	4.55
3,4,5	50.4	Com, Silage(AH)	300	250	1/2 Circle	▼	2,866	23.92	165	1.00	0.42	1.45	0.72	4.55
	24.7	Com, Silage(AH)	300	250	1/2 Circle	▼	2,866	23.92	165	1.00	0.42	1.45	0.72	4.55
T80 1	14.5	Com, Silage(AH)	300	250	1/2 Circle	▼	2,866	23.92	165	1.00	0.42	1.45	0.72	4.55
2,3,4	65.1	Com, Silage(AH)	300	250	1/2 Circle	▼	2,866	23.92	165	1.00	0.42	1.45	0.72	4.55
5	19.4	Com, Silage(AH)	300	250	1/2 Circle	▼	2,866	23.92	165	1.00	0.42	1.45	0.72	4.55
						▼								
						▼								
						▼								
						▼								

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply	3,216,672	gallons of liquids generated from the operation it will take approximately
all agronomic rates use the application depths, travel lengths, and loads per acre listed below for each crop.		

1,072 trips annually. Based on applying

NITROGEN, N

To apply at agronomic rates use the application depths, travel lengths, and loads per acre listed below for each crop.		1,4772 trips annually. Based on applying NITROGEN, N									
Field Number	Acres	Crop	Tank Wagon Capacity Gallons	Spread Width Feet	NITROGEN, N	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	
					Concentration in Storage Facility PPM						Lbs/1000Gal
T590 1,2	32.4	Corn, Silage(All)	3,000	15	2,866	23.92	165	1.00	0.15	2,104	1.4
34.5	50.4	Corn, Silage(All)	3,000	15	2,866	23.92	165	1.00	0.15	2,104	1.4
6,7,8	24.7	Corn, Silage(All)	3,000	15	2,866	23.92	165	1.00	0.15	2,104	1.4
T70 1	14.5	Corn, Silage(All)	3,000	15	2,866	23.92	165	1.00	0.15	2,104	1.4
2,3,4	65.1	Corn, Silage(All)	3,000	15	2,866	23.92	165	1.00	0.15	2,104	1.4
5	19.4	Corn, Silage(All)	3,000	15	2,866	23.92	165	1.00	0.15	2,104	1.4
							</				

	Annual Volume	Units	Concentration of Nutrients in Storage			
			N	P2O5	K2O	Units
Storage Facility	Production	Gallons	23.92	10.99	18.84	lbs/1,000 Gal
Tank (Uncovered)	3,216,672		14.15	6.38	10.53	lbs/10m
Folids Storage Facility (Roofed)	1,309	Tons				

	Annual Volume	Units	Concentration of Nutrients in Storage			
			N	P2O5	K2O	Units
Storage Facility	Production	Gallons	23.92	10.99	18.84	lbs/1,000 Gal
Tank (Uncovered)	3,216,672		14.15	6.38	10.53	lbs/10m
Folids Storage Facility (Roofed)	1,309	Tons				

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/29/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
	Daily	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Tank (Uncovered)	109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	56,933	21,391	35,323	75%	90%	90%	42,715	19,252	31,793
Grazing	NONE	0	0	0	100%	100%	100%	0	0	0

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		
	Spreading	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Spreading	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (Incorporated 2 or more days after application)	42,715	19,252	31,793	70%	100%	100%	29,900	19,252	31,793
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
	Crest	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Somewhat Poorly Drained	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	29,900	19,252	31,793	80%	100%	100%	23,920	19,252	31,793
Grazing	Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
TOTAL		70,000	64,604	92,396						

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/29/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON											
Field Number	Acres	Crop	LIQUIDS			SOLIDS			GRAZING		
			Percent of Nutrients to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent of Nutrients to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent of Nutrients to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization
1590 1.2	32.4	Com. Silage(AH)	9%	4,151	25	5%	1,196	10	0%	0	0
3.4.5	50.4	Com. Silage(AH)	14%	6,647	40	7%	1,674	6	0%	0	0
6.7.8	24.7	Com. Silage(AH)	7%	3,111	19	4%	957	3	0%	0	0
T80 1	14.5	Com. Silage(AH)	4%	1,920	12	2%	478	3	0%	0	0
2.3.4	65.1	Com. Silage(AH)	19%	8,586	52	9%	2,153	13	0%	0	0
5	19.4	Com. Silage(AH)	5%	2,493	13	3%	718	4	0%	0	0
Off Farm											
TOTAL	206.5		42%	19,349	163	70%	16,744	43	100%	0	0
			100%	46,160		100%	23,920		100%	0	0

42% of the liquid manure will be applied to Tract 177 fields and to Tract 590.80 fields and 70% of the solid manure is recycled for bedding/applied to 7-177 fields on the farm. 70% of the 590.80 fields once a 7-177 crop has been established.

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED			NUTRIENTS REMOVED			NUTRIENT BALANCE		
			Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
1590 1.2	32.4	Com. Silage(AH)	165	128	217	165	60	159	0	67	38
3.4.5	50.4	Com. Silage(AH)	165	128	217	165	60	159	0	67	38
6.7.8	24.7	Com. Silage(AH)	165	128	217	165	60	159	0	67	38
T80 1	14.5	Com. Silage(AH)	165	128	217	165	60	159	0	67	38
2.3.4	65.1	Com. Silage(AH)	165	128	217	165	60	159	0	67	38
5	19.4	Com. Silage(AH)	165	128	218	165	60	159	0	68	39
Off Farm											

22 tons of 3890 dry matter is the target yield for the corn

Manure (Phosphorus) Nutrient Distribution for Corn Crop. (Target Yield 22 tons)

Field #	Grazing cycle s/year	# of P2O5 by Livestock	# of P2O5 supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of P2O5 per field/yr solids	#of P2O5 per acre from solids	Gallons of liquid manure per field per year	#of P2O5 per field/year from liquid manure	#of P2O5 per acre per year from liquid manure	Total # of NP2O5 per acre/year
Tract 590										
1.	0	0	0	7,606	873	30	262,577	2,886	98	128
2.	0	0	0	780	90	30	26,923	296	99	129
3.	0	0	0	3,839	441	27	147,259	1,665	101	128
4.	0	0	0	1,468	168	27	56,292	636	101	128
5.	0	0	0	6,433	739	27	246,783	2,790	101	128
6.	0	0	0	979	112	31	32,874	348	97	128
7.	0	0	0	3,093	355	31	103,802	1,099	96	127
8.	0	0	0	2,637	303	31	88,491	936	96	127
Subtotal		0	0	26,835	3,081		965,001	10,656		
Tract 80										
1	0	0	0	3,354	385	27	128,667	1,464	101	128
2	0	0	0	1,570	180	26	63,562	684	101	127
3	0	0	0	2,551	293	27	103,287	1,111	101	128
4	0	0	0	10,973	1,260	27	444,319	4,781	101	128
5	0			5,031	578	30	160,834	1,909	98	128
Subtotal		0	0	23,479	2,696		900,669	9,949		
Totals				50,314	5,777		1,865,670	20,605		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/29/2015

CLIENT: **Silveira, Tony** Tracts 590.80
ASSISTED BY: **Pedersen**

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

Field Number	Acres	Crop	Tractor Spreader Capacity		Spread Width Feet	PHOSPHOROUS, P2O5 Concentration in Storage Facility		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
			Bushels	CF		PPM	Lbs/Ton						
T590 1,2	32.4	Com, Silage(AH)	357	444	15	3,189	6.38	60	1.00	9.5	2449	1	36
34.5	50.4	Com, Silage(AH)	357	444	15	3,189	6.38	60	1.00	9.5	2449	1	36
6.7.8	24.7	Com, Silage(AH)	357	444	15	3,189	6.38	60	1.00	9.5	2449	1	36
T80 1	14.5	Com, Silage(AH)	357	444	15	3,189	6.38	60	1.00	9.5	2449	1	36
2.3.4	65.1	Com, Silage(AH)	357	444	15	3,189	6.38	60	1.00	9.5	2449	1	36
5	19.4	Com, Silage(AH)	357	444	15	3,189	6.38	60	1.00	9.5	2449	1	36

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

Field Number	Acres	Crop	Sprinkler Flowrate GPM	Wetted Diameter Feet	Portion of Diameter Receiving Liquids	PHOSPHOROUS, P2O5 Concentration in Storage Facility		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
						PPM	Lbs/1000Gal						
T590 1,2	32.4	Com, Silage(AH)	300	250	1/2 Circle	1,317	10.99	60	1.00	0.20	1.45	0.34	9.50
34.5	50.4	Com, Silage(AH)	300	250	1/2 Circle	1,317	10.99	60	1.00	0.20	1.45	0.34	9.50
T80 1	24.7	Com, Silage(AH)	300	250	1/2 Circle	1,317	10.99	60	1.00	0.20	1.45	0.34	9.50
2.3.4	14.5	Com, Silage(AH)	300	250	1/2 Circle	1,317	10.99	60	1.00	0.20	1.45	0.34	9.50
5	65.1	Com, Silage(AH)	300	250	1/2 Circle	1,317	10.99	60	1.00	0.20	1.45	0.34	9.50

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 3,216,672 gallons of liquids generated from the operation it will take approximately at agronomic rates use the application depths, travel lengths, and loads per acre listed below for each crop.

1,072 trips annually. Based on applying

PHOSPHOROUS, P2O5

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

Page 2 of 2

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/29/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Tank (Uncovered)	109,505	41,391	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	56,953	21,391	35,325	75%	90%	90%	42,715	19,252	31,793
Grazing	NONE	0	0	0	100%	100%	100%	0	0	0

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Sprinkling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (Incorporated 7 or more days after application)	42,715	19,252	31,793	70%	100%	100%	29,900	19,252	31,793
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Soil Drainage Class	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	29,900	19,252	31,793	80%	100%	100%	23,920	19,252	31,793
Grazing	Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
TOTAL:								70,080	54,604	92,396

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

[illegible]

	70744.5	206.5	100%	35,352	3.41	100%	19,252	95	100%	0	0
42% of the liquid manure will be applied to tract 177 fields and to tract 55947 80 full acres a grass crop has been planted 70% of the solid manure is recycled for bedding applied to 177 fields, or to tract 570 & 80 fields once a grass crop has been established											
NUTRIENT BALANCE BASED ON AVAILABLE ACRES											

22 tons at 30% dry matter is the target yield for the corn

Manure (Potassium) Nutrient Distribution for Corn Crop. (Target Yield 22 tons)

Field #	Grazing cycle s/year	# of K2O by Livestock	# of K2O supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of K2O per field/yr solids	#of K2O per acre from solids	Gallons of liquid manure per field per year	#of K2O per field/year from liquid manure	#of K2O per acre per year from liquid manure	Total # of K2O per acre/year
Tract 590										
1.	0	0	0	7,606	1,442	49	262,577	4,947	168	217
2.	0	0	0	780	148	49	26,923	507	169	218
3.	0	0	0	3,839	728	44	147,259	2,854	173	217
4.	0	0	0	1,468	278	44	56,292	1,091	173	217
5.	0	0	0	6,433	1,219	44	246,783	4,782	173	217
6.	0	0	0	979	186	52	32,874	597	166	218
7.	0	0	0	3,093	586	51	103,802	1,883	165	216
8.	0	0	0	2,637	500	52	88,491	1,605	165	217
Subtotal		0	0	26,835	5,087		965,001	18,266		
Tract 80										
1	0	0	0	3,354	636	44	128,667	2,509	173	217
2	0	0	0	1,570	297	44	63,562	1,172	172	216
3	0	0	0	2,551	484	44	103,287	1,905	173	217
4	0	0	0	10,973	2,080	44	444,319	8,195	173	217
5	0			5,031	954	44	160,834	3,273	169	213
Subtotal		0	0	23,479	4,451	49	900,669	17,054		
Totals				50,314	9,538		1,865,670	35,320		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/30/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply 167,717 cubic feet of solids generated from the operation it will take approximately 378 trips annually. Based on applying POTASSIUM, K2O at agronomic rate use the application depths, set times, and travel rates listed below for each crop.

Field Number	Acres	Crop	Tractor Spreader Capacity		Spread Width Feet	POTASSIUM, K2O Concentration in Storage Facility		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
			Bushels	CF		PPM	Lbs/Ton						
T590 1,2	32.4	Com, Silage(AH)	357	444	15	5,266	10.53	159	1.00	15.1	1338	2	36
3,4,5	50.4	Com, Silage(AH)	357	444	15	5,266	10.53	159	1.00	15.1	1338	2	36
6,7,8	24.7	Com, Silage(AH)	357	444	15	5,266	10.53	159	1.00	15.1	1338	2	36
T60 1	14.5	Com, Silage(AH)	357	444	15	5,266	10.53	159	1.00	15.1	1338	2	36
2,3,4	65.1	Com, Silage(AH)	357	444	15	5,266	10.53	159	1.00	15.1	1338	2	36
5	19.4	Com, Silage(AH)	357	444	15	5,266	10.53	159	1.00	15.1	1338	2	36

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 116,697 gallons of liquids generated from the operation it will take approximately 179 hours of pumping annually. Based on applying POTASSIUM, K2O 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	POTASSIUM, K2O Concentration in Storage Facility		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
						PPM	Lbs/Ton						
T590 1,2	32.4	Com, Silage(AH)	300	250	1/2 Circle	2,258	18.84	159	1.00	0.31	1.45	0.53	6.19
3,4,5	50.4	Com, Silage(AH)	300	250	1/2 Circle	2,258	18.84	159	1.00	0.31	1.45	0.53	6.19
T60 1	24.7	Com, Silage(AH)	300	250	1/2 Circle	2,258	18.84	159	1.00	0.31	1.45	0.53	6.19
2,3,4	14.5	Com, Silage(AH)	300	250	1/2 Circle	2,258	18.84	159	1.00	0.31	1.45	0.53	6.19
5	65.1	Com, Silage(AH)	300	250	1/2 Circle	2,258	18.84	159	1.00	0.31	1.45	0.53	6.19

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10/30/2015

1,072 trips annually. Based on applying

POTASSIUM, K2O

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/30/2015

CLIENT: **Silveira, Tony** Tracts 590.80
 ASSISTED BY: **Pedersen**

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		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	From (Uncovered)	109,905	41,391	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Soils Storage Facility (Roofed)	56,953	21,391	35,325	75%	90%	90%	42,715	19,252	31,793
Grazing	NONE	0	0	0	100%	100%	100%	0	0	0

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Sprinkling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (Incorporated 7 or more days after application)	42,715	19,252	31,793	70%	100%	100%	29,900	19,252	31,793
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

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		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Somewhat Poorly Drained	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	29,900	19,252	31,793	80%	100%	100%	23,920	19,252	31,793
Grazing	Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
		TOTAL:						70,080	54,604	92,396

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

10/30/2015

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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

Field Number	Acres	Crop	LIQUIDS				SOLIDS				GRAZING			
			Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization
1390 L2	33.4	Com. Silage(AH)	9%	5,454	34	5%	1,590	10	0%	0	0	0%	0	0
3.4.5	50.4	Com. Silage(AH)	14%	8,727	55	7%	2,225	14	0%	0	0	0%	0	0
6.7.8	24.7	Com. Silage(AH)	7%	4,085	26	4%	1,372	8	0%	0	0	0%	0	0
180 1	14.5	Com. Silage(AH)	4%	2,509	16	2%	636	4	0%	0	0	0%	0	0
2.3.4	65.1	Com. Silage(AH)	19%	11,272	71	9%	2,861	18	0%	0	0	0%	0	0
5	19.4	Com. Silage(AH)	5%	3,273	21	3%	954	6	0%	0	0	0%	0	0
OFF Farm														
TOTAL	206.5			25,284	222	100%	31,793	60	100%	0	0			

42% of the liquid manure will be applied to Tract 177 fields and to Tract 590+80 fields once 20% of the solid manure is ready for bedding, applied to Tract 177 fields to Tract 590+80 fields once a grass crop has been established

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

22 tons a 30% dry matter is the target yield for the corn.

Field Number	Acres	Crop	NUTRIENTS APPLIED				NUTRIENTS REMOVED				NUTRIENT BALANCE			
			Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
1390 L2	33.4	Com. Silage(AH)	165	128	217	165	60	159	0	67	58			
3.4.5	50.4	Com. Silage(AH)	165	128	217	165	60	159	0	67	58			
6.7.8	24.7	Com. Silage(AH)	165	128	217	165	60	159	0	67	58			
180 1	14.5	Com. Silage(AH)	165	128	217	165	60	159	0	67	58			
2.3.4	65.1	Com. Silage(AH)	165	128	217	165	60	159	0	67	58			
5	19.4	Com. Silage(AH)	165	128	217	165	60	159	0	67	58			
OFF Farm														

Manure (Nitrogen) Nutrient Distribution for Corn Crop. (Target Yield 18 tons)

Field #	Grazing cycle s/year	# of N by Livestock	# of N supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of N per field/yr solids	#of N per acre from solids	Gallons of liquid manure per field per year	#of N per field/year from liquid manure	#of N per acre per year from liquid manure	Total # of N per acre/year
Tract 590										
1.	0	0	0	7,606	1,085	37	91,902	2,889	98	135
2.	0	0	0	780	111	37	9,423	296	99	136
3.	0	0	0	3,839	547	33	52,067	1,676	101	134
4.	0	0	0	1,468	209	33	19,903	640	102	135
5.	0	0	0	6,433	918	33	87,255	2,808	102	135
6.	0	0	0	979	140	39	10,567	346	96	135
7.	0	0	0	3,093	441	39	33,365	1,094	96	135
8.	0	0	0	2,637	376	39	28,443	933	96	135
Subtotal		0	0	26,835	3,827		332,925	10,682		
Tract 80										
1	0	0	0	3,354	478	33	43,425	1,477	102	135
2	0	0	0	1,570	224	33	21,076	691	102	135
3	0	0	0	2,551	364	33	34,248	1,123	102	135
4	0	0	0	10,973	1,565	33	147,326	4,833	102	135
5	0			5,031	718	37	57,900	1,893	98	135
Subtotal		0	0	23,479	3,349		303,975	10,017		
Totals				50,314	7,176		636,900	20,699		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

Version 5.0

10/27/2015

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply 167,717 cubic feet of solids generated from the operation it will take approximately an agronomic rate use the application depths, travel lengths, and loads per acre listed below for each crop

378 trips annually. Based on applying

NITROGEN, N

[illegible]

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 3,216,672 gallons of liquids generated from the operation it will take approximately at agronomic rate use the application depths, set times, and travel rates listed below for each crop.

179 hours of pumping annually. Based on applying

NITROGEN, N

To apply	3.216.672	gallons of liquids generated from the operation it will take approximately at agronomic rate use the application depths, set times, and travel rates listed below for each crop.										179	hours of pumping manually. Based on applying			NITROGEN, N	
Field Number	Acres	Crop	Sprinkler Flowrate GPM	Wetted Diameter Feet	Portion of Wetted Diameter Receiving Liquids	NITROGEN, N Concentration in Storage Facility PPM	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				
TS90 1,2	32.4	Com. Silage(AH)	300	250	1/2 Circle ▼	2,866	23.92	135	1.00	0.35	1.45	0.59	5.56				
3.4.5	50.4	Com. Silage(AH)	300	250	1/2 Circle ▼	2,866	23.92	135	1.00	0.35	1.45	0.59	5.56				
	24.7	Com. Silage(AH)	300	250	1/2 Circle ▼	2,866	23.92	135	1.00	0.35	1.45	0.59	5.56				
TN0 1	14.5	Com. Silage(AH)	300	250	1/2 Circle ▼	2,866	23.92	135	1.00	0.35	1.45	0.59	5.56				
2.3.4	65.1	Com. Silage(AH)	300	250	1/2 Circle ▼	2,866	23.92	135	1.00	0.35	1.45	0.59	5.56				
5	19.4	Com. Silage(AH)	300	250	1/2 Circle ▼	2,866	23.92	135	1.00	0.35	1.45	0.59	5.56				
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1000 JOURNAL OF CLIMATE

NITROGEN, N

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/27/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Peterzen

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		
			N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Truck (Uncovered)		109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (roofed)		56,953	21,291	35,325	75%	90%	90%	42,715	19,252	31,793
Grazing	NONE		0	0	0	100%	100%	100%	0	0	0

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 ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Spinkling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (Incorporated 7 or more days after application)	42,715	19,252	31,793	70%	100%	100%	29,900	19,252	31,793
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

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		
			N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids		Somewhat Poorly Drained	57,200	35,352	60,605	80%	100%	100%	46,160	35,352	60,603
Solids		Somewhat Poorly Drained	29,900	19,252	31,793	80%	100%	100%	23,920	19,252	31,793
Grazing		Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
			TOTAL-						70,080	54,604	92,396

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

10/27/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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

Field Number	Acres	Crop	LIQUIDS				SOLIDS				GRAZING			
			Percent of Nutrients 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	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients
T590 1.2	32.4	Com. Silage(AH)	7%	3,185	24	5%	1,196	9	0%	0	0	0%	0	0
3.4.5	50.4	Com. Silage(AH)	11%	5,124	38	7%	1,674	12	0%	0	0	0%	0	0
6.7.8	24.7	Com. Silage(AH)	5%	2,373	18	4%	937	7	0%	0	0	0%	0	0
T80 1	14.5	Com. Silage(AH)	3%	1,477	11	2%	478	4	0%	0	0	0%	0	0
2.3.4	65.1	Com. Silage(AH)	14%	6,647	49	9%	2,133	16	0%	0	0	0%	0	0
5	19.4	Com. Silage(AH)	4%	1,893	14	3%	718	5	0%	0	0	0%	0	0
Off Farm														
TOTALS	206.5		55%	25,462	153	70%	16,744	53	100%	0	0	100%	0	0
			100%	46,100		100%	23,920							

55% of the liquid manure will be applied to T-177 fields and to T-590 + 80 fields once a grass crop has been planted 70% of the solid manure is recycled for bedding, applied to T-177 fields or to Tract 590 + 80 fields once a grass crop has been planted

55% of the liquid manure will be applied to T-177 fields and to T-590 + 80 fields once a grass crop has been planted

Field Number	Acres	Crop	NUTRIENTS APPLIED				NUTRIENTS REMOVED				NUTRIENT BALANCE			
			Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
T590 1.2	32.4	Com. Silage(AH)	135	105	178	135	49	130	0	55	47	0	55	47
3.4.5	50.4	Com. Silage(AH)	135	105	178	135	49	130	0	55	47	0	55	47
6.7.8	24.7	Com. Silage(AH)	135	105	178	135	49	130	0	55	47	0	55	47
T80 1	14.5	Com. Silage(AH)	135	105	178	135	49	130	0	55	47	0	55	47
2.3.4	65.1	Com. Silage(AH)	135	105	178	135	49	130	0	55	47	0	55	47
5	19.4	Com. Silage(AH)	135	104	177	135	49	130	0	55	47	0	55	47
Off Farm														

18 tons is the target yield for the corn.

Manure (Phosphorus) Nutrient Distribution for Corn Crop. (Target Yield 18 tons)

Field #	Grazing cycle s/year	# of P2O5 by Livestock	# of P2O5 supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of P2O5 per field/yr solids	#of P2O5 per acre from solids	Gallons of liquid manure per field per year	#of P2O5 per field/year from liquid manure	#of P2O5 per acre per year from liquid manure	Total # of P2O5 per acre/year
Tract 590										
1.	0	0	0	7,606	873	30	91,902	2,212	75	105
2.	0	0	0	780	90	30	9,423	227	76	106
3.	0	0	0	3,839	441	27	52,067	1,283	78	105
4.	0	0	0	1,468	168	27	19,903	491	78	105
5.	0	0	0	6,433	739	27	87,255	2,150	78	105
6.	0	0	0	979	112	31	10,567	265	74	105
7.	0	0	0	3,093	355	31	33,365	838	74	105
8.	0	0	0	2,637	303	31	28,443	714	74	105
Subtotal		0	0	26,835	3,081		332,925	8,180		
Tract 80										
1	0	0	0	3,354	385	27	43,425	1,131	78	105
2	0	0	0	1,570	180	26	21,076	530	78	104
3	0	0	0	2,551	293	27	34,248	860	78	105
4	0	0	0	10,973	1,260	27	147,326	3,701	78	105
5	0			5,031	578	30	57,900	1,449	75	105
Subtotal		0	0	23,479	2,696		303,975	7,671		
Totals				50,314	5,777		636,900	15,851		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

Version 5.0

10/28/2015

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply 167,717 cubic feet of solids generated from the operation it will take approximately

378 trips annually. Based on applying

PHOSPHOROUS, P2O5

[illegible]

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 3.216,677 gallons of liquids generated from the operation it will take approximately

179 hours of pumping annually. Based on applying

PHOSPHOROUS, P2O5

Field Number	Acres	Crop	Sprinkler Flowrate GPM	Wetted Diameter Feet	Portion of Diameter Receiving Liquids	PHOSPHOROUS, P2O5 Concentration in Storage Facility		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	
						PPM	Lbs/1000Gals							
T590 I-2	32.4	Com, Silage(AH)	300	250	1/2 Circle	▶	1,317	10.99	49	1.00	0.17	1.45	0.28	11.61
3-4.5	50.4	Com, Silage(AH)	300	250	1/2 Circle	▶	1,317	10.99	49	1.00	0.17	1.45	0.28	11.61
	24.7	Com, Silage(AH)	300	250	1/2 Circle	▶	1,317	10.99	49	1.00	0.17	1.45	0.28	11.61
	780 I	14.5	Com, Silage(AH)	300	250	1/2 Circle	▶	1,317	10.99	49	1.00	0.17	1.45	0.28
3-3.4	65.1	Com, Silage(AH)	300	250	1/2 Circle	▶	1,317	10.99	49	1.00	0.17	1.45	0.28	11.61
5	19.4	Com, Silage(AH)	300	250	1/2 Circle	▶	1,317	10.99	49	1.00	0.17	1.45	0.28	11.61
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PHOSPHOROUS, P2O5 ▼

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OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

10/28/2015

Version 5.0

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Petersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Tank (uncovered)	109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	56,953	21,291	35,325	75%	90%	90%	42,715	19,252	31,793
Grazing	NONE	0	0	0	100%	100%	100%	0	0	0

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Spreading	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (incorporated 7 or more days after application)	42,715	19,252	31,793	70%	100%	100%	29,900	19,252	31,793
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER DENTRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Dentrification			Pounds of Nutrients Retained After Dentrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Soil Drainage Class	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	29,900	19,252	31,793	80%	100%	100%	23,920	19,252	31,793
Grazing	Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
								TOTAL	70,080	54,604
										92,396

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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

[illegible]

55 yds of the liquid manure is to be applied to Tract 177 full and to Tract 590 + 80 fields once a year. The crop has been planted to alfalfa and the manure is recycled as bedding, applied to tract 177 field or to Tract 590 + 80 fields once a year. The crop has been established.

	206.5	100%	35,353	330	100%	19,252	117	100%	0	0
1077/415										

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

18 tons is the target yield for corn.

Manure (Potassium) Nutrient Distribution for Corn Crop. (Target Yield 18 tons)

Field #	Grazing cycle s/year	# of K2O by Livestock	# of K2O supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of K2O per field/yr solids	#of K2O per acre from solids	Gallons of liquid manure per field per year	#of K2O per field/year from liquid manure	#of K2O per acre per year from liquid manure	Total # of K2O per acre/year
Tract 590										
1.	0	0	0	7,606	1,442	49	91,902	3,793	129	178
2.	0	0	0	780	148	49	9,423	389	130	179
3.	0	0	0	3,839	728	44	52,067	2,200	133	177
4.	0	0	0	1,468	278	44	19,903	841	133	177
5.	0	0	0	6,433	1,219	44	87,255	3,686	133	177
6.	0	0	0	979	186	52	10,567	455	126	178
7.	0	0	0	3,093	586	51	33,365	1,436	126	177
8.	0	0	0	2,637	500	52	28,443	1,224	126	178
Subtotal		0	0	26,835	5,087		332,925	14,024		
Tract 80										
1	0	0	0	3,354	636	44	43,425	1,939	134	178
2	0	0	0	1,570	297	44	21,076	908	133	177
3	0	0	0	2,551	484	44	34,248	1,475	134	178
4	0	0	0	10,973	2,080	44	147,326	6,344	134	178
5	0			5,031	954	49	57,900	2,485	128	177
Subtotal		0	0	23,479	4,451		303,975	13,151		
Totals				50,314	9,538		636,900	27,175		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

10/28/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply		167,717 cubic feet of solids generated from the operation it will take approximately		378 trips annually. Based on applying		POTASSIUM, K2O		▼					
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	CF	Spread Width Feet	POTASSIUM, K2O Concentration in Storage Facility PPM	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
T990 1.2	32.4	Com, Silage(All)	357	444	15	5,266	10.53	90	1.00	8.6	2706	1	36
3.4.5	50.4	Com, Silage(All)	357	444	15	5,266	10.53	90	1.00	8.6	2706	1	36
6.7.8	24.7	Com, Silage(All)	357	444	15	5,266	10.53	90	1.00	8.6	2706	1	36
T80 1	14.5	Com, Silage(All)	357	444	15	5,266	10.53	90	1.00	8.6	2706	1	36
2.3.4	65.1	Com, Silage(All)	357	444	15	5,266	10.53	90	1.00	8.6	2706	1	36
5	19.4	Com, Silage(All)	357	444	15	5,266	10.53	90	1.00	8.6	2706	1	36

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 1316,672 gallons of liquids generated from the operation it will take approximately 179 hours of pumping annually. Based on applying POTASSIUM, K2O													
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 Diameter Receiving Liquids	POTASSIUM, K2O	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	
						Concentration in Storage Facility PPM							Lbs/1000Gal
T990 1.2	32.4	Com, Silage(All)	300	250	1/2 Circle	2,258	18.84	90	1.00	0.18	1.45	0.30	10.90
3.4.5	50.4	Com, Silage(All)	300	250	1/2 Circle	2,258	18.84	90	1.00	0.18	1.45	0.30	10.90
	24.7	Com, Silage(All)	300	250	1/2 Circle	2,258	18.84	90	1.00	0.18	1.45	0.30	10.90
T80 1	14.5	Com, Silage(All)	300	250	1/2 Circle	2,258	18.84	90	1.00	0.18	1.45	0.30	10.90
2.3.4	65.1	Com, Silage(All)	300	250	1/2 Circle	2,258	18.84	90	1.00	0.18	1.45	0.30	10.90
5	19.4	Com, Silage(All)	300	250	1/2 Circle	2,258	18.84	90	1.00	0.18	1.45	0.30	10.90

Version 5.0

10/28/2015

CLIENT: **Silveira, Tony Tracts 590,80**
ASSISTED BY: **Pedersen**

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 3,216,672 gallons of liquids generated from the operation it will take approximately at agronomic rates use the application depths, travel lengths, and loads per acre listed below for each crop

1,072 trips annually. Based on applying

POTASSIUM K2O

[illegible]

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

	Annual Volume Production	Concentration of Nutrients				
		In Storage				Units
		N	P2O5	K2O	Units	
Storage Facility Tank (Unroofed)	1216,672	Gallons	23.92	10.99	18.84	lbs/1,000 Gal
Solids Storage Facility (Roofed)	1,509	Tons	14.15	6.38	10.53	lbs/Ton

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

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CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	100% (uncovered)	109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	56,953	21,391	35,325	75%	90%	90%	42,715	19,252	31,793
Grazing	NONE	0	0	0	100%	100%	100%	0	0	0

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Spilling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (incorporated 7 or more days after application)	42,715	19,252	31,793	70%	100%	100%	29,900	19,252	31,793
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Soil Drainage Class	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	29,900	19,252	31,793	80%	100%	100%	23,920	19,252	31,793
Grazing	Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
		70,741	70,080	54,604	70,741	70,080	54,604	70,741	70,080	54,604

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

10/28/2015

CLIENT: Silveira, Tony Tracts 590.80
ASSISTED BY: Pedersen

Version 6.0

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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

Field Number	Acres	Crop	LIQUIDS			SOLIDS			GRAZING		
			Pounds of Nutrients to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Pounds of Nutrients to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Pounds of Nutrients to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization
1390 1.2	32.4	Com. Silage(AH)	7%	4,182	46	1,590	2,225	18	0%	0	0
3.4.5	50.4	Com. Silage(AH)	11%	6,727	74	2,225	2,225	25	0%	0	0
6.7.8	24.7	Com. Silage(AH)	5%	3,115	34	1,272	1,272	14	0%	0	0
180 1	14.5	Com. Silage(AH)	3%	1,939	21	636	636	7	0%	0	0
2.3.4	65.1	Com. Silage(AH)	14%	8,727	97	2,861	2,861	32	0%	0	0
5	19.4	Com. Silage(AH)	4%	2,485	27	954	954	11	0%	0	0
OFF Farm											
TOTALS	206.5		100%	33,429	301	22,255	31,793	106	100%	0	0

55% of the liquid manure will be applied to Tract 177 fields and to Tract 590 and 80 once a grass crop has been planted. 70% of the solid manure will be recorded as bedding, applied to Tract 177 fields and to Tract 590 + 80 fields once a grass crop has been established. See NUTRIENT BALANCE BASED ON AVAILABLE ACRES

18 tons is the target yield for corn.

Field Number	Acres	Crop	NUTRIENTS APPLIED			NUTRIENTS REMOVED			NUTRIENT BALANCE		
			Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
1390 1.2	32.4	Com. Silage(AH)	135	105	113	94	34	90	41	71	88
3.4.5	50.4	Com. Silage(AH)	135	105	113	94	34	90	41	70	87
6.7.8	24.7	Com. Silage(AH)	135	105	113	94	34	90	41	70	87
180 1	14.5	Com. Silage(AH)	135	105	113	94	34	90	41	70	87
2.3.4	65.1	Com. Silage(AH)	135	105	113	94	34	90	41	70	88
5	19.4	Com. Silage(AH)	135	104	107	94	34	90	41	70	87
OFF Farm											

**Manure (Nitrogen) Nutrient Distribution for Perennial and Annual
Silage/Hay/Pasture Crop. (Wheat, Oats, or both may be in the mixture)**

Field #	Grazing cycle s/year	# of N by Livestock	# of N supplied by grazing/ac/yr	Cubic ft. of solids/yr.	#of N per field/yr solids	#of N per acre from solids	Gallons of liquid manure per field per year	#of N per field/year from liquid manure	#of N per acre per year from liquid manure	Total # of N per acre/year
Tract 590										
1.	0	0	0		1,226	42	438,779	6,280	214	256
2.	0	0	0		126	42	44,991	644	215	257
3.	0	0	0		619	37	253,109	3,622	219	256
4.	0	0	0		236	37	96,754	1,385	220	257
5.	0	0	0		1,037	37	424,171	6,071	220	257
6.	0	0	0		158	44	51,796	741	206	250
7.	0	0	0		499	44	163,901	2,346	206	250
8.	0	0	0		424	44	139,068	1,991	205	249
Subtotal		0	0		4,325		1,612,569	23,080		
Tract 80										
1	0	0	0		541	37	225,760	3,231	223	260
2	0	0	0		253	37	100,624	1,440	212	249
3	0	0	0		411	37	163,514	2,340	213	250
4	0	0	0		1,769	37	703,403	10,068	213	250
5	0				811	42	290,262	4,154	214	256
Subtotal		0	0		3,785		1,483,563	21,233		
Tract 177										
1	9	564	83		684	100	14,190	203	30	213
2	9	722	83		877	101	18,190	260	30	214
3	9	389	83		473	101	9,804	140	30	214
4	9	482	83		584	101	12,127	174	30	214
5	9	297	83		361	100	7,482	107	30	213
6	9	538	83		653	100	13,545	194	30	213

7	9	646	83		783	100	16,455	233	30	213
8	9	722	83		877	101	18,190	260	30	214
9	9	764	83		926	101	19,222	275	30	214
Subtotal		5,124			6,218		129,005	1,846		
Totals		5,124		219,096	14,328		3,225,137	46,159.		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

DESIGN APPROVAL:

Design approved by: /s/ Robert A. Pedersen Date: _____

Job Title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The client acknowledges that:

- a. They have received a copy of this specification and under-stands the contents and requirements.
- b. The following information must be provided NRCS by the client before this practice can be certified as applied:
 - ☒ Nutrient management application records including soil, water, plant and organic by-product test results.
 - ☒ Documentation showing amount, rate, form and application method of nutrient applied
 - ☒ Annual review of nutrient management including adjustments made.
- 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.
- d. Maintain records of nutrient application as required by state and local regulations.

Accepted by: /s/ _____

Date: _____

CERTIFICATION;

I have completed a review of the nutrient management and the specification's application and certify this practice has been applied.

