Animal Waste Management Plan

July 2005

MAH171338
Plan# 05079
Due 8/20/2005

RiMar Farms, Inc.

Operated by:

Rick Sheelar
48532 NW Oppenlander Lane
Forest Grove, Oregon 97116

Operation:

2180 NW Stringtown Road
Forest Grove, Oregon 97116

Dairy
Medium Federal CAFO

As owner and operator of **RiMar Farms Inc.,** I intend to manage in accordance with the practices described in this Animal Waste Management Plan.

Signature _____ Date _____

Animal Waste Management Plan

April 2005

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Signature Rick Sheelar Date 6-28-05

GENERAL NARRATIVE DESCRIPTION

RiMar Farms Inc. is located at **2180 NW Stringtown Road, Oregon** and is owned by **Rick Sheelar**. The operation is a dairy facility in Washington County. The facility is in full operation year round. The dairy is located on 850 acres in Forest Grove, Oregon. The Holstein herd is composed of 260 milking cows, 45 dry, 185 heifers, and 120 calves. The milk cows are milked 2 times a day and average 70 lbs per animal. All animals are confined year round.

The dairy is made up of two production areas on the same farm. The first production area is the location for the 120 calves up to a year and the dry and milk cows. The second production area is the location for the 185 heifers. Production area 1 utilizes a recycle flush system and a scrape system for the dairy cows and baby calves. Flush water and scraped manure is collected in a 40,000-gallon collection tank between the feed barns and the freestall barns. From the collection tank the effluent travels over a side hill drag chain separator. The liquid from the separator flows to the 21.8-acre foot lagoon space and the solids remain on the pad until they can be spread. The remaining calf barn and dry cow barn in production area 1 is dry packed straw that is scraped and handled solid. All manures removed are either stored on the solids pad or spread as weather allows.

The second production area utilizes a dry scrape system in all of its barns. All manure is stored as dry packed straw until it can be removed and spread on crop ground. The confinement area is utilized as a solid manure storage facility that handles at the most 66,000 cubic feet of material.

RiMar Farms Inc. has access to 845 owned acres to distribute manures to. Bedding materials consist of loose straw, paper pulp, and shavings. The cropping system takes into account the entire 845 acres and includes field corn, spring wheat, crimson clover seed, winter wheat, red clover seed, tall fescue seed, and sweet corn. Only two lines of old clay tiles are present on the farm. Prickett Creek runs east to west across the N end of the dairy and north to south along the east end of the dairy. There will be at least a 35-foot vegetative buffer during the growing season and a 100-foot vegetative buffer during the winter months between any manure application and surface water.

Manure Storage and Application

Production area 1 – Manure from all but one of the calf barns is flushed with recycled water or scraped into a 40,000-gallon below ground liquid tank (BGLT) and pumped over a static inclined drag chain separator. All liquid from the separator is pumped into 21.8 total acre-feet of lagoon space. The lagoon space is made up of two cells, the newest is 10.3 acres and the oldest is 11.5 acres (approximately). Solids from the separator are stored on a 11,250 cubic foot concrete pad with approximately 40 days of solid storage and the lagoon space provides approximately 137 days of liquid storage. The remaining calf barn and dry cow barn is dry packed straw. If application of manure is not possible the manure is stored within the barns as dry pack until it can be spread, approximately 33,000-cubic feet of solids storage is available as dry pack.

Production area 2 – All manure on site is handled dry. If application of manure is not possible the manure is stored within the barns as dry pack until it can be spread. Approximately 66,000 cubic feet of solids storage is available as dry pack. One hundred-sixty to 190 heifers (12-24 months) are housed on site.

Silage bunkers are located across the road from production area 2. Uncovered silage bunker area equals 20,780 square feet. All liquids drain to a collection pit and through a 6" PVC line across Gales Creek Hwy and into a 1.95 acre-foot lined leachate pond. The inflow of liquids in to the pond is surpassed by the evaporation rate. Pumping has not been necessary yet, but the operators monitor the levels throughout the year.

Manure is applied to the acreage via the use of a solid spreader wagon and liquid "big gun" travelers. Manure will be applied to the acreage via calibrated equipment to meet the expected nutrient uptake of the crop system.

SPECIFIC DESCRIPTIONS AND CALCULATIONS

Land Application Areas

The operation manages 845 acres of its own land in which it applies liquid and solid waste to. Solid manure can be applied to all 845 acres and liquid manure is limited to 720 acres. N, S, & E Myrons and Alexanders fields cannot receive liquid manure applications. Application of manure will be done at appropriate times of the year as to utilize nutrients for maximal forage production.

All animals are confined year round. Heifers at production area 2 utilize a dry lot for exercise. The dry lot area will be scraped and reseeded to avoid manure and nutrient accumulations.

Manure and Waste Volumes

Calculated volumes of all manure and bedding have been completed using the Oregon Animal Waste Management worksheet based from the NRCS Agricultural Waste Field Handbook. The worksheet is included in this Animal Waste Management Plan.

Nutrient Content of Manure, Litter and Process Waste Water

The same worksheet was used to estimate nutrient content of manure. Annual on farm manure test results are available for customers.

Farm Nutrient Balance

Nutrient balances for manure application on the farm is also included in the Oregon Animal Waste Management worksheet.

Application Schedule and Limitations

All of the manure is applied at a time of year in which the nutrients will best be utilized. It is the dairies goal to have solid and liquid storage available at the end of fall for winter storage and to start applying in the spring. If emergency application is

necessary the operation takes care not to spread on saturated or frozen ground and leaves at least a 100' buffer beside surface waters.

Animal Mortality Management

All animal mortalities are hauled off site to be rendered.

Record Keeping

a) Applications of manure, litter and process waste will be kept, including the date and the amount of N and P applied during each application.
b) Records of exporting manure, litter and process waste will also be kept.

Reporting to the Oregon Department of Agriculture (ODA)

a) Any discharge will be reported orally to ODA within 24 hours. Within 5 days, a written statement describing this discharge will also be submitted to ODA.
b) The amount of manure, litter and process waste applied will be reported annually.
c) The amount of manure, litter and process waste exported will be reported annually.

Protocol for Sampling Manure

Solid manure compost will be sampled and tested prior to manure exports in the spring. Approximately 20 small grab samples from the manure pile will be taken to make on composite sample. After collection, the grab samples will be thoroughly mixed. About one quart of manure will be removed for nutrient analysis. The sample will be preserved for shipping to an analytical laboratory to be tested for Total Nitrogen (TKN), Ammonium Nitrogen (NH4-N), Phosphorus (P), Potassium (K) and moisture content (or dry matter).

U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version 1.8

7/6/2005
STATE OREGON

CLIENT: Rick Sheelar
ASSISTED BY: S. Harshberger CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY

Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Milk Production in Pounds/Cow/Day= 70						Manure CF/D/AU	Annual	
				Nutrient Production								
				(lbs./day/1000 lb. Animal Unit)			(lbs./day)				Days Confined	Days Grazed
				N	P	K	N	P	K			
MILKER	260	1,300	338.0	0.57	0.09	0.32	194.25	31.65	107.18	1.57	365	0
MILKER (DRY)	45	1,400	63.0	0.36	0.05	0.23	22.68	3.15	14.49	1.10	365	0
HEIFERS (12-24 Months)	185	750	138.8	0.31	0.04	0.24	43.01	5.55	33.30	1.30	365	0
CALVES (1-12 Months)	120	400	48.0	0.31	0.04	0.24	14.88	1.92	11.52	1.30	365	0
Totals/Averages-	610	963	587.8	0.47	0.07	0.28	274.8	42.3	166.5	1.4		

GRAZING PERIOD

Type of Animal	Percent of Month and Number of Animals Grazing												AU-YR.
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
MILKER	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	260	260	260	260	260	260	260	260	260	260	260	260	0
MILKER (DRY)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	45	45	45	45	45	45	45	45	45	45	45	45	0
HEIFERS (12-24 Months)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	185	185	185	185	185	185	185	185	185	185	185	185	0
CALVES (1-12 Months)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	120	120	120	120	120	120	120	120	120	120	120	120	0
													0
													0
													0
													0
													0
													0
Total AUM's Available>	99						102	102	102	101	101	101	708
Total AUM's Needed>>>	0	0	0	0	0	0	0	0	0	0	0	0	0
Total AUM's>>>>>>>>>>	99	0	0	0	0	0	102	102	102	101	101	101	708

ANIMAL WASTE MANAGEMENT WORKSHEET

Version 1.8

CLIENT: Rick Sheelar

ASSISTED BY: S. Harshberger CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION: FOREST GROVE

Month	25Yr-24Hr	4.00	Lot Runoff Factors as a Percent of Monthly Precipitation	
	Monthly Average in Inches			
	Precipitation	Evaporation	Paved	Unpaved
October	3.54	1.66	100%	15%
November	6.75	0.74	100%	20%
December	9.18	0.42	100%	20%
January	7.18	0.47	100%	20%
February	5.47	0.79	100%	20%
March	5.00	1.52	100%	15%
April	2.52	2.32	100%	15%
May	1.76	3.63	100%	10%
June	1.35	4.21	100%	10%
July	0.43	5.24	100%	0%
August	0.69	4.78	100%	10%
September	1.55	3.26	100%	15%
Annual	45.42	29.04		