Certification by: /s/ _____

Date: _____

Job Title: _____

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/5/2015

CLIENT: Silveira, Tony All Tracts 590,80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply		219,096 cubic feet of solids generated from the operation it will take approximately		493 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	Acre	Crop	Tractor Spreader Capacity Bushels	Spread Width Feet	NITROGEN, N Concentration in Storage Facility PPM	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
T-90 1,2	32.4	Ryegrass Haylage	357	444	6,120	12.24	300	1.00	43.8	531	36
3,4,5	50.4	Ryegrass Haylage	357	444	6,120	12.24	300	1.00	43.8	531	36
6,7,8	24.7	Ryegrass Haylage	357	444	6,120	12.24	300	1.00	43.8	531	36
T-80 1	14.5	Ryegrass Haylage	357	444	6,120	12.24	300	1.00	43.8	531	36
2,3,4	65.1	Ryegrass Haylage	357	444	6,120	12.24	300	1.00	43.8	531	36
5	19.4	Ryegrass Haylage	357	444	6,120	12.24	300	1.00	43.8	531	36
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	357	444	6,120	12.24	245	1.00	35.7	650	36

Wheat, oats or both maybe in the Ryegrass Haylage crop mixture

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 3,225,137 gallons of liquids generated from the operation it will take approximately 179 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.										NITROGEN, N				
Field Number	Acre	Crop	Sprinkler Flowrate GPM	Wetted Diameter Feet	Portion of Diameter Receiving Liquids	NITROGEN, N Concentration in Storage Facility		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	
						PPM	Lbs/1000Gal							
T590 1,2	32.4	Ryegrass Haylage	300	250	1/2 circle	▼	2,859	23.85	300	1.00	0.77	1.45	1.31	2.49
3,4,5	50.4	Ryegrass Haylage	300	250	1/2 circle	▼	2,859	23.85	300	1.00	0.77	1.45	1.31	2.49
T80 1	24.7	Ryegrass Haylage	300	250	1/2 circle	▼	2,859	23.85	300	1.00	0.77	1.45	1.31	2.49
2,3,4	65.1	Ryegrass Haylage	300	250	1/2 circle	▼	2,859	23.85	300	1.00	0.77	1.45	1.31	2.49
5	19.4	Ryegrass Haylage	300	250	1/2 circle	▼	2,859	23.85	300	1.00	0.77	1.45	1.31	2.49
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	300	250	1/2 circle	▼	2,859	23.85	245	1.00	0.63	1.45	1.07	3.06
					▼									

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/5/2015

CLIENT: Silveira, Tony All Tracts 590,80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 3,225,137 gallons of liquids generated from the operation it will take approximately 1,075 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	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	
T590 1,2	32.4	Ryegrass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
3,4,5	50.4	Ryegrass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
6,7,8	24.7	Ryegrass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
T80 1	14.5	Ryegrass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
2,3,4	65.1	Ryegrass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
5	19.4	Ryegrass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	3,000	15	2,859	23.85	245	1.00	0.23	1,414	2.1

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

Storage Facility	Annual Volume Production	Concentration of Nutrients in Storage				
		Units	N	P2O5	K2O	Units
Tank (Uncovered)	3,225,137	Gallons	23.85	10.96	18.79	lbs/1,000 Gal
Solids Storage Facility (Roofed)	1,972	Tons	12.24	5.38	8.60	lbs/Ton

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM) Version 5.0

CLIENT: Silveira, Tony All Tracts 590.80, 177
ASSISTED BY: Pedersen

11/5/2015

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Leak (Uncovered)	109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	64,365	23,575	37,664	75%	90%	90%	48,274	21,217	33,898
Grazing	NONE	7,535	2,219	2,378	100%	100%	100%	7,535	2,219	2,378

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Sprinkling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (Incorporated 7 or more days after application)	48,274	21,217	33,898	70%	100%	100%	33,792	21,217	33,898
Grazing	Grazing	7,535	2,219	2,378	85%	100%	100%	6,405	2,219	2,378

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Soil Drainage Class	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	33,792	21,217	33,898	80%	100%	100%	27,033	21,217	33,898
Grazing	Somewhat Poorly Drained	6,405	2,219	2,378	80%	100%	100%	5,124	2,219	2,378
TOTAL-								78,317	58,789	96,879

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/6/2015

CLIENT: Silveira, Tony All Tracts 590,80,177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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

Field Number	Acres	Crop	LIQUIDS				SOLIDS				GRAZING			
			Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization
1390 1.2	32.4	Ryegrass Haylage	15%	6,924	23	5%	1,352	5	0%	0	0	0%	0	0
3.4.5	50.4	Ryegrass Haylage	24%	11,078	37	4%	1,892	6	0%	0	0	0%	0	0
6.7.8	24.7	Ryegrass Haylage	11%	5,078	17	4%	1,081	4	0%	0	0	0%	0	0
780 1	14.5	Ryegrass Haylage	7%	3,231	11	2%	541	2	0%	0	0	0%	0	0
2.3.4	65.1	Ryegrass Haylage	30%	13,848	46	9%	2,433	8	0%	0	0	0%	0	0
5	19.4	Ryegrass Haylage	9%	4,154	14	3%	811	3	0%	0	0	0%	0	0
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	4%	1,846	8	23%	6,218	25	100%	5,124	21			
Off Farm														
TOTALS	368.3		0%	0	155	47%	12,706	52	0%	0	21	100%	5,124	21
			100%	46,160	155	100%	27,033	52	100%	5,124	21			

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED				NUTRIENTS REMOVED				NUTRIENT BALANCE			
			Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
1390 1.2	32.4	Ryegrass Haylage	255	196	333	300	110	308	-45	86	25			
3.4.5	50.4	Ryegrass Haylage	257	198	336	300	110	308	-43	88	28			
6.7.8	24.7	Ryegrass Haylage	249	192	325	300	110	308	-51	82	17			
780 1	14.5	Ryegrass Haylage	260	200	339	300	110	308	-40	90	31			
2.3.4	65.1	Ryegrass Haylage	250	192	326	300	110	308	-50	82	19			
5	19.4	Ryegrass Haylage	256	197	334	300	110	308	-44	87	26			
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	213	138	204	245	82	234	-31	56	-30			
Off Farm														

47% of the solid manure is recycled as bedding.
Wheat, oats, or both maybe in the Ryegrass Haylage crop mix too

Manure (Phosphorous) Nutrient Distribution for Perennial and Annual Silage/Hay/Pasture Crop. (Wheat, Oats, or both may be in the mixture).

Field #	Grazing cycle/year	# of P2O5 by Livestock	# of P2O5 supplied by grazing/ac/yr	Loads of solid/yr	#of P2O5 per field/yr solids	#of P2O5 per acre from solids	Gallons of liquid manure per field per year	#of P2O5 per field/year from liquid manure	#of P2O5 per acre per year from liquid manure	Total # of P2O5 per acre/year
Tract 590										
1.	0	0	0	23	962	33	438,779	4,810	164	197
2.	0	0	0	2	99	33	44,991	493	164	197
3.	0	0	0	12	485	29	253,109	2,774	168	197
4.	0	0	0	4	186	29	96,754	1,061	168	197
5.	0	0	0	19	814	29	424,171	4,650	168	197
6.	0	0	0	3	124	34	51,796	568	158	192
7.	0	0	0	9	392	34	163,901	1,797	158	192
8.	0	0	0	8	333	34	139,068	1,524	157	191
Subtotal	0	0	0	80	3,395	0	1,612,569	17,677		
Tract 80										
1	0	0	0	10	424	29	225,760	2,475	171	200
2	0	0	0	5	199	29	100,624	1,103	162	191
3	0	0	0	7	323	29	163,514	1,792	163	192
4	0	0	0	32	1,388	29	703,403	7,711	163	192
5	0	0	0	15	637	33	290,262	3,182	164	197
Subtotal		0	0	69	2,971	0	1,483,563	16,263		
Tract 177										
1	9	244	36	13	537	79	14,190	156	23	138
2	9	313	36	16	688	79	18,190	199	23	138
3	9	169	36	9	371	79	9,804	108	23	138
4	9	208	36	11	459	79	12,127	133	23	138

5	9	129	36	7	283	79	7,402	82	23	138
6	9	233	36	12	512	79	13,545	148	23	138
7	9	279	36	15	615	79	16,255	178	23	138
8	9	313	36	16	688	79	18,190	199	23	138
9	9	331	36	17	727	79	19,222	211	23	138
Subtotal		2,219		116	4,880		129,005	1,414		
TOTAL		2,219		265	11,246		3,225,137	35,354		

⇒ Records are maintained of manure and/or commercial fertilizer applications.

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

⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

DESIGN APPROVAL:

Design approved by: /s/ Robert A. Pedersen Date: _____

Job Title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The client acknowledges that:

- They have received a copy of this specification and under-stands the contents and requirements.
- The following information must be provided NRCS by the client before this practice can be certified as applied:

☒ Nutrient management application records including soil, water, plant and organic by-product test results.

☒ Documentation showing amount, rate, form and application method of nutrient applied

☒ Annual review of nutrient management including adjustments made.

- 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.
- Maintain records of nutrient application as required by state and local regulations.

Accepted by: /s/ _____

Date: _____

CERTIFICATION;

I have completed a review of the nutrient management and the specification's application and certify this practice has been applied.

Certification by: /s/ _____

Date: _____

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/5/2015

CLIENT: Silveira, Tony All Tracts 590,80,177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply 219,096 cubic feet of solids generated from the operation it will take approximately 493 trips annually. Based on applying PHOSPHOROUS, P2O5 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	CF	Spread Width Feet	PHOSPHOROUS, P2O5 Concentration		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
						PPM	Lbs/Ton						
T590 12	32.4	Ryegrass Haylage	357	444	15	2,690	5.38	110	1.00	20.4	1136	3	36
3.45	50.4	Ryegrass Haylage	357	444	15	2,690	5.38	110	1.00	20.4	1136	3	36
6.28	24.7	Ryegrass Haylage	357	444	15	2,690	5.38	110	1.00	20.4	1136	3	36
T60 1	14.5	Ryegrass Haylage	357	444	15	2,690	5.38	110	1.00	20.4	1136	3	36
2.34	65.1	Ryegrass Haylage	357	444	15	2,690	5.38	110	1.00	20.4	1136	3	36
5	19.4	Ryegrass Haylage	357	444	15	2,690	5.38	110	1.00	20.4	1136	3	36
T-127 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	357	444	15	2,690	5.38	82	1.00	15.2	1528	2	36

wheat, oats, or both may be in the Ryegrass Haylage crop mix

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 3,226,137 gallons of liquids generated from the operation it will take approximately 179 hours of pumping annually. Based on applying PHOSPHOROUS, P2O5 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 Diameter Receiving Liquids	PHOSPHOROUS, P2O5 Concentration		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
						PPM	Lbs/1000Gal						
T590 12	32.4	Ryegrass Haylage	300	250	1/2 Circle	1,314	10.96	110	1.00	0.37	1.45	0.63	5.21
3.45	50.4	Ryegrass Haylage	300	250	1/2 Circle	1,314	10.96	110	1.00	0.37	1.45	0.63	5.21
	24.7	Ryegrass Haylage	300	250	1/2 Circle	1,314	10.96	110	1.00	0.37	1.45	0.63	5.21
T60 1	14.5	Ryegrass Haylage	300	250	1/2 Circle	1,314	10.96	110	1.00	0.37	1.45	0.63	5.21
2.34	65.1	Ryegrass Haylage	300	250	1/2 Circle	1,314	10.96	110	1.00	0.37	1.45	0.63	5.21
5	19.4	Ryegrass Haylage	300	250	1/2 Circle	1,314	10.96	110	1.00	0.37	1.45	0.63	5.21
T-127 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	300	250	1/2 Circle	1,314	10.96	82	1.00	0.27	1.45	0.47	7.01

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/5/2015

CLIENT: Silveira, Tony All Tracts 590,80,177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 3,225,137 gallons of liquids generated from the operation it will take approximately 1,075 trips annually. Based on applying PHOSPHOROUS P2O5 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	PHOSPHOROUS, P2O5 Concentration in Storage Facility	Pounds of Nutrients to be Applied	Number of Applications Needed to meet Crop Demand	Inches of Liquids to Apply	Travel	Loads per Acre	
					PPM				Lbs/1000Gals		Length per Load Needed in Feet
T590 12	32.4	Ryegrass Haylage	3,000	15	1,314	10.96	110	1.00	0.37	868	3.3
34.5	50.4	Ryegrass Haylage	3,000	15	1,314	10.96	110	1.00	0.37	868	3.3
67.8	24.7	Ryegrass Haylage	3,000	15	1,314	10.96	110	1.00	0.37	868	3.3
T700 1	14.5	Ryegrass Haylage	3,000	15	1,314	10.96	110	1.00	0.37	868	3.3
23.4	65.1	Ryegrass Haylage	3,000	15	1,314	10.96	110	1.00	0.37	868	3.3
5	19.4	Ryegrass Haylage	3,000	15	1,314	10.96	110	1.00	0.37	868	3.3
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	3,000	15	1,314	10.96	82	1.00	0.27	1,167	2.5

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

Storage Facility	Annual Volume Production	Concentration of Nutrients in Storage				
		Units	N	P2O5	K2O	Units
Tank (Uncovered)	3,225,137	Gallons	23.85	10.96	18.79	lbs/1,000 Gal
Solids Storage Facility (Roofed)	1,972	Tons	12.24	5.38	8.60	lbs/Ton

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 6.0

11/5/2015

CLIENT: Silveira, Tony All Tracts 590.80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Blank (Unknown)	109,205	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Soils Storage Facility (Roofed)	64,365	23,375	37,664	75%	90%	90%	48,274	21,217	33,898
Grazing	NONE	7,535	2,219	2,378	100%	100%	100%	7,535	2,219	2,378

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Sprinkling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (incorporated 7 or more days after application)	48,274	21,217	33,898	70%	100%	100%	33,792	21,217	33,898
Grazing	Grazing	7,535	2,219	2,378	85%	100%	100%	6,405	2,219	2,378

NUTRIENTS AVAILABLE AFTER DENTRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Dentrification			Pounds of Nutrients Retained After Dentrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Somewhat Poorly Drained	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	33,792	21,217	33,898	80%	100%	100%	27,033	21,217	33,898
Grazing	Somewhat Poorly Drained	6,405	2,219	2,378	80%	100%	100%	5,124	2,219	2,378
TOTAL								78,317	58,789	96,879

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/5/2015

CLIENT: Silveira, Tony All Tracts 590.80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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

Field Number	Acres	Crop	LIQUIDS				PHOSPHOROUS, P2O5				GRAZING			
			Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization
T590 L2	32.4	Ryegrass Haylage	15%	5,303	48	5%	1,061	10	0%	0	0	0%	0	0
3.4.5	50.4	Ryegrass Haylage	24%	8,485	77	7%	1,485	14	0%	0	0	0%	0	0
6.7.8	24.7	Ryegrass Haylage	11%	3,889	35	4%	849	8	0%	0	0	0%	0	0
T80 1	14.5	Ryegrass Haylage	7%	2,475	23	3%	424	4	0%	0	0	0%	0	0
2.3.4	65.1	Ryegrass Haylage	30%	10,606	96	9%	1,910	17	0%	0	0	0%	0	0
5	19.4	Ryegrass Haylage	9%	3,182	29	3%	637	6	0%	0	0	0%	0	0
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	4%	1,414	17	23%	4,880	60	100%	2,219	27	100%	2,219	27
Off Farm														
TOTALS	268.3		0%	0	47%	9,972	118	0%	0	0	0	0%	0	0
			100%	35,352	326	100%	21,217	118	100%	2,219	27	100%	2,219	27

47% of the solid manure is recycled as bedding or heat, cats, or both may be in the Ryegrass Haylage and not

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED				NUTRIENTS REMOVED				NUTRIENT BALANCE			
			Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
T590 L2	32.4	Ryegrass Haylage	235	196	333	300	110	308	-45	86	25	-45	86	25
3.4.5	50.4	Ryegrass Haylage	237	198	336	300	110	308	-43	88	28	-43	88	28
6.7.8	24.7	Ryegrass Haylage	249	192	325	300	110	308	-51	82	17	-51	82	17
T80 1	14.5	Ryegrass Haylage	260	200	339	300	110	308	-40	90	31	-40	90	31
2.3.4	65.1	Ryegrass Haylage	250	192	326	300	110	308	-50	82	18	-50	82	18
5	19.4	Ryegrass Haylage	256	197	334	300	110	308	-44	87	26	-44	87	26
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	213	138	204	245	82	234	-31	56	-30	-31	56	-30
Off Farm														

**Manure (Potassium) Nutrient Distribution for Perennial and Annual
Silage/Hay/Pasture Crop. (Wheat, Oats, or both may be in the mixture)**

Field #	Grazing cycle s/yea r	# of K2O by Livestock	# of K2O supplied by grazing/ac/yr	Loads of solid/yr	#of K2O per field/yr solids	#of K2O per acre from solids	Gallons of liquid manure per field per year	# K2O per field/year from liquid manure	#of K2O per acre per year from liquid manu re	Total # of K2O per acre/year
Tract 590				0						
1.	0	0	0	23	1,537	52	438,779	8,245	280	332
2.	0	0	0	2	158	53	44,991	845	282	335
3.	0	0	0	12	776	47	253,109	4,756	288	335
4.	0	0	0	4	297	47	96,754	1,818	289	336
5.	0	0	0	19	1,300	47	424,171	7,971	289	336
6.	0	0	0	3	198	55	51,796	973	270	325
7.	0	0	0	9	626	55	163,901	3,080	270	325
8.	0	0	0	8	532	55	139,068	2,613	269	324
Subtotal	0	0	0	80	5,424	0	1,612,569	30,301		
Tract 80										
1	0	0	0	10	678	47	225,760	4,242	292	339
2	0	0	0	5	317	47	100,624	1,891	278	325
3	0	0	0	7	516	47	163,514	3,073	279	326
4	0	0	0	32	2,218	47	703,403	13,217	279	326
5	0	0	0	15	1,017	52	290,262	5,454	281	333
SubTotal		0	0	69	4,746	0	1,483,563	27,877		
Tract 177										
1	9	262	38	13	858	126	14,190	267	39	203
2	9	335	38	16	1,099	126	18,190	342	39	203
3	9	181	38	9	593	126	9,804	184	39	203
4	9	223	38	11	733	126	12,127	228	39	203
5	9	138	38	7	452	126	7,482	141	39	203

6	9	250	38	12	819	126	13,545	254	39	203
7	9	300	38	15	982	126	16,255	305	39	203
8	9	335	38	16	1,099	126	18,190	342	39	203
9	9	354	38	17	1,162	126	19,222	361	39	203
Subtotal	0	2,378	0	116	7,797	0	129,005	2,424		
TOTAL		2,378	0	265	17,967		3,225,137	60,602		

- ⇒ Records are maintained of manure and/or commercial fertilizer applications.
- ⇒ Nutrient management plans are reviewed annually and adjustments are made as needed.
- ⇒ Refer to the Filter Strip Specification Sheet when applying manure adjacent to open watercourses.

DESIGN APPROVAL:

Design approved by: /s/ Robert A. Pedersen Date: _____

Job Title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The client acknowledges that:

- a. They have received a copy of this specification and under-stands the contents and requirements.
- b. The following information must be provided NRCS by the client before this practice can be certified as applied:
 - ☒ Nutrient management application records including soil, water, plant and organic by-product test results.
 - ☒ Documentation showing amount, rate, form and application method of nutrient applied
 - ☒ Annual review of nutrient management including adjustments made.
- 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.
- d. Maintain records of nutrient application as required by state and local regulations.

Accepted by: /s/ _____

Date: _____

CERTIFICATION;

I have completed a review of the nutrient management and the specification's application and certify this practice has been applied.

Certification by: /s/ _____

Date: _____

11/4/2015

Version 5.0

References

103 **misconduct.** Based on analysis

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subject, oats or both may be in the Rye grass Analysis

[illegible]

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1101

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/4/2015

CLIENT: Silveira, Tony All Tracts 590,80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 1.175 Gallons of liquids generated from the operation it will take approximately 1.075 trips annually. Based on applying POTASSIUM K2O 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	POTASSIUM, K2O Concentration in Storage Facility	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
					PPM Lbs/1000Gal					
T590 L2	32.4	Ryegrass Haylage	3,000	15	2,252 18.79	308	1.00	0.60	531	5.5
345	50.4	Ryegrass Haylage	3,000	15	2,252 18.79	308	1.00	0.60	531	5.5
678	24.7	Ryegrass Haylage	3,000	15	2,252 18.79	308	1.00	0.60	531	5.5
T801	14.5	Ryegrass Haylage	3,000	15	2,252 18.79	308	1.00	0.60	531	5.5
234	65.1	Ryegrass Haylage	3,000	15	2,252 18.79	308	1.00	0.60	531	5.5
5	19.4	Ryegrass Haylage	3,000	15	2,252 18.79	308	1.00	0.60	531	5.5
T-177 L-9	61.8	Perennial Hay/Pasture(Med Intensity)	3,000	15	2,252 18.79	234	1.00	0.46	701	4.1

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

Storage Facility	Annual Volume Production	Concentration of Nutrients in Storage				
		Units	N	PO5	K2O	Units
Tank (Uncovered)	3,335,137	Gallons	23.85	10.96	18.79	Lbs/1,000 Gal
Solids Storage Facility (Roofed)	1,972	Tons	12.34	5.38	8.60	Lbs/Ton

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

11/4/2015

CLIENT: Silveira, Tony All Tracts 590.80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Somehow	109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	64,365	23,575	37,664	75%	91%	90%	48,274	21,217	33,898
Grazing	NONE	7,535	2,219	2,378	100%	100%	100%	7,535	2,219	2,378

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Spinkling	76,033	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (incorporated 7 or more days after application)	48,274	21,217	33,898	70%	100%	100%	33,792	21,217	33,898
Grazing	Grazing	7,535	2,219	2,378	85%	100%	100%	6,405	2,219	2,378

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Soil Drainage Class	57,700	35,352	60,603	81%	100%	100%	46,160	35,352	60,603
Solids	Somewhat Poorly Drained	33,792	21,217	33,898	81%	100%	100%	27,033	21,217	33,898
Grazing	Somewhat Poorly Drained	6,405	2,219	2,378	80%	100%	100%	5,124	2,219	2,378
TOTAL								78,317	66,789	96,879

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

11/14/2015

Version 5.0

CLIENT: Silveira, Tony All Tracts 590,80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON POTASSIUM

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
1390 1.2	32.4	Ryegrass Haylage	15%	9,090	30	5%	1,695	6	0%	0	0
3.4.5	50.4	Ryegrass Haylage	24%	14,515	47	7%	2,373	8	0%	0	0
6.7.8	24.7	Ryegrass Haylage	11%	6,666	22	4%	1,356	4	0%	0	0
T80 1	14.5	Ryegrass Haylage	7%	4,242	14	2%	678	2	0%	0	0
2.3.4	65.1	Ryegrass Haylage	30%	18,181	59	9%	3,051	10	0%	0	0
5	19.4	Ryegrass Haylage	9%	5,454	18	3%	1,017	3	0%	0	0
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	4%	2,424	10	23%	7,797	33	100%	2,378	10
						0%					
Off Farm											
TOTAL	268.3		0%	0		43%	15,932		0%	0	
			100%	60,603	199	100%	33,898	66	100%	2,378	10

47% of total manure is recycled as bedding.

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED			NUTRIENTS REMOVED			NUTRIENT BALANCE		
			Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P2O5 Lbs/Acre	Potassium, K2O Lbs/Acre
1390 1.2	32.4	Ryegrass Haylage	255	196	531	300	110	308	-45	86	25
3.4.5	50.4	Ryegrass Haylage	257	198	512	300	110	308	-43	88	28
6.7.8	24.7	Ryegrass Haylage	249	192	512	300	110	308	-51	82	17
T80 1	14.5	Ryegrass Haylage	260	200	535	300	110	308	-40	90	31
2.3.4	65.1	Ryegrass Haylage	250	192	528	300	110	308	-50	82	18
5	19.4	Ryegrass Haylage	256	197	534	300	110	308	-44	87	26
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	213	138	204	245	82	234	-31	56	-10
OT Farm											

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
WASTE UTILIZATION SPECIFICATION SHEET

Client: Silveira, Tony

Location: 1445 Tone Road

Tillamook SWCD

Tract No. 590, 80, 177

Prepared By Pedersen

Date 0714

Perform the following operations:
☐ Have your technical assistance provider review the resource management system plan for your operation at least once every 5 years.
☐ Maintain records for all waste applications.
☐ Calibrate application equipment to apply wastes in accordance with the recommended amount and timing specified on the nutrient budget specification sheet, NRCS practice code 590, for the crop being grown.
☐ Chemical analysis of soils, plant tissue and waste should be used annually to monitor and adjust amounts of waste applied. Refer to Oregon State University Extension Service publication EC1478, "Soil Test Interpretation Guide" for guidance in getting soil tested and interpreting soil test results. Refer to Oregon State University Extension publication EM8585, "Manure Application Rates for Forage Production" and EM8768, "Calculating Dairy Manure Nutrient Application Rates" for guidance in getting animal waste tested for nutrient concentrations and computing application rates.
☐ Apply waste in a manner that will cover no more than 25 percent of the leaf surface with solids unless clean water applications are planned immediately after wastes are applied. For pasture/hayland it is best to apply waste 7 days after harvesting forage by haying or grazing.
☐ To reduce odor problems, apply waste in mid morning when temperatures are warming and air is rising rather than in the afternoon or evening when air is cooling and settling. Avoid applications during periods of fog.
☐ Do not apply waste directly into an open watercourse or where waste is likely to enter an open watercourse. Observe all waste application setbacks identified in the resource management system plan.
☐ Do not apply waste to fields where there is no growing crop. If applications are needed during fall and winter periods due to unforeseen circumstances, such as the storage facilities being full, use the following guidelines for waste applications: a) Only spread waste on fields that are growing a crop, preferably grass. b) Increase all waste application setbacks identified in the resource management system plan by at least 15 feet. c) Don't apply waste during any rainfall event that will cause runoff. d) Use maximum travel rates for the traveling big gun sprinkler and solids spreader. e) Use soil tests, such as the Pre-sidedress Soil Nitrate test, to determine if additional applications of waste are needed on those fields receiving emergency winter applications.
☐ Do not apply waste to fields with frozen or snow covered soil conditions unless provisions are made to control runoff.
☐ Do not spread waste on fields where soils are saturated, ponded, flooded and/or during times when waste is likely to runoff into open watercourses.
☐ Be aware of the location of sensitive areas, concerns of neighbors or concerns of the public which require special application procedures
☐ Handle all waste material with caution. Wear appropriate protective clothing.
☐ Clean up residual materials from equipment and dispose of properly.
☐ Equipment used in waste utilization should be regularly inspected and maintained as needed in accordance with equipment operation and maintenance guidelines from the manufacturer or provided by NRCS.
Additional Guidance and Notes: Any manure discharge into an open water course will be reported to Oregon Department of Agriculture (ODA) within 24 hours. Within 5 days a written statement describing the manure discharge will be submitted to ODA. Annual CAFO permit reports will be submitted on time to ODA.

DESIGN APPROVAL:Design Approved by: /s/ Robert A. PedersenDate: 11/4/2015Job 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 SWCD 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/ Jonny PedersenDate: 11-4-2015**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: _____

EMERGENCY RESPONSE PLAN

In Case of a Storage Facility Spill, Leak, or Failure

- a. Stop all other activities to address the emergency.
- b. Stop all flow into the storage facility.
- c. If the storage facility is at maximum capacity or overtopping, draw the waste level in the facility down by making an application to the emergency application area shown on the plan map in accordance with the Waste Utilization instructions found in the Operations section of this plan.
- d. Assess the extent of the emergency and determine how much help is needed to correct the problem.
- e. Call for help & excavator if needed.
- f. If possible, use a skid loader or tractor with blade to contain or divert spill or leak away from environmentally sensitive areas.
- g. If containment material is needed, excavate soil from appropriate areas away from the storage facility.
- h. If possible, begin applying the stored waste to the utilization fields at the prescribed application rates described in Section 6 of this plan.
- i. Complete the clean-up and repair the necessary components.

In Case of a Manure/Waste Discharge

- a. Stop all other activities to deal with the emergency.
- b. Call for help if needed.
- c. Call sheriffs office if spilled on road for traffic control and clean the spill immediately from the road and roadside if needed.
- d. Contain the spill or runoff from entering the stream or waterway using straw bales, saw dust, or soil material.
- e. If flow is coming from a tile, plug the tile with a tile plug immediately.
- f. Assess the extent of the emergency and determine how much help is needed.

Contacts to be made within 24 Hours of a Discharge (SEE NEXT PAGE FOR REQUIREMENTS FOR FILING A WRITTEN REPORT)

Organization	Phone
Oregon Department of Agriculture	1-503-986-4700
Oregon Emergency Response System (ORES)	1-800-452-0311

Be prepared to provide the following information:

- a. Your Name (See next page)
- b. Farm Identification (See next page)
- c. Description of emergency.
- d. Estimate of the amounts, area covered, and distance traveled.
- e. Has manure reached surface waters or major field drains?
- f. Is there any obvious damage: employee injury, fish kill, or property damage?
- g. What is currently in progress to contain situation?

EMERGENCY RESPONSE PLAN

Emergency Contact Information

Farm Name	Tony Silveria Dairy
Address	T-590 1445 Tone Road T-80 1245 Mateject Road, T-177 130 Fraser Road, Tillamook, Oregon 97141
Farm Phone	209-765-8669
Permit #	
DIRECTIONS TO FARM	T- 590 0. 7 miles south west of Tillamook City. After crossing the Trask River turn right from Tillamook River Road onto Tone Road. 1st farm on the left. T-80 1.2 miles south west of Tillamook. After crossing the Trask River, turn right from Tillamook River Road onto Matejeck Road. 1st dairy on the right.
Emergency Phone Numbers:	
Tony Silveria cell	Only has a Cell Phone: 209-765-8669
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 description and cause of the discharge.
- The period of discharge including exact dates, times and duration of discharge.
- An estimate of discharge volume.
- Name or location of receiving water.
- Corrective steps taken, if appropriate, to reduce, eliminate or prevent reoccurrence of the discharge.

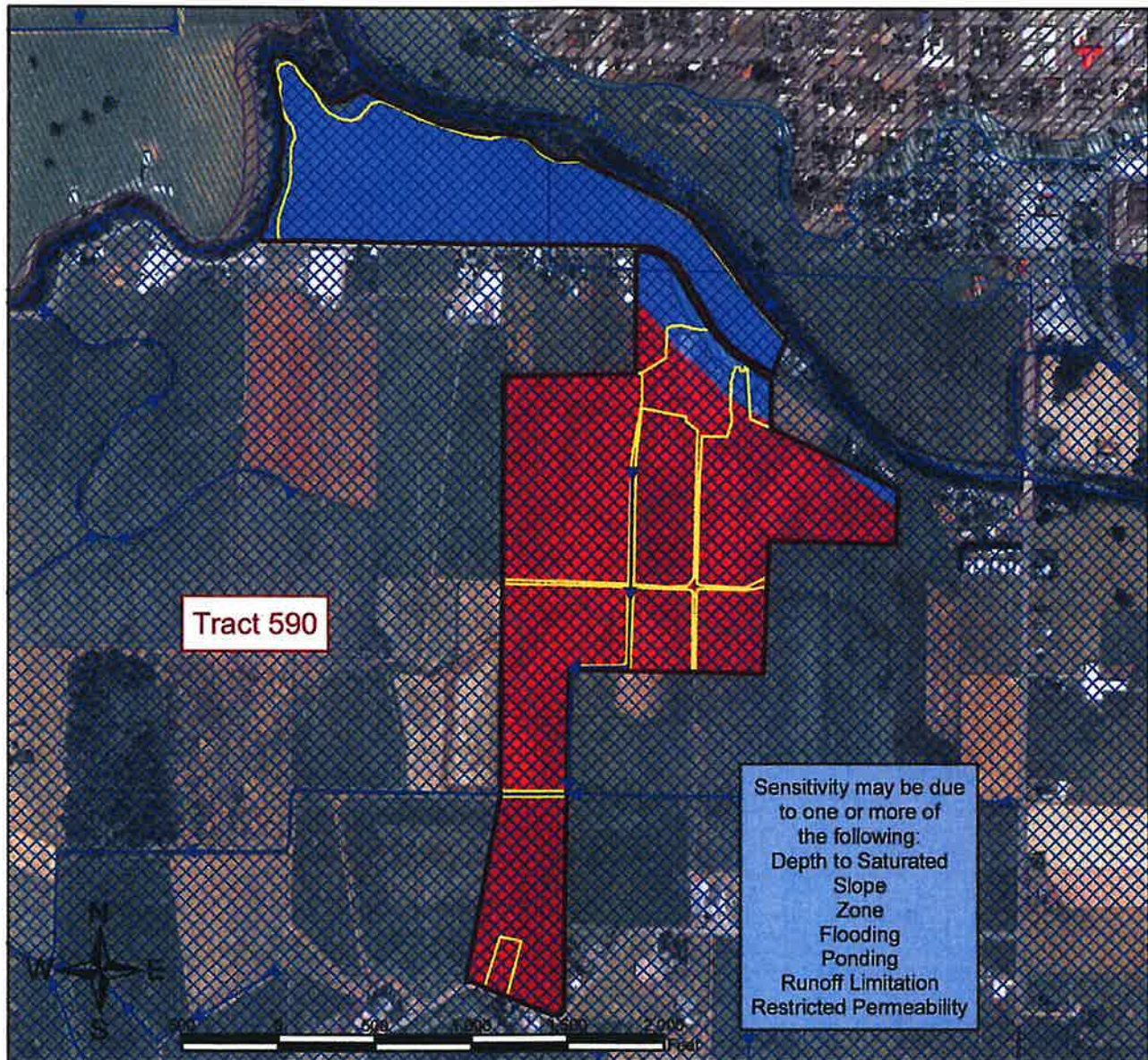
Silveira, Tony
TI014

Tract 590

TILLAMOOK SERVICE CENTER
Tillamook County SWCD
TILLAMOOK COUNTY, OREGON

District: Tillamook County SWCD
Approximate Acres: 107.5
Date: 11/20/2006

Flood Boundary Map Sensitive Manure Application Area



Legend	FEMA Classification	Flood Frequency Classification
Tract Boundaries	Sensitive Manure Application Area (100 Yr. Flood Plain)	Frequent
Planned Land Units	Winter Manure Application Area (Outside 500 Yr. Flood)	None
Open Water Course	500 Yr. Flood Plain	Occasional
	Undetermined Flood Plain	

Flooding Frequency Class- Tract 590

Month Range: January to December
Aggregation Method: Dominant Condition
Tie-break Rule: More Frequent

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

Map symbol	Map unit name	Rating
1A	Brenner silt loam, 0 to 1 percent slopes	Frequent
74A	Nehalem silt loam, 0 to 3 percent slopes	Occasional
77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	Frequent
103A	Coquille silt loam, 0 to 1 percent slopes, diked	Frequent
W	Water	

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 nonsol 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.

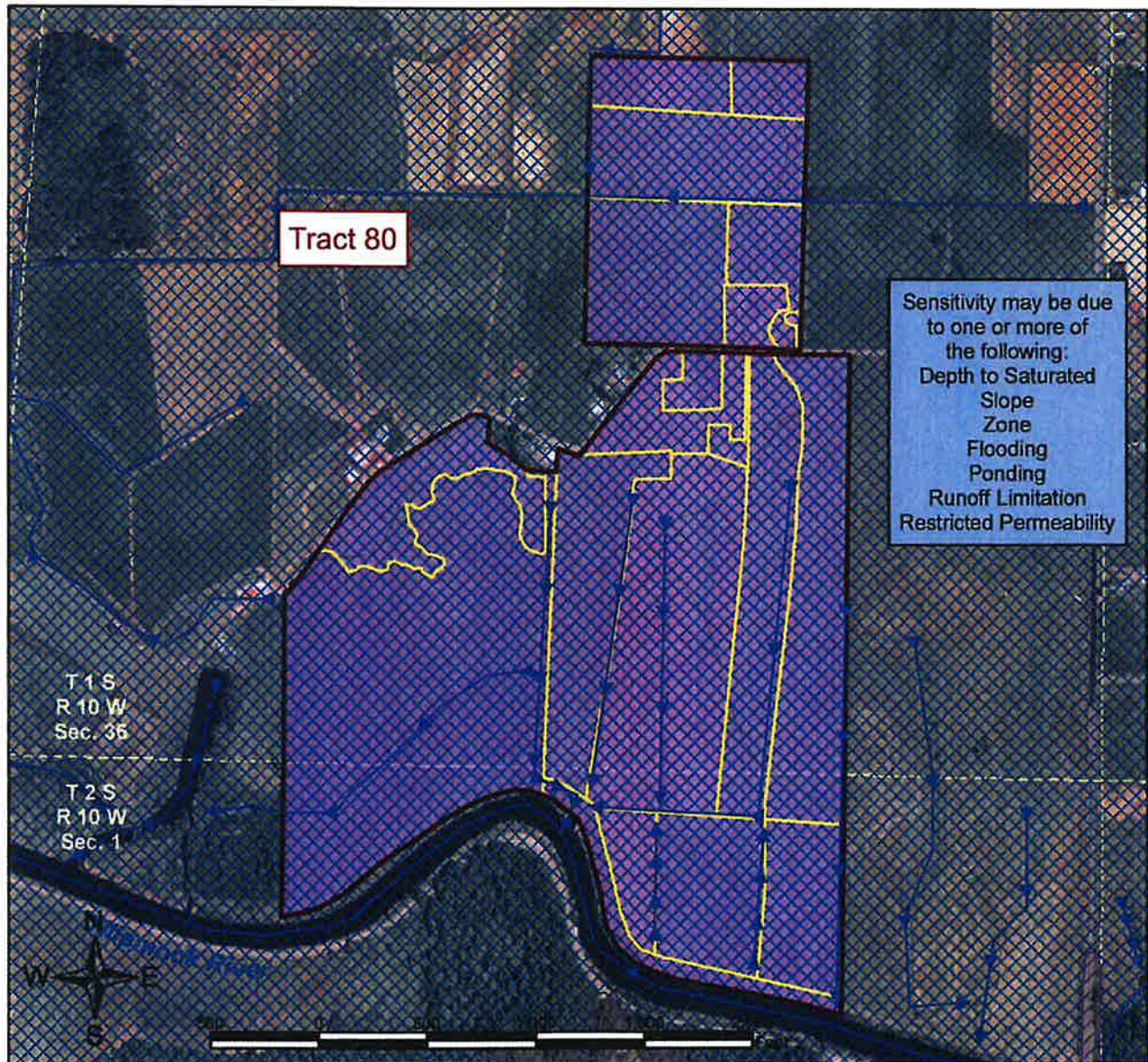
Silveira, Tony
T1080

- Tract 80

TILLAMOOK SERVICE CENTER
Tillamook County SWCD
TILLAMOOK COUNTY, OREGON

Tillamook County SWCD
Approximate Acres: 160.1
Date: 11/29/2006

Flood Boundary Map Sensitive Manure Application Area



Legend	FEMA Classification	Flood Frequency Classification
Tract Boundaries	Sensitive Manure Application Area (100 Yr. Flood Plain)	Frequent
Planned Land Units	Winter Manure Application Area (Outside 500 Yr. Flood)	None
Public Land Survey	500 Yr. Flood Plain	
Open Water Course	Undetermined Flood Plain	

Flooding Frequency Class-Tract 80

Month Range: January to December
Aggregation Method: Dominant Condition
Tie-break Rule: More Frequent

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

Map symbol	Map unit name	Rating
1A	Brenner silt loam, 0 to 1 percent slopes	Frequent
77A	Nestucca-Brenner silt loams, 0 to 3 percent slopes	Frequent
103A	Coquille silt loam, 0 to 1 percent slopes, diked	Frequent
W	Water	

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.

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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

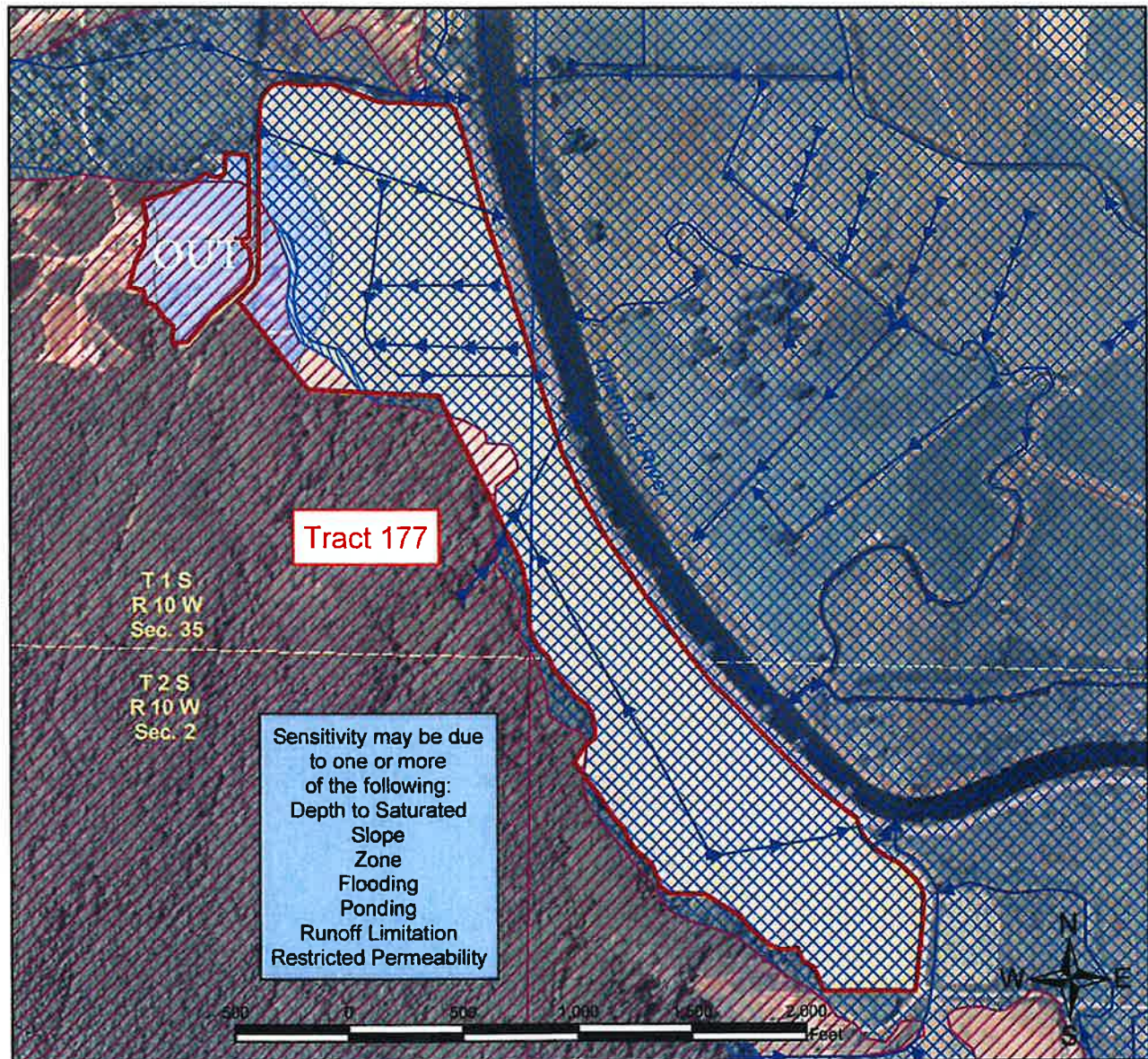
The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Silveira, Tony

Tillamook County SWCD
Approximate Acres: 76.3
Date: 2/25/2009

TILLAMOOK SERVICE CENTER
TILLAMOOK COUNTY SWCD
TILLAMOOK COUNTY,
OREGON

Flood Boundary Map Sensitive Manure Application Area



Legend		FEMA Classification	Flood Frequency Classification
Tract Boundary		Sensitive Manure Application Area (100 Yr. Flood Plain)	Frequent
Planned Land Units		Winter Manure Application Area (Outside 500 Yr. Flood)	None
Public Land Survey		500 Yr. Flood Plain	Occasional
Open Water Course		Undetermined Flood Plain	Rare

Flooding Frequency Class Silveira, Tony

Month Range: January to December
Aggregation Method: Dominant Condition
Tie-break Rule: More Frequent

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

Map symbol	Map unit name	Rating
30D	Templeton mediel silt loam, 5 to 30 percent slopes	None
30E	Templeton-Ecola medial silt loams, 30 to 60 percent slopes	None
32D	Munsoncreek-Flowerpot complex, 5 to 30 percent slopes	None
33D	Tolovana medial silt loam, 5 to 30 percent slopes	None
45B	Hebo silty clay loam, 0 to 5 percent slopes	None
103A	Coquille silt loam, 0 to 1 percent slopes, diked	Frequent
119B	Typic Fulvudands complex, 0 to 7 percent slopes	Occasional
170B	Logsdan-Nehalem silt loams, 0 to 5 percent slopes	Rare
191B	Siletz-Euchre medial silt loams, 0 to 7 percent slopes	None

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.

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Month Range: January to December

Aggregation Method: Dominant Condition

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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.

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

PRESCRIBED GRAZING SPECIFICATION SHEET

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec.36 T 2S; R 10W; Sec. 1

County: Tillamook SWCD Tillamook County Farm/Tract No. T-177

Field No.: 1-9

Prepared By: Pedersen

Date: 07/14

⇒ **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 17 tons at 30% dry matter is produced per acre per year.
- ⇒ Pasture fields will be reestablished when forage yield falls below 13 tons at 30% 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 once during the growing season.
- ⇒ Manure and commercial fertilizer applications are based on soil tests. Soil tests will be taken at least every 5 years. Nitrogen applications for pasture fields will not exceed 245 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 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.
- ⇒ Livestock are removed from the pastures in the fall when the ground becomes wet and the grasses have at least 3 inches of growth going into the winter.

DESIGN APPROVAL:

Design approved by: /s/ Robert A. Pedersen

Date: 11/4/2015

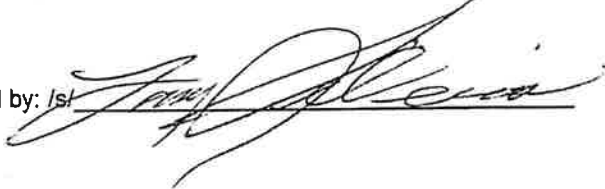
Job Title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The client acknowledges that:

- a. They have received a copy of this specification and understands the contents and requirements.
- b. 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: 11-4-2015

CERTIFICATION;

I have completed a review of the prescribed grazing practice and the specification's application and certify this practice has been applied.

Certification by: /s/ _____

Date: _____

Job Title: _____

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT

FORAGE HARVEST MANAGEMENT SPECIFICATION SHEET

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 25. 36

County: Tillamook SWCD Tillamook County Farm/Tract No. T-590, 80

Field No.: T-590 Fields:1-8 T-80 Fields 1,5

Prepared By: Pedersen

Date: 07/14

⇒ **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:

- ⇒ Forage fields are double cropped. When corn is in rotation, the enclosed Cover Crop Specification Sheet will be used.
- ⇒ Target yield for the corn is 23 tons at 25% dry matter per acre per year. The target yield for grass silage is 20 tons at 30% dry matter per acre per year.
- ⇒ Cropland fields are reestablished when the grass silage yields fall below 14 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 5 years. Nitrogen applications will not exceed 384 lbs. of nitrogen per acre per year unless soil tests and forage production justifies higher application rates.
- ⇒ Forage Tissue Tests will be taken during the growing season.
- ⇒ Manure is applied to cropland fields in accordance with the enclosed Waste Utilization Specification Sheet and the Nutrient Management Specification Sheet.
- ⇒ Field may be grazed when the required amount of forage is harvested. Grazing will be in accordance with the enclosed Prescribed Grazing Specification Sheet

DESIGN APPROVAL:

Design approved by: /s/ Robert A. Pedersen

Date:

11/4/2015

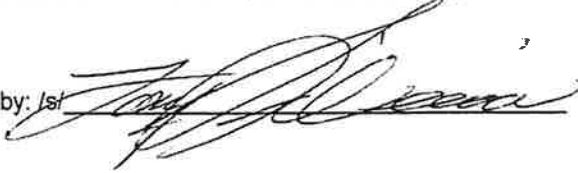
Job Title: CAFO PLANNER

CLIENTS ACKNOWLEDGEMENT STATEMENT:

The client acknowledges that:

- a. They have received a copy of this specification and understand the contents and requirements.
- b. 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:

11-4-2015

CERTIFICATION;

I have completed a review of the forage harvest management practice and the specification's application and certify this practice has been applied.

Certification by: /s/

Date:

Job Title:

**TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
COVER CROP SPECIFICATION SHEET**

Landowner/Operator: Tony Silveira

Job Location: T 1S; R 10W; Sec. 25, 36 T 2S; R 10W; Sec. 1

County Tillamook

SWCD Tillamook County

Farm/Tract No. 590, 80

Field No. T-590 Fields: 1-8 T-80 Fields 1, 5

Date: 8/15

Prepared By: Pedersen

PURPOSES:

- Reduce soil erosion and sedimentation.
- Maintain or improve water quality.
- Manage the balance of plant nutrients.

Specifications:

- Corn fields target yield is 18 to 22 tons at 30% dry matter per acre per year.
- Soil tests for nitrate-Nitrogen (NO₃-N) will be taken in early spring to evaluate the nutrient available for corn production. The corn should have five collared leaves or at least a week before planned side-dressing. Take the soil samples between the rows. Request in soil test results in ppm.
- Send the soil sample to the lab immediately. Do not mail the samples on Thursday or Friday.
- If soil nitrate-N is above 25 ppm no additional nitrogen is needed.
- Manure tests for nitrate-Nitrogen, phosphorus, and potassium will be taken. Request the results in lbs/1,000 for the liquid manure and lbs/ton for solid manure.
- On fields that received frequent manure application both early-season and post harvest tests should be taken as a planning tool for future years.
- Recommend pH tests be taken. Silage corn prefers soil pH values ideally around 6.0-6.5 pH. Research shows yield reductions when soils get down to 5.5 pH. Manure tests will be taken prior to any manure application to the fields that will be planted to corn in the spring. Do not apply liquid or solid manure on these fields during November, December, or January. Do not apply any manure and/or fertilizer to growing corn from August 15th to harvest in any year.
- Any liquid and/or solid manure application must be at least 100 feet back from surface water.

- Establish a winter cover crop as soon as corn is harvested in the fall.
- Seed the grass or grains into the just harvested corn field.
- Cover crop species recommended:

Annual Rye Grass	20 lbs/Ac
Barley, Oats, Triticale, Wheat	80 lbs/Ac.
Common Vetch	30 lbs/Ac
Hairy Vetch	15 lbs/Ac
Austrian Winter Peas	30-40 lbs/Ac

TILLAMOOK COUNTY
SOIL AND WATER CONSERVATION DISTRICT
FILTER STRIP SPECIFICATION SHEET

Landowner/Operator: Silveira, Tony

Job Location: T 1S; R 10W; Sec. 25,35, 36 T 2S; R 10W; Sec.1,2

County: Tillamook SWCD Tillamook County Farm/Tract No. T-590,80,177

Field No. T 590 Fields: 3,4,5,6,7,8 T-80 Fields 1,3,4,5,T-177 Fields: 1-9

Prepared By: Pedersen Date 07/14

Purpose: To reduce manure runoff into an adjacent open watercourse and the resulting fecal and organic contamination in the watercourse.

Specifications:

- ⇒ A grass filter strip will be maintained adjacent to all open water courses that flow through the farm. from April to October a 10 foot wide grass filter strip will be maintained for solid manure spreader and manure tank wagon applied manure. A 35 foot wide filter strip will be maintained from April to October when liquid manure is applied with a manure gun traveler. A 50 foot wide filter strip will be maintained when manure is applied during the winter time with a manure spreader or a manure tank wagon. A 70 foot wide filter strip will be maintained during the winter months when liquid manure is applied with a manure gun traveler.
- ⇒ No manure will be applied to the filter strip area.
- ⇒ Noxious weeds such as Tansy Ragwort and Canada thistle are controlled in accordance with an Integrated Pesticide Management Plan.
- ⇒ Excessive accumulation of sediment and/or manure will be removed. The filter strip will be harrowed at least once each year prior to May 1st to shape and maintain at least a 1 % grade sloping away from the existing open water courses. Filter strip grade will be maintained to allow the runoff to occur along the entire length of the filter strip and not occur in only certain areas of the filter strip.
- ⇒ Depressions will be prevented from forming in the filter strip area where manure and sediment can be trapped.
- ⇒ Debris will not be allowed to accumulate in the filter strip.
- ⇒ Filter strips will be clipped, dragged, and or grazed at least twice during the growing season.
- ⇒ Grass will be at least 3 inches high by October 15th.

DESIGN APPROVAL

Design approved by: Robert A. Pedersen Date: 11/4/2015

Job Title: CAFO PLANNER

Client Acknowledgement Statement:

The client acknowledges that:

- a. They have received a copy of this specification and under-stands the contents and requirements.
- b. 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/ Jerry Pleasance Date: 11-4-2015

Certification:

I have completed a review and checked out the filter strip practice specifications and certify that the practice has been applied in accordance with specifications.

Certified by: /s/ _____ Date: _____

Job Title: _____

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.

MANURE SAMPLES

Solid Manure Samples

- Solid manure samples should be sampled during the first application made in the spring(March-April).
- Lay a piece of tarp or plastic on the pasture and make a pass over or next to it to obtain a representative sample from the spreader.
- Scoop up enough material to fill the sample bag about half full.
- Label the sample with the farm or operator name, date, and solid manure sample.
- Keep the sample cool while in the field. (You can put the sample in a small cooler with some ice.)
- Freeze the sample until ready to ship to the lab.

SHIPPING INSTRUCTIONS

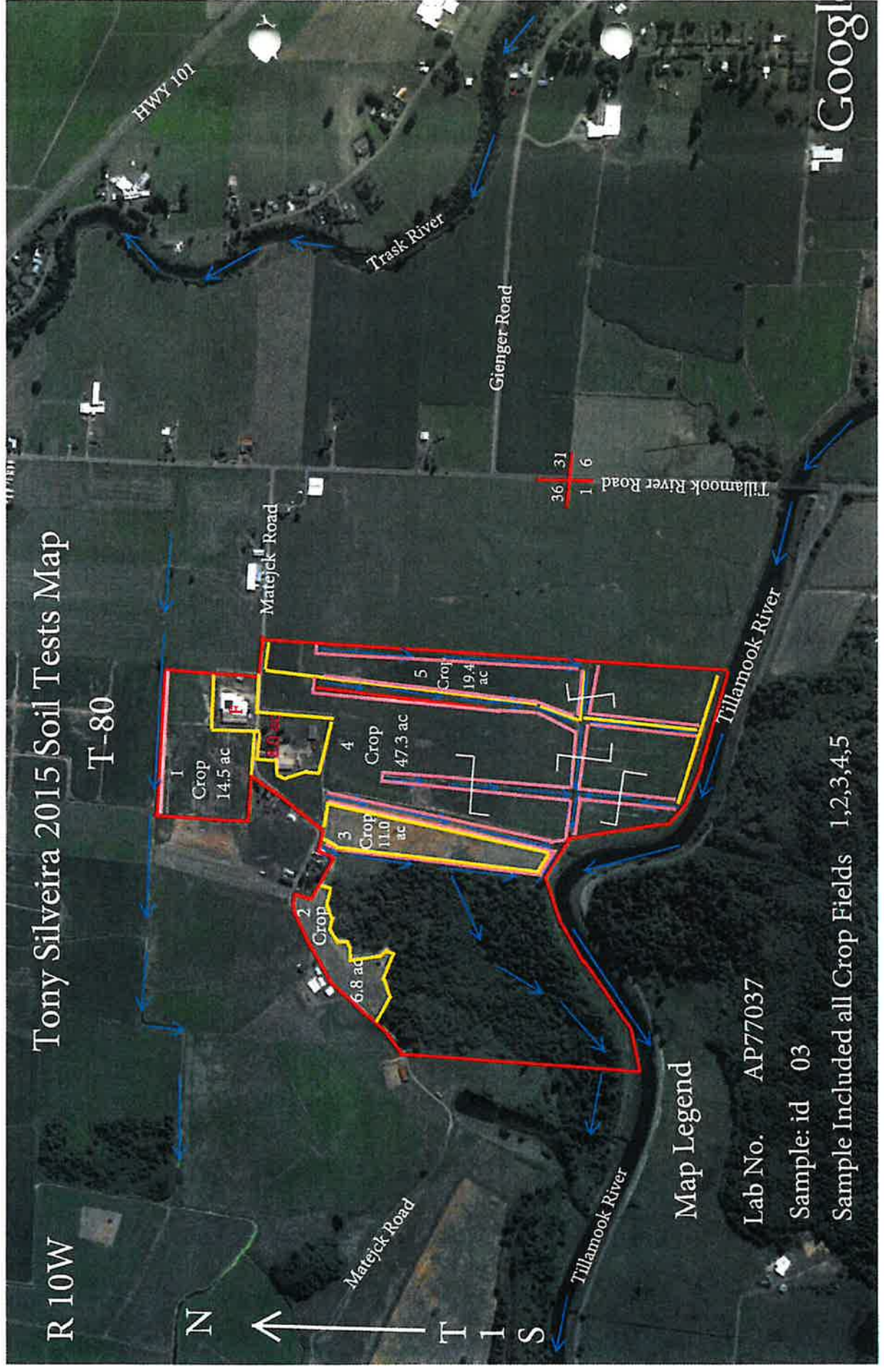
- Nitrogen is heat sensitive. Keeping the samples cool in shipping helps to improve reliability of data.
- Ship frozen soil samples in small cooler.
- If shipping refrigerated soil samples, it is recommended that these be shipped in a small cooler with ice.
- Ship frozen liquid or solid manure samples in a small cooler.
- Ship frozen soil samples or refrigerated soil samples with frozen liquid and/or solid samples in a small cooler. Lab should send cooler back to you if request them to do so.
- Ship any or all samples on Monday, Tuesday, or Wednesday using any parcel post service.
- Include a note with the samples for the analysis needed.

Soils Analysis Needed;

pH
P—Phosphorus (Weak Bray)
K—Potassium
NH₄-N—Ammonium
NO₃-N—Nitrate

Liquid and Solid Manure Analysis Needed;

Total Nitrogen, Phosphorus, & Potassium plus Ammonium and Solids



Tony Silveira 2015 Soil Tests Map

T-80

R 10W

N

T 1 S

Map Legend

Lab No. AP77037

Sample: id 03

Sample Included all Crop Fields 1,2,3,4,5

Google

From:

07/21/2015 17:58

#987 P.001/002

323 Sixth Street
Umatilla, OR 97882
Tel:541-922-4894
umatilla@agsource.com

Soil Analysis

Laboratory Sample #
AP77035 - AP77039

Submitted for:
TONY SILVEIRA

Information Sheet No.
S6985

Date Reported
21-Jul-2015

Sampled: **20-Jul-2015**

Crop:

Soil Analysis Report																			
Lab No.	Sample Id	pH	SS mm	Clay %	Ex Carb	Bray P	Olsen P	K ppm	Ca ppm	Mg ppm	Na ppm	NH4 ppm	S ppm	B ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	Al ppm
AP77035 01		5.5	0.2	NONE	23	7.8	23.6	0.22	33	41	25.2	49.5	30.3	1.7	15.7	31.8	0.4	49.5	32.3
AP77038 02		5.6	0.2	NONE	33	8.6	22.7	0.23	43	57	31.5	49.5	32.3	3.9	17.5	45.9	0.5	49.5	32.3
AP77037 03		5.0	0.3	NONE	18	8.1	19.4	0.23	128	80	64.2	49.5	32.3	2.3	18.4	38.6	0.5	49.5	32.3

DISCLAIMER: Data and information in this report are intended solely for the individual(s) for whom samples were submitted. Reproduction of this report must be in its entirety. Levels listed are guidelines only. Data was reported based on standard laboratory procedures and deviations.

Producer: Silveira, Tony- Dry Cows/Heifers	County: Tillamook	Tract No. 80	Field No(s). 1, 4, 5	Date: 07-21-2015
Soil Map Unit(s): 1A Brenner silt loam ,0-1% slopes	Soil Test P: 18 ppm	Lab. Method: Weak Bray	Sample Depth: 6 "	
Crop Rotation: Corn Silage and Grass Silage	Nutrient Application Method(s): Big Gun Sprinkler, Manure Spreader			
Planner: Pedersen	Notes: Lab. No. AP77037	Sample id 03		

		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	0
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	2.0	2.0
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)	0.75	0.75
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)	0.5	0.5
Transport Factors Subtotal (TFS)							6.25	6.25

Tract 80		Fields 1, 4, 5					PHOSPHORUS LOSS RATING				Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)					Current	Planned
Soil Test P - ppm (Bray P1)	1.00	(Soil Test P - 40) / 10					(18 - 40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm				0	0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02					_____ x 0.02 = _____				0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)					0	0
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02					200 x 0.02 = 4.0 lbs/ac P ₂ O ₅				4.0	4.0
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)					2.0	2.0

		Current	Planned
Total Rating Value TFS + SFS	Transport Factors Subtotal (TFS)	6.25	6.25
< 13.0	Source Factors Subtotal (SFS)	6.0	6.0
13.0 -- 25.0	Total Rating Value (TFS + SFS)	12.25	12.25
25.1 -- 50.0	Site Vulnerability Class	LOW	LOW
> 50.0			

Total Rating Value TFS + SFS	Site Vulnerability Class
< 13.0	Low
13.0 -- 25.0	Medium
25.1 -- 50.0	High
> 50.0	Very High

PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony – Dry Cows/Heifers County: Tillamook Tract No. 80 Field No(s). 1 2, 3, 4, 5, Date: 7-21-2015
 Soil Map Unit(s): 103A Coquille silt loam, 0-1% slopes Soil Test P: 18 ppm Lab. Method: Weak Bray Sample Depth: 6 "
 Crop Rotation: Corn Silage and Grass Silage Nutrient Application Method(s): Big Gun Sprinkler, Manure Spreader
 Planner: Pedersen Notes: Lab No. AP77037 Sample Id. 03

TRANSPORT FACTORS	Factor Weight	PHOSPHORUS LOSS RATING						Weighted Rating Value	
		None (0)	Low (1)	Medium (2)	High (4)	Very High (6)	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	0
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation	Application rate < infiltration rate OR No visible runoff at field borders	Application rate = infiltration rate OR Little to no visible runoff at field borders	Application rate > infiltration rate OR Visible runoff at field borders	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present.	0	0	0
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	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)	3.0	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	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters	100 – 199 feet AND buffer < 10 ft. wide next to surface waters	< 100 feet AND No buffer next to surface waters	0.75	0.75	0.75
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)	0.5	0.5	0.5
Transport Factors Subtotal (TFS)							5.25	5.25	5.25

Tract 80		PHOSPHORUS LOSS RATING						Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P - ppm (Bray P1)	1.00	(Soil Test P - 40) / 10 (6 - 40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm Soil Test P						0	0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $\frac{\text{lbs/ac P}_2\text{O}_5}{\text{lbs/ac P}_2\text{O}_5} \times 0.02 = \underline{\hspace{2cm}}$						0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0	0	
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $200 \times 0.02 = 4.0 \text{ lbs./ac P}_2\text{O}_5$						4.0	4.0
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0	2.0	

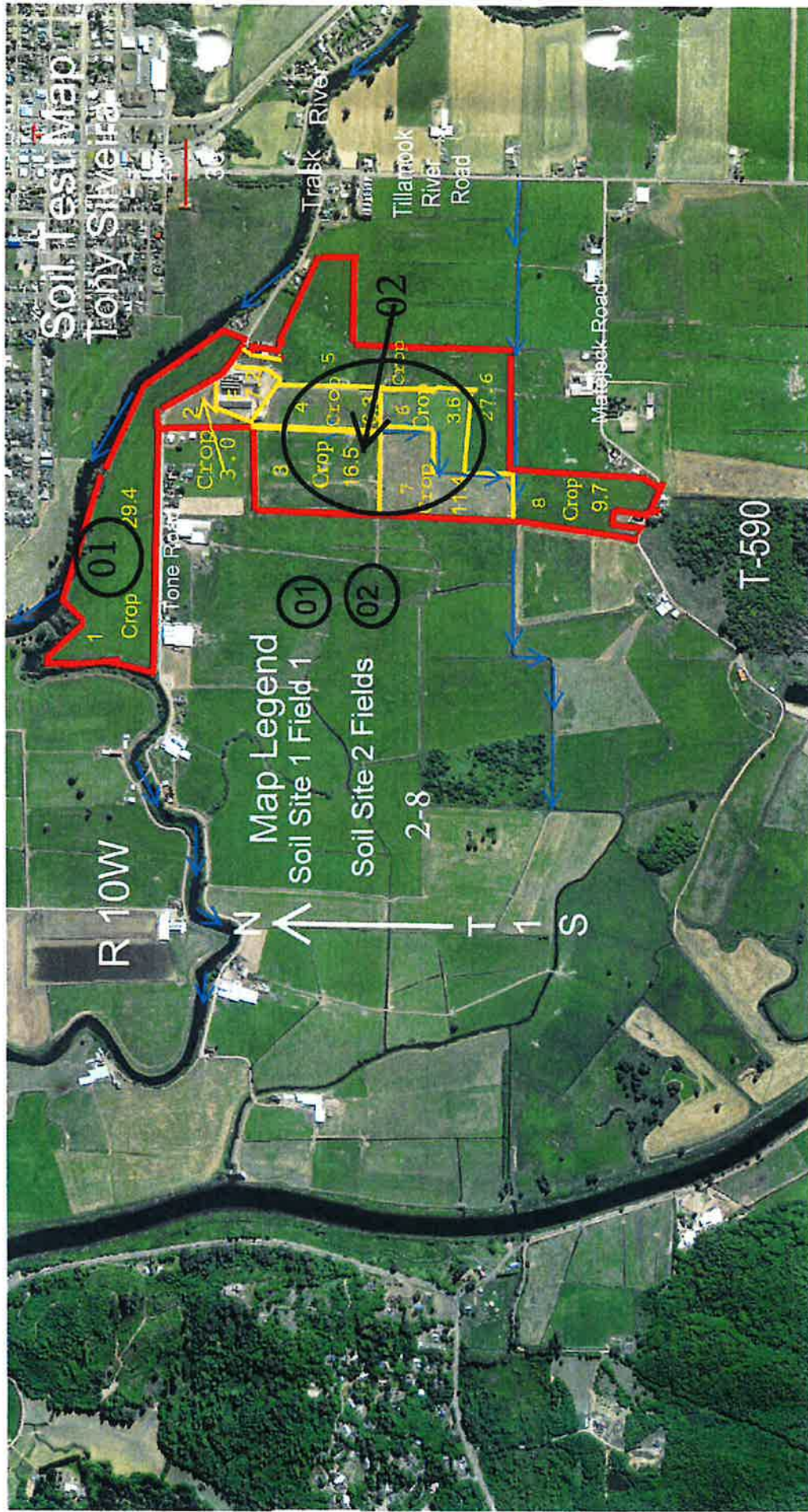
Total Rating Value TFS + SFS	Site Vulnerability Class
< 13.0	Low
13.0 - 25.0	Medium
25.1 - 50.0	High
> 50.0	Very High

Current	Planned
Transport Factors Subtotal (TFS)	5.25
Source Factors Subtotal (SFS)	6.0
Total Rating Value (TFS + SFS)	11.25
Site Vulnerability Class	LOW

PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony – Dry Cows	County: Tillamook	Tract No. 80	Field No(s). 1, 2, 3, 4, 5	Date: 7-21-2015
Soil Map Unit(s): 77A Nestucca-Brenner silt loam, 0-3% slopes	Soil Test P: 18 ppm	Lab. Method: Weak Bray	Sample Depth: 6 "	
Crop Rotation: Corn Silage and Grass Silage	Nutrient Application Method(s): Big Gun Sprinkler, Manure Spreader,			
Planner: Pedersen	Notes: Lab. No. AP77037	Sample id. 03		

		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	0
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	2.0	2.0
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)	0.75	0.75
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)	0.5	0.5
Transport Factors Subtotal (TFS)							6.25	6.25



From:

07/21/2015 17:58

#987 P.001/002

Soil Analysis

323 Sixth Street
Umatilla, OR 97882
Tel: 541-922-4894
umatilla@agsource.com

Laboratory Sample #
AP77035 - AP77039

Submitted for:
TONY SILVEIRA

Information Sheet No.
S6985

Date Reported
21-Jul-2015

Sampled: **20-Jul-2015**

Crop:

Soil Analysis Report

Lab No.	Sample Id.	pH	BpH	SS	Org C	Ex Carb	Bray P	Olsen P	K	Ca	Mg	Cu	Mn	Zn	B	S	NH4-N	NO3-N	N	P	K	H	CEC	Sat	Base Sat	Na
AP77035	01	5.5	5.6	0.2	NONE	NONE	23	700	7.8	23.0	0.22	33	41	25.2	49.5	30.3	1.7	13.7	31.8	0.4	49.5	32.3	3.9	17.5	45.9	0.5
AP77036	02	5.6	5.5	0.2	NONE	NONE	33	700	8.6	22.7	0.23	43	57	31.5	49.5	32.3	3.9	17.5	45.9	0.5	49.5	32.3	3.9	17.5	45.9	0.5
AP77037	03	5.0	5.1	0.3	NONE	NONE	18	535	8.1	18.4	0.23	128	90	64.2	49.5	40.7	2.8	18.4	30.6	0.5	49.5	40.7	2.8	18.4	30.6	0.5

Field: FIELD

Date Received
20-Jul-2015

Submitted by: **UMS15197**
SILVEIRA, TONY
1445 TONE ROAD
TILLAMOOK, OREGON 97141

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PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony	County: Tillamook	Tract No. 590	Field No(s). 1	Date: 7-20-2015
Soil Map Unit(s): 74A Nehalem silt loam 0-3% slopes	Soil Test P: 23 ppm	Lab. Method: Weak Bray	Sample Depth: 6 "	
Crop Rotation: Corn Silage and Grass Silage	Nutrient Application Method(s) Manure Gun Traveler			
Planner: Pedersen	Notes: Lab. No. AP77035	Sample id: 01		

		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	0
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)	0.75	0.75
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

Tract 590 Fields 1,2		PHOSPHORUS LOSS RATING					Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) / 10 (23-40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm Soil Test P					0	0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $\frac{\text{lbs/ac P}_2\text{O}_5}{\text{lbs/ac P}_2\text{O}_5} \times 0.02 =$					0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied through August through March (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0	0
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $197 \times 0.02 = 3.94 \text{ lbs.ac P}_2\text{O}_5$					3.94	3.94
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0	2.0

Total Rating Value TFS + SFS		Site Vulnerability Class	
< 13.0	Low	Current	Planned
13.0 – 25.0	Medium	3.25	3.25
25.1 – 50.0	High	5.94	5.94
> 50.0	Very High	9.19	9.19
Transport Factors Subtotal (TFS)		LOW	
Source Factors Subtotal (SFS)		LOW	
Total Rating Value (TFS + SFS)		LOW	
Site Vulnerability Class		LOW	

From:

07/21/2015 17:58

#987 P.001/002

Soil Analysis

323 Sixth Street
Umatilla, OR 97882
Tel: 541-922-4894
umatilla@agsource.com

Laboratory Sample #
AP77035 - AP77039

Submitted for:
TONY SILVEIRA

Information Sheet No.
S6985

Date Reported
21-Jul-2015

Sampled: 20-Jul-2015

Orig:

Soil Analysis Report

Soil Analysis Report																															
Lab No.	Sample Id	pH	BpH	SS mm	D60 %	Ex Chart	Bray #	Cation					Anion					NPK		S	B	Zn	Mn	Cu	Fe	Al	Cl	Base Saturation			
								P	K	Ca	Mg	Na	Cl	F	NO3	N	NO3	Br	Br									Br	H	CEC	Est.
								ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	
AP77035	01	5.5	5.6	0.2	NONE	NONE	73	335	7.8	25.6	0.22	33	41	25.2												49.5	30.3	1.7	15.7	31.8	0.4
AP77036	02	5.6	5.5	0.2	NONE	NONE	33	760	8.6	22.7	0.23	43	57	31.5												49.5	32.3	3.9	17.5	45.9	0.5
AP77037	03	5.0	5.1	0.3	NONE	NONE	18	535	8.1	19.4	0.23	178	90	54.2												49.1	40.7	2.8	18.4	38.6	0.5

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PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony	County: Tillamook	Tract No. 590	Field No(s). 3, 4, 5, 6, 7 8	Date: 7-20-2015
Soil Map Unit(s): 77A Nestucca-Brenner, silt loam 0-3% slopes	Soil Test P: 33 ppm	Lab. Method: Weak Bray	Sample Depth: 6 "	
Crop Rotation: Corn Silage and Grass Silage	Nutrient Application Method(s) Manure Gun Traveler			
Planner: Pedersen	Notes: Lab No. AP77036	Sample id: 02		

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 – 8 (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	0
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	2.0	2.0
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)	1.5	0.75
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)	0.5	0.5
Transport Factors Subtotal (TFS)							7.0	6.25

Tract 590 Fields 3,4,5,6,7,8		PHOSPHORUS LOSS RATING						Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P - ppm (Bray P1)	1.00	(Soil Test P - 40) / 10 (33 - 40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm						0	0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $\frac{\text{lbs/ac P}_2\text{O}_5}{\text{lbs/ac P}_2\text{O}_5} \times 0.02 = \underline{\hspace{2cm}}$						0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 6 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied through August through March (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)			
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $197 \times 0.02 = 3.94 \text{ lbs./ac P}_2\text{O}_5$						3.94	3.94
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0	2.0	2.0

Total Rating Value TFS + SFS	Site Vulnerability Class
< 13.0	Low
13.0 - 25.0	Medium
25.1 - 50.0	High
> 50.0	Very High

	Current	Planned
Transport Factors Subtotal (TFS)	7.0	6.25
Source Factors Subtotal (SFS)	5.94	5.94
Total Rating Value (TFS + SFS)	12.94	12.19
Site Vulnerability Class	LOW	LOW

PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony	County: Tillamook	Tract No. 590	Field No(s). 2, 5	Date: 7-20-2015
Soil Map Unit(s): 74A Nehalem silt loam 0-3% slopes	Soil Test P 33 ppm	Lab. Method: Weak Bray	Sample Depth: 6 "	
Crop Rotation: Corn Silage and Grass Silage	Nutrient Application Method(s) Manure Gun Traveler			
Planner: Pedersen	Notes: Lab. No. AP77036	Sample id: 02		