AREAS CONTRIBUTING RUNOFF TO LIQUID STORAGE FACILITY

Description of Runoff Area	Area in SF
Paved Lot Area >> Is paved lot scraped daily? (Y/N) YES	20,520
Unpaved Lot Area >>>	0
Roof Area >>>	432
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>>>>>>>>>>>>>>>>	20,952

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	260.0	0	0.00	0	0.0
Equipment Wash		1	625.00	625	83.6
Flushwater		1	2500.00	2500	334.2
Miscellaneous		1	0.00	0	0.0
Total>>				3125	417.8

CROP DATA

Field Number	Acres	Crop	Condition	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre		
						Nitrogen N	Phosphorous P_2O_5	Potassium K_2O
1,8,10	100.0	Corn, Silage(AH)	As Harvested	Ton	30.00	231	120	276
2	40.0	Wheat, Spring Soft White	DHM	Bu	110.00	110	58	27
3,4,5,18	135.0	Clover for Seed	DHM	cwt	12.00	62	30	29
6,7,20,22,23,26	205.0	Wheat, Winter Soft White	DHM	Bu	120.00	120	63	29
9,13,21,24	115.0	Clover for Seed	DHM	cwt	12.00	62	30	29
11,15,25	85.0	Tall Fescue Seed	DHM	cwt	20.00	32	9	10
12,14,16,17,19	165.0	Corn, Sweet	As Harvested	Ton	10.00	178	110	140
Off-Farm								

ANIMAL WASTE MA‹ ›GEMENT WORKSHEET

V‹ ›on 1.8

CLIENT: Rick Sheelar

ASSISTED BY: S. Harshberger CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

Type of Animal	Type of Bedding Facility	Bedding Material	Unit Weight Lbs/CF	Amount Needed Lbs/Day/AU	Volume CF/Day/AU	Total Volume CF/Day	Total Weight Lbs/Day
MILKER	Free Stall	Paper Pulp	**4.00**	**11.66**	**2.92**	985	3,941
MILKER (DRY)	Free Stall	Wood Shavings	**9.00**	**6.66**	**0.74**	47	420
HEIFERS (12-24 Months)	Loose Housing	Loose Hay	**4.13**	**0.73**	**0.18**	25	101
CALVES (1-12 Months)	Loose Housing	Loose Straw	**2.50**	**15.46**	**6.18**	297	742

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	Separation Factor %	Volume of Solids Separated CF/Day	Volume of Solids in Liquids CF/Day	Volume of Manure in Liquids CF/Day	Volume of Manure in Solids CF/Day	Accumulated Sludge in Storage CF/Day	Density of Separated Solids Lbs/CF	Weight of Separated Solids Lbs/Day
MILKER	Static Inclined Screen with Drag Chain	**20%**	210	841	518	13	281	**36**	7,572
MILKER (DRY)	Dry Scrape System	**100%**	116	0	0	69	0	**36**	4,173
HEIFERS (12-24 Months)	Dry Scrape System	**100%**	205	0	0	180	0	**36**	7,376
CALVES (1-12 Months)	Static Inclined Screen with Drag Chain	**35%**	106	197	60	2	13	**36**	3,824
Total Solids>>>			637	1,039	578	265	295		22,946

U.S. D[illegible]tment of Agriculture
Natur[illegible]sources Conservation Service

ANIMAL WASTE MA[illegible]GEMENT WORKSHEET

V[illegible]on 1.8

7/6/2005
ST. [illegible] OREGON

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**
CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

Month	Runoff in Cubic Feet: Roof Area Square Feet 432	Paved Slab Area Square Feet 20,520	Unpaved Lot Area Square Feet 0	Silage Pit Surface Area, SF 0	Facility Water Use Cubic Feet	Manure Solids Cubic Feet	Manure Liquids Cubic Feet	Bedding Cubic Feet	Bedding Pounds	Solids Separated Cubic Feet	Solids Separated Pounds	Solids in Liquids Cubic Feet	Solids in Liquids Pounds	Total Solids Cubic Feet	Total Liquids Cubic Feet
October	127	6,053	0	0	12,951	10,006	16,144	41,951	161,325	19,759	711,327	32,198	1,159,130	19,759	69,257
November	243	11,543	0	0	12,533	9,684	15,624	40,597	156,121	19,122	688,381	31,159	1,121,739	19,122	73,405
December	330	15,698	0	0	12,951	10,006	16,144	41,951	161,325	19,759	711,327	32,198	1,159,130	19,759	79,104
January	258	12,278	0	0	12,951	10,006	16,144	41,951	161,325	19,759	711,327	32,198	1,159,130	19,759	75,612
February	197	9,354	0	0	11,698	9,038	14,582	37,891	145,713	17,847	642,489	29,082	1,046,956	17,847	68,257
March	180	8,550	0	0	12,951	10,006	16,144	41,951	161,325	19,759	711,327	32,198	1,159,130	19,759	71,806
April	91	4,309	0	0	12,533	9,684	15,624	40,597	156,121	19,122	688,381	31,159	1,121,739	19,122	66,019
May	63	3,010	0	0	12,951	10,006	16,144	41,951	41,951	19,759	711,327	32,198	1,159,130	19,759	66,149
June	49	2,309	0	0	12,533	9,684	15,624	40,597	156,121	19,122	688,381	31,159	1,121,739	19,122	63,977
July	15	735	0	0	12,951	10,006	16,144	41,951	161,325	19,759	711,327	32,198	1,159,130	19,759	63,827
August	25	1,180	0	0	12,951	10,006	16,144	41,951	161,325	19,759	711,327	32,198	1,159,130	19,759	64,281
September	56	2,651	0	0	12,533	9,684	15,624	40,597	156,121	19,122	688,381	31,159	1,121,739	19,122	64,326
Annual	**1,635**	**77,668**	**0**	**0**	**152,490**	**117,818**	**190,088**	**493,935**	**1,780,096**	**232,647**	**8,375,298**	**379,106**	**13,647,824**	**232,647**	**826,020**

DAILY NUTRIENT PRODUCTION

Type of Animal	Pounds/Day of Nutrients from LIQUIDS: N	P_2O_5	K_2O	Pounds/Day of Nutrients from SOLIDS: N	P_2O_5	K_2O	Pounds/Day of Nutrients from GRAZING: N	P_2O_5	K_2O
MILKER	155.40	58.00	103.32	38.85	14.50	25.83	194.25	72.50	129.15
MILKER (DRY)	0.00	0.00	0.00	22.68	7.22	17.46	22.68	7.22	17.46
HEIFERS (12-24 Months)	0.00	0.00	0.00	43.01	12.72	40.13	43.01	12.72	40.13
CALVES (1-12 Months)	9.67	2.86	9.02	5.21	1.54	4.86	14.88	4.40	13.88
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**

CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

Month	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Pounds of Nutrients going OFF-FARM			Total Pounds of Nutrients from ALL SOURCES		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
October	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
November	4,952	1,826	3,370	3,293	1,079	2,648	0	0	0	0	0	0	8,245	2,905	6,019
December	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
January	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
February	4,622	1,704	3,146	3,073	1,007	2,472	0	0	0	0	0	0	7,695	2,711	5,617
March	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
April	4,952	1,826	3,370	3,293	1,079	2,648	0	0	0	0	0	0	8,245	2,905	6,019
May	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
June	4,952	1,826	3,370	3,293	1,079	2,648	0	0	0	0	0	0	8,245	2,905	6,019
July	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
August	5,117	1,887	3,483	3,402	1,115	2,737	0	0	0	0	0	0	8,519	3,002	6,219
September	4,952	1,826	3,370	3,293	1,079	2,648	0	0	0	0	0	0	8,245	2,905	6,019
Annual	**60,251**	**22,214**	**41,006**	**40,059**	**13,130**	**32,221**	**0**	**0**	**0**	**0**	**0**	**0**	**100,310**	**35,344**	**73,227**

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**

CHECKED BY:

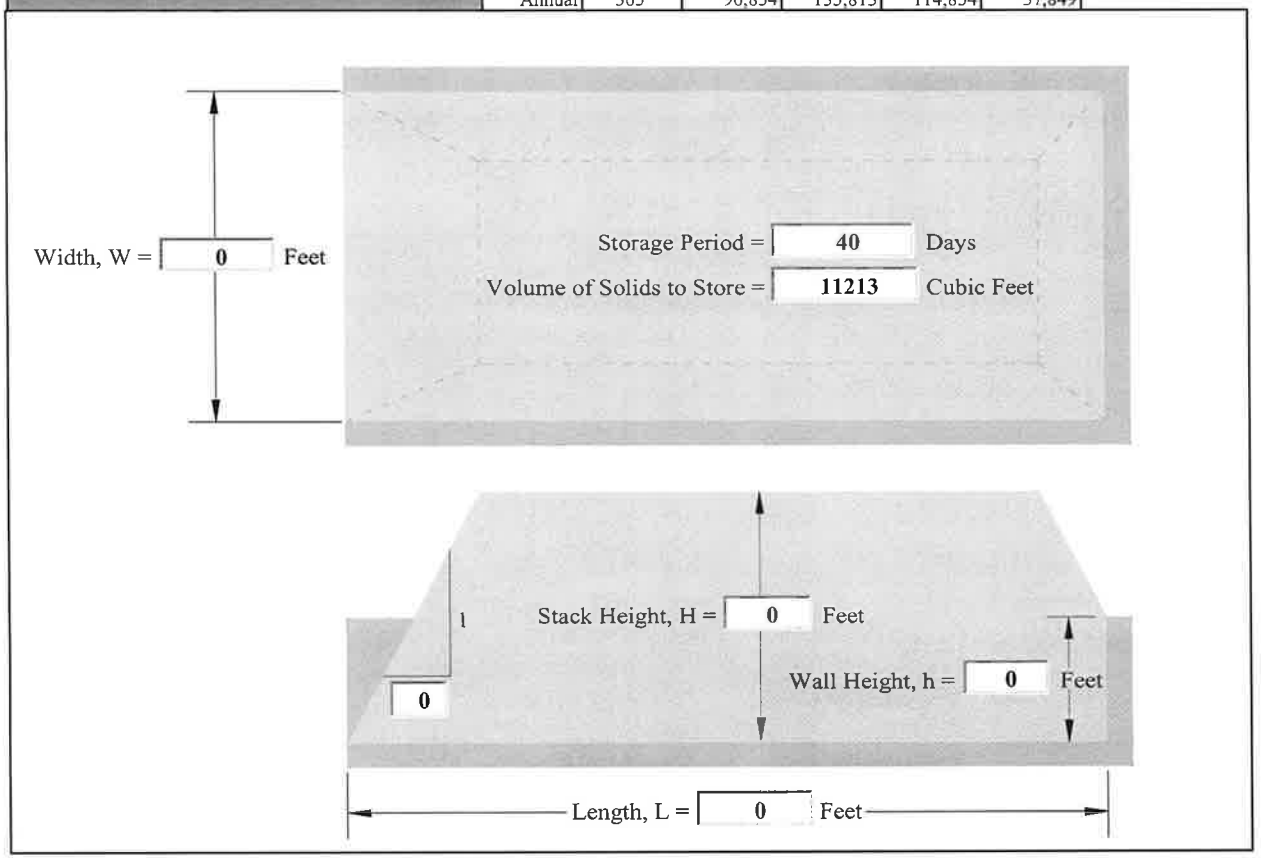
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY

Solids Storage Facility Parameters	Value
Storage Period, Days=	**40**
Stacking Width, W in Feet=	**0**
Stacking Height, H in Feet=	**0.00**
Wall Height, h in Feet=	**0.00**
Stack Side Slope (X:1)=	**0.00**
Existing Storage, Cubic Feet=	**11,250**
Surface Area of Existing Storage, SF=	**1,875**
25 Year-24 Hour Storm Runoff, CF=	**625**
Volume Needed, Cubic Feet=	**11,213**
Design Volume, Cubic Feet=	**0**
Is Facility Covered?	NO

MONTHLY SOLIDS VOLUME STACKED IN FACILITY

Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Normal Runoff CF
October	31	8224	11,535	8,410	2,572
November	30	7959	11,163	9,561	6,328
December	31	8224	11,535	9,880	8,893
January	31	8224	11,535	9,880	6,956
February	28	7428	10,419	8,923	4,786
March	31	8224	11,535	9,880	3,633
April	30	7959	11,163	9,561	1,772
May	31	8224	11,535	9,880	853
June	30	7959	11,163	9,561	633
July	31	8224	11,535	9,880	0
August	31	8224	11,535	9,880	334
September	30	7959	11,163	9,561	1,090
Annual	365	96,834	135,813	114,854	37,849



CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger** CHECKED BY:

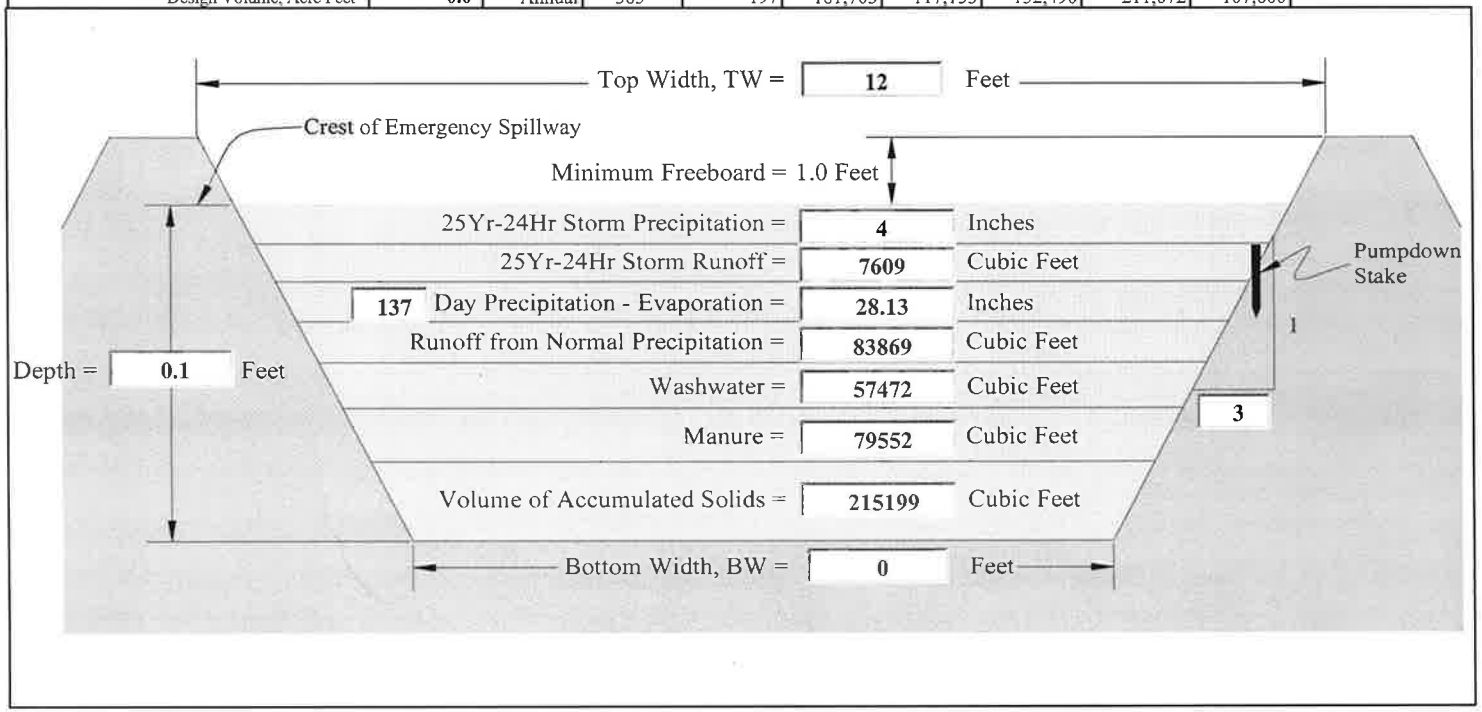
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

WASTE STORAGE POND

Pond Parameters	Value
Storage Period, Days=	**137**
Side Slope (X:1)=	**3.00**
Bottom Width, BW, Feet=	**0**
Bottom Length, BL, Feet=	**0**
Accumulated Solids Duration, Years=	**2**
Existing Storage, Acre Feet=	**21.80**
Surface Area of Existing Storage, SF=	**133,116**
Minimum Soil Liner Depth, Feet=	**1.00**
25 Year-24 Hour Storm Runoff, CF=	**7,609**
Top Width, TW, Feet=	**12**
Top Length, TL, Feet=	**12**
Volume Needed, Acre Feet=	**21.0**
Design Volume, Acre Feet=	**0.0**

MONTHLY INFLOWS INTO WASTE STORAGE POND

Month	Number of Days	Rain-Evap on Pond CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Manure CF	Accum Solids CF
October	31	23	20,855	8,753	12,951	17,927	9,139
November	30	72	66,669	18,114	12,533	17,348	8,844
December	31	105	97,175	24,921	12,951	17,927	9,139
January	31	81	74,434	19,492	12,951	17,927	9,139
February	28	56	51,915	14,337	11,698	16,192	8,254
March	31	42	38,604	12,363	12,951	17,927	9,139
April	30	2	2,219	6,172	12,533	17,348	8,844
May	31	-22	-20,744	3,925	12,951	17,927	9,139
June	30	-34	-31,726	2,990	12,533	17,348	8,844
July	31	-58	-53,357	751	12,951	17,927	9,139
August	31	-49	-45,370	1,539	12,951	17,927	9,139
September	30	-21	-18,969	3,796	12,533	17,348	8,844
Annual	365	197	181,703	117,153	152,490	211,072	107,600