PHOSPHORUS LOSS RATING								
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	Application rate < infiltration rate OR No visible runoff at field borders	Application rate = infiltration rate OR Little to no visible runoff at field borders	Application rate > infiltration rate OR Visible runoff at field borders	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present.	0	0
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)	0.75	0.75
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

Tract 590 Fields 1,2		PHOSPHORUS LOSS RATING						Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P - ppm (Bray P1)	1.00	(Soil Test P - 40) / 10 (33- 40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm Soil Test P						0	0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 _____ x 0.02 = _____ lbs/ac P ₂ O ₅						0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0	0	
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 _____ 197 x 0.02 = 3.94 lbs.ac P ₂ O ₅						3.94	3.94
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0	2.0	

Site Vulnerability Class		-Current	Planned
Total Rating Value TFS + SFS	Transport Factors Subtotal (TFS)	3.25	3.25
< 13.0	Source Factors Subtotal (SFS)	5.94	5.94
13.0 - 25.0	Total Rating Value (TFS + SFS)	9.19	9.19
25.1 - 50.0	Site Vulnerability Class	LOW	LOW
> 50.0			

Producer: Silveira, Tony	County: Tillamook	Tract No. 590	Field No(s). 7, 8	Date: 7-20-2015
Soil Map Unit(s): 103A Coquille silt loam, Coquille, 0-1% slopes	Soil Test P: 33 ppm	Lab. Method: Weak Bray	Sample Depth: 6 "	
Crop Rotation: Corn Silage & Grass Silage	Nutrient Application Method(s): Manure Gun Traveler			
Planner: Pedersen	Notes: Lab No. AP77036	Sample Id: 02		

		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	0
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)	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)	1.5	0.75
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)	0.5	0.5
Transport Factors Subtotal (TFS)							6.0	5.25

Tract 590 Fields: 7,8		PHOSPHORUS LOSS RATING						Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) / 10 (33 – 40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm Soil Test P						0	0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 _____ lbs/ac P ₂ O ₅ x 0.02 = _____						0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0	0	
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 _____ 197 x 0.02 = 3.94 lbs./ac P ₂ O ₅						3.94	3.94
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0		2.0

Total Rating Value TFS + SFS		Site Vulnerability Class	
< 13.0		Low	
13.0 – 25.0		Medium	
25.1 – 50.0		High	
> 50.0		Very High	

Transport Factors Subtotal (TFS)		Site Vulnerability Class	
6.0		Low	
5.94		Low	
11.94		Low	
11.19		Low	

Source Factors Subtotal (SFS)		Site Vulnerability Class	
5.25		Low	
5.94		Low	
11.19		Low	
11.19		Low	

Tony Silveira

Tillamook County SWCD

Approximate Acres: 76.3

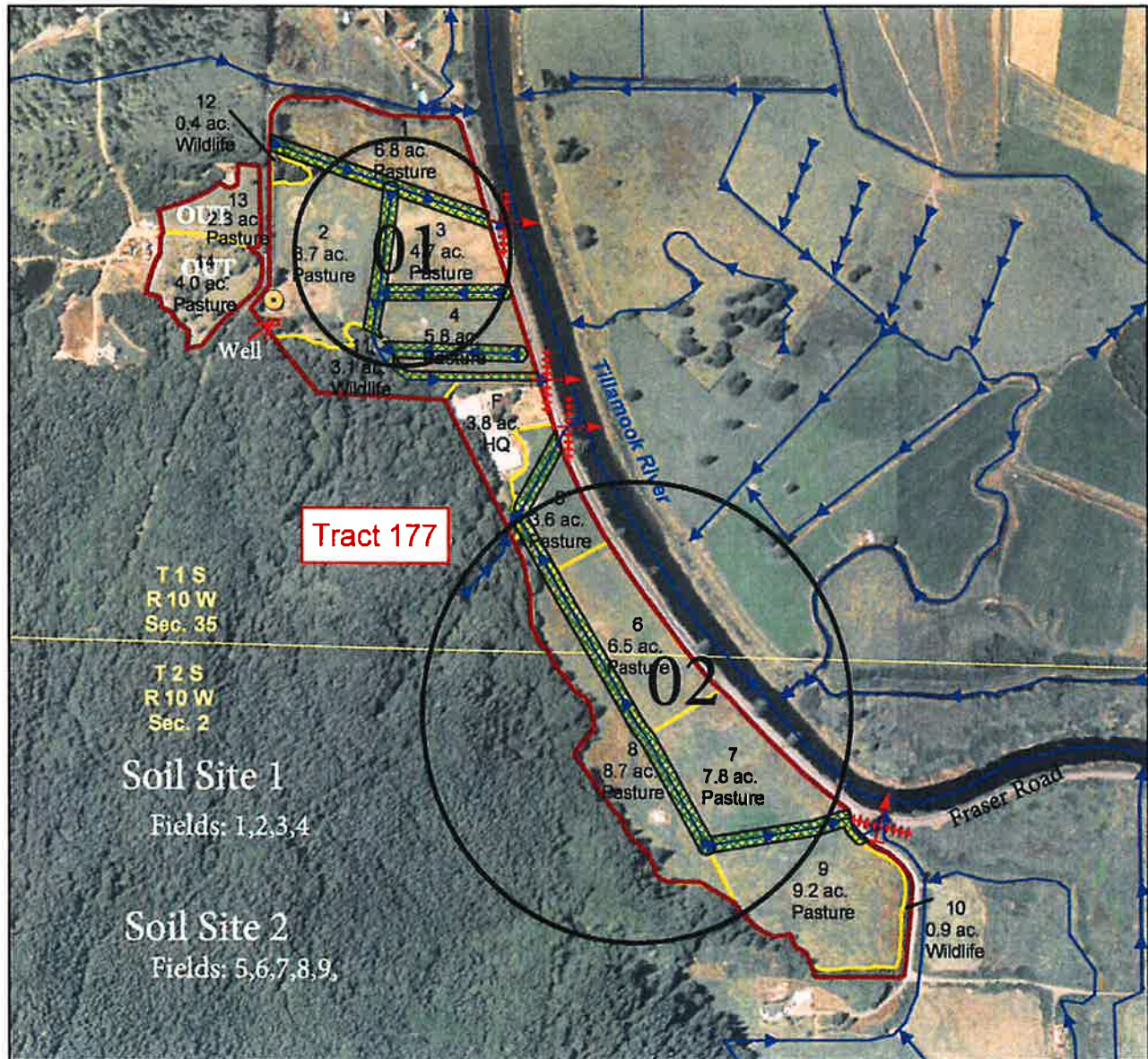
Date: 2/25/2009

TILLAMOOK SERVICE CENTER

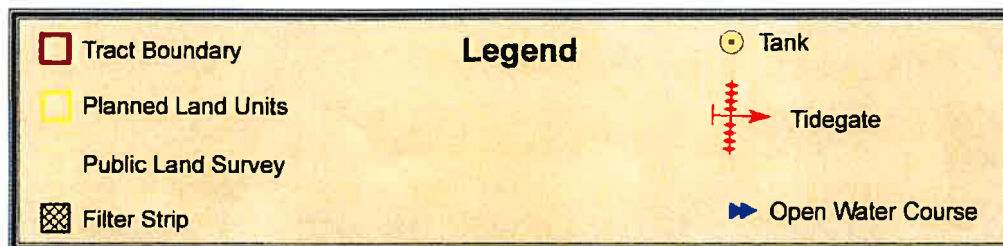
Tillamook County SWCD

TILLAMOOK COUNTY, OREGON

2015 Soil Tests Map



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



From:

07/21/15 17:59

#987 P.002/002

Soil Analysis

323 Sixth Street
Umatilla, OR 97882
Tel: 541-922-4894
umatilla@agsource.com

Submitted for:
TONY SILVEIRA

Laboratory Sample #
AP77035 - AP77039

Date Received
20-Jul-2015

Date Requested
21-Jul-2015

Information Sheet No.
S6985

Field: **FRAISER**

Crop:

Sampled: **20-Jul-2015**

Soil Analysis Report

Lab No.	Sample Id	pH	Bpt	SS	OM	Cats	Ex	Bray	P	Ca	Mg	K	Na	Cu	Fe	Al	Cl	Est	Best Estimation			
																			H	K	Mg	Na
AP77038 01		5.0	5.2	0.3	NONE	37	NONE	37	375	7.2	14.8	0.28	141	75	57.0	41.2	44.9	2.3	17.1	35.0	0.7	
AP77039 02		4.9	5.2	0.3	NONE	87	NONE	87	494	8.1	14.5	0.28	130	75	35.3	41.2	44.9	3.1	14.9	35.2	0.7	

DISCLAIMER: Data and information in this report are intended solely for the individual(s) for whom samples were submitted. Reproduction of this report must be in its entirety. Levels listed are guidelines only. Data was reported based on standard laboratory procedures and deviations.

PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveria, Tony	County: Tillamook	Tract No. 177	Field No(s). 1, 2, 3, 4	Date: 07-21-2015
Soil Map Unit(s): 103A Coquille silt loam 0-1% slopes, diked	Soil Test P: 31 ppm	Lab. Method: Weak Bray	Sample Depth: 0-6"	
Crop Rotation: Permanent Pasture	Nutrient Application Method(s) Manure Gun Traveler, Tank wagon, Manure Spreader, Grazing			
Planner: Pedersen	Notes: Lab. No. AP77038	Sample id 01		

		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	0	
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)	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)	1.5	0.75	
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)							5.5	4.75	

Tract 177 Fields 1,2,3,4

PHOSPHORUS LOSS RATING

SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) / 10 (31- 40) x .10 = 0 Assign 0 points if Soil Test P < 40 ppm Soil Test P						0.0	0.0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 _____ x 0.02 = _____ lbs/ac P ₂ O ₅						0.0	0.0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0.0	0.0	
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 138 x 0.02 = 2.76 lbs/ac P ₂ O ₅						2.76	2.76
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0	2.0	

Total Rating Value TFS + SFS	Site Vulnerability Class
< 13.0	Low
13.0 – 25.0	Medium
25.1 – 50.0	High
> 50.0	Very High

	Current	Planned
Transport Factors Subtotal (TFS)	5.5	4.75
Source Factors Subtotal (SFS)	4.76	4.76
Total Rating Value (TFS + SFS)	10.26	9.51
Site Vulnerability Class	LOW	LOW

PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony	County: Tillamook	Tract No. 177	Field No(s). 2	Date: July, 21, 2015
Soil Map Unit(s): 30D Templeton medial silt loam, 5-30% slopes	Soil Test P: 31 ppm	Lab. Method: Weak Bray	Sample Depth: 0-6"	
Crop Rotation: Permanent Pasture	Nutrient Application Method(s) Manure Gun Traveler, Tank Wagon Manure Spreader, Grazing			
Planner: Pedersen	Notes: Lab No. AP77038	Sample id 01		

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)	1.5	1.5	
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation	Application rate < infiltration rate OR No visible runoff at field borders	Application rate = infiltration rate OR Little to no visible runoff at field borders	Application rate > infiltration rate OR Visible runoff at field borders	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present.	0	0	
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	2.0	2.0	
Flooding Frequency Class	0.75	None or very rare (0)	Rare (0.75)	Occasional (1.5)	Frequent (3.0)	Very Frequent (6.0)	0	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	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters	100 – 199 feet AND buffer < 10 ft. wide next to surface waters	< 100 feet AND No buffer next to surface waters	1.5	0.75	
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)							5.0	4.25	

Tract T-177 Fields: 2		PHOSPHORUS LOSS RATING						Weighted Rating Value	
SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) / 10 (31 – 40) x .10 = 0.10 Assign 0 points if Soil Test P < 40 ppm						0.0	0.0
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $\frac{\text{lbs/ac P}_2\text{O}_5}{\text{lbs/ac P}_2\text{O}_5} \times 0.02 = \underline{\hspace{2cm}}$						0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied through August through October (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0	0	
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 $138 \times 0.02 = 2.76$ lbs/ac P ₂ O ₅						2.76	2.76
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied through August through October (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2.0	2.0	

Total Rating Value TFS + SFS		Site Vulnerability Class	
< 13.0		Low	
13.0 – 25.0		Medium	
25.1 – 50.0		High	
> 50.0		Very High	

Transport Factors Subtotal (TFS)		Planned	
5.0		4.25	
Source Factors Subtotal (SFS)			
4.76		4.76	
Total Rating Value (TFS + SFS)			
9.76		9.01	
Site Vulnerability Class			
LOW		LOW	

Soil Analysis

323 Sixth Street
Umatilla, OR 97882
Tel: 541-922-4894
umatilla@agsource.com

AP77035 - AP77039

Submitted for:
TONY SILVEIRA

Information Sheet No.
S6985

Sampled: 20-Jul-2015

Date Reported
21-Jul-2015

2.05

Lab No.		Sample Id	pH	Soil moist	SS mm	OM %	Ex Carb	Bray p	Ca ppm	P ppm	K ppm	Mg mg	Na mg	N lbs	NO ₃ lbs	NH ₄ lbs	S ppm	B ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	Al ppm	Cl ppm	CEC	H %	K %	Mg %	Ca %	Na %
AP77038	01		5.0	5.2	0.3	NONE	31		375	7.2	14.8	0.28	141	75	37.0										42.3	44.9	2.3	17.1	35.0	0.7
AP77038	02		4.9	5.2	0.3	NONE	37		434	6.1	14.5	0.20	130	75	35.8										41.2	45.1	3.1	14.3	35.2	0.7

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PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Silveira, Tony

County: Tillamook

Tract No.177

Field No(s). 5, 6, 7, 8, 9 Date: 7-20-2015

Soil Map Unit(s):103A Coquille silt loam
0-1% slopes, diked

Soil Test P:87 ppm

Lab. Method: Weak Bray

Sample Depth: 0-6"

Crop Rotation: Permanent Pasture

Nutrient Application Method(s) Manure Gun Traveler, Tank Wagon, Manure Spreader, Grazing

Planner: Pedersen

Notes: Lab No. AP77039 Sample id: 02

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	Application rate < infiltration rate OR No visible runoff at field borders	Application rate = infiltration rate OR Little to no visible runoff at field borders	Application rate > infiltration rate OR Visible runoff at field borders	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present.	0	0
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)	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	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters	200 – 299 feet OR buffer 10 - 19 ft. wide next to surface waters	100 – 199 feet AND buffer < 10 ft. wide next to surface waters	< 100 feet AND No buffer next to surface waters	1.5	0.75_
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)							5.5	4.75

Tract _____ Fields _____

PHOSPHORUS LOSS RATING

SOURCE FACTORS	Factor Weight	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Current	Planned	
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) / 10 (87 – 40) x .10 = 4.7 Assign 0 points if Soil Test P < 40 ppm Soil Test P						4.7	4.7
Commercial P Fertilizer Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 _____ x 0.02 = _____ lbs/ac P ₂ O ₅						0	0
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September	Incorporated within 5 days of application from October through February OR Surface applied through August	Incorporated more than 5 days after application OR Surface applied September through October	Surface applied November through February	0	0	
			(1.0)	(2.0)	(4.0)	(8.0)			
Organic P Source Application Rate	1.00	lbs/ac P ₂ O ₅ x 0.02 138 x 0.02 = 2.76 lbs/ac P ₂ O ₅						2.76	2.76
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September	Incorporated within 5 days of application from October through February OR Surface applied through August	Incorporated more than 5 days after application OR Surface applied September through October	Surface applied November through February	2.0	2.0	

Total Rating Value TFS + SFS	Site Vulnerability Class
< 13.0	Low
13.0 – 25.0	Medium
25.1 – 50.0	High
> 50.0	Very High

Current	Planned
5.5	4.75
9.46	9.46
14.96	14.21
MEDIUM	MEDIUM

CLIENT: **Silveira, Tony All Tracts 590,80, 177**

ASSISTED BY: Pedersen

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=						Manure CF/D/AU	Annual			
				Nutrient Production							Days Confined	Days Grazed	Days Off Farm	
				(lbs./day/1000 lb. Animal Unit)			(lbs./day)							
				N	P	K	N	P	K					
MILKER (Jersey)	440	900	396.0	0.76	0.13	0.44	299.22	49.62	173.78	1.71	365	0	0	
MILKER (Holstein)	110	1,300	143.0	0.66	0.11	0.30	94.95	15.75	43.34	1.57	365	0	0	
MILKER (Dairy)	80	1,100	88.0	0.30	0.04	0.10	26.40	3.70	8.80	0.92	365	0	0	
HEIFERS (12-24 Months)	250	550	137.5	0.27	0.05	0.12	36.58	6.26	16.50	0.90	365	0	0	
CALVES (1-12 Months)	300	325	97.5	0.42	0.05	0.11	40.95	5.27	10.73	1.34	181	184	0	
Totals/Averages-	1,180	835	862.0	0.58	0.09	0.29	498.1	80.6	253.1	1.4				

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.
MILKIER (Jersey)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
	440	440	440	440	440	440	440	440	440	440	440	440	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
MILKIER (Holstein)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
	110	110	110	110	110	110	110	110	110	110	110	110	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
MILKIER (DRY)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
	80	80	80	80	80	80	80	80	80	80	80	80	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
HEIFERS (12-24 Months)	250	250	250	250	250	250	250	250	250	250	250	250	0
	100%	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%	100%	585
	300	300	300	300	300	300	300	300	300	300	300	300	0
CALVES (1-12 Months)													0
													0
													0
													0
													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
	98	0	0	0	0	0	0	98	98	98	98	98	585
	-98	0	0	0	0	0	0	-98	-98	-98	-98	-98	-585

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION		TILLAMOOK 1 W		▼	
Month	25Yr-24Hr	6.00	Lot Runoff Factors as a Percent of Monthly Precipitation		
	RCN=	95.00			
	Average Monthly 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) YES	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 Wastes per Day	Gallons of Water Used per Wash-Day	Total Water Use per Day, Gallons	Total Water Use per Day, Cubic Feet
Animal Washwater	550	0	3.00	0	0.0
Equipment Wash		2	803.00	1600	213.9
Flushwater		0	3.00	0	0.0
Miscellaneous		2	25.00	50	6.7
Total				1650	220.6

CROP DATA

CROF DATA									
Field Number	Acres	Crop	Percent Dry Matter (DM)	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre			
						Nitrogen N	Phosphorous P ₂ O ₅	Potassium K ₂ O	
T590 1,2	32.4	Ryegrass Haylage ✕	▶	Ton	20.00	300	110	308	
3,4,5	50.4	Ryegrass Haylage	▶	Ton	20.00	300	110	308	
6,7,8	24.7	Ryegrass Haylage	▶	Ton	20.00	300	110	308	
T80 1	14.5	Ryegrass Haylage	▶	Ton	20.00	300	110	308	
2,3,4	65.1	Ryegrass Haylage	▶	Ton	20.00	300	110	308	
5	19.4	Ryegrass Haylage	▶	Ton	20.00	300	110	308	
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	▶	Ton	17.00	245	82	234	
			▶						
			▶						
			▶						
Off Farm									
Total Acres	268.3								

Total Acres-	268.3
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wheat, oats, or both may be in the Ryegrass Haylage.

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

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 (Jersey)	Free Stall	Composted Manure	36.00	3.00	0.08	33	1,188
MILKER (Holstein)	Free Stall	Composted Manure	36.00	3.00	0.08	12	429
MILKER (DRY)	Free Stall	Chopped Straw	7.00	2.70	0.39	34	238
HEIFERS (12-24 Months)	Free Stall	Chopped Straw	7.00	2.70	0.39	53	371
CALVES (1-12 Months)	Loose Housing	Chopped Straw	7.00	11.00	1.57	153	1,073

Type of Animal	Type of Separator	% Solids Separated	Volume of Solids Separated CF/Day	Volume of Liquids in Solids 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 (Jersey)	Press Type (Screw or Roller) ▼	30%	213	498	475	203	397	36	7,681
MILKER (Holstein)	Press Type (Screw or Roller) ▼	30%	71	166	158	68	90	36	2,560
MILKER (DRY)	Dry Scrape System ▼	60%	69	46	32	49	9	36	2,482
HEIFERS (12-24 Months)	Dry Scrape System ▼	60%	106	71	50	74	24	36	3,819
CALVES (1-12 Months)	Dry Scrape System ▼	100%	284	0	0	131	0	36	10,219
	▼								
	▼								
	▼								
	▼								
	▼								
Total Solids:	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	743	780	714	524	519		26,761

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

DAILY NUTRIENT PRODUCTION

All Tracts ORAWM 5.0.xls

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony All Tracts 590,80, 177
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Total Pounds of Nutrients from ALL SOURCES		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
October	9,334	3,532	6,055	4,837	1,817	3,000	1,269	374	401	15,441	5,723	9,456
November	9,033	3,418	5,860	5,910	2,120	3,291	0	0	0	14,943	5,538	9,151
December	9,334	3,532	6,055	6,107	2,191	3,401	0	0	0	15,441	5,723	9,456
January	9,334	3,532	6,055	6,107	2,191	3,401	0	0	0	15,441	5,723	9,456
February	8,431	3,191	5,469	5,516	1,979	3,072	0	0	0	13,947	5,169	8,541
March	9,334	3,532	6,055	6,107	2,191	3,401	0	0	0	15,441	5,723	9,456
April	9,033	3,418	5,860	5,910	2,120	3,291	0	0	0	14,943	5,538	9,151
May	9,334	3,532	6,055	4,837	1,817	3,000	1,269	374	401	15,441	5,723	9,456
June	9,033	3,418	5,860	4,681	1,758	2,903	1,229	362	388	14,943	5,538	9,151
July	9,334	3,532	6,055	4,837	1,817	3,000	1,269	374	401	15,441	5,723	9,456
August	9,334	3,532	6,055	4,837	1,817	3,000	1,269	374	401	15,441	5,723	9,456
September	9,033	3,418	5,860	4,681	1,758	2,903	1,229	362	388	14,943	5,538	9,151
Annual	109,905	41,591	71,298	64,365	23,575	37,664	7,535	2,219	2,378	181,805	67,385	111,340

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

8/11/2015

Version 5.0

CLIENT: Silveira, Tony All Tracts 590.80, 177

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

TANK

				MONTHLY INFLOWS INTO TANK					
Tank Parameters	Value	Month	Number of days	Rain-Evap on Tank CF	Rain-Evap on Existing Storage CF	Normal Runoff CF	Washwater CF	Solids CF	Waste to Store CF
Storage Period, Days=	122	October	31	2,403	2,403	1,290	6,838	24,195	37,129
Tank Diameter, Feet=	80	November	30	5,426	5,426	1,227	6,618	23,414	42,111
		December	31	5,585	5,585	1,290	6,838	24,195	43,493
Existing Storage, Cubic Feet=	123,392	January	31	5,279	5,279	1,290	6,838	24,195	42,882
Surface Area of Existing Storage, SF=	5,024	February	28	4,191	4,191	1,164	6,176	21,853	39,558
25 Year-24 Hour Storm Runoff, CF=	0	March	31	3,617	3,617	1,290	6,838	24,195	39,558
Volume Needed, Cubic Feet=	173,722	April	30	2,056	2,056	1,227	6,618	23,414	35,370
Design Volume, Cubic Feet=	50,330	May	31	678	678	0	6,838	24,195	32,389
Is Tank Covered? NO		June	30	4	4	0	6,618	23,414	30,040
Tank Dimensions? Circular		July	31	-950	-950	0	6,838	24,195	29,133
		August	31	-879	-879	0	6,838	24,195	29,275
		September	30	477	477	1,227	6,618	23,414	32,214
		Annual	365	27,887	27,887	10,005	80,515	284,873	431,168

See operation & maintenance worksheet waste storage facility for details at 1-590, 80, 177

1.0 Feet

10 Feet

Depth = 10 Feet

Minimum Freeboard = 1.0 Feet

25Yr-24Hr Storm Precipitation = 6 Inches

25Yr-24Hr Storm Runoff = 0 Cubic Feet

122 Day Precip - Evap = 49.5 Inches

Runoff from Normal Precipitation = 5057 Cubic Feet

Washwater = 26926 Cubic Feet

Manure = 87185 Cubic Feet

Diameter = 80 Feet

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

8/11/2015

Version 5.0

CLIENT: Silveira, Tony All Tracts 590,80, 177

ASSISTED BY: Pedersen

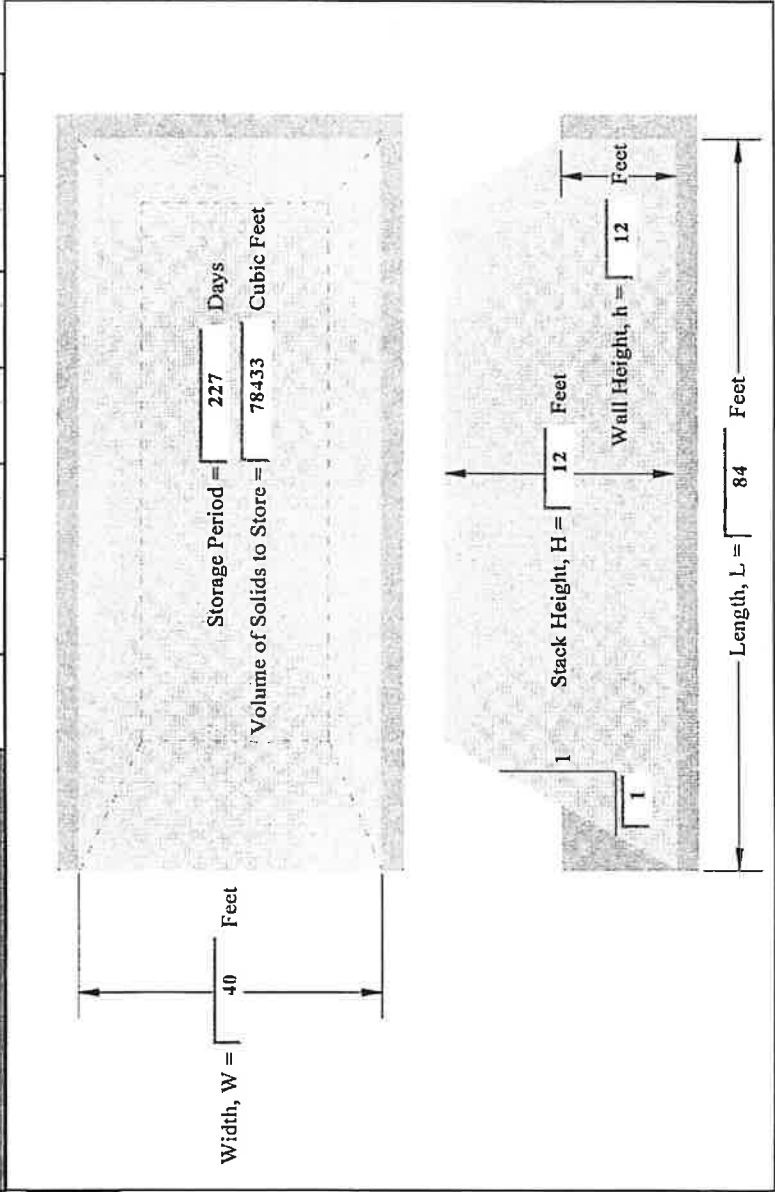
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY

VOLUME OF MONTHLY SOLIDS STACKED IN FACILITY

Solids Storage Facility Parameters	Value	Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Solids to Store Tons	Normal Runoff CF
Storage Period, Days=	227	October	31	12,209	2,036	7,122	256	0
Stacking Width, W in Feet=	40	November	30	15,735	6,566	11,150	401	0
Stacking Height, H in Feet=	12.00	December	31	16,259	6,785	11,522	415	0
Wall Height, h in Feet=	12.00	January	31	16,259	6,785	11,522	415	0
Stack Side Slope (X:1)=	1.00	February	28	14,686	6,129	10,407	375	0
Existing Storage, Cubic Feet=	41,219	March	31	16,259	6,785	11,522	415	0
Surface Area of Existing Storage, SF=	0	April	30	15,735	6,566	11,150	401	0
25 Year-24 Hour Storm Runoff, CF=	0	May	31	12,209	2,036	7,122	256	0
Volume Needed, Cubic Feet=	78,433	June	30	11,815	1,970	6,892	248	0
Design Volume, Cubic Feet=	37,440	July	31	12,209	2,036	7,122	256	0
Is Facility Covered?/yes	▼	August	31	12,209	2,036	7,122	256	0
Volume Reduction Factor=	0.50	September	30	11,815	1,970	6,892	248	0
		Annual	365	167,398	51,698	109,548	3,944	0

See operation and maintenance work sheet for the solid storage facility for T. 590,80, & 177



MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To supply 219,096 cubic feet of solids generated from the operation it will take approximately 11,000 tons of material. The following table shows the approximate tonnage of material required for each crop.

[illegible]

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

To apply 3,225,137 gallons of liquids generated from the operation it will take approximately 100 days. The following table shows the estimated application depths, set times, and travel rates listed below for each crop.

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS													
To apply 3,225,137 gallons of liquids generated from the operation it will take approximately 179 hours of pumping annually. Based on applying NITROGEN, N at a 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		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
						PPM	Lbs/1000Gal						
T590 1,2	32.4	Rye-grass Haylage	300	250	1/2 Circle ▼		2,859	23.85	300	1.20	1.45	1.31	2.49
3,4,5	50.4	Rye-grass Haylage	300	250	1/2 Circle ▼		2,859	23.85	300	1.20	1.45	1.31	2.49
	24.7	Rye-grass Haylage	300	250	1/2 Circle ▼		2,859	23.85	300	1.20	1.45	1.31	2.49
T60 1	14.5	Rye-grass Haylage	300	250	1/2 Circle ▼		2,859	23.85	300	1.20	1.45	1.31	2.49
2,3,4	65.1	Rye-grass Haylage	300	250	1/2 Circle ▼		2,859	23.85	300	1.20	1.45	1.31	2.49
5	19.4	Rye-grass Haylage	300	250	1/2 Circle ▼		2,859	23.85	300	1.20	1.45	1.31	2.49
T-177 1-2	61.8	Perennial Hay/Pasture(Med Intensity)	300	250	1/2 Circle ▼		2,859	23.85	245	1.20	1.45	1.07	3.06
					▼								

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony All Tracts 590,80, 177
ASSISTED BY: Pedersen

11/4/2015

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 3,225,137 gallons of liquids generated from the operation it will take approximately 1,075 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		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
					PPM	Lbs/1000Gal					
TS90 1,2	32.4	Rye/Grass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
3,4,5	50.4	Rye/Grass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
6,7,8	24.7	Rye/Grass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
T80 1	14.5	Rye/Grass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
2,3,4	65.1	Rye/Grass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
5	19.4	Rye/Grass Haylage	3,000	15	2,859	23.85	300	1.00	0.28	1,154	2.5
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	3,000	15	2,859	23.85	245	1.00	0.23	1,414	2.1

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

Storage Facility	Annual Volume Production	Concentration of Nutrients in Storage			
		Units	N	P2O5	K2O
Tank (Uncovered)	3,225,137	Gallons	23.85	10.96	18.79
Solids Storage Facility (Roofed)	1,972	Tons	12.24	5.38	8.60

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 6.0

CLIENT: Silveira, Tony All Tracts 590,80, 177
 ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Tank (Uncovered)	109,905	41,591	71,298	70%	85%	85%	76,933	35,352	60,603
Solids	Solids Storage Facility (Roofed)	64,365	23,575	37,664	75%	90%	90%	48,274	21,217	33,898
Grazing	NONE	7,535	2,219	2,378	100%	100%	100%	7,535	2,219	2,378

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Spilling	76,933	35,352	60,603	75%	100%	100%	57,700	35,352	60,603
Solids	Broadcast (Incorporated 7 or more days after application)	48,274	21,217	33,898	70%	100%	100%	33,792	21,217	33,898
Grazing	Grazing	7,535	2,219	2,378	85%	100%	100%	6,405	2,219	2,378

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Coast	57,700	35,352	60,603	80%	100%	100%	46,160	35,352	60,603
Solids	Soil Drainage Class	33,792	21,217	33,898	80%	100%	100%	27,033	21,217	33,898
Grazing	Somewhat Poorly Drained	6,405	2,219	2,378	80%	100%	100%	5,124	2,219	2,378
							TOTAL	78,317	58,789	98,879

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony All Tracts 590.80, 177
ASSISTED BY: Pedersen

11/4/2015

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON									
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	
T590 1,2	32.4	Ryegrass Haylage	15%	6,924	25	5%	1,352	5	0%
3,4,5	50.4	Ryegrass Haylage	24%	11,078	37	7%	1,892	6	0%
6,7,8	21.7	Ryegrass Haylage	11%	5,078	17	4%	1,081	4	0%
T80 1	14.5	Ryegrass Haylage	7%	3,231	11	2%	541	2	0%
2,3,4	65.1	Ryegrass Haylage	30%	13,848	46	9%	2,433	8	0%
5	19.4	Ryegrass Haylage	9%	4,134	14	3%	811	3	0%
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	4%	1,846	8	23%	6,218	25	100%
Off Farm			0%	0		47%	12,706		0%
TOTAL	268.3		100%	46,160	155	100%	27,033	52	100%

47% of the solid manure will be recycled as bedding

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED			NUTRIENTS REMOVED			NUTRIENT BALANCE		
			Nitrogen, Lbs/Acre	Phosphorus, P ₂ O ₅ Lbs/Acre	Potassium, K ₂ O Lbs/Acre	Nitrogen, Lbs/Acre	Phosphorus, P ₂ O ₅ Lbs/Acre	Potassium, K ₂ O Lbs/Acre	Nitrogen, Lbs/Acre	Phosphorus, P ₂ O ₅ Lbs/Acre	Potassium, K ₂ O Lbs/Acre
T590 1,2	32.4	Ryegrass Haylage	255	196	333	300	110	308	-45	86	25
3,4,5	50.4	Ryegrass Haylage	257	198	336	300	110	308	-43	88	28
6,7,8	21.7	Ryegrass Haylage	249	192	325	300	110	308	-51	82	17
T80 1	14.5	Ryegrass Haylage	260	200	339	300	110	308	-40	90	31
2,3,4	65.1	Ryegrass Haylage	250	192	326	300	110	308	-50	82	18
5	19.4	Ryegrass Haylage	256	197	334	300	110	308	-44	87	26
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	213	138	204	245	82	234	-31	56	-30
Off Farm											

ASSISTED BY: Pedersen

ANIMAL INVENTORY

GRAZING PERIOD

Milking Operation T-590 ORAWMv5 0.xls

CLIENT: **Silveira, Tony T-590 Milking Operation**
 ASSISTED BY: **Pedersen**

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION		TILLAMOOK 1 W	
Month	25Yr-24Hr	6.00	Lot Runoff Factors as a Percent of Monthly Precipitation
	RCN=	95.00	
	Average Monthly Inches		
	Precipitation	Evaporation	
October	7.16	1.42	50%
November	13.71	0.75	60%
December	13.94	0.60	60%
January	13.09	0.48	60%
February	10.79	0.78	50%
March	9.90	1.26	45%
April	6.81	1.90	40%
May	4.84	3.22	40%
June	3.41	3.40	35%
July	1.64	3.91	30%
August	1.42	3.52	40%
September	3.68	2.54	45%
Annual	90.39	23.78	15%

AREAS CONTRIBUTING RUNOFF TO LIQUID STORAGE FACILITY

[illegible]

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	550	0	0.00	0	0.0
Equipment Wash		2	800.00	1600	213.9
Flushwater		0	0.00	0	0.0
Miscellaneous		2	25.00	50	6.7
Total				1650	220.6

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
T590 1,2	32.4	Ryegrass Haylage	▼ 30 %	Ton	20.00	300	110	308
3 4,5	50.4	Ryegrass Haylage	▼ 30 %	Ton	20.00	300	110	308
6,7,8	24.7	Ryegrass Haylage	▼ 30 %	Ton	20.00	300	110	308
			▼					
			▼					
			▼					
			▼					
			▼					
			▼					
Off Farm								
Total Acres	107.5							

Version 5.0

CLIENT: Silveira, Tony T-590 Milking Operation

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

[illegible]

SOLIDS SEPARATION FACTOR

SOLIDS SEPARATION FACTOR									
Type of Animal	Type of Separator	% Solids Separated	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 (Jersey)	Press Type (Screw or Roller) ▼	30%	213	498	475	203	397	36	7,681
MILKER (Holstein)	Press Type (Screw or Roller) ▼	30%	71	166	158	68	90	36	2,560
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ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

Month	Runoff in Cubic Feet						Facility Water Use Cubic Feet	Manure				Bedding				Solids Separated				Solids in Liquids				Total Solids	
	Roof Area Square Feet	Paved Slab Area Square Feet	Unpaved Lot Area Square Feet	Sillage Pit Surface Area, SF	Solids			Liquids		Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds				
					Cubic Feet	Cubic Feet		Cubic Feet	Cubic Feet																
October	0	0	0	807	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	28,223	8,819	28,223								
November	0	0	0	767	6,618	3,430	23,671	1,348	48,510	8,535	307,244	19,914	716,904	8,535	27,299	8,535	27,299								
December	0	0	0	807	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	28,223	8,819	28,223								
January	0	0	0	807	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	28,223	8,819	28,223								
February	0	0	0	728	6,176	3,201	22,093	1,258	45,276	7,966	286,761	18,586	669,110	7,966	25,491	7,966	25,491								
March	0	0	0	807	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	28,223	8,819	28,223								
April	0	0	0	767	6,618	3,430	23,671	1,348	48,510	8,535	307,244	19,914	716,904	8,535	27,299	8,535	27,299								
May	0	0	0	0	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	27,416	8,819	27,416								
June	0	0	0	0	6,618	3,430	23,671	1,348	48,510	8,535	307,244	19,914	716,904	8,535	26,532	8,535	26,532								
July	0	0	0	0	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	27,416	8,819	27,416								
August	0	0	0	0	6,838	3,544	24,460	1,392	50,127	8,819	317,486	20,578	740,800	8,819	27,416	8,819	27,416								
September	0	0	0	767	6,618	3,430	23,671	1,348	48,510	8,535	307,244	19,914	716,904	8,535	27,299	8,535	27,299								
Annual	0	0	0	6,256	80,515	41,731	287,999	16,393	590,268	103,037	3,738,140	242,287	8,722,326	103,037	339,058	103,037	339,058								
Annual Gallons	0	0	0	46,795	602,250	312,145	2,154,232	122,631	776,702	1,812,306	776,702	2,461,352	776,702	2,461,352	776,702	2,461,352	776,702	2,461,352							

DAILY NUTRIENT PRODUCTION

[illegible]

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-590 Milking Operation
 ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS				Pounds of Nutrients from SOLIDS				Pounds of Nutrients from GRAZING				Total Pounds of Nutrients from ALL SOURCES			
	N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O	
October	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
November	8,278	3,145	5,494		3,548	1,348	2,355		0	0	0		11,825	4,493	7,849	
December	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
January	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
February	7,726	2,935	5,128		3,311	1,258	2,198		0	0	0		11,037	4,193	7,326	
March	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
April	8,278	3,145	5,494		3,548	1,348	2,355		0	0	0		11,825	4,493	7,849	
May	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
June	8,278	3,145	5,494		3,548	1,348	2,355		0	0	0		11,825	4,493	7,849	
July	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
August	8,553	3,250	5,677		3,666	1,393	2,433		0	0	0		12,219	4,642	8,111	
September	8,278	3,145	5,494		3,548	1,348	2,355		0	0	0		11,825	4,493	7,849	
Annual	100,710	38,262	66,847		43,162	16,398	28,649		0	0	0		143,872	54,660	95,495	

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-590 Milking Operation

ASSISTED BY: Pedersen

8/11/2015

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

TANK

MONTHLY INFLOWS INTO TANK

Tank Parameters	Value	Month	Number of days	Rain-Event on Tank CF	Rain-Event on Existing Storage, CF	Normal Runoff CF	Washwater CF	Solids CF	Waste to Store CF	Waste to Store Gallons
Storage Period, Days=	122	October	31	2,403	2,403	807	6,838	20,578	33,029	247,074
Tank Diameter, Feet=	80	November	30	5,426	5,426	767	6,618	19,914	38,151	285,387
Existing Storage, Cubic Feet=	116,132	December	31	5,585	5,585	807	6,838	20,578	39,393	294,678
Surface Area of Existing Storage, SF=	5,024	January	31	5,279	5,279	807	6,838	20,578	38,781	290,105
25 Year-24 Hour Storm Runoff, CF=	0	February	28	4,191	4,191	728	6,176	18,586	33,872	253,384
Volume Needed, Cubic Feet=	170,585	March	31	3,617	3,617	807	6,838	20,578	35,457	265,238
Design Volume, Cubic Feet=	54,453	April	30	2,056	2,056	767	6,618	19,914	31,410	234,965
Is Tank Covered? NO		May	31	678	678	0	6,838	20,578	28,773	215,233
Tank Dimensions? Circular		June	30	4	4	0	6,618	19,914	26,540	198,533
		July	31	-950	-950	0	6,838	20,578	25,515	190,868
		August	31	-879	-879	0	6,838	20,578	25,658	191,932
		September	30	477	477	767	6,618	19,914	28,253	211,351
		Annual	365	27,887	27,887	6,256	80,515	242,287	384,832	2,878,747

liquid manure storage tanks at T-177 will be used to store liquid waste generated at this operation
T-590 additional tanks
40'x12'x8' below ground
32'x8' below ground
134 ft³ waste collection
T-177 tanks
80'x16' above ground
35'x7.5' below ground
40'x10' below ground
30'x7.5' below ground
30'x7.5' below ground

Minimum Freeboard = 1.0 Feet

25Yr-24Hr Storm Precipitation = 6 Inches

25Yr-24Hr Storm Runoff = 0 Cubic Feet

133 Day Precip - Evap = 52.66 Inches

Runoff from Normal Precipitation = 3457 Cubic Feet

Washwater = 29433 Cubic Feet

Manure = 84377 Cubic Feet

Depth = 11.0 Feet

Diameter = 80 Feet

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

8/11/2015

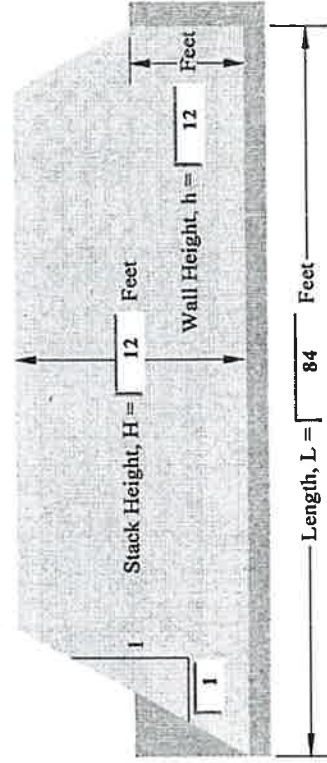
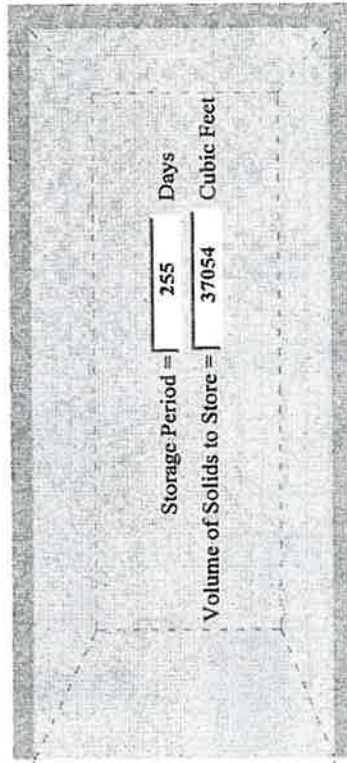
Version 5.0

CLIENT: Silveira, Tony T-590 Milking Operation

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY		VOLUME OF MONTHLY SOLIDS STACKED IN FACILITY									
Solids Storage Facility Parameters	Value	Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Solids to Store Tons	Normal Runoff CF			
Storage Period, Days=	255	October	31	8,401	418	4,410	159	0			
Stacking Width, W in Feet=	40	November	30	8,130	404	4,267	154	0			
Stacking Height, H in Feet=	12.00	December	31	8,401	418	4,410	159	0			
Wall Height, h in Feet=	12.00	January	31	8,401	418	4,410	159	0			
Stack Side Slope (X:1)=	1.00	February	28	7,588	377	3,983	143	0			
Existing Storage, Cubic Feet=	0	March	31	8,401	418	4,410	159	0			
Surface Area of Existing Storage, SF=	0	April	30	8,130	404	4,267	154	0			
25 Year-24 Hour Storm Runoff, CF=	0	May	31	8,401	418	4,410	159	0			
Volume Needed, Cubic Feet=	37,054	June	30	8,130	404	4,267	154	0			
Design Volume, Cubic Feet=	37,440	July	31	8,401	418	4,410	159	0			
Is Facility Covered? YES	▶	August	31	8,401	418	4,410	159	0			
Volume Reduction Factor=	0.50	September	30	8,130	404	4,267	154	0			
		Annual	365	98,919	4,918	51,918	1,869	0			



OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-590 Milking Operation
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TRACTOR SPREADER APPLICATION OF SOLIDS

To apply 103,837 cubic feet of solids generated from the operation it will take approximately 234 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		Spread Width Feet	NITROGEN, N Concentration in Storage Facility		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
			Bushels	CF		PPM	Lbs/Ton						
T590.1.2	32.4	Ryegrass Haylage	357	444	15	8,660	17.32	300	1.00	30.9	751	4	36
3.4.5	50.4	Ryegrass Haylage	357	444	15	8,660	17.32	300	1.00	30.9	751	4	36
6.7.8	24.7	Ryegrass Haylage	357	444	15	8,660	17.32	300	1.00	30.9	751	4	36
									</				

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

160 hours of pumping annually. Based on applying													NITROGEN, N	
To apply 2,878,547 gallons of liquids generated from the operation it will take approximately														
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		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	
						PPM	Lbs/1000Gal							
T590 1.2	32.4	Ryegrass Haylage	300	250	1/2 Circle	▼	2,935	24.49	300	1.00	0.75	1.45	1.28	2.56
3.4.5	50.4	Ryegrass Haylage	300	250	1/2 Circle	▼	2,935	24.49	300	1.00	0.75	1.45	1.28	2.56
	24.7	Ryegrass Haylage	300	250	1/2 Circle	▼	2,935	24.49	300	1.00	0.75	1.45	1.28	2.56
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CLIENT: Silveira, Tony T-590 Milking Operation
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

[illegible]

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE		Concentration of Nutrients in Storage				
	Annual Volume Production	Units				Units
		N	PrOx	K ₂ O		
Storage Facility		24.49	11.30	19.74	lbs/l,000 Gal	
Tank (Uncovered)	2,878,547	17.32	7.90	13.80	lbs/7ton	
Solids Storage Facility (Roofed)	935					

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 6.0

1/1/2015

CLIENT: Silveira, Tony T-590 Milking Operation
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Dairy	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
			N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids		Tank (Uncovered)	100,710	38,262	66,847	70%	85%	85%	70,497	32,523	56,820
Solids		Solids Storage Facility (Roofed)	43,162	16,398	28,649	75%	90%	90%	32,371	14,758	25,784
Grazing		NONE	0	0	0	100%	100%	100%	0	0	0

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	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Spreading	70,497	32,523	56,820	75%	100%	100%	52,873	32,523	56,820
Solids	Broadcast (Incorporated 7 or more days after application)	32,371	14,758	25,784	70%	100%	100%	22,660	14,758	25,784
Grazing	Grading	0	0	0	85%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Coast	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
			N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids		Soil Drainage Class	52,873	32,523	56,820	80%	100%	100%	42,298	32,523	56,820
Solids		Somewhat Poorly Drained	22,660	14,758	25,784	80%	100%	100%	18,128	14,758	25,784
Grazing		Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
TOTAL									60,428	47,281	82,603

CLIENT: Silveira, Tony T-590 Milking Operation
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

[illegible]

CLIENT: **Silveira, Tony** (Dry Cow/Heifer Operation) Unit 80

ASSISTED BY: Pedersen

ANIMAL INVENTORY

Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Nutrient Production								Manure CF/D/AU	Annual		
				(lbs./day/1000 lb. Animal Unit)				(lbs./day)					Days Confined	Days Grazed	Days Off Farm
				N	P	K	N	P	K						
MILKERS (Dry)	80	1,100	88.0	0.30	0.04	0.10	26.40	3.70	8.80	365	0	0			
HEIFERS (12-24 Months)	250	550	137.5	0.27	0.05	0.12	36.58	6.26	16.50	365	0	0			

Percent of Month and Number of Animals Grazing

[illegible]

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

11/4/2015

Version 5.0

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION		TILLAMOOK 1 W		Lot Runoff Factors as a Percent of Monthly Precipitation
Month	25Yr-24Hr RCN=	Average Monthly Inches	Evaporation	
	Precipitation	Paved		
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			Area in SF
Paved Lot Area	Description of Runoff Area	Is paved lot scraped daily? (Y/N)	NO
Unpaved Lot Area			0
Roof Area			0
Surface Area of Silage Storage Facility			0
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	0	0	1.00	0	0.0
Equipment Wash		0	1.00	0	0.0
Flushwater		0	1.00	0	0.0
Miscellaneous		0	1.00	0	0.0
Total				0	0.0

CROP DATA

Field Number	Acres	Crop	Percent Dry Matter (DM)	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre
1801	14.5	Ryegrass Haylage	30%	Ton	20.00	Nitrogen N 300 Phosphorous P ₂ O ₅ 110 Potassium K ₂ O 308
231	65.1	Ryegrass Haylage	30%	Ton	20.00	Nitrogen N 300 Phosphorous P ₂ O ₅ 110 Potassium K ₂ O 308
5	19.4	Ryegrass Haylage	30%	Ton	20.00	Nitrogen N 300 Phosphorous P ₂ O ₅ 110 Potassium K ₂ O 308
Off Farm						
Total Acres	99.0					

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

[illegible]

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	% Solids Separated	Volume of Solids Separated CF/Day	Volume of Liquids in Manure in 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 (DRY)	Dry Scrape System	60%	69	46	32	49	36	2,482
HEIFERS (12-24 Months)	Dry Scrape System	60%	106	71	50	74	36	3,819
Total Solids:		>>>>>	175	117	82	123	45	6,300

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES		Runoff in Cubic Feet										Facility		Manure		Bedding		Solids Separated		Solids in Liquids		Total Solids	
		Roof Area		Paved	Unpaved	Silage Pit	Water Use	Liquids	Solids	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds		
		Square Feet	Square Feet	Slab Area	Lot Area	Surface Area, SF																Cubic Feet	Cubic Feet
Month	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
October	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
November	0	0	0	0	0	0	0	850	5,292	18,266	5,250	189,014	3,500	126,009	5,250	126,009	3,500	126,009	5,250	126,009	3,500		
December	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
January	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
February	0	0	0	0	0	0	0	793	4,939	17,048	4,900	176,413	3,267	117,609	4,900	117,609	3,267	117,609	4,900	117,609	3,267		
March	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
April	0	0	0	0	0	0	0	850	5,292	18,266	5,250	189,014	3,500	126,009	5,250	126,009	3,500	126,009	5,250	126,009	3,500		
May	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
June	0	0	0	0	0	0	0	850	5,292	18,266	5,250	189,014	3,500	126,009	5,250	126,009	3,500	126,009	5,250	126,009	3,500		
July	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
August	0	0	0	0	0	0	0	878	5,468	18,874	5,425	195,315	3,617	130,210	5,425	130,210	3,617	130,210	5,425	130,210	3,617		
September	0	0	0	0	0	0	0	850	5,292	18,266	5,250	189,014	3,500	126,009	5,250	126,009	3,500	126,009	5,250	126,009	3,500		
Annual	0	0	0	0	0	0	0	10,139	64,980	222,230	63,890	2,999,673	42,597	1,533,115	63,890	1,533,115	42,597	1,533,115	63,890	1,533,115	42,597		
Annual Gallons	0	0	0	0	0	0	0	77,333	481,566	237,469	477,821	318,547	318,547	477,821	318,547	477,821	318,547	477,821	318,547	477,821	318,547		

DAILY NUTRIENT PRODUCTION

[illegible]

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80
ASSISTED BY: Pedersen

8/17/2015

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Total Pounds of Nutrients from ALL SOURCES		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
October	781	283	378	1,171	424	567	0	0	0	1,952	707	945
November	756	274	366	1,134	410	549	0	0	0	1,889	684	915
December	781	283	378	1,171	424	567	0	0	0	1,952	707	945
January	781	283	378	1,171	424	567	0	0	0	1,952	707	945
February	705	255	341	1,058	383	512	0	0	0	1,763	638	854
March	781	283	378	1,171	424	567	0	0	0	1,952	707	945
April	756	274	366	1,134	410	549	0	0	0	1,889	684	915
May	781	283	378	1,171	424	567	0	0	0	1,952	707	945
June	756	274	366	1,134	410	549	0	0	0	1,889	684	915
July	781	283	378	1,171	424	567	0	0	0	1,952	707	945
August	781	283	378	1,171	424	567	0	0	0	1,952	707	945
September	756	274	366	1,134	410	549	0	0	0	1,889	684	915
Annual	9,194	3,329	4,451	13,792	4,993	6,677	0	0	0	22,986	8,322	11,128

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

8/11/2015

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80
 ASSISTED BY: Pedersen

Version 5.0

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

TANK	Tank Parameters	Value	Month	Number of days	MONTHLY INFLOWS INTO TANK					Waste to Store CF	Waste to Store Gallons
					Rain-Evap on Tank CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Solids CF		
	Storage Period, Days=	61	October	31	0	0	0	0	3,617	3,617	27,057
	Tank Width, Feet=	22	November	30	0	0	0	0	3,500	3,500	26,184
	Tank Length, Feet=	55	December	31	0	0	0	0	3,617	3,617	27,057
	Existing Storage, Cubic Feet=	0	January	31	0	0	0	0	3,617	3,617	27,057
	Surface Area of Existing Storage, SF=	0	February	28	0	0	0	0	3,267	3,267	24,438
	25 Year-24 Hour Storm Runoff, CF=	0	March	31	0	0	0	0	3,617	3,617	27,057
	Volume Needed, Cubic Feet=	7,237	April	30	0	0	0	0	3,500	3,500	26,184
	Design Volume, Cubic Feet=	7,237	May	31	0	0	0	0	3,617	3,617	27,057
	Is Tank Covered? YES		June	30	0	0	0	0	3,500	3,500	26,184
	Tank Dimensions? Rectangular		July	31	0	0	0	0	3,617	3,617	27,057
			August	31	0	0	0	0	3,617	3,617	27,057
			September	30	0	0	0	0	3,500	3,500	26,184
			Annual	365	0	0	0	0	42,537	42,587	318,569

Minimum Freeboard = 1.0 Feet

25Yr-24Hr Storm Precipitation = 0 Inches

25Yr-24Hr Storm Runoff = 0 Cubic Feet

61 Day Precip - Evap = 0 Inches

Runoff from Normal Precipitation = 0 Cubic Feet

Washwater = 0 Cubic Feet

Manure = 5079 Cubic Feet

Depth = 6 Feet

Width = 22 Feet

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

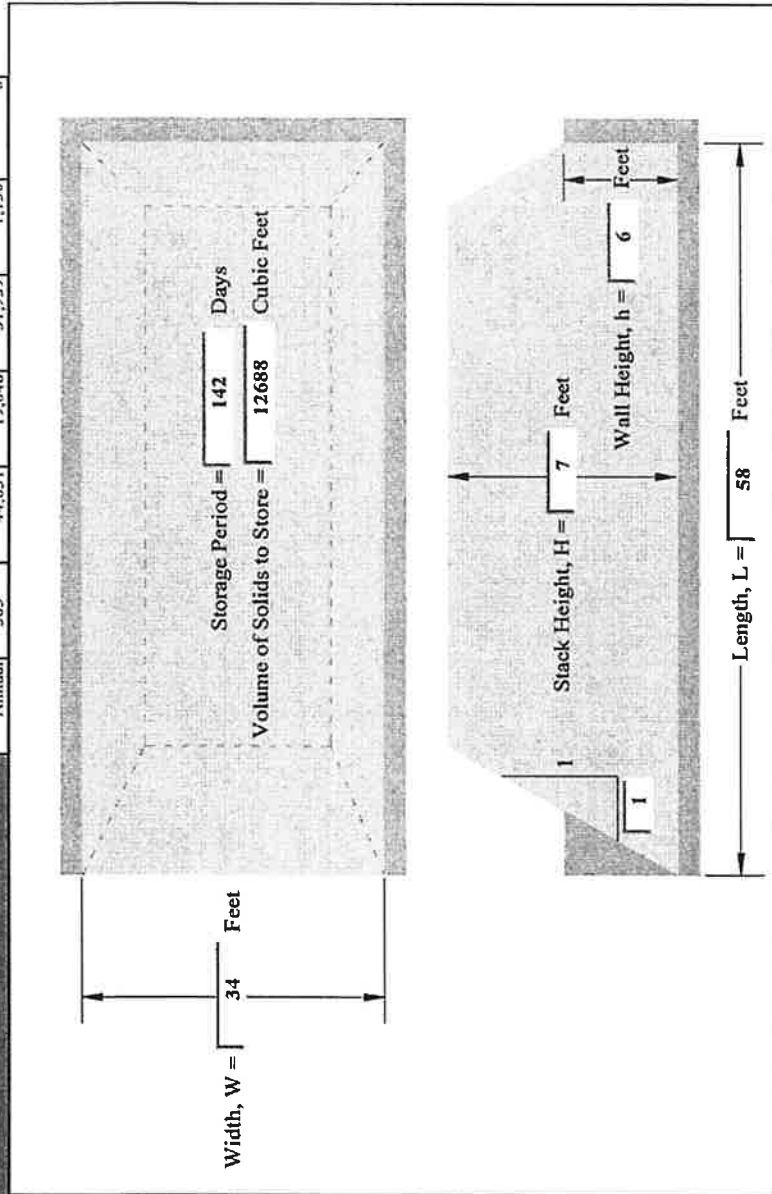
Version 5.0

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY		VOLUME OF MONTHLY SOLIDS STACKED IN FACILITY						
Solids Storage Facility Parameters	Value	Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Solids to Store Tons	Normal Runoff CF
Storage Period, Days=	142	October	31	3,808	1,618	2,713	98	0
Stacking Width, W in Feet=	34	November	30	3,685	1,566	2,625	95	0
Stacking Height, H in Feet=	7.00	December	31	3,808	1,618	2,713	98	0
Wall Height, h in Feet=	6.00	January	31	3,808	1,618	2,713	98	0
Stack Side Slope (X:1)=	1.00	February	28	3,439	1,461	2,450	88	0
Existing Storage, Cubic Feet=	0	March	31	3,808	1,618	2,713	98	0
Surface Area of Existing Storage, SF=	0	April	30	3,685	1,566	2,625	95	0
25 Year-24 Hour Storm Runoff, CF=	0	May	31	3,808	1,618	2,713	98	0
Volume Needed, Cubic Feet=	12,688	June	30	3,685	1,566	2,625	95	0
Design Volume, Cubic Feet=	12,903	July	31	3,808	1,618	2,713	98	0
Is Facility Covered?/ yes	0.50	August	31	3,808	1,618	2,713	98	0
Volume Reduction Factor=	0.50	September	30	3,685	1,566	2,625	95	0
		Annual	365	44,831	19,048	31,939	1,150	0



ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

[illegible][illegible]

2015

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

[illegible]

COMPUTED TO PRESENT CONCENTRATIONS IN STORAGE		Concentration of Nutrients in Storage				
	Annual Volume Production	Units				Units
		N	P ₂ O ₅	K ₂ O		
Storage Facility						
Tank (Covered)	318,547	Gallons	23.09	9.41	12.58	lbs/1,000 Gal
Solids Storage Facility (Roofed)	575	Tons	9.00	3.91	5.23	lbs/Ton

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE											
Nutrient Source	Type of Operation		Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
	Dairy	▼	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
Liquids	Type of Storage Facility	▼	9,194	3,329	4,451	80%	90%	96%	7,355	2,956	4,006
Solids	Tank (Covered)	▼	13,792	4,993	6,677	75%	90%	96%	10,344	4,494	6,009
	Solids Storage Facility (Roofed)	▼									
Cropings	NONE	▼	0	0	0	100%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER APPLICATION

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	PrOs	K ₂ O	N	PrOs	K ₂ O	N	PrOs	K ₂ O
Liquids	▼ Sprinkling	7,355	2,996	4,006	75%	100%	104%	5,517	2,996	4,006
Solids	Broadcast (incorporated 7 or more days after application)	10,344	4,494	6,009	70%	100%	104%	7,241	4,494	6,009
Grazing	▼ Grazing	0	0	0	85%	100%	104%	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

NUTRIENTS AVAILABLE AFTER DENITRIFICATION														
Nutrient Source	Location		Pounds of Nutrients Available						Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
	Coast	Soil Drainage Class	N	P2O5	K2O			N	P2O5	K2O	N	P2O5	K2O	
Liquids		Poorly Drained	▼	5.517	2.996	4.066		60%	100%	100%	3.310	2.996	4.006	
Solids		Poorly Drained	▼	7.241	4.494	6.009		60%	100%	100%	4.344	4.494	6.009	
Grazing		Poorly Drained	▼	0	0	0		60%	100%	100%	0	0	0	
TOTAL											7.864	7.490	10.016	

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

11/4/2015

CLIENT: Silveira, Tony Dry Cow/Heifer Operation Tract 80
 ASSISTED BY: Pedersen

Version 5.0

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON									
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	
T80 1	14.5	Ryegrass Haylage	15%	485	2	15%	636	2	0
2,3,4	65.1	Ryegrass Haylage	66%	2,177	7	66%	2,857	10	0
5	19.4	Ryegrass Haylage	20%	649	2	20%	851	3	0
Off Farm			0%	0		0%			0
TOTALS	99		100%	3,310	11	100%	4,344	14	0

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED			NUTRIENTS REMOVED			NUTRIENT BALANCE		
			Nitrogen, N Lbs/Acre	Phosphorus, P ₂ O ₅ Lbs/Acre	Potassium, K ₂ O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P ₂ O ₅ Lbs/Acre	Potassium, K ₂ O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorus, P ₂ O ₅ Lbs/Acre	Potassium, K ₂ O Lbs/Acre
T80 1	14.5	Ryegrass Haylage	77	76	101	300	110	308	-223	-34	-207
2,3,4	65.1	Ryegrass Haylage	77	76	101	300	110	308	-223	-34	-207
5	19.4	Ryegrass Haylage	77	76	101	300	110	308	-223	-34	-207
Off Farm											

CLIENT: **Silveira, Tony T-177 Calf Operation Barns A & B Combined**

ASSISTED BY: **Pedersen**

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY

ANIMAL INVENTORY		Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Nutrient Production						Manure CF/D/AU	Annual		
Type of Animal					(lbs./day/1000 lb. Animal Unit)			(lbs./day)				Days Confined	Days Grazed	Days Off Farm
					N	P	K	N	P	K				
CALVES (1-12 Months)	▼	300	325	97.5	0.42	0.05	0.11	40.95	5.27	16.73	181	184	0	
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GRAZING PERIOD

[illegible]

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

CLIENT:	Silveira, Tony T-177 Calf Operation Barns A & B Combined
ASSISTED BY:	Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

[illegible]

SOLIDS SEPARATION FACTOR

SOLIDS SEPARATION FACTOR									
Type of Animal	Type of Separator	% Solids Separated	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
CALVES (1-12 Months)	Dry Scrape System	▼ 100%	284	0	0	131	0	36	10,219
		▼							
		▼							
		▼							
		▼							
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		▼							
		▼							
Total Solids	284	0	0	131	0				10,219

CLIENT: Silveira, Tony T-177 Calf Operation Barns A & B Combined
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

Month	Runoff in Cubic Feet					Facility Water Use Cubic Feet	Manure		Bedding		Solids Separated		Solids in Liquids		Total Solids	
	Roof Area Square Feet 0	Paved Slab Area Square Feet 0	Unpaved Lot Area Square Feet 0	Silage Pit Surface Area, SF 0	Solids Cubic Feet		Liquids Cubic Feet	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	431	3,488	4,596	32,175	8,516	306,573	0	0	8,516	0	8,516	0
December	0	0	0	0	446	3,605	4,750	33,248	8,800	316,793	0	0	8,800	0	8,800	0
January	0	0	0	0	446	3,605	4,750	33,248	8,800	316,793	0	0	8,800	0	8,800	0
February	0	0	0	0	402	3,256	4,290	30,030	7,948	286,135	0	0	7,948	0	7,948	0
March	0	0	0	0	446	3,605	4,750	33,248	8,800	316,793	0	0	8,800	0	8,800	0
April	0	0	0	0	431	3,488	4,596	32,175	8,516	306,573	0	0	8,516	0	8,516	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual	0	0	0	0	2,601	21,046	27,732	194,123	51,379	1,849,660	0	0	51,379	0	51,379	0
Annual Gallons	0	0	0	0	19,457	157,427	207,434	384,318	384,318	0	0	0	384,318	0	384,318	0

DAILY NUTRIENT PRODUCTION

Type of Animal	Pounds/Day of Nutrients from LIQUIDS				Pounds/Day of Nutrients from SOLIDS				Pounds/Day of Nutrients from GRAZING				Grazing Manure Gallons/Yr	Confined Manure Cubic Feet/Yr
	N	P2O5	K2O		N	P2O5	K2O		N	P2O5	K2O			
CALVES (1-12 Months)	0.00	0.00	0.00		40.95	12.06	12.92		40.95	12.06	12.92		179,816	23,648
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0	0
				0.00	0.00	0.00		0.00	0.00	0.00		179,816	23,648	

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-177 Calf Operation Barns A & B Combined
 ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS				Pounds of Nutrients from SOLIDS				Pounds of Nutrients from GRAZING				Total Pounds of Nutrients from ALL SOURCES			
	N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O	
October	0	0	0	0	0	0	0	0	1,269	374	401	0	1,269	374	401	0
November	0	0	0	0	1,229	362	388	0	0	0	0	0	1,229	362	388	0
December	0	0	0	0	1,269	374	401	0	0	0	0	0	1,269	374	401	0
January	0	0	0	0	1,269	374	401	0	0	0	0	0	1,269	374	401	0
February	0	0	0	0	1,147	338	362	0	0	0	0	0	1,147	338	362	0
March	0	0	0	0	1,269	374	401	0	0	0	0	0	1,269	374	401	0
April	0	0	0	0	1,229	362	388	0	0	0	0	0	1,229	362	388	0
May	0	0	0	0	0	0	0	0	1,269	374	401	0	1,269	374	401	0
June	0	0	0	0	0	0	0	0	1,229	362	388	0	1,229	362	388	0
July	0	0	0	0	0	0	0	0	1,269	374	401	0	1,269	374	401	0
August	0	0	0	0	0	0	0	0	1,269	374	401	0	1,269	374	401	0
September	0	0	0	0	0	0	0	0	1,229	362	388	0	1,229	362	388	0
Annual	0	0	0	0	7,412	2,183	2,339	0	7,535	2,219	2,378	0	14,947	4,403	4,717	0

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

CLIENT: Silveira, Tony T-177 Calf Operation Barns A & B Combined

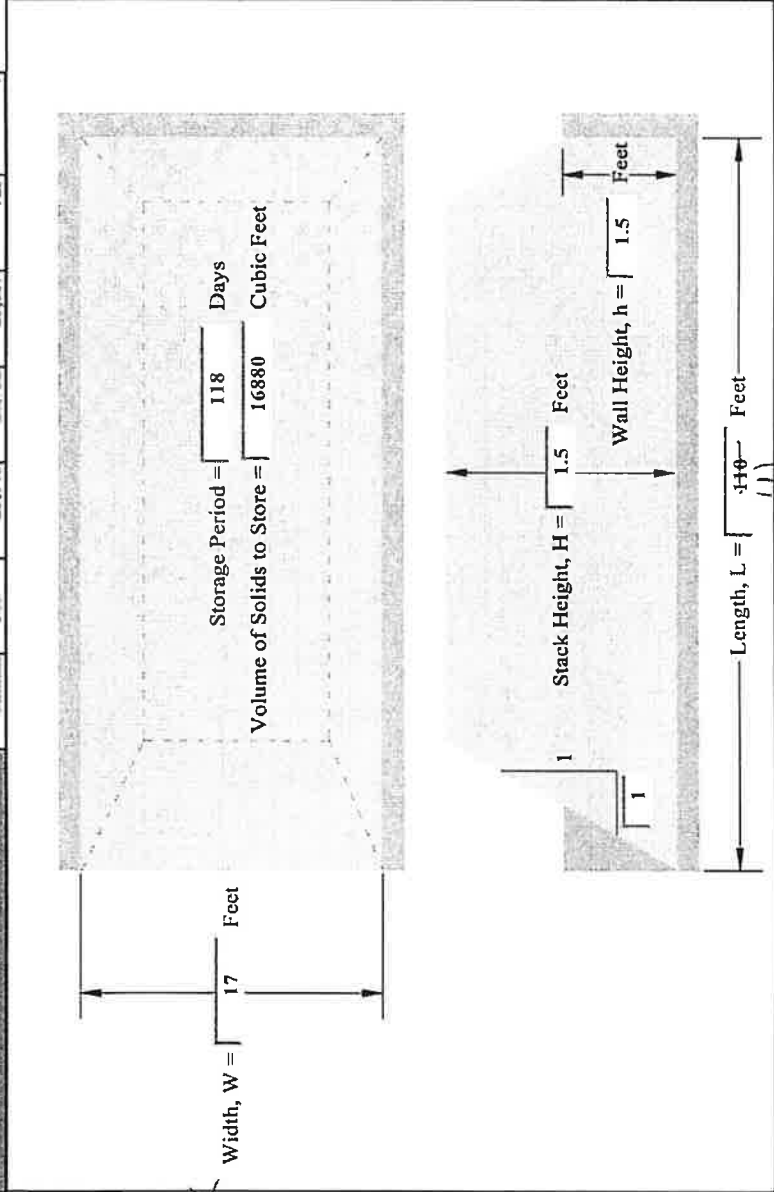
ASSISTED BY: Pedersen

Version 5.0

8/11/2015

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY				VOLUME OF MONTHLY SOLIDS STACKED IN FACILITY					
Solids Storage Facility Parameters	Value	Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Solids to Store Tons	Normal Runoff CF	
Storage Period, Days=	118	October	31	0	0	0	0	0	
Stacking Width, W in Feet=	17	November	30	3,920	4,596	4,258	153	0	
Stacking Height, H in Feet=	1.50	December	31	4,050	4,750	4,400	158	0	
Wall Height, h in Feet=	1.50	January	31	4,050	4,750	4,400	158	0	
Stack Side Slope (X:1)=	1.00	February	28	3,658	4,290	3,974	143	0	
Existing Storage, Cubic Feet=	14,107	March	31	4,050	4,750	4,400	158	0	
Surface Area of Existing Storage, SF=	0	April	30	3,920	4,596	4,258	153	0	
25 Year-24 Hour Storm Runoff, CF=	0	May	31	0	0	0	0	0	
Volume Needed, Cubic Feet=	16,880	June	30	0	0	0	0	0	
Design Volume, Cubic Feet=	2,786	July	31	0	0	0	0	0	
Is Facility Covered? YES		August	31	0	0	0	0	0	
Volume Reduction Factor=	0.50	September	30	0	0	0	0	0	
		Annual	365	23,648	27,732	25,689	925	0	



Additional dry pack storage facilities

Barn A

51' x 111' x 1.5'

13' x 58' x 1.5'

50' x 98' x 1.5'

17.2' x 78.2' x 1.5'

Barn B

82' x 12' x 2.5'

55' x 12' x 4.0'

82' x 12' x 2.5'

CLIENT: Silveira, Tony T-177 Calf Operation Barns A & B Combined
ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

[illegible]

MANAGEMENT CRITERIA FOR BIG GUN SPRINKLER APPLICATION OF LIQUIDS

[illegible]

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-177 Calf Operation Barns A & B Combined
 ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Beef									
	Type of Storage Facility									
	Tank (Covered)	0	0	0	80%	90%	90%	0	0	0
Solids	Solids Storage Facility (Roofed)	7,412	2,183	2,339	60%	75%	65%	4,447	1,637	1,520
Grazing	NONE	7,535	2,219	2,378	100%	100%	100%	7,535	2,219	2,378

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 ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Sprinkling	0	0	0	75%	100%	100%	0	0	0
Solids	Broadcast (incorporated 7 or more days after application)	4,447	1,637	1,520	70%	100%	100%	3,113	1,637	1,520
Grazing	Grazing	7,535	2,219	2,378	85%	100%	100%	6,405	2,219	2,378

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Coast									
	Soil Drainage Class									
	Poorly Drained	0	0	0	60%	100%	100%	0	0	0
Solids	Poorly Drained	3,113	1,637	1,520	60%	100%	100%	1,868	1,637	1,520
Grazing	Poorly Drained	6,405	2,219	2,378	60%	100%	100%	3,843	2,219	2,378
							TOTAL	6,711	3,867	3,893

8/11/2015

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

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

All Hoffer Operation T-177 Bams A&B CRAWMV5 0.xls

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY														
Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Nutrient Production							Manure CF/D/AU	Annual		
				(lbs./day/1000 lb. Animal Unit)		(lbs./day)			Days Confined	Days Grazed		Days Off Farm		
				N	P	K	N	P					K	
► CALVES (1-12 Months)	200	325	65.0	0.42	0.05	0.11	27.30	3.51	1.15	1.34	181	184	0	
►														
►														
►														
►														
►														
►														
►														
►														
Totals/Averages	200	325	65.0	0.42	0.05	0.11	27.3	3.5	1.2	1.3				

GRAZING PERIOD

[illegible]

CLIENT: Silveira, Tony 'T-177 Calve Operation (Loose Housing Barn A)