U.S. De[p]tment of Agriculture
Natura[l] ources Conservation Service

ANIMAL WASTE MA[N]GEMENT WORKSHEET

V[e]n 1.8

7/6/2005
ST. OREGON

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**

CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation / Type of Storage Facility	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
	Dairy	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Anaerobic Lagoon	60,251	22,214	41,006	**30%**	**45%**	**60%**	18,075	9,996	24,604
Solids	Solids Storage Facility (Unroofed)	40,059	13,130	32,221	**65%**	**80%**	**80%**	26,038	10,504	25,777
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_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Sprinkling	18,075	9,996	24,604	**75%**	**100%**	**100%**	13,556	9,996	24,604
Solids	Broadcast (Incorporated 7 or more days after application)	26,038	10,504	25,777	**70%**	**100%**	**100%**	18,227	10,504	25,777
Grazing	Grazing	0	0	0	**90%**	**100%**	**100%**	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location: Between Coastal and Cascade Mountains / Soil Drainage Class	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Somewhat Poorly Drained	13,556	9,996	24,604	**83%**	**100%**	**100%**	11,252	9,996	24,604
Solids	Somewhat Poorly Drained	18,227	10,504	25,777	**83%**	**100%**	**100%**	15,128	10,504	25,777
Grazing	Somewhat Poorly Drained	0	0	0	**83%**	**100%**	**100%**	0	0	0

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**

CHECKED BY:

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 Percent to be Applied	LIQUIDS Pounds of Nutrients to be Applied	LIQUIDS Acres Needed for Utilization of Nutrients	SOLIDS Percent to be Applied	SOLIDS Pounds of Nutrients to be Applied	SOLIDS Acres Needed for Utilization of Nutrients	GRAZING Percent to be Applied	GRAZING Pounds of Nutrients to be Applied	GRAZING Acres Needed for Utilization of Nutrients
1,8,10	100.0	Corn, Silage(AH)	**30%**	3,376	15	**30%**	4,538	20	**0%**	0	0
2	40.0	Wheat, Spring Soft White	**10%**	1,125	10	**10%**	1,513	14	**0%**	0	0
3,4,5,18	135.0	Clover for Seed	**10%**	1,125	18	**10%**	1,513	24	**0%**	0	0
6,7,20,22,23,26	205.0	Wheat, Winter Soft White	**20%**	2,250	19	**30%**	4,538	38	**0%**	0	0
9,13,21,24	115.0	Clover for Seed	**10%**	1,125	18	**10%**	1,513	24	**0%**	0	0
11,15,25	85.0	Tall Fescue Seed	**0%**	0	0	**0%**	0	0	**0%**	0	0
12,14,16,17,19	165.0	Corn, Sweet	**20%**	2,250	13	**10%**	1,513	8	**0%**	0	0
0											
0											
Off-Farm			**0%**	0		**0%**	0		**100%**	0	
		TOTALS-	**100%**	**11,252**	**92**	**100%**	**15,128**	**128**	**100%**	**0**	**0**

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED Nitrogen, N Lbs/Acre	NUTRIENTS APPLIED Phosphorous, P_2O_5 Lbs/Acre	NUTRIENTS APPLIED Potassium, K_2O Lbs/Acre	- NUTRIENTS REMOVED Nitrogen, N Lbs/Acre	- NUTRIENTS REMOVED Phosphorous, P_2O_5 Lbs/Acre	- NUTRIENTS REMOVED Potassium, K_2O Lbs/Acre	= NUTRIENT BALANCE Nitrogen, N Lbs/Acre	= NUTRIENT BALANCE Phosphorous, P_2O_5 Lbs/Acre	= NUTRIENT BALANCE Potassium, K_2O Lbs/Acre
1,8,10	100.0	Corn, Silage(AH)	79	62	151	231	120	276	-152	-59	-125
2	40.0	Wheat, Spring Soft White	66	51	126	110	58	27	-44	-7	99
3,4,5,18	135.0	Clover for Seed	20	15	37	62	30	29	-43	-15	8
6,7,20,22,23,26	205.0	Wheat, Winter Soft White	33	25	62	120	63	29	-87	-38	33
9,13,21,24	115.0	Clover for Seed	23	18	44	62	30	29	-39	-12	15
11,15,25	85.0	Tall Fescue Seed	0	0	0	32	9	10	-32	-9	-10
12,14,16,17,19	165.0	Corn, Sweet	23	18	45	178	110	140	-155	-91	-94
0											
0											
Off-Farm											

U.S. Department of Agriculture
Natural Resources Conservation Service

ANIMAL WASTE MANAGEMENT WORKSHEET

Version 1.8

7/6/2005
ST OREGON

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**

CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation: Dairy / Type of Storage Facility	Pounds of Nutrients Available			Percent Nutrients Retained After Storage			Pounds of Nutrients Retained After Storage		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Anaerobic Lagoon	60,251	22,214	41,006	**30%**	**45%**	**60%**	18,075	9,996	24,604
Solids	Solids Storage Facility (Unroofed)	40,059	13,130	32,221	**65%**	**80%**	**80%**	26,038	10,504	25,777
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_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Sprinkling	18,075	9,996	24,604	**75%**	**100%**	**100%**	13,556	9,996	24,604
Solids	Broadcast (Incorporated 7 or more days after application)	26,038	10,504	25,777	**70%**	**100%**	**100%**	18,227	10,504	25,777
Grazing	Grazing	0	0	0	**90%**	**100%**	**100%**	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location: Between Coastal and Cascade Mountains / Soil Drainage Class	Pounds of Nutrients Available			Percent Nutrients Retained After Denitrification			Pounds of Nutrients Retained After Denitrification		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Liquids	Somewhat Poorly Drained	13,556	9,996	24,604	**83%**	**100%**	**100%**	11,252	9,996	24,604
Solids	Somewhat Poorly Drained	18,227	10,504	25,777	**83%**	**100%**	**100%**	15,128	10,504	25,777
Grazing	Somewhat Poorly Drained	0	0	0	**83%**	**100%**	**100%**	0	0	0

CLIENT: **Rick Sheelar**
ASSISTED BY: **S. Harshberger**

CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON PHOSPHOROUS, P2O5

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
1,8,10	100.0	Corn, Silage(AH)	**18%**	1,818	15	**35%**	3,676	31	**0%**	0	0
2	40.0	Wheat, Spring Soft White	**5%**	454	8	**10%**	1,050	18	**0%**	0	0
3,4,5,18	135.0	Clover for Seed	**18%**	1,818	60	**5%**	525	17	**0%**	0	0
6,7,20,22,23,26	205.0	Wheat, Winter Soft White	**18%**	1,818	29	**30%**	3,151	50	**0%**	0	0
9,13,21,24	115.0	Clover for Seed	**18%**	1,818	60	**10%**	1,050	35	**0%**	0	0
11,15,25	85.0	Tall Fescue Seed	**5%**	454	50	**0%**	0	0	**0%**	0	0
12,14,16,17,19	165.0	Corn, Sweet	**18%**	1,818	17	**10%**	1,050	10	**0%**	0	0
0											
0											
Off-Farm			**0%**	0		**0%**	0		**100%**	0	
		TOTALS-	**100%**	**9,996**	**238**	**100%**	**10,504**	**160**	**100%**	**0**	**0**

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED			- NUTRIENTS REMOVED			= NUTRIENT BALANCE		
			Nitrogen, N Lbs/Acre	Phosphorous, P_2O_5 Lbs/Acre	Potassium, K_2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P_2O_5 Lbs/Acre	Potassium, K_2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P_2O_5 Lbs/Acre	Potassium, K_2O Lbs/Acre
1,8,10	100.0	Corn, Silage(AH)	73	55	135	231	120	276	-158	-65	-141
2	40.0	Wheat, Spring Soft White	51	38	92	110	58	27	-59	-20	66
3,4,5,18	135.0	Clover for Seed	21	17	43	62	30	29	-42	-13	14
6,7,20,22,23,26	205.0	Wheat, Winter Soft White	32	24	60	120	63	29	-88	-39	31
9,13,21,24	115.0	Clover for Seed	31	25	61	62	30	29	-31	-5	32
11,15,25	85.0	Tall Fescue Seed	6	5	13	32	9	10	-26	-4	4
12,14,16,17,19	165.0	Corn, Sweet	22	17	43	178	110	140	-156	-93	-97
0											
0											
Off-Farm											

ANIMAL WASTE MANAGEMENT PLAN
MINIMUM REQUIRED ELEMENT

OPERATION AND MAINTANENCE

Above and/or Below Ground Liquid Tank

The tank serves as a collection point for effluent to drain to or be scraped from the animal feeding areas. If the tank will provide storage capacity to the waste management system it shall be completely emptied at the beginning of the storage period and the contents applied to cropland as weather and crop conditions permit. A 1-foot free board will be maintained to prevent spillage. Continually maintain all pumps, agitators, piping valves and all other electrical and mechanical equipment in good operating condition by following manufacturer's recommendations. Float valves will be maintained in good working order. Perform daily inspections of waterlines including drinking water or cooling water lines. Repair leaking lines immediately to prevent excess water from entering the waste storage system. Depth markers are installed to assure maximum volume will be maintained and checked weekly. At least once every 5 years, the tank shall be emptied and inspected for structural damage and leakage. Any damage found shall be corrected before putting the tank back in service. Remove all foreign debris within the structure that may cause damage to pumps and agitator. If below ground, the tank lid will not be subjected to more than two, 8,000 pound wheel loads. Before entering a tank, for any reason whatever, proper ventilation shall be provided, and self-contained breathing apparatus shall be used, if required, when entering a covered tank. No one shall enter the tank unless safety ropes are used and someone else capable of providing assistance is outside of the tank. Warning: Entering Unventilated Tanks Is Extremely Dangerous.