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION		TILLAMOOK 1 W	
Month	25Yr-24Hr	Lot Runoff Factors as a Percent of Monthly Precipitation	
	RCN=		
	Average Monthly Inches	Paved	Unpaved
October	7.16	Evaporation 1.42	50%
November	13.71	0.75	60%
December	13.94	0.60	60%
January	13.09	0.48	60%
February	10.79	0.78	50%
March	9.90	1.26	45%
April	6.81	1.90	40%
May	4.84	3.22	40%
June	3.41	3.40	35%
July	1.64	3.91	30%
August	1.42	3.52	40%
September	3.68	2.54	45%
Annual	90.39	23.78	15%

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 Wastes per Day	Gallons of Water Used per Wash-Day	Total Water Use per Day, Gallons	Total Water Use per Day, Cubic Feet
Animal Washwater	0	0	0.00	0	0.0
Equipment Wash		0	0.00	0	0.0
Flushwater		0	0.00	0	0.0
Miscellaneous		0	0.00	0	0.0
Total				0	0.0

CROP DATA

CROP DATA									
Field Number	Acres	Crop	Percent Dry Matter (DM)	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre		Potassium K ₂ O	
				Ton		Nitrogen N	Phosphorous P ₂ O ₅		
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	▶		17.00	245	82	234	
			▶						
			▶						
			▶						
			▶						
			▶						
			▶						
			▶						
			▶						
Off Farm									
Total Acres	61.8								

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

[illegible]

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	% Solids Separated	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
CALVES (1-12 Months)	Dry Scrape System	► 100%	189	0	0	87	0	36	6,813
		►							
		►							
		►							
		►							
		►							
		►							
		►							
		►							
		►							
Total Solid s	>>>>>>>>>>>>>>>>>>>>>>>>>>>>	>>>>>>>>>>>>>>>>>>>>>>>>>>>>	189	0	0	87	0		6,813

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)
ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES																	
Month	Runoff in Cubic Feet					Facility Water Use Cubic Feet	Manure		Bedding		Solids Separated		Solids in Liquids		Total Solids		
	Roof Area Square Feet 0	Slab Area Square Feet 0	Unpaved Lot Area Square Feet 0	Silage Pit Surface Area, SF 0	Solids Cubic Feet		Liquids Cubic Feet	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Total Liquids Cubic Feet
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	287	2,326	3,064	21,450	5,677	204,382	0	0	0	5,677	0	0
December	0	0	0	0	0	297	2,403	3,166	22,165	5,867	211,195	0	0	0	5,867	0	0
January	0	0	0	0	0	297	2,403	3,166	22,165	5,867	211,195	0	0	0	5,867	0	0
February	0	0	0	0	0	268	2,171	2,860	20,020	5,299	190,757	0	0	0	5,299	0	0
March	0	0	0	0	0	297	2,403	3,166	22,165	5,867	211,195	0	0	0	5,867	0	0
April	0	0	0	0	0	287	2,326	3,064	21,450	5,677	204,382	0	0	0	5,677	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual	0	0	0	0	0	1,794	14,031	18,488	129,415	34,253	1,233,106	0	0	0	34,253	0	0
Annual Gallons	0	0	0	0	0	12,972	104,951	138,289	256,212	256,212	0	0	0	0	256,212	0	0

DAILY NUTRIENT PRODUCTION

[illegible]

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)

ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS				Pounds of Nutrients from SOLIDS				Pounds of Nutrients from GRAZING				Total Pounds of Nutrients from ALL SOURCES			
	N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O	
October	0	0	0	0	0	0	0	0	846	249	267	0	846	249	267	0
November	0	0	0	0	819	241	258	0	0	0	0	0	819	241	258	0
December	0	0	0	0	846	249	267	0	0	0	0	0	846	249	267	0
January	0	0	0	0	846	249	267	0	0	0	0	0	846	249	267	0
February	0	0	0	0	764	225	241	0	0	0	0	0	764	225	241	0
March	0	0	0	0	846	249	267	0	0	0	0	0	846	249	267	0
April	0	0	0	0	819	241	258	0	0	0	0	0	819	241	258	0
May	0	0	0	0	0	0	0	0	846	249	267	0	846	249	267	0
June	0	0	0	0	0	0	0	0	819	241	258	0	819	241	258	0
July	0	0	0	0	0	0	0	0	846	249	267	0	846	249	267	0
August	0	0	0	0	0	0	0	0	846	249	267	0	846	249	267	0
September	0	0	0	0	0	0	0	0	819	241	258	0	819	241	258	0
Annual	0	0	0	0	4,941	1,455	1,559	0	5,023	1,480	1,585	0	9,965	2,935	3,145	0

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

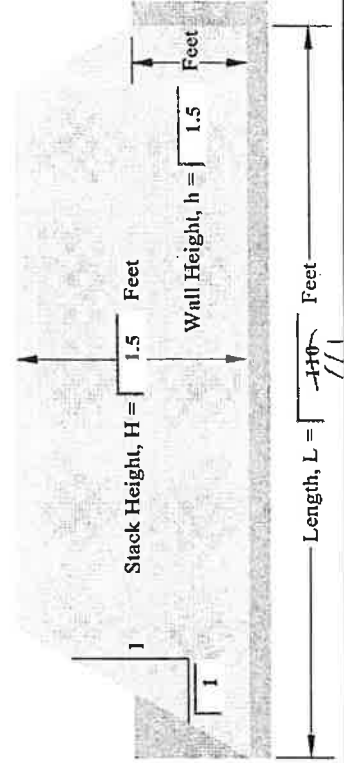
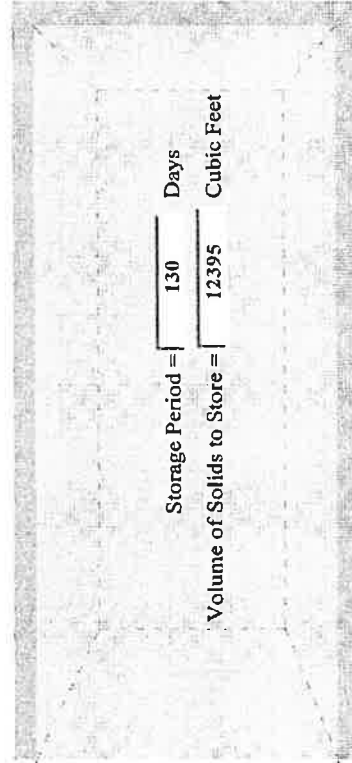
CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)
 ASSISTED BY: Technical Service Provider

8/11/2015

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY		VOLUME OF MONTHLY SOLIDS STACKED IN FACILITY									
Solids Storage Facility Parameters	Value	Month	Number of Days	Manure CF	Bedding CF	Solids to Store to CF	Solids to Store to Tons	Normal Runoff CF			
Storage Period, Days=	130	October	31	0	0	0	0	0			
Stacking Width, W in Feet=	17	November	30	2,613	3,064	2,839	102	0			
Stacking Height, H in Feet=	1.50	December	31	2,700	3,166	2,933	106	0			
Wall Height, h in Feet=	1.50	January	31	2,700	3,166	2,933	106	0			
Stack Side Slope (X:1)=	1.00	February	28	2,439	2,860	2,649	95	0			
Existing Storage, Cubic Feet=	9,622	March	31	2,700	3,166	2,933	106	0			
Surface Area of Existing Storage, SF=	0	April	30	2,613	3,064	2,839	102	0			
25 Year-24 Hour Storm Runoff, CF=	0	May	31	0	0	0	0	0			
Volume Needed, Cubic Feet=	12,395	June	30	0	0	0	0	0			
Design Volume, Cubic Feet=	2,786	July	31	0	0	0	0	0			
Is Facility Covered? yes	▼	August	31	0	0	0	0	0			
Volume Reduction Factor=	0.50	September	30	0	0	0	0	0			
		Annual	365	15,765	18,488	17,126	617	0			

Additional dry pack storage facilities
 51' x 11' x 1.5'
 13' x 58' x 1.5'
 50' x 88' x 1.5'
 17.2' x 78.5' x 1.5'



Dry Pack Facility

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)
ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

[illegible][illegible]

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)

ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

[illegible]

COMBUSTIBLE LIQUID WASTE CONCENTRATIONS IN STORAGE		Concentration of Nutrients in Storage				
Storage Facility	Annual Volume Production	Units	N	P ₂ O ₅	K ₂ O	Units
		Gallons	0.00	0.00	0.00	lbs/1,000 Gal
Tank (Uncovered)	0					
Solids Storage Facility (Roofed)	308	Tons	6.01	2.12	2.28	lbs/T on

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

8/11/2015

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn A)
 ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Dairy	0	0	0	70%	85%	82%	0	0	0
Solids	Tank (Uncovered)	4,941	1,455	1,559	75%	90%	99%	3,706	1,310	1,404
Grazing	Solids Storage Facility (Roofed)	5,023	1,480	1,585	100%	100%	100%	5,023	1,480	1,585
	NONE									

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 ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Spreading	0	0	0	75%	100%	100%	0	0	0
Solids	Broadcast (Incorporated 7 or more days after application)	3,706	1,310	1,404	70%	100%	100%	2,594	1,310	1,404
Grazing	Grazing	5,023	1,480	1,585	85%	100%	100%	4,270	1,480	1,585

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Coast	0	0	0	60%	100%	100%	0	0	0
Solids	Soil Drainage Class	2,594	1,310	1,404	60%	100%	100%	1,557	1,310	1,404
Grazing	Poorly Drained	4,270	1,480	1,585	60%	100%	100%	2,562	1,480	1,585
							TOTAL	4,118	2,780	2,989

2015

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

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Page 2 of 2

Silveira, Tony T-177 Calve Operation (Eos-10144-14-11-8)

ASSISTED BY: Pedersen

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY													
Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lbs.)	Nutrient Production						Manure CF/D/AU	Annual		Days Off Farm
				(lbs./day/1000 lb. Animal Unit)			(lbs./day)				Days Confined	Days Grazed	
				N	P	K	N	P	K				
► CALVES (1-12 Months)	100	325	32.5	0.42	0.05	0.11	13.65	1.76	3.58	1.34	181	184	0
►													
►													
►													
►													
►													
►													
►													
►													
►													
►													
Totals/Averages	100	325	32.5	0.42	0.05	0.11	13.7	1.8	3.6	1.3			

GRAZING PERIOD

[illegible]

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)

ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION		TILLAMOOK 1 W			
Month	25Vr-24Hr	6.00	Lot Runoff Factors as a Percent of Monthly Precipitation		
	RCN=	95.00			
	Average Monthly Inches	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

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

WATER USE THAT ENTERS LIQUID STORAGE FACILITY

Type of Water Use	Number of Animals	Number of Wastes per Day	Gallons of Water Used per Wash-Day	Total Water Use per Day, Gallons	Total Water Use per Day, Cubic Feet
Animal Washwater	0	0	0.00	0	0.0
Equipment Wash		0	0.00	0	0.0
Flushwater		0	0.00	0	0.0
Miscellaneous		0	0.00	0	0.0
Total				0	0.0

CROP DATA

Field Number	Acres	Crop		Percent Dry Matter (DM)	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre		
							Nitrogen N	Phosphorous P ₂ O ₅	Potassium K ₂ O
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	▶	30%	Ton	17.00	245	82	234
			▶						
			▶						
			▶						
			▶						
			▶						
			▶						
			▶						
Off Farm			▶						
Total Acres	61.8								

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)

ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

[illegible]

SOLIDS SEPARATION FACTOR

[illegible]

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)
ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES																
Month	Runoff in Cubic Feet					Facility Water Use Cubic Feet	Manure		Bedding		Solids Separated		Solids in Liquids		Total Solids	
	Roof Area Square Feet	Paved Slab Area Square Feet	Unpaved Lot Area Square Feet	Silage Pit Surface Area, SF	0		Solids Cubic Feet	Liquids Cubic Feet	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Pounds	Cubic Feet	Total Liquids Cubic Feet
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	144	1,163	1,532	10,725	2,839	102,191	0	0	0	2,839
December	0	0	0	0	0	0	149	1,202	1,583	11,083	2,933	105,598	0	0	0	2,933
January	0	0	0	0	0	0	149	1,202	1,583	11,083	2,933	105,598	0	0	0	2,933
February	0	0	0	0	0	0	134	1,085	1,430	10,010	2,649	95,378	0	0	0	2,649
March	0	0	0	0	0	0	149	1,202	1,583	11,083	2,933	105,598	0	0	0	2,933
April	0	0	0	0	0	0	144	1,163	1,532	10,725	2,839	102,191	0	0	0	2,839
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual	0	0	0	0	0	0	867	7,015	9,244	64,708	17,126	616,553	0	0	0	17,126
Annual Gallons	0	0	0	0	0	0	6,486	52,476	69,145	128,106	128,106	128,106	0	0	0	128,106

DAILY NUTRIENT PRODUCTION

[illegible]

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)
 ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Total Pounds of Nutrients from ALL SOURCES		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
October	0	0	0	0	0	0	423	125	134	423	125	134
November	0	0	0	410	121	129	0	0	0	410	121	129
December	0	0	0	423	125	134	0	0	0	423	125	134
January	0	0	0	423	125	134	0	0	0	423	125	134
February	0	0	0	382	113	121	0	0	0	382	113	121
March	0	0	0	423	125	134	0	0	0	423	125	134
April	0	0	0	410	121	129	0	0	0	410	121	129
May	0	0	0	0	0	0	423	125	134	423	125	134
June	0	0	0	0	0	0	410	121	129	410	121	129
July	0	0	0	0	0	0	423	125	134	423	125	134
August	0	0	0	0	0	0	423	125	134	423	125	134
September	0	0	0	0	0	0	410	121	129	410	121	129
Annual	0	0	0	2,471	728	780	2,512	740	793	4,982	1,468	1,572

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)

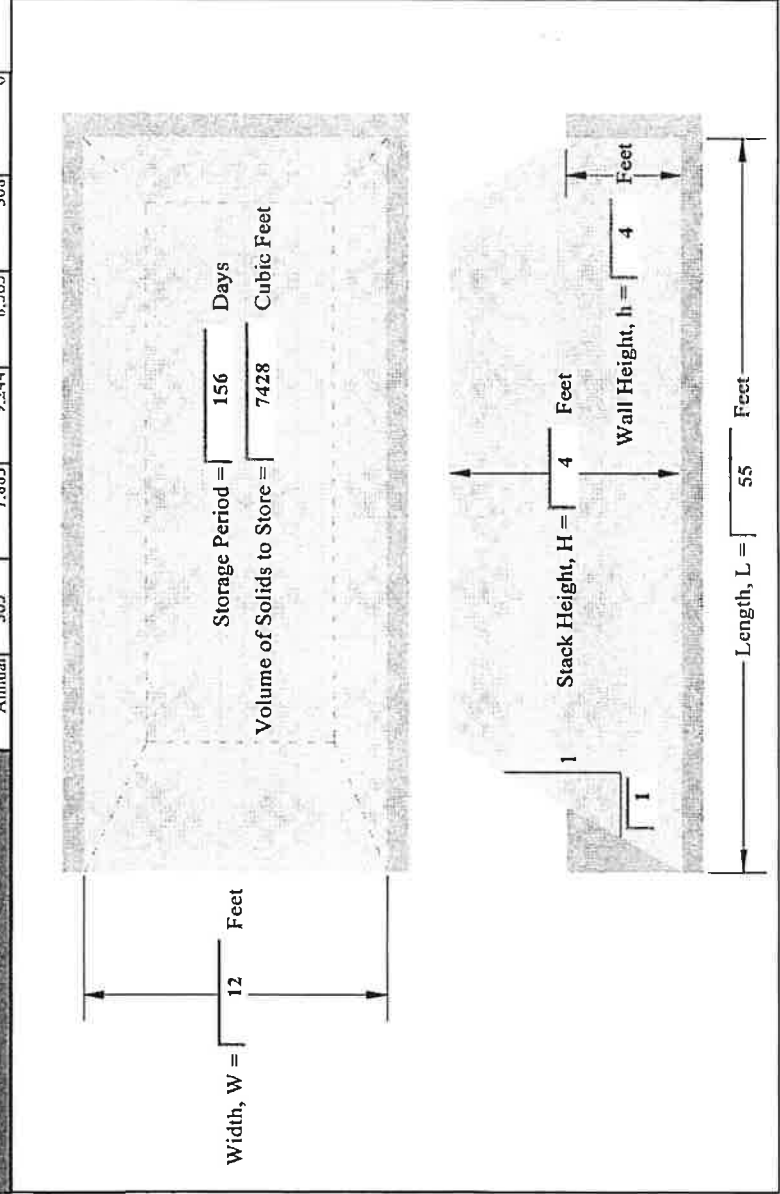
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8/11/2015

ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY		VOLUME OF MONTHLY SOLIDS STACKED IN FACILITY									
Solids Storage Facility Parameters	Value	Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Solids to Store Tons	Normal Runoff CF			
Storage Period, Days=	156	October	31	0	0	0	0	0			
Stacking Width, W in Feet=	12	November	30	1,307	1,532	1,419	51	0			
Stacking Height, H in Feet=	4.00	December	31	1,350	1,583	1,467	53	0			
Wall Height, h in Feet=	4.00	January	31	1,350	1,583	1,467	53	0			
Stack Side Slope (X:1)=	1.00	February	28	1,219	1,430	1,325	48	0			
Existing Storage, Cubic Feet=	4,920	March	31	1,350	1,583	1,467	53	0			
Surface Area of Existing Storage, SF=	0	April	30	1,307	1,532	1,419	51	0			
25 Year-24 Hour Storm Runoff, CF=	0	May	31	0	0	0	0	0			
Volume Needed, Cubic Feet=	7,428	June	30	0	0	0	0	0			
Design Volume, Cubic Feet=	2,544	July	31	0	0	0	0	0			
Is Facility Covered? YES	▼	August	31	0	0	0	0	0			
Volume Reduction Factor=	0.50	September	30	0	0	0	0	0			
		Annual	365	7,883	9,244	8,563	308	0			

Additional Dry Pits
82' x 12' x 2.5'
82' x 12' x 2.5'



QALZ
Date: 11-14

Version 5.0

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)

ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM APPLICATION

MANAGEMENT CRITERIA FOR TANK WAGON APPLICATION OF LIQUIDS

To apply 0 gallons of liquids generated from the operation it will take approximately 0 acres. Agronomic rates use the application depths, travel lengths, and loads per acre listed below for each crop.

[illegible]

COMPUTED NUTRIENT CONCENTRATIONS IN STORAGE

COMPLETED NUTRIENT CONCENTRATIONS IN STORAGE		Annual Volume Production	Units	Concentration of Nutrients in Storage			
				N	P ₂ O ₅	K ₂ O	Units
Storage Facility			Gallons	0.00	0.00	0.00	lbs/1,000 Gal
Tank (Uncovered)	0		Tons	6.01	2.12	2.28	lbs/Ton
Solids Storage Facility (Roofed)	154						

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

8/11/2015

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CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)
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ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Dairy									
	Type of Storage Facility									
	Tank (Uncovered)	0	0	0	70%	85%	85%	0	0	0
Solids	Solids Storage Facility (Roofed)	2,471	728	780	75%	90%	90%	1,853	655	702
Grazing	NONE	2,512	740	793	100%	100%	100%	2,512	740	793

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 ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Sprinkling	0	0	0	75%	100%	100%	0	0	0
Solids	Broadcast (Incorporated 7 or more days after application)	1,853	655	702	70%	100%	100%	1,297	655	702
Grazing	Grazing	2,512	740	793	85%	100%	100%	2,135	740	793

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Liquids	Coast									
	Soil Drainage Class									
	Poorly Drained	0	0	0	60%	100%	100%	0	0	0
Solids	Poorly Drained	1,297	655	702	60%	100%	100%	778	655	702
Grazing	Poorly Drained	2,135	740	793	60%	100%	100%	1,281	740	793
							TOTAL	2,059	1,365	1,494

CLIENT: Silveira, Tony T-177 Calve Operation (Loose Housing Barn B)
ASSISTED BY: Technical Service Provider

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

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	
T-177 1-9	61.8	Perennial Hay/Pasture(Med Intensity)	0%	0	0	100%	778	3	100%	1,281	5	
						</						

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

[illegible]

Calculating Dairy Manure Nutrient Application Rates

T. Downing

Whether your goal is to manage manure application to balance for nitrogen or for phosphorus, knowing how much nutrient you are applying is a crucial step toward ideal manure management. Determining the relationship between volume of waste and the amount of nutrients applied is essential.

This publication describes how to calibrate waste-handling equipment and to calculate nutrient application rates. It covers typical equipment found on dairies and uses nitrogen in the examples. The same techniques can be used with phosphorus.

Generally, it is desirable to apply no more than 100 pounds N per acre at a time. See the publications listed under "For more information" on page 6 to learn how to determine appropriate nutrient application rates for your situation.

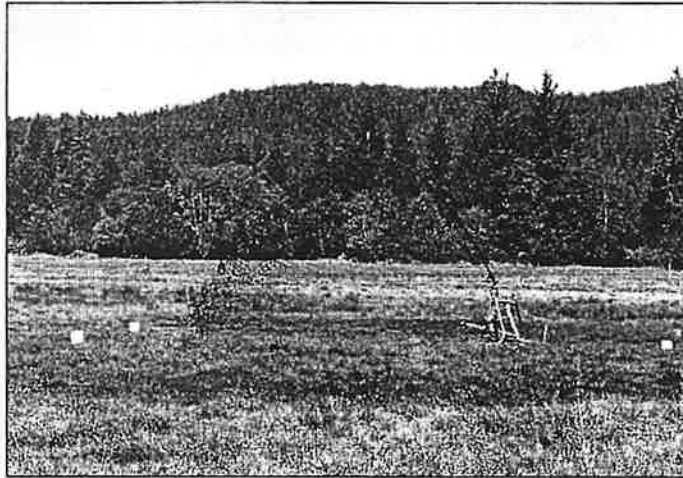


Figure 1. Place several straight-sided, flat-bottom buckets in the area where the gun is to apply liquid.

Doing the calculations

To calculate nutrient application rates, you need to know three things:

- The concentration of nitrogen in the manure—For example, if you apply 100 pounds or 100 gallons of manure, you must know how much nitrogen is in each pound or gallon. Having a sample analyzed by a lab is the best way to determine nutrient concentration, but using book values usually puts you in the ballpark.
- How much manure (pounds or gallons) you have applied
- The area (square feet or acres) that received the application



**OREGON STATE
UNIVERSITY**

EXTENSION SERVICE

Troy Downing, Extension agent (dairy), Tillamook County, Oregon State University.

Calculating rates with a stationary gun

1. **Measure the amount of manure applied.** Place several straight-sided, flat-bottom buckets in the area where the gun is to apply liquid (Figure 1). Run the gun for a predetermined amount of time (for example, 30 minutes) and then turn off the pump. Pour the contents of all the buckets into one bucket and measure the depth of the liquid. Divide the depth by the number of buckets. The result is the inches of liquid manure applied in 30 minutes. Let's say you applied ½ inch in 30 minutes.

2. **Measure the area covered.** To calculate the area of a circle, multiply the radius squared by 3.14. (The radius is half the diameter.) For example, if your big gun covers a circle 180 feet across, the radius is 90 feet. Multiply 90 ft x 90 ft x 3.14 to get the total area in square feet (25,434 square feet). There are 43,560 square feet in an acre, so 25,434 square feet is approximately 0.58 acres:

$$\frac{25,434 \text{ ft}^2}{43,560 \text{ ft}^2 \text{ per acre}} = 0.58 \text{ acre}$$

3. **Convert the inches applied to gallons.** If you had an average of ½ inch of liquid manure in your buckets, you can assume

you applied ½ inch over the 25,434 square feet.

a. **First, convert the square feet to cubic feet** by dividing 25,434 by 24 (½ inch in the bucket is ¼ of a foot). This is equivalent to 1,059 cubic feet of liquid manure.

$$\frac{25,434 \text{ ft}^2}{24} = 1,059 \text{ ft}^3$$

b. **Now, convert the cubic feet to gallons.** There are 7.5 gallons per cubic foot, so multiply 1,059 cubic feet by 7.5. The result is 7,948 gallons pumped in 30 minutes.

4. **Determine the pumping rate.** Divide 7,948 gallons by 30 minutes. Your pumping rate is 265 gallons per minute.

5. **Calculate the total amount of nitrogen applied.** If the nitrogen concentration of the manure is 10 pounds per 1,000 gallons, and you applied 7,948 gallons, then you applied 79 pounds of nitrogen.

$$\frac{7,948 \text{ gal} \times 10 \text{ lb N}}{1,000 \text{ gal}} = 79 \text{ lb N}$$

6. **Calculate the amount of nitrogen applied per acre.** Since you covered 0.58 acres, you applied the equivalent of 137 pounds of nitrogen per acre.

$$\frac{79 \text{ lb N}}{0.58 \text{ acres}} = 137 \text{ lb per acre}$$

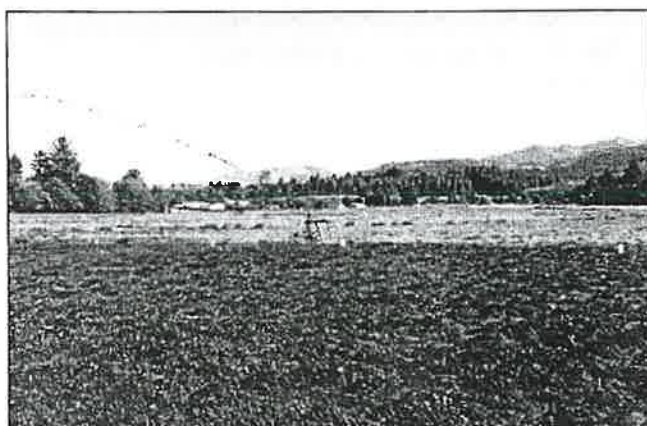


Figure 2. Calibrating a traveler involves the same principles described for the stationary gun, but you adjust for the speed of the traveler.

Calculating rates with a traveling gun

Calibrating a traveler involves the same principles described for the stationary gun, but you adjust for the speed of the traveler (Figure 2).

You need to know the width of application, the number of feet of hose pulled out (the distance covered by a single pass), and the speed at which the gun is moving. Let's say, for example, that your application is 240 feet wide, each pass is 1,000 feet, and the traveler moves at 6 feet per minute.

1. **Calculate the area covered.** Multiply the 240-foot width by the 1,000-foot pass to determine that you covered 240,000 square feet. This represents 5.5 acres.

$$\frac{240,000 \text{ ft}^2}{43,560 \text{ ft}^2 \text{ per acre}} = 5.5 \text{ acres}$$

2. **Measure the amount of liquid applied.** During the application, place several buckets throughout the pass area. Combine the liquid waste collected in all the buckets into one bucket and measure the depth of the liquid. Divide this amount by the number of buckets to determine how many inches you applied. For example, let's say your application averaged $\frac{1}{8}$ inch.

3. **Convert the inches applied to gallons.**

- a. First, convert the square inches to cubic feet by dividing 240,000 by 36 ($\frac{1}{8}$ inch in the bucket is $\frac{1}{8}$ of a foot). This is equivalent to 6,667 cubic feet of manure.

$$\frac{240,000 \text{ ft}^2}{36} = 6,667 \text{ ft}^3$$

- b. Now, convert the cubic feet to gallons. There are 7.5 gallons in a cubic foot, so multiply 6,667 cubic feet by 7.5. The result is 50,002 gallons.

4. **Calculate the total amount of nitrogen applied.** If the manure contains 8 pounds of nitrogen (N) per 1,000 gallons, and you applied 50,002 gallons, then you applied 400 pounds N.

$$\frac{50,002 \text{ gal} \times 8 \text{ lb N}}{1,000 \text{ gal}} = 400 \text{ lb N}$$

5. **Calculate the amount of N applied per acre.** Four hundred pounds of N applied over 5.5 acres equals around 73 pounds per acre.

$$\frac{400 \text{ lb N}}{5.5 \text{ acres}} = 73 \text{ lb N per acre}$$

6. **Calculate application rates at various speeds.** From these calculations, you can generate a table that easily demonstrates the amount of nitrogen applied at various speeds (see Table 1 for an example). In the example above, the speed was 6 feet per minute. At 3 feet per minute, the application rate would be twice that at 6 feet, or 146 pounds N per acre.

7. **Estimate the pump rate per minute.** At 6 feet per minute, it takes 166 minutes to complete a 1,000-foot pass.

$$\frac{1,000 \text{ ft}}{6 \text{ ft per minute}} = 166 \text{ minutes}$$

Divide the total gallons pumped by the total minutes pumped. For this example, 50,002 gallons divided by 166 minutes equals 301 gallons per minute.

Table 1.—Example calibration chart.

Traveler speed (feet/minute)	Inches applied	N applied per acre (lb) (if 8 lb N/ 1,000 gal)	Total N applied (lb)		
			500 ft hose pulled	1,000 ft hose pulled	1,500 ft hose pulled
2.0	1	219	600	1,200	1,800
4.0	0.5 inches	109	300	600	900
6.0	0.33 inches	73	200	400	600
8.0	0.25 inches	55	150	300	450
10.0	0.20 inches	44	120	240	360

Fill in your own farm's numbers here.

Traveler speed (feet/minute)	Inches applied	N applied per acre (lb) (if 8 lb N/ 1,000 gal)	Total N applied (lb)		
			500 ft hose pulled	1,000 ft hose pulled	1,500 ft hose pulled
2.0					
4.0					
6.0					
8.0					
10.0					

Calculating rates with a liquid wagon

The following are two ways to calibrate liquid wagons to determine nutrient application rates.

The most common method

Determine the total volume of liquid applied to a field, and then calculate the nutrients applied. For example:

1. Measure the amount of liquid applied.

If you hauled 30 loads of liquid with a wagon that holds 3,000 gallons, you hauled 90,000 gallons of liquid.

$$30 \text{ loads} \times 3,000 \text{ gal} = 90,000 \text{ gal}$$



Figure 3. Place several trays, pans, or short buckets in the field to catch liquid applied with one pass.

It is important to realize that although most liquid wagons are rated for a specific volume, the actual working volume is less. For example, a 3,000-gallon wagon might deliver only 2,700 gallons to the field.

2. Calculate the per-acre manure application rate.

If the manure is applied to a 10-acre field, this is equivalent to 9,000 gallons per acre.

$$\frac{90,000 \text{ gal}}{10 \text{ acres}} = 9,000 \text{ gal per acre}$$

3. Calculate the per-acre N application rate.

If the manure has a nitrogen concentration of 10 pounds N per 1,000 gallons, you applied 90 pounds of N per acre.

$$\frac{9,000 \text{ gal} \times 10 \text{ lb N}}{1,000 \text{ gal}} = 90 \text{ lb N}$$

A second method

This method measures the volume of liquid applied to a small area and uses that quantity to calculate the volume applied over the entire field. It assumes that the application rate is constant. For example:

1. Measure the amount of liquid applied.

Place several trays, pans, or short buckets in the field to catch liquid applied with one pass (Figure 3). Pour the contents of all the pans into one pan and measure the depth of the liquid.

Divide this number by the number of pans. The result is the inches of liquid manure applied. Let's assume you applied ½ inch.

2. Convert the inches applied to gallons applied per acre.

- a. First, convert the inches to cubic feet per acre by dividing 43,560 (the number of square feet in an acre) by 24 (½ inch in the bucket is ½ of a foot). This is equivalent to 1,815 cubic feet of liquid manure per acre.

$$\frac{43,560 \text{ ft}^2}{24} = 1,815 \text{ ft}^3 \text{ per acre}$$

- b. Now, convert the cubic feet per acre to gallons per acre. There are 7.5 gallons per cubic foot, so multiply 1,815 cubic feet by 7.5. The result is 13,612 gallons per acre.

3. Calculate the nitrogen application rate. If the concentration of nitrogen is 10 pounds per 1,000 gallons, the rate of N applied is 136 pounds per acre.

$$\frac{13,612 \text{ gal/a} \times 10 \text{ lb N}}{1,000 \text{ gal}} = 136 \text{ lb N/a}$$

Calculating rates with a solids spreader

The following are two ways to calibrate solids spreaders.

The most common method

Calculate the nutrient (e.g., nitrogen) content of each spreader load and multiply that number by loads per acre or per field.

- 1. Calculate the capacity (in cubic feet) of your spreader.** If your spreader is 16 feet long, 5 feet wide, and 5 feet deep, it holds 400 cubic feet per load.

$$16 \text{ ft} \times 5 \text{ ft} \times 5 \text{ ft} = 400 \text{ ft}^3$$

- 2. Calculate the nitrogen application rate.** If your solid manure has a concentration of 10 pounds N per 100 cubic feet, you are applying 40 pounds of N per load of solids.

$$\frac{400 \text{ ft}^3 \times 10 \text{ lb N}}{100 \text{ ft}^3} = 40 \text{ lb N}$$



Figure 4. Place a tarp or piece of plastic in the field and apply solids over the area.

- 3. Calculate the amount of N applied to the field.** Record the number of loads hauled on each field. Multiply the number of loads by the amount of N per load. For example, if you hauled 25 loads of solids, multiply 25 loads by 40 pounds N per load, for a total application of 1,000 pounds N.

- 4. Calculate the number of pounds of N applied per acre.** Divide the total amount of N applied by the number of acres, in this example 10 acres.

$$\frac{1,000 \text{ lb total N}}{10 \text{ acres}} = 100 \text{ lb N per acre}$$

A second method

This method measures the pounds of solids applied to a small area and uses that quantity to calculate the volume applied over the entire field. It assumes that the application rate is constant. For example:

- 1. Measure the amount of solids applied.**

Place a tarp or piece of plastic in the field and apply solids over the area (Figure 4). A 10' x 10' tarp measures 100 square feet, which represents 1/435 of an acre.

$$\frac{100 \text{ ft}^2}{43,560 \text{ ft}^2 \text{ per acre}} = 1/435 \text{ acre}$$

After spreading across the sample area, fold the tarp and weigh the solids collected on it. Let's assume the solids on the tarp weigh 110 pounds.

2. Convert the pounds to wet tons per acre.

- a. First, convert the pounds collected to pounds per acre by multiplying 110 by 435. This is equivalent to 47,850 lb per acre.

$$110 \text{ lb} \times 435 = 47,850 \text{ lb per acre}$$

- b. Now, convert the pounds per acre to wet tons per acre by dividing 47,850 by 2,000 (the number of pounds per ton). The result is 23.9 wet tons per acre.

$$\frac{47,850 \text{ lb/acre}}{2,000} = 23.9 \text{ wet tons/acre}$$

3. Calculate the nitrogen application rate. If the concentration of nitrogen is 5 pounds per wet ton, the rate of N applied is 119 pounds N per acre.

$$23.9 \text{ wet tons/acre} \times 5 \text{ lb N/wet ton} = 119 \text{ lb N/acre}$$

Manure sampling and testing

Testing manure for nutrient content is relatively easy. However, it can be a major problem to get one sample that represents the nutrient concentration of the manure. Nutrient content can vary considerably within a load, and agitation usually is inadequate to achieve thorough mixing. Analyzing the samples taken during the calibration process is the most desirable method, especially when testing for nitrogen, because these values should represent what actually reaches the soil. This method accounts for nutrient losses that occur during storage and application.

Take samples from a liquid tank or lagoon only after agitation.

Book values are a reasonable approach if testing is not feasible, but actual values

vary from operation to operation depending on water added, feed composition (both quality and quantity), age and stage of lactation of the cattle, and the manure storage system.

For more information

Hart, J., *A List of Analytical Laboratories Serving Oregon*, EM 8677 (Oregon State University, Corvallis, revised 2000). No charge.

Hart, J., M. Gangwer, M. Graham, and E. Marx, *Dairy Manure as a Fertilizer Source*, EM 8586 (Oregon State University, Corvallis, published 1995, reprinted 1997). 75¢

Hart, J., E.S. Marx, and M. Gangwer, *Manure Application Rates for Forage Production*, EM 8585 (Oregon State University, Corvallis, published 1996, reprinted 1997). \$1.50

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

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Estimating Plant-available Nitrogen from Manure



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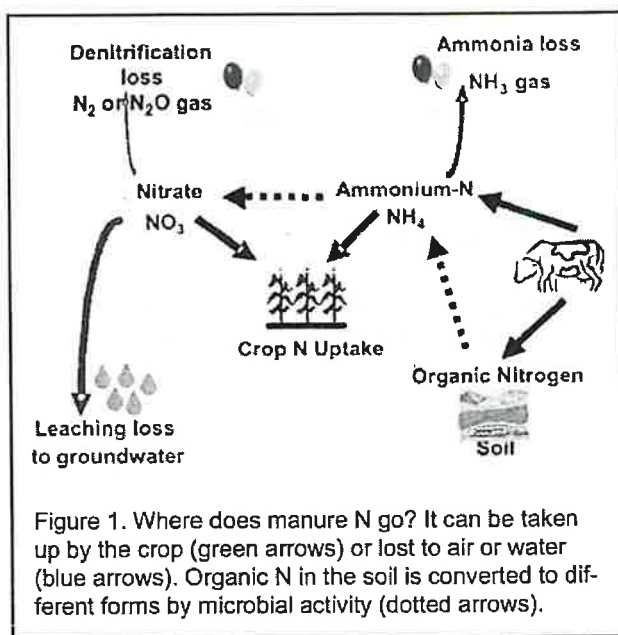
Prepared by Dan M. Sullivan, Extension soil scientist, Oregon State University.