Animal Access Lanes or Walkways

Damaged components will be repaired or replaced as needed. Debris and excess manure will be removed from roadway surfaces, road ditch and drainage areas. Maintain drainage area capacities. Maintain good vegetative cover on all slopes and watercourses.

Concrete Gutters

Floor gutters and grates will be inspected periodically. All foreign material restricting flow will be removed. Damage will be repaired as needed.

Curbs

Curbs, gutters and slabs that are used to convey effluent will be inspected periodically. Broken sections will be repaired or replaced. Manure or other solids will be prevented from building up next to curbs or flowing over them. If over flow is a consistent problem the curb height should be increased.

Culverts

Inspect annually or after large rainfall event. All foreign objects restricting water flow will be removed. Damaged sections will be repaired or replaced. Erosion around inlet or outlet will be corrected.

Dry Stack Storage Facility

Solid manure storage facility will be inspected annually. Broken slabs and curbs will be repaired. Repair or replace rusted or damaged areas on roof structure. Broken gutters and/or downspouts will be repaired or replaced. Check for adequacy and function of drain away from downspouts. Check

side and back walls for soundness. Manure solids and leachate will not escape through cracks in the facility.

Fencing

Fences will be inspected periodically. Broken or decayed posts will be replaced. Sagging wire will be tightened. Broken wire will be spliced or replaced. Broken or missing insulators for electric fencing will be replaced. Vegetation will be controlled under the fences. Electric fencing will be sufficiently charged to detour animals.

Filter Strips

Maintain vigorous growth of vegetative covering. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing, harvesting or grazing may also be needed to control height. Remove all foreign debris that hinders system operation. Limit the traffic from filter strip area. Limit livestock usage to vegetative growth periods when the animals will not damage vegetative root system or compact the soil. Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage.

Gutters and Downspouts

Gutters will be inspected annually to ensure all gutters are free of foreign materials. Broken gutters or downspouts will be replaced or repaired. Gutters will be connected to downspouts. Leaky gutters and downspouts will be repaired. Weeds and sediment will be removed from downspout outlets. All downspouts will be connected to outlets, which are kept free flowing. Outlets will be inspected for rodent guards and repaired or replaced as needed.

Irrigation Water Management

Irrigation water application will be at rates that minimize transport of sediment, nutrients, and chemicals to surface water and ground water. Equipment modifications and/or soil amendments such as polyacrylamides and mulches should be considered to reduce erosion if needed.

Manure Application Equipment

All manure application equipment (including but not limited to sprinklers, big gun irrigators, spreaders and/or tank wagons) will be operated and maintained according to the manufacturer's manual. Equipment found to be broken or worn will be replaced. Equipment will be calibrated to ensure recommended rates are applied. Liquids will be drained from sprinklers or big guns prior to freezing weather. When system is flushed, rinse water is used following waste, and liquid and sediment is applied agronomically. Nozzles will be checked periodically and if worn, nozzles will be replaced. Minimize exposure to animal and organic waters and manure gasses. Wear protective clothing when appropriate. When cleaning equipment after nutrient application, remove and save wastes in an appropriate manner. Avoid applying manure near surface water by establishing buffer strips and set backs, and use extreme care to avoid contaminating ground water.

Manure Effluent and Irrigation Transfer Lines.

Manure, effluent and irrigation lines shall be flushed with clean water periodically to prevent particle buildup and plugging. Manure flushed from the lines will be applied agronomically so that surface and groundwater will be protected. Manure, effluent and irrigation lines shall be inspected periodically for leaks or worn out nozzles, and repairs or replacements made as needed. Special inspection shall be done to pressure relief valves, risers and control valves. Shut off valves will be inspected annually. Avoid unnecessary travel over pipelines that will damage their integrity. Equipment found to be broken or worn will be replaced. Water will be drained during cold weather

to prevent frozen or broken lines. These lines can explode if not properly maintained and may cause human injury.

Pumps

Pumps will be maintained in accordance with manufacturer's operation and maintenance manual. Effluent will be drained from pumps prior to freezing weather. Pumps will be inspected periodically to identify and remove debris wrapped around impeller or worn parts. Appropriate action will be taken to repair any worn parts. Liquids will be drained from pump prior to freezing weather to prevent breakage. It is recommended to have a spare pump or back up system in case a pump must be removed for an extended time for repair.

Roofs

Roofs will be inspected annually. Rusted sections will be replaced or repaired if needed. Loose sections will be secured. All broken trusses, beams, poles, gutters and downspouts will be repaired or replaced.

Solid Manure Separator

The separator should be inspected regularly for deterioration of protective coatings and repaired as necessary. All plumbing will be inspected annually and broken lines will be replaced or repaired. Loose connections will be tightened. If applicable, electric motors, pumps and gears should be routinely maintained. Separator will be operated and maintained according to manufacturer's manual.

Subsurface Drainage System

Subsurface drainage will be inspected annually. Fields will be checked for breaks or suck holes. Outlets will be kept free of vegetation and sediment. Erosion at outlets will be corrected with riprap or other means. Damage or broken lines will be repaired. Outlets from fields on which animal waste is being applied will be monitored daily. Animal waste applications will cease if the tile outflow contains any indication of animal waste.

Trough or Tank

Watering facility will be inspected periodically. Damaged tank/trough will be repaired or replaced. Float valves will be maintained in good working order. Area immediately surrounding the trough/tank will be maintained in a stable condition. Watering facility will be inspected periodically. Damaged tank/trough will be repaired or replaced. Float valves will be maintained in good working order. Area immediately surrounding the trough/tank will be maintained in a stable condition. Watering facilities will not be allowed to overflow if additional liquid will affect waste storage capacities.

Waste Storage Pond

Prior to the storage season, empty the pond to provide storage capacity for the accumulation of wastewater and precipitation during the winter storage period. Sludge and accumulated solids will be removed from the pond periodically when buildup limits storage capacity in the pond. Depth markers are installed to assure maximum volume will be maintained and checked weekly. A 2-foot free board will be maintained to prevent spillage.

Maintain all pumps, agitators, pipeline, valves, and electrical and mechanical equipment in good operating condition following the manufacturer's recommendations. Immediately repair any vandalism, vehicular, or livestock damage to any earth fill. Immediately remove any obstructions or blockage of spillways, trash racks or pipe inlets. Settlement or cracks in earthen sections should be investigated to determine cause and immediately repaired. Maintain vigorous growth of

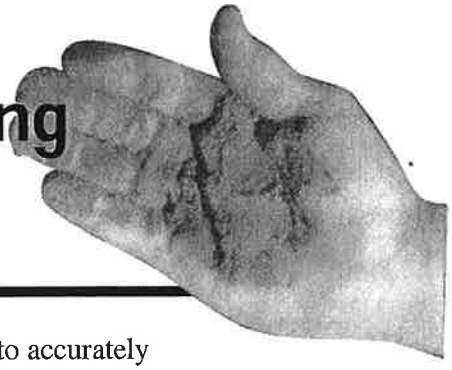
vegetative coverings on the dikes to eliminate soil erosion. Eradicate or otherwise remove all rodents or burrowing animals and repair any damage caused by their activity. Fences and/or warning signs should be maintained as necessary to unauthorized human or livestock entry. Operate systems in a manner that minimizes odor and drift.

EM 8716 • August 1998

Simple irrigation scheduling

Using the "look and feel" method

F. Niederholzer and L. Long



Why schedule irrigation?

Accurate irrigation scheduling maximizes the benefits of irrigation while minimizing potential negative impacts of over-irrigation or under-irrigation.

Over-irrigation **(too much water):**

- Drowns roots, thus stressing plants
- Encourages root diseases
- Reduces nutrient uptake
- Cools soil, thus reducing root growth
- Leaches nutrients and pesticides from the root zone to groundwater
- Reduces crop quality
- Wastes money

Under-irrigation **(too little water):**

- Reduces crop yield
- Reduces crop quality (fruit and vegetable size)
- Reduces plant growth
- Weakens plants

Many people schedule irrigation by the calendar rather than by plant need. Calendar-based scheduling can be very inaccurate since plant water needs and the amount of soil water available to plants are affected by factors such as climate, plant size, soil type, and rooting depth.