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.

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

less PAN in the short term, and must be managed as a long-term investment in soil building.

Efficient manure N management matches N supply to crop needs. Management can reduce ammonia loss to the atmosphere and nitrate leached to groundwater.

Introduction to the Worksheet

The Worksheet estimates:

- Nutrients supplied this year and their dollar value
- Ammonia-N lost and its value
- Amount of organic N stored in the soil from this year's manure application

The Worksheet uses manure N analyses for ammonium-N ($\text{NH}_4\text{-N}$) and organic N as starting points for calculations (instead of a "total N" book value). This approach allows site-specific adaptation of calculations.

To use the Worksheet, you will need:

- This year's manure analysis
- Planned manure application rate for this year
- Manure application rate and manure N analyses from previous years

If you don't have manure analysis data, you can still use the Worksheet, but the results will not be customized for your farm.

The Worksheet does have some limitations.

- It is not a complete planning tool for long-term nutrient management. The Worksheet is most useful for quick, "ballpark" estimates. It can be used by farm managers to adjust in-season application rates based on manure analyses.
- It is not a nitrogen recommendation or nitrogen budget (N budgets are used to estimate crop N need). You need to know how much PAN the crop needs before using the Worksheet.
- It allows input for only one kind of manure for the current year. If two types of significantly different manure will be applied, you can use the Worksheet twice and add the results together. (Take credit for manure applied in previous years only one time.) For complicated scenarios, the calculation method presented here is compatible with several software packages that are available for nutrient management planning.
- Worksheet estimates of PAN from manure should be regarded as rough estimates. Post-application

monitoring (crop yield, plant tissue tests, soil tests) are needed before adjusting manure management practices to fit site-specific conditions.

Nutrient Analysis of Manure

Typical values for manure nutrient content (book values) can be used for a general comparison of the nutrient content of different manure sources (e.g., chicken vs. horse manure). Manure nutrient composition depends on management practices, such as:

- Source and quality of livestock feed
- Water added to manure
- Type and amount of livestock bedding
- Manure storage method and length of storage

Because management practices vary substantially among farms, it is important to sample and test manure to determine its nutrient content.

For livestock farms that utilize manure on their own acreage, we recommend that you sample and analyze manure several times a year to develop a "running average" of manure nutrient content. Usually, it takes 2 to 4 years to develop a reliable estimate of average manure nutrient content and of the variability of nutrient content during the year. Several "quick test" meters can be used for on-farm monitoring of manure $\text{NH}_4\text{-N}$. The "Agros Meter" has been used in western Oregon and has accurately determined $\text{NH}_4\text{-N}$ in dairy manure. See "On-Farm Quick Tests" in the "For More Information" section for details.

The best time to sample manure is at the time of field application, because:

- Manure is well-mixed, so the sample is representative.
- The analysis will reflect changes in manure N concentration that occur during storage (volatilization) or in preparation for field application (agitation, mixing, and dilution with water).

For Worksheet input, you may choose to separate manure test results into two or more different groups (instead of averaging test results over the entire year). For example, you may want to average early-spring manure tests separately from midsummer tests.

To locate a suitable analytical laboratory, see *Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis*, EM 8677 (listed in "For More Information").

Ask the laboratory to perform these analyses:

1. **Nitrogen:** total N and ammonium-N ($\text{NH}_4\text{-N}$). For compost only, also request an analysis for nitrate-N ($\text{NO}_3\text{-N}$). Other manures contain insignificant amounts of $\text{NO}_3\text{-N}$. To obtain an accurate value for manure $\text{NH}_4\text{-N}$, make sure the laboratory determines $\text{NH}_4\text{-N}$ on a fresh sample (not a dried sample). Most of the manure $\text{NH}_4\text{-N}$ 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 $\text{P} \times 2.29$ 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:

$$\text{PAN} = \text{NH}_4\text{-N retained after application} + \text{N mineralized from manure organic N in soil}$$

The amount of manure $\text{NH}_4\text{-N}$ 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 $\text{NH}_4\text{-N}$

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 ($\text{NH}_4\text{-N}$).
- **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 $\text{NH}_4\text{-N}$ is lost to the atmosphere. Lagoon water, on the other hand, infiltrates soil rapidly, retaining almost all of its manure $\text{NH}_4\text{-N}$. With slurries, some of the $\text{NH}_4\text{-N}$ 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 $\text{NH}_4\text{-N}$ 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 $\text{NH}_4\text{-N}$ 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 $\text{NH}_4\text{-N}$ at application" (page 13) for additional information on directed incorporation methods.

Table 1. Estimated fraction of manure ammonium-N retained after application. Use the appropriate value from this table in Worksheet Step 3, "PAN from $\text{NH}_4\text{-N}$."

Time to incorporation ^a	Manure type and dry matter (DM) content					
	Lagoon water (< 1% DM)	Thin slurry (1–5 % DM)	Thick slurry (5–10% DM)	Solid (> 10% DM)	Compost	Solid poultry (> 10% DM)
	Fraction of manure $\text{NH}_4\text{-N}$ retained ^b					
Immediate incorporation (1 hr)	0.95	0.95	0.95	0.95	1.00	0.95
Incorporation 1 day after	0.95	0.70	0.60	0.50	1.00	0.70
Incorporation 2 days after	0.95	0.60	0.45	0.30	1.00	0.50
Incorporation 7 days after	0.95	0.55	0.40	0.20	1.00	0.40

Directed application methods:

Subsurface injection	0.95	0.95
Surface band (partial incorporation)	0.85	0.70
Surface band (no incorporation)	0.75	0.60

^a Tillage with harrow, cultivator, plow, etc. to incorporate manure, or overhead sprinkler irrigation (0.5 inch) after manure application.

^b Ammonium-N retention estimates for lagoon water, slurry, solid manure, and compost apply to all livestock manures except solid poultry.

Table 2. Estimating PAN from manure organic N. Use the appropriate value in Worksheet Step 3, "PAN from organic N."

Manure	Manure dry matter (as applied)	Organic N applied this year	Organic N applied in previous years			
			1 year ago	2 years ago	3 years ago	4 to 9 years ago
-----Fraction mineralized to PAN-----						
Dairy cattle or other livestock						
Lagoon water	< 1% DM	0.40	0.15	0.07	0.03	0.02 per year
Thin slurry	1 to 5 % DM	0.40	0.15	0.07	0.03	0.02 per year
Thick slurry	5 to 10% DM	0.30	0.15	0.07	0.03	0.02 per year
Solid	> 10% DM	0.30	0.15	0.07	0.03	0.02 per year
Separated dairy solids or horse manure ^a						
		0.10	0.05	0.05	0.03	0.02 per year
Compost ^b		0.10	0.05	0.05	0.03	0.02 per year
Solid poultry						
	> 10% DM	0.50	0.15	0.07	0.03	0.02 per year

^a PAN for dairy solids from a mechanical separator. If separated solids come from gravity separation (settling basin or evaporation basin), use PAN values for the type of manure (lagoon water or slurry) that flows into the settling basin.

^b Stable or finished compost. A finished compost does not smell like ammonia, has a pile temperature less than 95°F (35°C), and often contains significant amounts of nitrate-N. Not all materials sold as compost meet these criteria.

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 $\times$ 0.02 per year). Table 3 shows examples of estimated N mineralization for manure (page 8) applied 4 to 9 years ago.

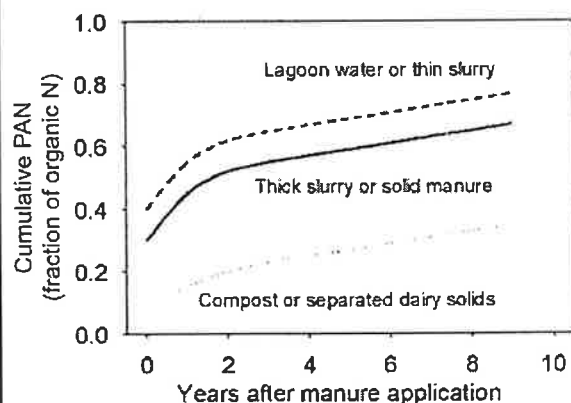


Figure 2. Cumulative PAN supplied by manure organic N, using the mineralization factors presented in Table 2. For this example, manure was applied in Year 0, with no subsequent manure applications. Slow release of PAN from mineralization continues beyond the 10-year period shown in the graph.

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.

Table 3. Examples: Mineralization factors for estimating PAN from manure applied 4 to 9 years ago.

Manure application frequency	Calculation	Mineralization factor to use for "4 to 9 years ago" in Worksheet
Annual (6 out of 6 years)	0.02 per year x 6 years	0.12
5 out of 6 years	0.02 per year x 5 years	0.10
3 out of 6 years	0.02 per year x 3 years	0.06
1 out of 6 years	0.02 per year x 1 year	0.02

Worksheet Instructions and Example Data Inputs

Input your data in the yellow worksheet cells. The Worksheet automatically calculates the values in the green cells.

The Worksheet shows "example" calculations for dairy slurry. The example is provided to help you follow the steps in the calculation. It is **not** a recommendation for manure application rate.

The mini-worksheets below include only the input data. You can use these mini-worksheets to assemble your manure and field management data before using the Worksheet. **The Worksheet has six steps.**

Step 1. Enter manure data.

Instructions

- Enter the kind of manure and the measurement units used for manure application. The Worksheet is not designed for use with more than one kind of manure for "this year." If you will apply more than one kind of manure this year, repeat the process with additional blank Worksheets.
- Enter analysis values for manure on an "as-is" or wet weight basis. If laboratory analysis units are different than field application units, see Table 5 (page 18) for conversion factors. For compost only: enter the compost $\text{NH}_4\text{-N} + \text{NO}_3\text{-N}$ analysis value in the Worksheet " $\text{NH}_4\text{-N}$ " box.
- Enter solids fraction in manure: 5% DM (dry matter) = Solids fraction of 0.05

Example input data (Step 1)

	Example	Your information
Kind of manure	Thin dairy slurry	
Field application units (choose one)		
Per ton (solid or semi-solid manure)		
Per 1,000 gallons (slurry)	X	
Per acre-inch (lagoon or holding pond effluent)		
This year's manure analysis ^{a, b, c}		
Total N	10 lb/1,000 gal	
Ammonium-N ($\text{NH}_4\text{-N}$)	6 lb/1,000 gal	
Phosphate (P_2O_5)	7 lb/1,000 gal	
Potash (K_2O)	16 lb/1,000 gal	
Manure solids fraction (dry matter percentage $\div$ 100)	0.03	

^a Input "as-is" or wet weight manure analysis data.

^b Enter only "lb nutrient" if the manure analysis is in units of "lb nutrient per 1,000 gallons." For example, you would enter total N of "8" for a manure analysis of "8 lb/1,000 gallons."

^c If laboratory analysis units are different than field application units, see Table 5 for conversion factors.

^d The Worksheet calculates this figure automatically for this year's manure application.

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		

^aEstimate from past manure analyses. Organic N = total N - $\text{NH}_4\text{-N}$.

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

Instructions

Enter appropriate fractions for $\text{NH}_4\text{-N}$ 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 $\text{NH}_4\text{-N}$ retained at application (Table 1) = 0.55
- Fraction of organic N mineralized (Table 2)

Fraction of $\text{NH}_4\text{-N}$ 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	

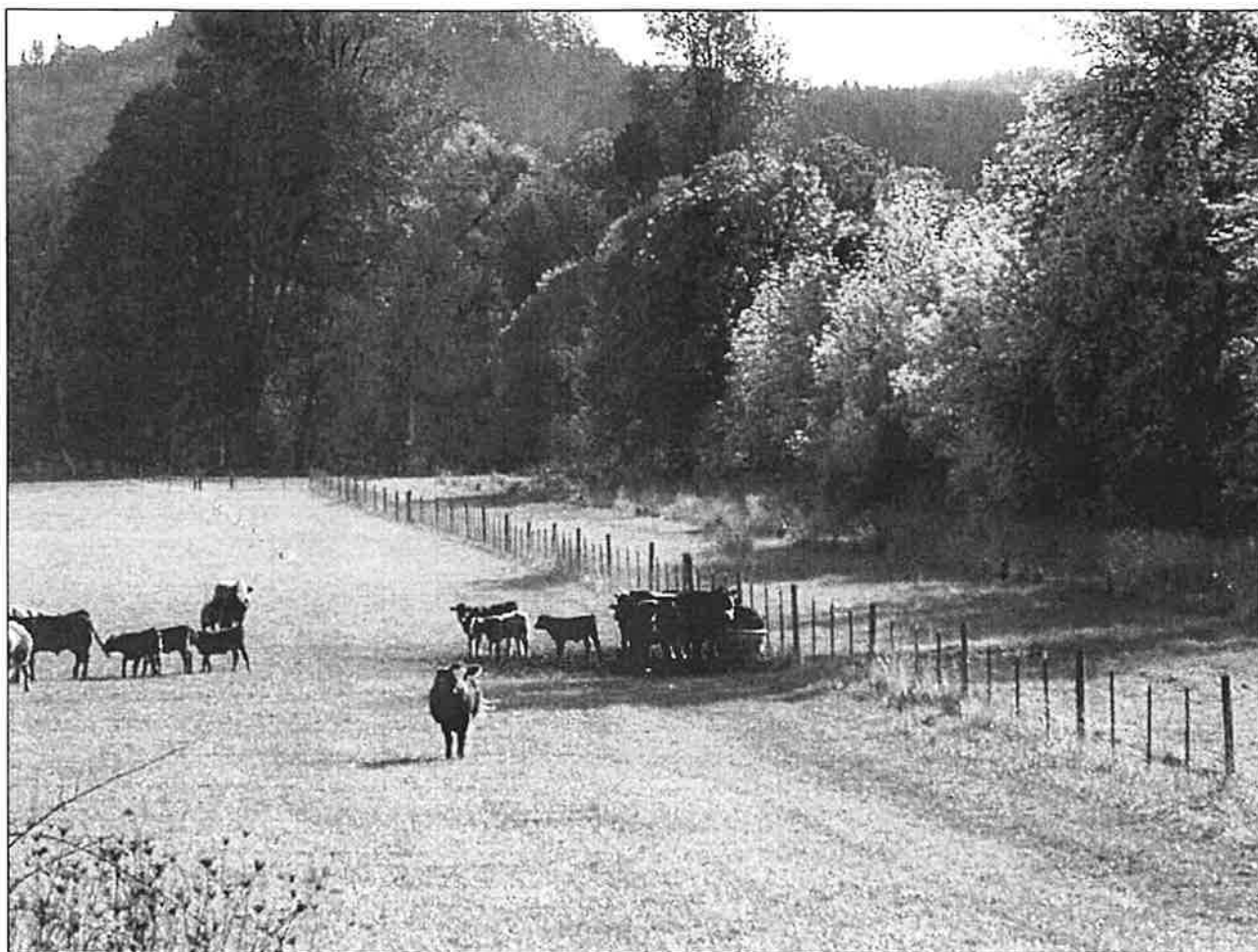
Steps 4–6. Plant available nutrients and their values.

Instructions

These steps show plant-available N, P, and K provided at the selected manure application rate. You can enter local values for cost of nutrients from commercial fertilizer to get an estimate of the value of manure nutrients. Because manure is an excellent source of P and K, it has the greatest value when applied to soils that test “low” or “medium” in plant-available P and K. If your soil test values are “high” or “excess,” adding additional P or K will not have economic benefit.

Example input data

	Example	Your information
Nutrient	Nutrient price (\$/lb nutrient)	Nutrient price (\$/ lb nutrient)
Phosphate (P_2O_5)	\$0.40/lb	
Potash (K_2O)	\$0.24/lb	
Nitrogen (N)	\$0.50/lb	



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).

Step 1. Enter manure data

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

Kind of manure

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	Example
Application rate selected	20	20,000 gallons

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 =	6	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 =	4	80
20	4	80
From manure analysis (this year):		
4 lb organic N/1000 gal		

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

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 9 lb/1000 gal =	9	225	
	25		225	
2 years ago	15,000 gal x 5 lb/1000 gal =	5	75	
	15		75	
3 years ago	10,000 gal x 7 lb/1000 gal =	7	70	
	10		70	
4 to 9 years ago	15,000 gal x 6 lb/1000 gal =	6	90	
	15		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				

Note: We recommend turning off the following options in Acrobat Reader:

- Show border hover color for fields
- Auto-calculate

To turn off these options, choose Preferences from the

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

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

Instructions: Consult Tables 1 and 2, and choose appropriate values for manure $\text{NH}_4\text{-N}$ retained and organic-N mineralized.

PAN (from $\text{NH}_4\text{-N}$)			PAN (from organic N applied this year)			PAN (from residual organic N)		
$\text{NH}_4\text{-N}$ applied (lb/acre)	Fraction retained (Table 1)	PAN (lb/acre)	Organic N applied (lb/acre)	Fraction mineralized to PAN (Table 2)	PAN (lb/acre)	Year	Organic N residual (lb/acre)	Fraction mineralized to PAN (Table 2)
120	0.55	66	80	0.4	32	1 year ago	225	0.15
120	0.55	66	80	0.40	32	2 years ago	75	0.07
Surface applied not incorporated			Thin dairy slurry			3 years ago	70	0.03
						4 to 9 years ago	90	0.12
						4 to 9 years ago: manure applied annually	90	0.12
						Years 4 to 9, fraction mineralized = $0.02/\text{year} \times 6 \text{ years} = 0.12$		

Step 4. Sum plant-available N (PAN) supplied by manure application

(PAN from this year + PAN from residual manure organic N)

PAN from $\text{NH}_4\text{-N}$ (lb/acre)	PAN from this year's organic-N (lb/acre)	PAN from residual organic N (lb/acre)	Total PAN (lb/acre)
66	32	52	150

Step 5. Phosphate (P_2O_5) and potash (K_2O) supplied by this year's manure application, and its fertilizer value

Instructions: Enter local \$ value for phosphate (P_2O_5) and potash (K_2O).

Note: Manure P and K have value when soil test values are "low" or "medium." When P and K soil test values are "high" or "excess," value of P and K is zero or negative.

Phosphate (P_2O_5)				Potash (K_2O)			
Manure rate (lb/acre)	P_2O_5 analysis (lb/unit)	P_2O_5 applied (lb/acre)	Phosphate fertilizer price (\$/lb P_2O_5)	Manure rate (lb/acre)	K_2O analysis (lb/unit)	K_2O applied (lb/acre)	Potash fertilizer price (\$/lb K_2O)
20,000 gal x 7 lb/1000 gal = 140	7	140	\$0.40	20,000 gal x 16 lb/1000 gal = 320	16	320	\$0.24
20			\$56	20			\$77
			\$0.40				
			\$56				

Step 6. Estimated fate of this year's manure N, and its fertilizer value

Instructions: Enter local \$ value for fertilizer N.

PAN this year, and its value				$\text{NH}_4\text{-N}$ lost, and its value			N stored in soil	
Total N applied (lb/acre)	PAN (lb/acre)	Nitrogen fertilizer price (\$/lb N)	Manure PAN value (\$/acre)	Manure $\text{NH}_4\text{-N}$ lost at application (lb/acre)	Fertilizer N price (\$/lb N)	Value of Manure $\text{NH}_4\text{-N}$ lost (\$)	Residual soil organic N from this year's manure (lb/acre)	
200	98	\$0.50	\$49	54	\$0.50	\$27	48	
200	98	\$0.50	\$49	54	\$0.50	\$27	48	

Management to Increase Crop N Utilization

Conserve manure $\text{NH}_4\text{-N}$ at application

Directed application methods reduce exposure of slurry to the atmosphere, which reduces ammonia loss. When properly done, directed application increases $\text{NH}_4\text{-N}$ 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

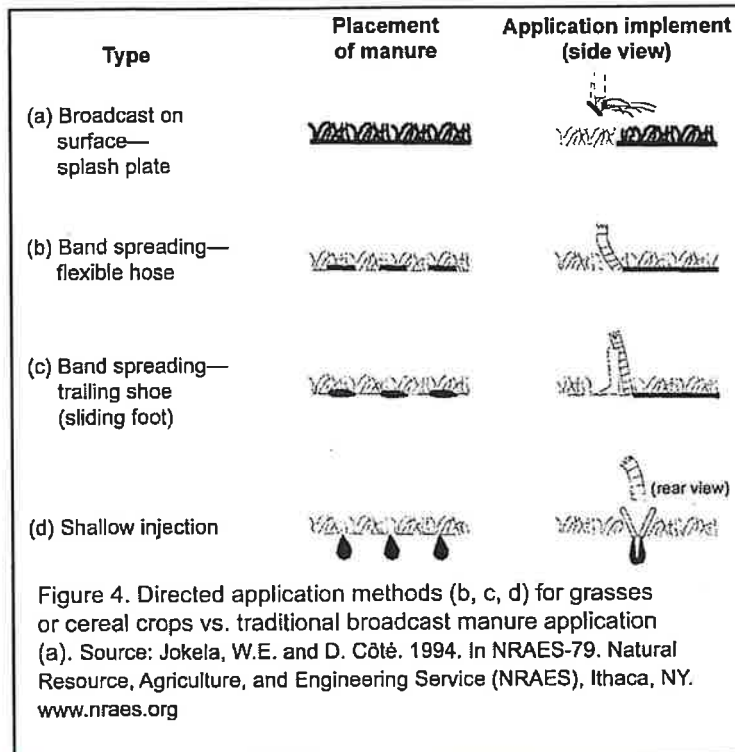
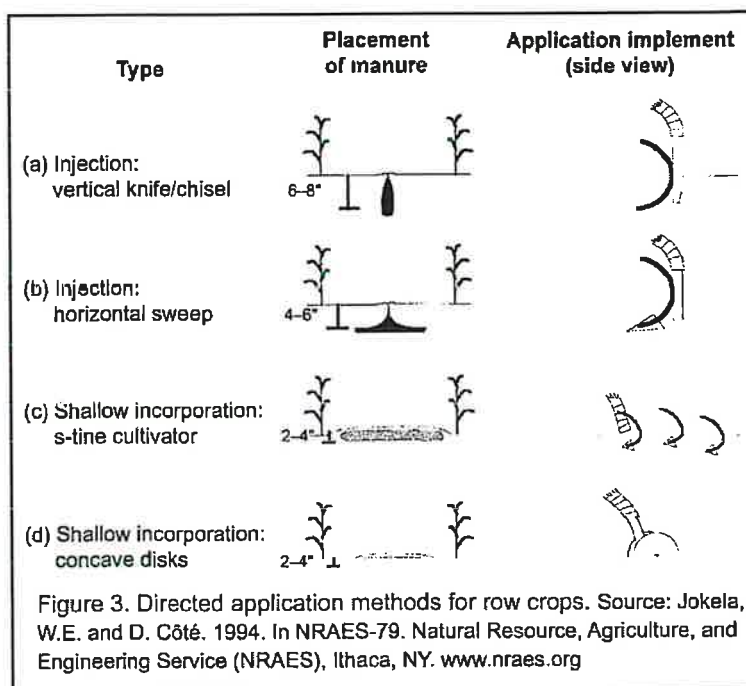
Many equipment configurations are available. Slurry is supplied to tractor-mounted application equipment through a drag hose or from a tanker. Many directed application methods are suitable for use with no-till or reduced tillage cropping systems.

Because surface banding does not completely cover slurry with soil, it does not increase $\text{NH}_4\text{-N}$ 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).



- Injection with a sweep (4 to 6 inches depth)—this kind of injection has a wider application zone (Figure 3b).
- Shallow injection (2 to 4 inches) into soil, followed by shallow tillage with tines or discs (Figure 3c and 3d).

Surface band application in established grass (Figure 4). Slurry is placed in a line (band) on the soil surface. For best results, surface bands need to be close together (3 to 6 inches apart) and placed under crop residues. A “sleigh foot applicator” is one type of surface banding implement that has been tested extensively in coastal British Columbia. (The “sleigh” is pulled across the soil surface like Santa in his sleigh.) The “sleigh foot” applicator is similar to a “trailing shoe” or “sliding foot” applicator (Figure 4c). A recent innovation has combined aerator tines with sleigh foot application (Bittman and Kowelenko, 2004). The aerator tines make small holes or slots that encourage rapid slurry infiltration and improve $\text{NH}_4\text{-N}$ retention.

Limitations of directed application methods include:

- More labor, fuel, equipment, and expertise are required than for broadcast surface application.
- Requires driving on the field, which may be impractical during wet spring months.
- When manure is supplied by a tanker, row length must be matched to tanker volume to avoid “driving empty.”
- Requires closely spaced bands (3 to 6 inches between bands) when application is made to grass.
- When injection slots are spaced far apart, injected slurry may move deeper than desired, or may move to the soil surface. This problem can be overcome by limiting the slurry application rate.
- If manure is supplied by a tanker, an equipment turn-around area usually is needed at the top and bottom of the field.
- Injection may increase N loss from leaching and denitrification in some situations.
- Injection slots may channel runoff, causing increased erosion.

Schedule manure applications to minimize N leaching loss

The manure application date affects the efficiency of crop uptake of PAN supplied by manure (Table 4, page 15). The PAN values estimated in the Worksheet (pages 11–12) assume that manure is applied during months when crop N utilization is “medium” to “high.” When crop utilization is “low” or “very low” (Table 4), a substantial portion of PAN is likely to be lost by leaching before it can be utilized by the crop. Crop N utilization estimates given in Table 4 assume that:

- Manure application rate is not excessive.
- Manure application does not cause significant damage to soil (compaction) or crop (smothering).

Most crops have the greatest ability to take up N before it can be lost by leaching below the root zone when manure is applied in spring or summer. Nitrate-N already present in the soil in the fall usually is sufficient to support winter cover crop establishment, so applying manure to cover crops in the fall generally is not an efficient use of manure N. However, winter crops often can utilize manure N applied in early spring (February–March). Crop utilization of manure PAN is lowest when manure is applied in fall to fallow ground or corn stubble.

Crop N utilization values given in Table 4 do not apply to well-composted manures or to dairy solids removed by a mechanical separator. These materials release PAN slowly and in small amounts, reducing the importance of season of application.

Although crop N utilization is “medium” for fall or winter application to grass, manure or compost application may cause excessive runoff of phosphorus or bacteria from the field. Consider contacting a crop consultant or the Natural Resources Conservation Service for help in identifying grass fields that are suitable for winter manure application.

Table 4 does not specify a method of manure application. At times of the year when crop N utilization is “medium,” “high,” or “very high,” you can gain the most benefit from manure application methods that conserve $\text{NH}_4\text{-N}$. When crop N utilization is “low” or “very low” (Table 4), changing the manure application method will **not** improve crop N utilization.

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."

Crop	Manure application date				
	March	April–June	July	August	September–February ^b
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

The Environment and N Loss from Manures—Why Do We Care?

Plant-available N (PAN) losses from the soil represent lost fertilizer value. Nitrogen can be lost as ammonia, nitrate, or nitrous oxides (Figure 1, page 3). Besides losing a valuable resource, the lost PAN can contribute to off-site problems.

Ammonia lost to the atmosphere is an air pollution problem in some areas of the western U.S., particularly in winter when atmospheric inversions prevent air mixing. In the atmosphere, ammonia can react with dust and other compounds to reduce visibility and to acidify rain or fog. Ammonia emissions may contribute to:

- Human health problems (inhalation hazard)
- Changes in natural plant communities in forests and rangeland. (Nitrogen deposited in N-poor ecosystems can alter the balance between adapted species and N-loving invasive species.)
- Acid fog or rain damage to limestone buildings or cultural artifacts (for example, petroglyphs on limestone)
- Reduction in visibility (haze)

Nitrate moves with soil water. Nitrate lost from soil enriches groundwater or surface water and can contribute to:

- Human health problems (blue baby syndrome, elevated cancer risk)
- Algae blooms in lakes or other slow-moving bodies of water
- Reduced survival and reproduction of some amphibians

Nitrous oxides lost to the atmosphere through denitrification can contribute to:

- Human health problems (inhalation hazard)
- Global warming (A molecule of nitrous oxide (N_2O) traps approximately 300 times more heat than a molecule of carbon dioxide.)
- Increased N deposits in sensitive ecosystems, resulting in soil acidification or change in plant communities
- Reduction in visibility (haze)

grass or alfalfa to a row crop, a large amount of PAN is mineralized during the first 6 months following tillage. Tillage aerates the soil and breaks up soil aggregates that protect organic N from soil biota. Lower rates of PAN addition are required for most row crops following plow-down of a perennial grass sod. When grass sod is plowed down in the fall, a substantial amount of N is lost over the winter through leaching.

Supply only a portion of crop N need from manure

One of the most efficient N management strategies for row crops is to supply only 50 to 70 percent of planned crop N need with manure. Then, side-dress with N fertilizer at midseason if needed (based on soil nitrate test results). This practice improves crop N utilization by:

- Supplying PAN when the crop needs it
- Minimizing the accumulation of PAN at the end of the growing season
- Allowing some margin for error in estimating PAN release from manure

Because less manure is applied, this practice will also reduce accumulation of manure P and K in soil. See OSU Extension publication EM 8832 (listed in "For More Information") to learn how to collect and interpret data from a midseason soil nitrate test.

Questions and Answers

Is the calculation method used for PAN in this publication different from that used in the "Organic Fertilizer Calculator"?

The Organic Fertilizer Calculator (OSU Extension publication EM 8936-E) is primarily designed to assist organic farmers who are purchasing manure or other organic fertilizers. The Calculator provides an estimate of first-season N availability, assuming all of the manure $\text{NH}_4\text{-N}$ is retained after application. The Calculator is based on a linear regression equation (generated from local research) between manure total N (organic + ammonium-N) and first-season PAN.

Because the Calculator uses a different approach to PAN estimates, the PAN values from the Calculator and from this publication are not directly comparable. PAN estimates from this publication's Worksheet and from the Organic Fertilizer Calculator are most similar for manures that contain mostly organic N.

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, $\text{NH}_4\text{-N}$ 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)

Conversion Factors

Nutrient concentrations in manure can be expressed in different units or in different chemical forms. Use the unit conversion table on the next page to convert laboratory analysis units to field application units.

Carefully examine your laboratory report to determine whether nutrient concentration is expressed on an "as-is" basis (moist manure) or on a dry matter basis (no moisture).

Table 5. Conversion factors. To convert from units in column 2 (blue) to those in column 5 (orange), multiply by the conversion factor in column 4. To convert from units in column 5 to units in column 2, divide by the conversion factor. For example, to convert P₂O₅ to P, divide by 2.29.

Measurement	Unit	Symbol	Multiply by	To obtain	Symbol
Volume	acre-inch	ac-in	27000	gallon	gal
	gallon	gal	8.35	pound	lb
Concentration	parts per million	ppm or mg/kg	0.002	pound/ton	lb/t
	parts per million	ppm or mg/L	0.00835	pound/1,000 gallon	lb/1,000 gal
	parts per million	ppm or mg/L	0.227	pound/acre-inch	lb/ac-in
	percent	%	20	pound/ton	lb/t
	percent	%	83.5	pound/1,000 gallon	lb/1,000 gal
	percent	%	2,266	pound/acre-inch	lb/ac-in
	percent	%	10,000	parts per million	ppm
	pound/1,000 gallon	lb/1000 gal	27	pound/acre-inch	lb/ac-in
Dry or wet	percent dry matter (total solids)	% DM	0.01	solids fraction	DM
	percent moisture	% moisture	0.01	moisture fraction	MF
	manure, dry wt. basis		100/(%DM)	manure, "as-is" basis	
Nutrients	phosphorus	P	2.29	phosphate	P ₂ O ₅
	potassium	K	1.20	potash	K ₂ O
	nitrogen in nitrate form	NO ₃ -N	1	nitrogen	N
	nitrogen in ammonium form	NH ₄ -N	1	nitrogen	N
	nitrogen in organic form	org-N	1	nitrogen	N

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>



Research references

The references listed below were consulted by the author in preparation of this publication. Much of the field research cited below was conducted in western Oregon, Washington, and British Columbia (the target region for this publication). Where local research was not available, best professional judgment was used to select applicable research from other regions. To determine the rationale behind existing Extension recommendations, the author also interviewed authors of state Extension publications that utilize a similar calculation method for PAN (PAN = $\text{NH}_4\text{-N}$ retained at application + organic N mineralized after application).

Extension estimates of PAN from manure

Beegle, D. 2007. Manure nutrient availability, Table 1.2-15. Factors for calculating nitrogen availability. In: *Penn State Agronomy Guide 2007-08*. <http://agguide.agronomy.psu.edu/cm/pdf/table1-2-15.pdf>

Chang A., ed. 2005. Managing Dairy Manure in the Central Valley of California. Univ. Calif. Div. of Agric. and Nat. Res. Comm. of Experts on Dairy Manure Mgmt. <http://groundwater.ucdavis.edu/Publications/uc-committee-of-experts-final-report%202006.pdf>

Jokela, B. 2004. Nutrient credits from manure. In: *Nutrient Recommendations for Field Crops in Vermont*. BR 1390, p. 11-15. University of Vermont, Burlington, VT.

Jokela, W.E. and D. Côté. 1994. Options for direct incorporation of liquid manure. In: *Liquid Manure Application Systems: Design, Management, and Environmental Assessment*. NRAES-79. p. 201-215. Northeast Reg. Agr. Engin. Serv., Cornell Univ., Ithaca, NY.

Koelsch, R. and C. Shapiro. 2006. *Determining Crop Available Nutrients from Manure*. NebGuide G1335, Univ. Nebraska, Lincoln, NE.

Meisinger, J.J. and W.E. Jokela. 2000. Ammonia volatilization from dairy and poultry manure. In: *Managing Nutrients and Pathogens from Animal Agriculture*, p. 334-354. NRAES-130, Ithaca, NY.

Sullivan, D.M. 2007. Developing extension guidance for management effects on ammonia loss: a computer simulation modeling approach. In: J. Hart, ed. *Western Nutrient Management Conf. Proc.*, Vol. 7, p. 56-61. International Plant Nutrition Institute, Brookings, SD.

Manure application method effects on $\text{NH}_4\text{-N}$ retention

Bittman, S.C., G. Kowalenko, D.E. Hunt, and O. Schmidt. 1999. Surface-banded and broadcast dairy manure effects on tall fescue yield and nitrogen uptake. *Agron J.* 91:826-833.

Bittman, S., L.J.P. Van Vliet, C.G. Kowalenko, S. McGinn, D.E. Hunt, and F. Bounaix. 2005. Surface banding liquid manure over aeration slots: a new low-disturbance method for reducing ammonia emission and improving yield of perennial grasses. *Agron J.* 97:1304-1313.

Bitzer, C.C. and J.T. Sims. 1988. Estimating the availability of nitrogen in poultry manure through laboratory and field studies. *J. Environ. Qual.* 17:47-54.

Pote, J.W., J.R. Miner, and J.R. Koelliker. 1980. Ammonia loss during sprinkler application of animal wastes. *Transactions of the ASAE*, p. 1202-1206.

Wu, J., D.L. Nofziger, J. Warren, and J. Hatley. 2003. Estimating ammonia volatilization from swine-effluent droplets in sprinkle irrigation. *Soil Sci. Soc. Am. J.* 67:1352-1360.

Estimating PAN from mineralization of manure organic N

Eghball, B. 2000. Nitrogen mineralization from field-applied beef cattle feedlot manure or compost. *Soil Sci. Soc. Am. J.* 64:2024-2030.

Gilmour, J.T., C. Cogger, L.W. Jacobs, G.K. Evanylo, and D.M. Sullivan. 2003. Decomposition and plant available N in biosolids: laboratory studies, field studies and computer simulation. *J. Environ. Qual.* 32:1498-1507.

Kusonwiriawong, C. 2005. Nitrogen mineralization from organic amendments during the second season following application. M.S. thesis, Oregon State University, Corvallis, OR.

Moberg, D., R. Johnson, and D. Sullivan. 2007. Cool season mineralization of recalcitrant organic nitrogen in undisturbed cores of manured soils. In: J. Hart, ed. *Western Nutrient Management Conf. Proc.*, Vol. 7, p. 147-152. International Plant Nutrition Institute, Brookings, SD.

Paul, J.W. and E.G. Beauchamp. 1994. Short-term nitrogen dynamics in soil amended with fresh and composted cattle manures. *Can. J. Soil Sci.* 74:147-155.

Shi, W., J.M. Norton, B.E. Miller, and M.G. Pace. 1999. Effects of aeration and moisture during windrow composting on the nitrogen fertilizer values of dairy waste composts. *Appl. Soil Ecol.* 11:17-28.

Sullivan, D.M., A.I. Bary, C.G. Cogger and E.A. Myhre. 1999. Field microplot estimates of soil N mineralization for manured and non-manured soils. p. 193-200. In: *Proc. Western Nutrient Management Conference*. Salt Lake City, UT. 4-5 Mar. 1999. Potash & Phosphate Institute, Manhattan, KS.

Van Kessel, J.S. and J.B. Reeves III. 2002. Nitrogen mineralization potential of dairy manures and its relationship to composition. *Biol. Fertil. Soils* 36:118-123.

Van Kessel, J.S., J.B. Reeves III, and J.J. Meisinger. 2000. Nitrogen and carbon mineralization of potential manure components. *J. Environ. Qual.* 29:1669-1677.