The goal of accurate irrigation scheduling is to replace soil water lost by evaporation and plant use as precisely as possible. To accomplish this goal, you need to accurately assess soil moisture content. Then you can determine the need for irrigation and how much water to deliver.

Irrigation scheduling can seem complicated. It doesn't have to be. Anyone can use a simple, effective method known as the "look and feel" (or "soil appearance and feel") method to determine when to irrigate.

How does it work?

This method is based on three simple ideas:

- Soil is at "field capacity" when it is holding as much water as possible after the excess has drained away. (A wet sponge is at "field capacity" when it holds all the water it can without any dripping away.)
- It's best to irrigate when half of this water is depleted.
- Your goal when irrigating is to return the soil to field capacity.

So, all you need to know to schedule irrigation is:

- How much water will the soil hold within the plants' rooting zone when it's at field capacity?
- What does the soil look like when half of that water is gone?
- How much water should be applied to return the soil to field capacity?

Franz Niederholzer, Extension horticulture agent, Hood River County; and Lynn Long, Extension horticulture agent, Wasco County; Oregon State University. *Photos are from* Estimating Soil Moisture by Feel and Appearance, *and are reproduced courtesy of USDA/NRCS. Special thanks to Mr. Diego León for his excellent work with English/Spanish translation.*

OREGON STATE UNIVERSITY EXTENSION SERVICE

Published August 1998.

Fact Sheet

Fertilizing for Profit

Tips for Small Acreages in Oregon

NO. 12 JANUARY 1999

"Watch earnestly over every acre."
- Clarence Poe

USDA Agricultural Research Service

Make the Most of Your Fertilizer

In 1900, each American farmer produced enough food and fiber for 10 people. Today, with advances such as synthetic fertilizers, that number is 129 people. This abundance of food and fiber brings with it the responsibility to keep fertilizers on the land and out of the water. **Nutrient management** is a practice that applies fertilizers efficiently without polluting water. The benefits are:

High crop yields with lower fertilizer costs.

In one study, Oregon dairy farmers applied manure as a fertilizer. They saved $30 to $70 in commercial fertilizer costs per acre without decreasing yield.

Healthy animals.

Horses, cattle, sheep, and goats can get nitrate poisoning from forage grown on overfertilized soils. Taking a soil test and applying the right rates of fertilizer and manure can reduce this health problem.

Clean water for healthy people and fish.

When fertilizers reach surface water and groundwater, nitrate in well water may harm infants. Excess phosphorous may cause algae blooms, reduce oxygen, and kill fish. Applying fertilizers correctly has reduced nitrate in groundwater in Ontario, Oregon.

Fertilize at the Right Rate: Soil Tests

A soil test is the simplest way to manage fertilizers for a healthy crop and environment. A soil test will tell you the level of nutrients in your soil and how much fertilizer to apply to the crop. Follow these steps to take a soil test:

1. **Draw a map of your farm.**
   Assign a name or code for each area to be soil tested. Use this map to record fertilizer applied, crops grown, and yields. This will help you to identify your soil samples and to record the results of your nutrient management program.
2. **Use the right equipment.**
   Take soil samples with a soil probe, garden spade, or shovel. Collect the samples in a clean plastic pail or paper bag. Soil sampling tools should be chrome-plated or stainless steel when testing for micronutrients.
3. **Establish sampling areas.**
   Identify areas that have different soils, crops, or manure histories and test these separately. Avoid taking samples from unusual areas like fence rows, manured areas, and old building sites. Stay at least 150 feet from gravel roads.
4. **Sample in the spring or fall.**
   Send in soil samples at least 3 to 6 weeks before planting. This should give labs enough time to test soils and send you the results in time for planting. Consider sending samples in the fall when labs are less busy. Test at the same time of year to compare results from year to year. Follow lab fertilizer and lime recommendations or use OSU Fertilizer Guides.
5. **Take 15 to 20 subsamples per area.**
   The area should be less than 20 acres. Scrape plant litter from the soil surface and sample the top 8 inches of soil (depths for special situations are in the table on page 2). If using a shovel, dig an 8-inch-deep hole and slice a 1-inch-thick slab from the side. Trim soil away on each side, leaving a 1-inch-thick strip for the subsample.
6. **Mix subsamples together in pail and dry in a clean area.**
   Do not use an oven or the hot sun to dry soils.
7. **Send at least 1 cup of soil for each sample to a lab.**
   Ask the lab about costs and mailing instructions. Include information on past cropping history, crop to be grown, and yield goal. Label soil samples and key them to your map. For a list of labs, see the Oregon State University (OSU) Extension Service publication A List of Analytical Laboratories Serving Oregon (EM8677). To get this publication, see the website listed in the "For Help" section at the end of this fact sheet or visit your local Extension Service office.

This fact sheet was produced by the Washington County Soil and Water Conservation District (SWCD) and the Small Acreage Steering Committee. The Governor's Watershed Enhancement Board, the Oregon Association of Conservation Districts, and the USDA Natural Resources Conservation Service funded the project. Media Works of Bozeman, Montana designed the fact sheet.

Location	Building Site	Garden	Permanent Pasture	Lawn	Cropland	No-till Crop
How Often to Take Soil Test	Once, after topsoil is replaced	1 to 3 years	2 to 3 years	3 to 5 years	1 to 3 years	1 to 3 years
How Deep to Sample Soil	0 to 8 inches	0 to 8 inches	0 to 3 inches	0 to 8 inches	0 to 8 inches	0 to 4 inches pH, P, K

Fertilizer Labels: Cracking the Code

Plants need many nutrients to grow and reproduce. Plants most often lack **nitrogen, phosphorus, potassium,** and **sulfur.** In the late winter and early spring, plants may be yellow or purple due to temporary deficiencies in wet or cold soils. Wait until plants are actively growing before fertilizing. Here are some signs of nutrient deficiencies in plants:

- **Nitrogen (N)** - Older leaves have a light green to a pale yellow color that proceeds to the younger leaves.
- **Phosphorus (P)** - Leaves have a dull blue-green color and stems may be purple.
- **Potassium (K)** - Older leaves have scorched brown tips or a yellow color that proceeds to younger leaves.
- **Sulfur (S)** - Older leaves are green while younger leaves are light green or yellow.

Fertilizers add to nutrients already in the soil. All fertilizer bags are labeled with a series of numbers that show the percentage of nutrients in a bag. A label of **27-13-7** means there's 27 percent **nitrogen,** 13 percent **phosphate,** and 7 percent **potash** by weight in the bag. A 100-pound (lb.) bag of 27-13-7 spread over 1 acre would spread 27 pounds of nitrogen, 13 pounds of phosphate, and 7 pounds of potash per acre.

Organic fertilizers are unprocessed and unrefined fertilizers like blood meal, rock phosphate, and manure. When organic fertilizers are purchased in bags, they are labeled in the same manner as synthetic fertilizers. In general, an organic fertilizer releases nutrients over a longer time than a synthetic one. This can be an advantage as nutrients are supplied to a plant throughout its growth. A drawback is that the organic fertilizer may not release enough nutrients at a critical growth point.

Soil pH: the Acid Test

Soil pH is a measure of soil acidity and affects the availability of nutrients. A soil with a pH below 7.0 is acidic, while one with a pH above 7.0 is alkaline. A very acidic soil will release aluminum and manganese and become toxic to plants. A very alkaline soil will make phosphorus and iron unavailable to plants. Ideal pH ranges are:

- Pure grass stands 5.5 - 6.0
- Legume-grass mixes 6.0 - 6.5
- Row crops, small grains 6.0 - 6.5
- Alfalfa 6.5 - 7.5

Western Oregon soils are generally acidic and **eastern Oregon** soils are often alkaline. If the soil is too acidic for your crop, add lime to raise the pH. OSU Fertilizer Guides will help you to determine how much lime is needed based on the soil pH and buffer pH shown on your soil test results. If your soil test shows that magnesium is deficient, apply dolomite lime. If magnesium levels are acceptable, apply the less expensive "ag lime." Sometimes soil is too alkaline for a particular crop and sulfur is needed to lower pH. For more information, see the OSU Extension Service publication *Fertilizer and Lime Materials* (FG52).

Fertilizers in the Right Place, Right Time

To get the most bang for your fertilizer buck and avoid pollution, follow these strategies:

Ada Soil Conservation District

Use the right amount.

This is where "an ounce of prevention is worth a pound of cure." Avoid applying excess levels of nutrients to the soil. Otherwise, nitrate may leach and pollute groundwater, phosphorus runoff may cause algae blooms, and high nitrate levels in forages may poison horses, goats, sheep, and cattle. Fertilize based on a soil test and realistic crop yield goals. Calibrate fertilizer spreaders. If manure cannot be worked into the soil, avoid spreading manure more than one-half inch thick on the ground each year. This will reduce the potential for polluted runoff.

Put it in the right place and work it into the soil.

Most phosphorus is immobile in soil. This means plant roots must grow to the source of phosphorus. If phosphorus is needed, band the fertilizer 2 inches to the side and 2 inches below the seed to give seedlings a good start. Beware of banding fertilizers too close as banded nitrogen, potash, and boron may burn the seed. Manure that is broadcast should be worked into the soil within 3 days. Otherwise, up to a third of the available nitrogen in manure may be lost as gas. Know your field limitations. When nutrients cannot be worked into the soil, avoid spreading in areas where water flow may concentrate, in floodplains, or within 50 feet of streams.

Apply it at the right time.

Water can dissolve nitrogen and carry phosphorus attached to soil particles. This means rain, snow, or floods can move nitrate into groundwater and nitrogen and phosphorus over land and into lakes and streams. Apply fertilizer and manure during the growing season when crops will use the nutrients. Split the applications of nitrogen on pastures, lawns, and crops for maximum plant uptake and minimum loss to runoff. Avoid applying fertilizer or manure during fall rains, in the winter, or on saturated soils. This may require manure storage, depending on your situation. For more about manure storage, see the fact sheet *Managing Mud and Manure* in this series.

Follow the right conservation practices.

Phosphorus is held tightly to soil and is moved mostly by loss of soil due to erosion. Reduce phosphorus losses using erosion control practices such as conservation tillage, contour strip cropping, and grass waterways. Capture phosphorus and nitrogen with winter cover crops, grass filter strips at field borders, and streamside buffers. Manage irrigation water to reduce leaching and erosion losses and excessive runoff.

Take Credit for Legumes

Grow legumes to add nitrogen naturally to the soil. Legumes include alfalfa, clovers, beans, peas, and birdsfoot trefoil. Reduce your nitrogen application by 40 pounds when following clover and up to 100 pounds per acre after alfalfa. Even grass may add a flush of nitrogen to the soil.

Fertilizing Pastures

Pastures need less fertilizer than row crops because grazing animals return manure nutrients to the soil. Rotational grazing will distribute manure more evenly. Take a soil test to find out the nutrient levels and pH in your soil. For more information, see the OSU Extension Service publication *Pastures: Western Oregon and Western Washington* (FG63).

Make the Most of Manure

Manure is like an unmarked bag of fertilizer. Consider this: if you fed **10 acres of corn** to your livestock, your animals would excrete enough phosphorus and potassium to grow another **7 acres of corn.** Treat manure as you would treat a bag of fertilizer. Store it in a covered place and apply it when and where it won't get washed away. With a little patience, you can find the fertilizer value of manure on your farm:

1. Take a manure test. Manure is not uniform.

Take samples from many places in the manure pile or from each spreader load. Find a lab that tests manure. Fill a plastic container two-thirds full to accommodate liquid expansion, freeze or refrigerate before shipping to reduce nitrogen loss, and send to the lab at the beginning of the week so that samples are not held over the weekend. As a minimum, test for percent solids, total nitrogen (N), ammonium-nitrogen (NH4+-N), total phosphorus (P), and total potassium (K). Test at least once a year or more if there are significant changes in manure storage methods.

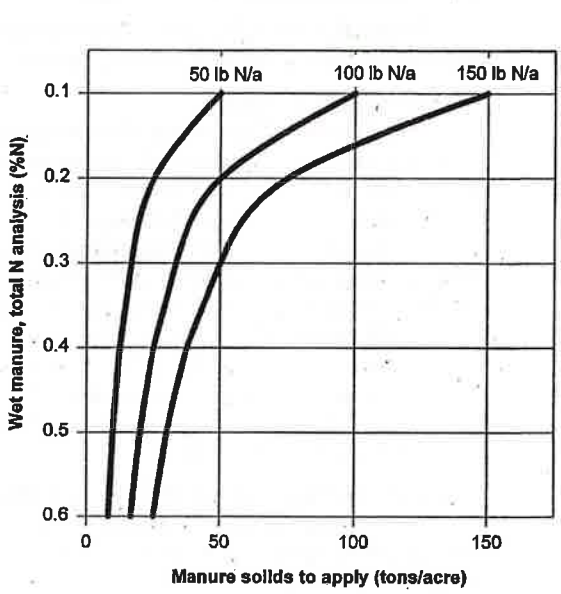
2. Use soil and manure test results to determine the amount of nutrients in soils and manure.

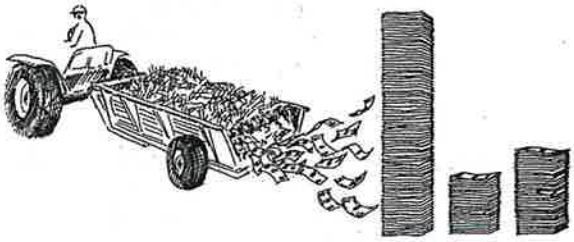
Use soil test results and OSU Fertilizer Guidelines to determine the nutrient needs for your particular crop. Manure test results are reported in "percent N, P, and K as received."

3. Calibrate your wheelbarrow or spreader.

Estimate the number of cubic feet of manure that your wheelbarrow will hold. One cubic foot of manure weighs about 62 pounds. Divide the number of cubic feet by 2,000 pounds to determine the fraction of a ton that your wheelbarrow will hold. Use your answer, the soil test, and the manure test results to spread the correct number of tons needed per acre to spread manure as a fertilizer, according to the graph.

To find the number of tons of manure in a **spreader load,** use the sheet method, the stated capacity from the owner's manual, or portable truck scales. To use the sheet method, place a **10-foot by 10-foot plastic tarp** in the field and drive over it with the spreader. Weigh the manure and multiply the weight (in pounds) by 0.22 to determine tons applied per acre. Do this at least three times and take an average. Use your answer, the soil test, and the manure test results to spread the correct number of tons needed per acre to spread manure as a fertilizer, according to the graph. For more information, see the Oregon State University Extension Service publications *Manure Application Rates for Forage Production* (EM 8585) and *Dairy Manure as a Fertilizer Source* (EM 8586).





- The soil and water conservation district and USDA Natural Resources Conservation Service may provide technical advice on soil testing, applying fertilizers, and spreading manure. Contact your local office by looking in the phone book blue pages under Federal Government.
- The Oregon State University (OSU) Extension Service provides technical advice through publications, workshops, and over-the-phone assistance. Publications may be found online at http://osu.orst.edu/dept/infonet/soilfert.htm or at your local Extension Service office.

PNW 549
August 2001

Keeping Track of Manure Nutrients in Dairy Pastures

T. Downing

Keeping track of nutrient levels in dairy pastures has become an important part of farm management plans. The current recommendation is to fertilize pastures at a level to replace, in equal measure, the nutrients removed through grazing or cutting each year.

The Confined Animal Feeding Operations Program (CAFO) run by the Oregon Department of Agriculture assumes that most livestock facilities apply manure at agronomic rates for nitrogen. Thus, they expect CAFO operations to make sure the amount of nitrogen applied to a field each year equals the amount removed.

For operations with grazing animals, determining manure application rates and forage consumption can be challenging. This publication will help you work through this process.

In concept, tracking nitrogen balance is simple: the grazing animal adds nitrogen in the form of manure and urine and removes it in the form of protein in the grass grazed. To quantify these values, you need to determine both how much manure was applied and the amount and quality (percentage nitrogen content) of grass grazed.

The variables include:

- Manure generated: number of animals and the amount of time spent in each field
- Quantity of forage removed through grazing and cutting
- Quality of forage removed: percent protein (i.e., percent nitrogen)
- Amount of manure stored and spread from the confinement facility
- Acreage of each pasture unit
- Calibration of waste-handling equipment

Estimating manure generated

The nitrogen content of dairy manure is well documented, but these values vary depending on feed intake. Table 1 shows the direct relationship between nutrient intake and excretion.

By estimating the percentage of the day cows spend in the field, you can calculate the amount of the day's waste applied as fertilizer. Note in Table 1 that the amount of nutrients excreted by a cow can be estimated based on her milk production or feed intake.

Table 1. – Estimated daily nitrogen (N) and phosphorus (P) excretion.

Milk Production	100 lb/day	70 lb/day	50 lb/day	Dry
Intake/day	56 lb	46 lb	39 lb	25 lb
Total N, lb/day waste	0.9 lb/day	0.8 lb/day	0.65 lb/day	0.4 lb/day
Total P, lb/day (diet 0.45% P)	0.151 lb/day	0.138 lb/day	0.126 lb/day	0.113 lb/day

Source: H.H. Van Horn et al., 1999.

Troy Downing, Extension agent, Tillamook County, Oregon State University.

For example, if a Holstein cow is grazed for 9 hours at night and 9 hours during the day, she spends 75 percent of her time in the field and deposits 75 percent of her daily waste production there. If she excretes 0.8 lb of nitrogen per day, she applies 0.6 lb of nitrogen to the field. The remaining 25 percent, or 0.2 lb, is deposited in the confinement facility.

If you graze 100 Holstein cows in Field 1, a 4-acre field, for 2 days at 18 hours per day, they will apply 120 lb of nitrogen to the field, or 30 lb per acre.

Measuring quantity and quality of grass consumed by the animals

There are four common ways to measure standing grass volume before and after grazing to determine the amount of nutrient removed.