PAN from manures and composts in multiyear field studies

Bittman, S., C.G. Kowalenko, T. Forge, D.E. Hunt, F. Bounaix, and N. Patri. 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.

Sullivan, D.M., S.C. Fransen, A.I. Bary, and C.G. Cogger. 1998. Fertilizer nitrogen replacement value of food residuals composted with yard trimmings, paper, or wood wastes. *Compost Sci. Util.* 6(1):6–18.

Sullivan, D.M., S.C. Fransen, C.G. Cogger, and A.I. Bary. 1997. Biosolids and dairy manure as nitrogen sources for prairiegrass on poorly drained soil. *J. Prod. Agric.* 10:589–596.

Prediction of $\text{NH}_4\text{-N}$ retention

Søgaard, H.T., S.G. Sommer, N.J. Hutchings, J.F.M. Huijsmans, D.W. Bussink, and F. Nicholson. 2002. Ammonia volatilization from field-applied animal slurry—the ALFAM model. *Atmospheric Environ.* 36:3309–3319.

Sommer, S.G. and N.J. Hutchings. 2001. Ammonia emission from field-applied manure and its reduction—invited paper. *European J. Agron.* 15:1–15.

Denitrification in manured soils in the Pacific Northwest

Myrold, D.D. 1988. Denitrification in ryegrass and winter wheat cropping systems of western Oregon. *Soil Sci. Soc. Am. J.* 52:412–416.

Myrold, D.D., N.C. Baumeister, and J.A. Moore. 1992. Quantifying losses from land-applied dairy manures. *Oregon Water Resources Research Inst. Publ. WRR-115*, Corvallis, OR.

Paul, J.W., V. Etches, and B.J. Zebarth. 1997. Denitrification and nitrate leaching during the fall and winter following dairy cattle slurry application. *Can. J. Soil Sci.* 77:231–240.

Paul, J.W. and B.J. Zebarth. 1997. Denitrification during the growing season following dairy cattle slurry and fertilizer application for silage corn. *Can. J. Soil Sci.* 77:241–248.

Paul, J.W. and B.J. Zebarth. 1997. Increased denitrification below the root zone in the fall following a spring manure application. *Can. J. Soil Sci.* 77:249–251.

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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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The second section of this publication is designed primarily for use by conservation planners and other agricultural professionals working with farmers to implement nutrient management plans. This section is also designed for dairy operators who do their own soil sampling. This section includes detailed suggestions for the following:

- ◆ Collecting, preserving, and analyzing the soil sample
- ◆ Developing a long-term soil sampling plan

The post-harvest test and how to use it

What the post-harvest test measures

The post-harvest soil nitrate test measures the quantity of plant-available nitrogen present in the nitrate form in the surface foot of soil in the late summer or early fall. The test measures nitrate-N not utilized by the recently harvested crop. Because crops differ in their ability to remove nitrate-N from the soil, test interpretation is crop-specific.

The test looks backward in time. It evaluates the balance between N supply and crop uptake for the crops produced during the summer. Nitrate-N accumulates in the soil when more plant-available N is supplied than can be utilized by the summer crop (see "Crop and soil response to excess plant-available N," page 4).

Use the post-harvest test to:

- ◆ Get a general idea of balance between N supply from manure and other sources and crop N demand
- ◆ Identify imbalances in N supply among fields on a farm
- ◆ Identify fields that may respond to changes in timing or amount of manure application or other agronomic practices

Soil sampling protocols

Sampling depth

Sample the 0- to 12-inch depth for the post-harvest test. This shallow sampling depth is a good predictor of nitrate in the rest of the soil profile when (1) in-season irrigation is not excessive, and (2) samples are taken prior to heavy rains in the fall.

Composite soil sample

Collect a composite soil sample consisting of a mixture of 15 to 30 soil cores from each field or management unit. See "Collecting, preserving, and analyzing the soil sample" (page 9) for detailed sampling instructions and suggestions for special situations.

What fields to sample

In general, it is not necessary to sample every field on a farm every year. Consult with your farm advisor to determine any regulatory requirements for sampling frequency. We recommend that you sample selected fields that represent typical manure and crop management practices each year to track long-term trends in post-harvest soil nitrate values. See "Developing a sampling plan" (page 11) for more information.

When to sample

In general, samples for the post-harvest test should be collected as soon as possible after a crop harvest. Avoid sampling a field that has had manure application within the past 30 days.

Samples must be taken before heavy fall rains move nitrate below the 12-inch depth. Because the timing of fall rainfall is unpredictable, the best strategy is to sample fields before October 1 whenever possible.

Collect samples from medium- to fine-textured soils (loams, clay loams, and clays) prior to 5 inches of cumulative fall rainfall. Sandy soils (sand, loamy sand, or sandy loam soil texture) have lower water-holding capacities and should be sampled prior to

continues on page 5

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.

Crop and soil response to excess plant-available N

Crop response to applied N. Crop N uptake is controlled by the environment, crop N uptake potential, and management. Crops respond to plant-available nitrogen supply (ammonium + nitrate-N) by the law of diminishing returns (Figure 1). Without added N, some crop yield is produced from N supplied by soil organic matter, residual plant-available N, and other non-fertilizer sources (e.g., mineralization of crop residues). Additional N supplied from manure or fertilizer increases crop yield until site yield potential is reached.

The application rate of manure or N fertilizer needed to reach near-maximum yield is termed the *agronomic rate*. Rather than a single agronomic rate, the crop response to N is best described as an *agronomic rate range* (Figure 1). The agronomic rate range concept allows for variability in crop performance among years and for crop uptake of N beyond the yield maximum (increased protein).

Post-harvest soil nitrate test measures nitrate-N not used by the crop. At excessive plant-available N supply levels, crop yield and crop N uptake do not respond to further N additions. The extra soil N not used by the crop accumulates as nitrate-N.

Elevated post-harvest soil nitrate-N concentrations are an indicator of one or more of the following: (1) excess plant-available N, (2) N supplied too late in the season for crop utilization, or (3) poor crop growing conditions due to insect infestation, moisture/heat stress, plant disease, or other cultural problems. If crop yields are acceptable and crop protein is at typical levels, then the most likely explanation is that plant-available N was supplied in excess of crop needs.

Because grass is more efficient than corn at N uptake, target post-harvest soil nitrate levels given in this publication are lower for grass than for corn. There are two key reasons that grass is more efficient than corn in N removal.

- ◆ Grass has a greater capacity to take up N supplied in excess of that needed for maximum yield. After enough N has been supplied

for maximum yield, grass protein content increases in response to increased N supply. With grass, soil nitrate increases only when the available N supply exceeds that required to produce near-maximum protein. Corn does not take up additional N after the maximum yield is reached. Corn silage protein does not increase much in response to excess N supply.

- ◆ Grass utilizes N mineralized late in the growing season more efficiently. Grass managed for silage or hay continues to take up N until harvest. Corn grown for silage completes its N uptake approximately 4 weeks before harvest. Some of the soil nitrate measured after corn harvest is produced by mineralization of soil organic N to available forms during the final weeks of the growing season.

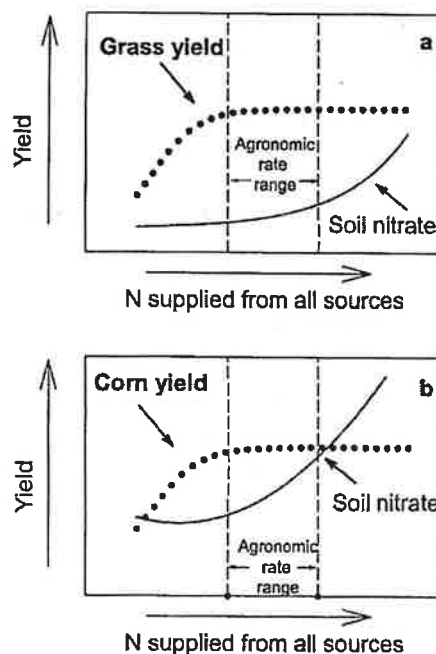


Figure 1.—Crop yield and soil nitrate response to increased N supply. Agronomic rate range = range of N supplied from all sources that results in near-maximum crop yield with acceptable post-harvest nitrate accumulation. Above the agronomic rate range, excess N accumulates as nitrate in soil. More nitrate accumulates in the agronomic rate range with corn (b) than with grass (a).

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

Cumulative rainfall after Sept. 1 (inches)	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)
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

^aAverage 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

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)

about 3.5 million pounds (3.5 lb per acre-foot = 1 ppm).

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.

Response of post-harvest soil test N to changes in management

Success in N management is indicated by long-term trends in post-harvest soil nitrate (at least 3 to 5 years). **Because of the large pool of readily mineralizable N in manured soils, fall soil nitrate values may not decline for 3 to 5 years in response to improved management.** For multiyear comparisons, sampling methods and timing must be consistent.

Some portions of a crop rotation will have higher fall nitrate values because of rapid N mineralization stimulated by tillage or incorporation of crop residues. For example, soil nitrate concentrations typically are high, regardless of overall N management, after a perennial grass sod is plowed down and reseeded.

Reductions in fall soil N are most likely to be measured when (1) commercial N fertilizer amounts are reduced or eliminated, (2) cropping systems that maximize N removal in late summer and fall (August to October) are used, and (3) manure or N application is eliminated after August 1. It is more difficult to attain post-harvest soil nitrate-N values of less than 20 ppm for corn than for grass (see "Crop and soil response to excess plant-available N," page 4).

Interpretation for individual fields

Interpretations of soil test nitrate-N should be made first at the field level. You may be able to discover a probable cause for differences in test values among fields. Questions to ask include:

- ◆ Are relationships present between known management factors (e.g., manure application rate or timing, crop yield and quality, irrigation frequency, distance to the barn) and soil test values?
- ◆ Is a large amount of variation present between fields? Is there a logical explanation for unusual values?
- ◆ Are values for grass and corn fields similar?

Annual averages across grass and corn crops

After looking at test values for individual fields, it may be useful to look at averages across all grass or corn fields. You may want to calculate averages only for fields under similar management.

Average nitrate-N test values are most useful for consideration of changes in whole farm nutrient management. Tables 3 and 4 present interpretive information separately for grass and corn fields.

If a few fields have unusual test values, you may be justified in excluding those fields from an average. Although you may want to exclude unusually high test values from the farm average, you definitely should evaluate those fields further to determine the probable cause of the high soil test values. The unusually high test values may reflect the need for management changes or may reflect a soil sampling or analytical error.

Using the interpretive tables (Tables 3 and 4)

Interpretations and management suggestions given in Tables 3 and 4 (pages 7–8) are general in nature and should serve as only one portion of a nutrient management plan evaluation. Some of the management suggestions can be implemented for individual fields, while others need to be implemented on a whole farm basis.

Remember not to focus solely on post-harvest nitrate-N in evaluating N management. Include other important aspects of N management in your evaluation, such as success in following a plan for manure application, calibration of manure application equipment, maintaining good manure application records, and effective irrigation management.

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.

^aThe 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.

Table 4.—Grass for hay or silage. Suggested interpretation for post-harvest soil nitrate-N (0- to 12-inch depth).^a

If post-harvest nitrate-N is less than 15 ppm (less than approximately 55 lb N per acre)

- ◆ Continue present N management.

If post-harvest nitrate-N is 15 to 30 ppm (approximately 55 to 105 lb N/acre)

- ◆ Apply manure earlier in the growing season.
- ◆ 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.
- ◆ Check protein levels in forage. Grass crude protein greater than 21 percent is associated with increased potential for nitrate toxicity to cows.
- ◆ Plan to reduce manure-N application by 10 to 25 percent.
- ◆ Improve whole farm nutrient balance.

If post-harvest nitrate-N is greater than 30 ppm N (greater than approximately 105 lb N/acre)

- ◆ Apply manure earlier in the growing season. Reduce manure application after August 1.
- ◆ Keep records to document crop yield, dry matter, and crop N removal. Total manure-N + fertilizer-N should be less than or equal to crop N removal. Even if calculated crop removal exceeds 400 lb N per acre, apply manure-N + fertilizer-N not to exceed 400 lb N per acre per year.
- ◆ Consider reseeding or interseeding if grass yield is limited by poor stand or undesirable species.
- ◆ Check protein levels in forage. Grass crude protein greater than 21 percent is associated with increased potential for nitrate toxicity to cows.
- ◆ Plan to reduce manure-N application by 25 to 40 percent.
- ◆ Consult experts to improve whole farm nutrient balance and reduce danger of nitrate toxicity to cows.

^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

Collect 15 to 30 soil cores from each management unit or representative sampling area with a push probe or similar tool. If you use an auger, 10 holes per management unit or zone is sufficient.

Choose sampling locations in a zigzag pattern across the field. Your general route of travel should be across rows, rather than down one row in the field. Make sure you sample within the part of the field where manure is routinely applied. For grazed pastures, choose sampling locations that have average crop growth and productive forage species.

Scrape away loose crop residues or manure present on the soil surface. Sample only the soil. Including the accumulated organic debris from the soil surface in the soil sample will increase variability in test results.

Once you are satisfied with a sampling strategy, repeat the same procedure each year. This will increase the validity of year-to-year comparisons of results.

Obtaining a representative sample from fields where manure has been injected into soil or placed in bands on the soil surface is difficult. The depth of manure injection, the width of injection zone, and the spacing between bands depend on equipment, soil, and the applicator. Some injection equipment can place manure below the 12-inch sampling depth used for the post-harvest nitrate test. Manure may be injected or banded more than one time per year, with several orientations in a field (e.g., north-south or east-west). Because of the added variability associated with manure injection or banding, plan to collect a larger number of soil cores to obtain a representative composite sample.

Sample handling

Mixing. If it is not too hard to break up the soil cores, break them, mix them all together, and homogenize thoroughly. Take a 1-cup subsample for shipment to the lab. If

the soil cores are too hard to break apart, send the entire sample to the lab, where they can pass the sample through a mechanical grinder. Check with the lab to make sure they will grind and mix the entire sample before subsampling.

Preservation. Soils kept moist and warm continue to accumulate nitrate via biological activity after sampling. The simplest way to limit biological activity is to cool the soil after collection. Put the samples in plastic bags and place them in a cooler on ice while still in the field. Refrigerate them when you return from the field. Freeze the samples if they will be held longer than 48 hours before analysis.

Shipment. Keep the samples refrigerated or frozen until you deliver them to the lab. Contact the lab before you sample, so they will be prepared to receive the samples. Use a shipping method that will get the samples to the lab within 48 hours. You may want to freeze the samples before shipping to make sure they remain cool in transit.

Working with an analytical laboratory

Choose a laboratory that has experience with agricultural samples. Ask if they participate in the North American Proficiency Testing Program or a similar quality assurance program for agricultural testing labs. Find out what extraction and analytical procedures they use. Procedures should be consistent with those recommended for the western states (Gavlak et al., 1994).

Labs may use one of several colorimetric (color-based) lab procedures or they may use an electrode method to measure nitrate. Sample comparisons have shown that the colorimetric procedures usually are more precise than the electrode method.

Some testing labs also have sampling and consulting services. This can be convenient for people who have little experience in sampling or need help with sampling.

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.

Sampling priority

Prioritize fields for fall sampling ahead of time so that you get high-priority fields sampled at an appropriate time. Highest priority should be given to representative fields used to track long-term trends. Fields with high manure application rates or elevated soil test N the previous year should also have a high priority.

Corn fields can be sampled for soil nitrate in June (PSNT, pre-sidedress nitrate test) or in the fall (post-harvest test described in this publication). You will get the most management information by sampling your high-priority representative corn fields both in June (PSNT) and after harvest. You also may want to sample fields with PSNT values greater than 45 ppm nitrate-N again in the fall.

For other corn fields where only one soil test per year is planned, we recommend using the PSNT in preference to the post-harvest soil nitrate test. The PSNT is preferred because test results are applicable to in-season N management. Growers can save money and reduce post-harvest nitrate by omitting sidedress N fertilizer application on fields where sufficient soil nitrate-N is present in June.

Sampling corn fields at PSNT time also will reduce the number of post-harvest samples that need to be collected during the short interval between harvest and the end of the fall sampling window (approximately October 15). If you miss a planned fall sampling on a corn field, consider sampling next year using the PSNT.

Grass fields are best sampled in the fall, using the protocols described in this publication. Think carefully about the best way to achieve consistent timing of sample collection for your fields. The timing of manure application and the timing of grass harvest are key variables to consider.

Samples collected shortly after manure application are not a good indicator of the

balance between N supply and crop N demand over the entire growing season. If manure is applied late in the year, postpone soil sampling until after a fall grass harvest. Wait at least 30 days after a late-season manure application before sampling. Sampling need *not* be postponed until after the last manure application or until after the last grass harvest in the fall.

Questions and answers

Why is it difficult to achieve post-harvest nitrate-N less than 15 to 20 ppm with organic sources such as manure?

First, the timing and rate of application for organic sources is less flexible than for fertilizer N. Second, environmental processes that control the quantity and timing of N availability from organic sources are difficult to manage. The biggest factors controlling N availability are soil temperature and moisture. The timing of crop N uptake usually does not match the timing of N supplied from manure and other organic sources. Soil temperature and moisture often support continued release of available N after crop N uptake is complete.

Is there a relationship between soil organic matter content and potential N mineralization?

Research west of the Cascades has demonstrated a lack of correlation between soil organic matter content and N mineralization potential for soils having 3 to 8 percent organic matter. The active fraction of soil organic matter that controls annual N mineralization rates is a small proportion of total organic matter (usually less than 10 percent of total). Recent site management affects soil N mineralization potential; it does not have much effect on soil organic matter content. Because most soil total N is contained in soil organic matter, soil total N is also an unreliable indicator of mineralization potential.

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 ($\text{ppm} \times 3.5 = \text{lb/acre}$). 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

utilization of nutrients on the farm, and nutrient losses to air and water.

The Livestock and Poultry Environmental Stewardship (LPES) Curriculum, available through the Midwest Plan Service, includes a Web presentation of whole farm nutrient management principles and a worksheet for evaluating whole farm nutrient balance. See "For more information" (page 15) for details.

What is the role of post-harvest nitrate testing in connection with Comprehensive Nutrient Management Plans (CNMPs)?

CNMPs, developed by the Natural Resources Conservation Service (NRCS) or other nutrient management professionals under NRCS supervision, are broader than just nutrient management. Other components of a CNMP are: (1) manure and wastewater handling and storage, (2) land treatment practices, (3) record-keeping, (4) feed management, and (5) other waste utilization options.

Post-harvest nitrate test values may be used as part of a process to develop a new CNMP or to update an existing CNMP. The CNMP typically includes a plan for regular

soil testing. Appropriate timing of the post-harvest nitrate test is critical (see "When to sample," page 2), while soil samples for P and K analysis may be collected any time of the year. Soil samples collected for the post-harvest nitrate test can be analyzed by routine agronomic soil testing procedures and used in developing plans for P and K utilization in a CNMP.

What are the implications of high nitrate concentrations in forages?

Nitrate in ensiled forages can interfere with normal fermentation processes, resulting in poor-quality forage. Forage nitrate affects the distribution of nitrogen compounds in silage. It is difficult to use the silage to formulate rations that meet cow needs for specific protein fractions. Enough nitrate is sometimes present in the silage itself to create a health risk to the animal. Grass silage that is greater than 21 percent crude protein should be tested for the level of nitrate-N. See Johnson et al. (2002) for interpretation of forage nitrate concentrations.

For more information

OSU Extension Service publications

Hart, J. 2002. A List of Analytical Laboratories Serving Oregon, EM 8677.

Marx, E.S., J. Hart, and R.G. Stevens. 1996. Soil Test Interpretation Guide, EC 1478.

Marx, E.S., N.W. Christensen, J. Hart, M. Gangwer, C.G. Cogger, and A.I. Bary. 1996. The Pre-sidedress Soil Nitrate Test (PSNT) for Western Oregon and Western Washington, EM 8650.

Sullivan, D.M., C.G. Cogger, and A.I. Bary. 1997. Which Test Is Best? Customizing Dairy Manure Nutrient Testing, PNW 505.

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

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).

WSU Cooperative Extension publications

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

Daniels, C.H. 2002. Analytical Laboratories and Consultants Serving Agriculture in the Pacific Northwest, EB1578E.

Visit the WSU Cooperative Extension publications Web site at <http://pubs.wsu.edu>

Other resources

Gavlak, R.G., D.A. Horneck, and R.O. Miller. 1994. Plant, Soil and Water Reference Methods for the Western Region, WREP 125 (University of Alaska-Fairbanks).

Johnson, L., J. Harrison, F. Hoisington, and M. Bueler. 2002. Nitrate levels in grass silage. Washington State Dairy News 11(2). Available at: <http://www.puyallup.wsu.edu/dairy/>. Verified 1 August 2002.

Mahler, R.L. and T.A. Tindall. 1994. Soil Sampling, Bulletin 704 (University of Idaho Cooperative Extension System, Moscow, ID).

Midwest Plan Service. Livestock and Poultry Environmental Stewardship (LPES) Curriculum. Available at: <http://www.lpes.org/>. Verified 14 January 2002.

North American Proficiency Testing Program. Standard Reference Soil Samples (Soil Science Society of America, 677 S. Segoe Rd., Madison, WI 53711; phone: 608-273-8080; Web: <http://www.soils.org>).

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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.

Ammonium-nitrogen ($\text{NH}_4^+\text{-N}$)

Ammonium-nitrogen does not accumulate in the soil, as soil temperature and moisture conditions suitable for plant growth also are ideal for conversion of $\text{NH}_4^+\text{-N}$ to $\text{NO}_3^-\text{-N}$. Ammonium-nitrogen concentrations of 2–10 ppm are typical. Soil $\text{NH}_4^+\text{-N}$ levels above 10 ppm may occur in cold or extremely wet soils, or if the soil contains fertilizer residue.

Nitrate-nitrogen ($\text{NO}_3^-\text{-N}$)

West of the Cascades. Soil nitrate-nitrogen measurements are most useful as a post-harvest “report card” to evaluate N management. Nitrate remaining in the soil after harvest can leach during winter rains, contaminating surface and groundwater. If residual nitrate levels are consistently high, reduce fertilizer N inputs in future growing seasons.

Table 1.—Residual soil nitrate-nitrogen for evaluating N management.

	$\text{NO}_3^-\text{-N}$ in surface foot (ppm)*
low	<10
medium	10–20
high	20–30
excessive	>30

*See Table 13 (page 7) for conversion of ppm to lb/acre.

Mid-season measurement of soil nitrate is used for field corn production. See EM 8650, *The Pre-sidedress Soil Nitrate Test (PSNT) for Western Oregon and Western Washington*, for more information.

East of the Cascades. In arid regions, soil nitrate ($\text{NO}_3^-\text{-N}$) is evaluated by measuring $\text{NO}_3^-\text{-N}$ to the expected rooting depth of the crop to be grown. If test results are reported in ppm, convert to lb/acre using Table 13 (page 7). Then subtract the soil nitrate from the crop requirement to determine a fertilizer rate.

Failure to account for $\text{NO}_3^-\text{-N}$ in the soil can lead to over-application of nitrogen fertilizers. Also, irrigation water should be analyzed for $\text{NO}_3^-\text{-N}$ content, and fertilizer rates reduced accordingly. Proper irrigation increases N use efficiency and reduces nitrate leaching.

Total nitrogen

Total nitrogen analysis measures N in all organic and inorganic forms. Total nitrogen does *not* indicate plant-available N, and is not included in standard soil testing programs.

A typical agricultural soil in the Willamette Valley contains about 0.10 to 0.15 percent N, or approximately 5,000 lb N/acre in the surface foot. Only 1 to 4 percent of this total N becomes plant-available during a growing season. East of the Cascades, soils tend to have smaller amounts of total N.

Total N analysis, while not recommended as part of a standard soil testing program, may be better than organic matter analysis for estimating soil N supplying capability.

Phosphorus (P)

The Bray P1 (for acid soils) and the Olsen sodium bicarbonate (NaHCO_3) (for alkaline soils) tests estimate plant-available phosphorus. Soil testing laboratories also use several other extraction methods. For interpretation of results from other extraction methods, contact the laboratory that performed the analysis.

Phosphorus soil tests are an index of P availability. The test values cannot be used to calculate available lb P_2O_5 /acre.

When sampling soil, you must be aware of previous P management. Phosphorus is relatively immobile in soil. If phosphorus has been applied in a fertilizer band, concentrations of P may persist where the band was placed. Avoid fertilizer bands when collecting soil samples.

Table 2.—Phosphorus soil test.

	West of Cascades (Bray P1 test) ppm P	East of Cascades (Olsen test) ppm P
low	<20	<10
medium	20–40	10–20
high	40–100	20–40
excessive	>100	>40

The phosphorus application rate necessary to correct P deficiencies varies depending on soil properties. Phosphorus availability decreases in cool, wet soils. In many situations, banded phosphorus applications are more effective than broadcast applications.

Phosphorus applications generally are not recommended if tests are high or excessive. High soil phosphorus combined with surface runoff can cause excessive growth of plants and algae in surface waters, damaging aquatic ecosystems.

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 ($\text{SO}_4^{2-}\text{-S}$)

Plants absorb sulfur in the sulfate ($\text{SO}_4^{2-}\text{-S}$) 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.

	$\text{SO}_4^{2-}\text{-S}$ (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.

Boron (B)

Crops such as alfalfa, table beets, brassicas, caneberries, and root crops have responded to boron fertilization on B-deficient soils in western Oregon. Tree fruits and alfalfa are examples of crops sensitive to low boron levels east of the Cascades.

While low levels of boron may limit plant growth, high concentrations can be toxic. When applying boron, apply uniformly and mix thoroughly with the soil.

Table 7.—Boron by the hot water extraction method.*

	B (ppm)
low	<0.5
medium	0.5–2
high	>2

*The hot water extraction method for boron may result in incorrectly high values on soils with high organic matter content.

Zinc (Zn)

Zinc values above 1.0 ppm using the DTPA extraction method are sufficient. Zinc deficiencies have been identified in some crops in certain regions. Corn, beans, grapes, hops, onions, and deciduous fruit trees are especially sensitive to low levels of available zinc. Deficiencies sometimes are associated with high soil P concentrations, soils high in fine clay and silt, or soils with high pH.

Copper (Cu)

Copper values above 0.6 ppm using the DTPA extraction method are sufficient. Copper deficiencies are uncommon. Deficiencies have been identified on muck soils such as those in the Klamath area in Oregon and the Colville area in Washington.

Manganese (Mn)

Manganese values above 1.5 ppm using the DTPA extraction method are sufficient. Manganese deficiencies generally occur only in soils with pH 7.0 or above. Manganese toxicity may occur on acid soils. On alkaline soils east of the Cascades, Mn availability may increase in acidified microzones where fertilizers have been placed. These acidified microzones can alleviate Mn deficiencies sometimes encountered on high pH soils. In some instances, however, acidic microzones can result in Mn toxicity.

Iron (Fe)

Soil testing for iron is not recommended. Most test methods do not discern between forms of iron, and therefore have little meaning for plant nutrition.

Iron deficiencies are uncommon on acid soils in the Pacific Northwest. Where deficiencies occur, they often are associated with acid soil plants, such as azaleas or rhododendrons, growing on soils with unsuitably high pH. Acidifying fertilizers such as ammonium sulfate will help correct problems.

Iron applications on alkaline soils are inefficient unless a chelated form is used. Lowering soil pH to increase iron availability on a field scale is not economical. However, adding acidifying materials such as elemental sulfur to fertilizer mixes can acidify microzones around the fertilizer material and increase Fe availability.

Foliar applications of Fe sometimes are used to correct deficiencies in fruit, turf, and other high-value crops.

Molybdenum (Mo)

Soil Mo concentrations are too low for most labs to evaluate. Molybdenum deficiencies are rare, and are of concern mostly for leguminous crops. Molybdenum-deficient legumes appear chlorotic. Liming to raise soil pH may alleviate deficiencies. Molybdenum-coated seed also can be used.

Excessive molybdenum in forage can harm animal health. If you suspect excessive molybdenum in your forage, determine Mo content by forage analysis.

Chloride (Cl)

Soil testing for chloride is not a common practice, and little data exists for interpretation of test results. Evidence indicates that wheat sometimes benefits from chloride applications. The values in Table 8 are based on wheat research in Montana and South Dakota. Little information exists on chloride soil testing in Washington and Oregon.

Table 8.—Chloride soil test ranges for wheat in Montana and South Dakota, 2-foot sampling depth.

	ppm	lb/acre
low	0–4	0–32
medium	4–8	32–64
high	>8	>64

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 ft ²)
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.

Sodium (Na)

Sodium is not a plant nutrient and therefore is not necessary for plant growth. High levels of sodium are detrimental to soil tilth and plant growth.

Sodium levels are evaluated based on Exchangeable Sodium Percentage (ESP). The ESP is the percent of the cation exchange capacity (CEC) occupied by Na.

ESP values above 10 percent are of concern. Excessive sodium levels can occur naturally or can result from irrigation with high-sodium water. Reclamation involves establishment of drainage followed by gypsum application and leaching with low-sodium water.

Soluble salts (SS)

Soluble salt problems usually are associated with arid regions such as eastern Oregon and Washington. Soils with high levels of soluble salts are called saline soils. Soils high in sodium are called sodic soils (see "Sodium"). Saline-sodic soils are high in both soluble salts and sodium. Soluble salts are measured by electrical conductivity (EC) of a saturated paste soil extract.

Table 12.—Soluble salts.

	Conductivity (mmhos/cm*)	ppm salt**
low	<1.0	<640
medium	1.0–2.0	640–1,280
high	>2.0	>1,280

*mmhos/cm is equivalent to decisiemen/m.

**Multiply mmhos/cm by 640 to estimate ppm salt.

Because salts move readily with water, salt problems often are transient. Salt toxicity can occur, and salts may leach before soil is tested. Low salt values, therefore, do not always rule out salt toxicity as a cause of problems.

Salt tolerance varies greatly among plant species. Seedlings are especially sensitive to high salt concentrations. Excessive salts may inhibit seed germination. Excessive fertilization and poor irrigation water quality are sources of salts.

Organic matter

Maintenance of soil organic matter is one of the most important goals of soil management. Accurate measurement of soil organic matter is difficult.

Many laboratory methods are used. Most methods are indirect; they measure soil carbon and make an assumption about the percent carbon content of organic matter. The Walkley-Black method is common and gives consistent results. The loss on ignition method can give inconsistent results and tends to overestimate organic matter.

When estimating potential nitrogen release of a soil, total N testing is preferred to organic matter determination. Neither approach provides accurate estimates of soil N availability. If you are monitoring changes in organic matter over time, use the same lab for all analyses.

Cation exchange capacity (CEC)

CEC is a measure of a soil's capacity to retain and release elements such as K, Ca, Mg, and Na. Soils with high clay or organic matter content tend to have a high CEC. Sandy soils have a low CEC. Soil CEC is relatively constant over time, so there is no need for repeated analyses.

CEC often is determined by the ammonium acetate (NH_4OAc) or sodium acetate (NaOAc) methods. While these methods are standard in many regions, there are potential sources of error. Errors are most likely to occur for soils containing appreciable amounts of CaCO_3 or gypsum.

Some labs estimate CEC based on soil texture, organic matter content, cations, and pH. Such estimates often are inaccurate. The "sum of bases" method for calculating CEC of alkaline soils can give inaccurate results, especially if there are significant amounts of free CaCO_3 .

CEC determination can be important for predicting behavior of pesticides and other chemicals in soils.

Base saturation

Base saturation is the percentage of the CEC that is occupied by cations other than hydrogen (H) and aluminum (Al). Soils with low base saturation generally are acidic. Base saturation and pH increase together.

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¢

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Table 13.—Conversions.

To convert column 1 into column 2, <i>divide</i> by	Column 1	Column 2	To convert column 2 into column 1, <i>multiply</i> 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.



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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 ($\text{NH}_4\text{-N}$), 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*.

Determining manure application rate

Your goal is to match manure nutrient application rates with crop removal rates. Table 1 and Figures 1 and 2 provide the information you need to determine nutrient removal for many annual and perennial crops. Instructions for using the table and figures follow.

1. In Table 1, find the crop you will grow. Let's assume it's perennial ryegrass. The table is arranged to help you separate different levels of intensity. For example, low-intensity harvesting might be only one or two cuttings per year, medium will be three to five cuttings, and high intensity is six to seven cuttings per year.
2. For our example, let's assume you harvest four times a year, and your ryegrass averages 15 percent protein. That is equivalent to 48 lb of nitrogen per ton of dry matter, yielding around 5 tons of dry matter (240 lb N) per year.
3. You need to replace 240 lb N/a/year from the four cuttings. This is equivalent to 60 lb/a of nitrogen per cutting.
4. Find the figure below (Figure 1 or 2) that represents the type of manure you want to apply. Let's assume you want to apply lagoon effluent, so you'll use Figure 2.

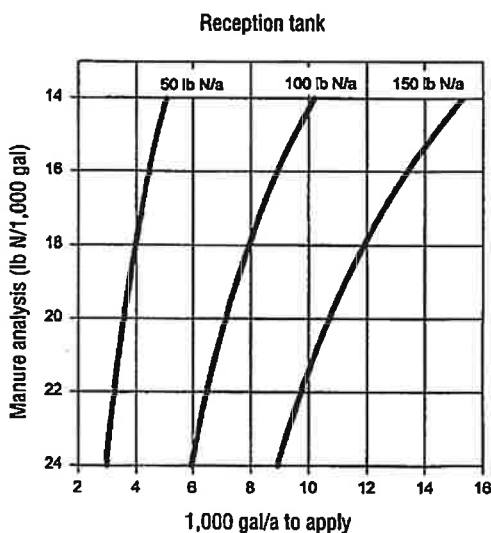


Figure 1.—Determining application rate for reception tank manure.

Note: For reception-tank manure, approximately 70 percent of the total N is considered available. For lagoon effluent, 100 percent of the total N is considered available.

5. Figure 2 contains three lines representing N application rates of 50, 100, and 150 lb N/a. Find the line closest to the rate you need to apply. In this example, you'll use the line for 50 lb/a.
6. Select the manure analysis from your dairy for nitrogen on the left side of the graph. Assume a manure test shows that the effluent contains 6 lb/1,000 gal or 750 ppm N. Move to the right across the graph until you meet the line for the application rate you have chosen (50 lb N/a).
7. Now move straight down to the line labeled "effluent acre-inches to apply" and estimate the number of acre-inches of effluent to apply (in this case, about 0.3 acre-inch). Remember that you will need about 20 percent more nitrogen because no line exists for 60 lb N/a. Your final result will be about 0.4 acre-inch.

Testing your soil for P and K

Test your soil for phosphorus (P) and potassium (K) before applying manure. Table 2 (back page) provides interpretations of P and K soil tests.

If you've applied manure for more than 5 years, additions of P and K usually are not needed. For example, potassium usually is not deficient in soils

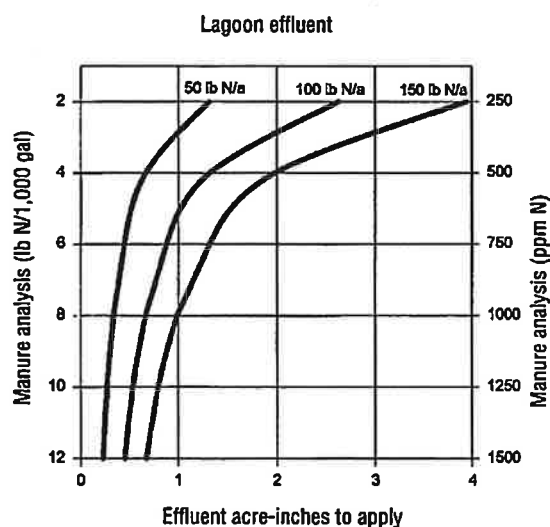


Figure 2.—Determining application rate for lagoon effluent.

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

¹DM=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.

Table 2.—Interpretation of soil tests for P and K.

Soil status	Nutrient (ppm)	
	Phosphorus (P)	Potassium (K)
Deficient	below 25	below 150
Sufficient	25–50	150–500
High	50–75	500–1,000
Excess	above 75	above 1,000

For more information, see *The Presidedress Soil Nitrate Test* (EM 8650) and *Post-harvest Soil Nitrate Testing for Manured Cropping Systems West of the Cascades* (EM 8832).

For more information

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Pirelli, G., J. Hart, S. Filley, A. Peters, M. Porath, T. Downing, M. Bohle, and J. Carr. *Early Spring Forage Production for Western Oregon Pastures*, EM 8852-E (2004)

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

Hart, J., G. Pirelli, L. Cannon, and S. Fransen. *Pastures Fertilizer Guide*, FG 63-E (1993)

Hart, J., M. Gangwer, M. Graham, and E.S. Marx. *Dairy Manure as a Fertilizer Source*, EM 8586 (reprinted 1997)

Marx, E.S., N.W. Christensen, J. Hart, M. Gangwer, C.G. Cogger, and A.I. Bary. *The Presidedress Soil Nitrate Test*, EM 8650 (reprinted 1997)

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

Other publications

Marx, E. *Evaluation of Soil and Plant Analyses as Components of a Nitrogen Monitoring Program for Silage Corn* (Master's thesis, Oregon State University, 1995)