Clipping and weighing

The most accurate method is to clip a small subsample of the field before grazing. Use a hoop to calculate how many square feet you are clipping; throw the hoop at random, then clip the standing forage inside the ring down to the ground. Figure 1 shows a hoop that measures 1 square foot. Cut at least 10 to 15 sample plots per field, depending on the size of the field and the variation in the height of existing forage. The larger the field, or the greater the variation in forage height, the more samples you need. The more uniform your forage height, the more accurate your estimate.

By calculating the total square feet clipped and weighing the forage, you can determine how many pounds of total feed were standing per acre before grazing. An acre is 43,560 sq ft. Divide your total clipped area into 43,560; then multiply the answer times the weight of the forage clipped to determine your estimated pounds of standing wet grass per acre. Measuring again after grazing tells you how much forage was removed.

To determine pounds of dry matter (DM) per acre, however, you need to know what percentage of the forage is dry matter versus moisture. A commercial forage lab can analyze the forage, but the following process lets you perform a quick moisture test at home with a small scale and a microwave oven.

1. Weigh a paper bag large enough to hold 4 ounces of the clipped forage. Write down the weight as value "A."
2. Place about 4 ounces, or 100 grams, of your forage into the bag and weigh again. This becomes value "B."
3. Place a cup of water in the corner of the microwave oven and the filled bag in the center. Dry the sample at a medium power setting for 3 minutes. Remove the sample and stir gently, then dry for another 1½ minutes. Stir again, then dry for another minute.
4. The sample should be getting dry and crisp. Weigh the sample and bag, stir again gently, then dry for another 30 seconds. Continue 30-second drying and weighing intervals until the weight measurement reads the same twice. Record the final weight as value "C." If the sample begins to char, use the previous measurement.
5. Calculate the dry matter content using this formula:

$$\%DM = \frac{\text{Total dry weight "C"} - \text{bag weight "A"} \times 100}{\text{Total wet weight "B"} - \text{bag weight "A"}}$$

Now you can calculate the total dry matter in the field before and after grazing by multiplying the percent dry matter times the forage removed by grazing. In our example, the calculations show 2,400 lb of dry matter per acre before and 1,200 lb after grazing 100 cows for 2 days at 18 hours per day. Therefore, for 4-acre Field 1, the cows removed a total of 4,800 lb of dry matter.

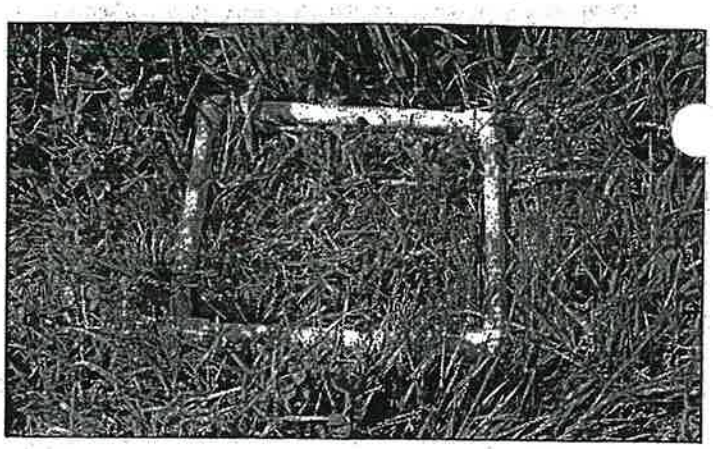


Figure 1.—By clipping several 1-square-foot samples of forage before and after grazing, you can estimate the amount of forage removed by grazing.

Rising plate meter

The second most common method of measuring forage in the field involves a rising plate meter (Figure 2). This device estimates standing forage dry matter by accounting for pasture height and density. The electronic meter pictured allows the operator to select the "cover equations" that most closely represent existing pasture conditions. To determine the correct cover equation, take 30 to 50 pasture clipping samples per paddock to establish an average reading. Once calibrated, the device will provide standing forage measurements in pounds of dry matter per acre or kilograms per hectare. Most commercially available rising plate meters are made in New Zealand.

Yard stick

The third method for calculating standing forage uses a yardstick. By measuring the standing height of the forage, you can make an educated estimate of the total pounds of dry matter. This method does not account for stand density, so the more uniform your pastures, the more accurate your estimate will be.

To use this method, measure the height of the pasture (Figure 3). Use the clipping and weighing method to determine how many pounds of dry matter are in the standing forage per acre. Divide this value by the number of inches in height to calculate an estimated per-inch value. For example, if your pasture measures on average 12 inches tall and you calculate that there are 3,000 lb of dry matter per acre, your pasture averages 250 lb of dry matter per acre-inch.

It is important to complete these steps several times to account for variations in your technique and in the fields. Common values for good ryegrass pastures range from 250 to 300 lb DM per inch for well-established pastures. In our clipping and weighing example, Field 1 had 2,400 lb of dry matter per acre before grazing, so the pasture would have been around 8 inches tall. After grazing, we had 1,200 lb of dry matter left, so the pasture should have been around 4 inches tall.

Capacitance meter

The fourth method for calculating standing forage is with a capacitance meter (Figure 4), an electronic device that measures dry matter in standing forage as you walk across the field. Take at least 30 to 40 measurements before turning the animals into the field and immediately after the period of grazing. Like the rising plate meter, the capacitance meter provides measurements in pounds of dry matter per acre or kilograms per hectare. This equipment also is available from many New Zealand companies.

Testing protein levels

If you periodically test the protein level of the forage grazed, you can use this value to determine nitrogen content. For example, if Field 1 tests 20 percent protein, a ton of dry matter (2,000 lb) contains 400 lb of protein.

Nitrogen is a significant component of protein, and nitrogen levels can be determined with a simple calculation. If you divide the protein content (in this case, 400 lb) by 6.25, the resulting figure represents the approximate amount of nitrogen removed per dry matter ton, or 64 lb. Therefore, extending our earlier example of 4,800 lb of forage dry matter removed, we can make the following calculation: 2.4 tons x 64 lb nitrogen per ton = 154 lb of nitrogen removed from the 4-acre Field 1, or 38 lb of nitrogen per acre. Table 2 (page 4) shows the relationship between percentage of protein and pounds of nitrogen content in dry matter.

Determining the net N balance

In our example, the grazing cows deposited 120 lb of nitrogen and removed 154 lb in the 4-acre field. Therefore, there was a net loss of 34 lb of nitrogen from the field during this grazing session, an 8.5-lb loss per acre.

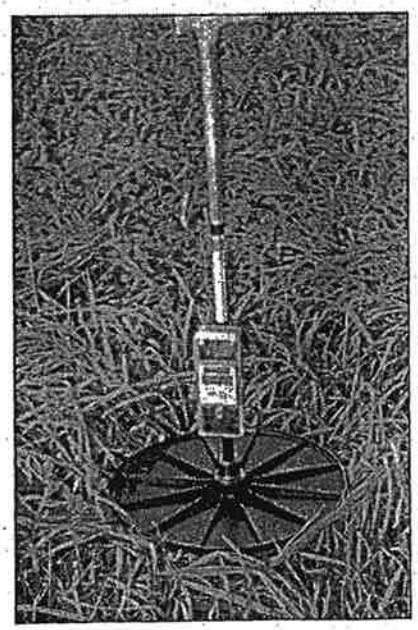


Figure 2.—The electronic rising plate meter estimates standing forage dry matter, accounting for pasture height and density.

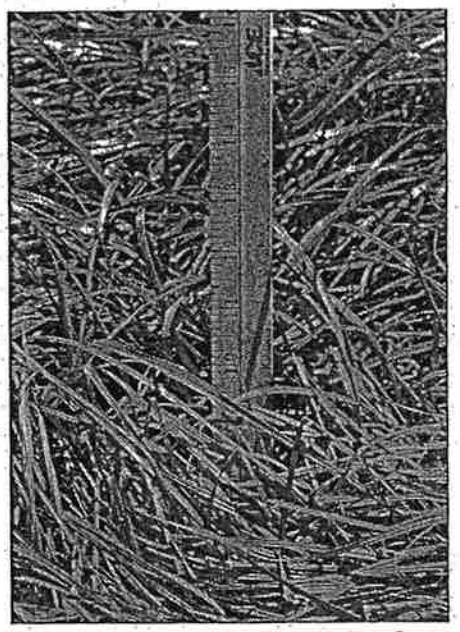


Figure 3.—By measuring the height of forage, you can estimate the total pounds of dry matter in a pasture.

Figure 4.—A capacitance meter measures dry matter in standing forage as you walk across the field.

Table 2. – Pounds of nitrogen removed as crude protein increases.

Protein	8%	12%	16%	20%	24%	28%
Pounds of N per ton of dry matter	25.6	38.4	51.2	64	76.8	89.6

Table 3.—Example record keeping system (Field 1, 4 acres).

Date	Action	DM removed/ per acre	N removed/ field	N removed/ acre	N applied to field	N applied/ acre	N balance for field	N balance/ acre
6/6	Grazed 100 cows	1,200	-154	-38	120	30.0	-34	-8.5
6/9	Pumped manure	—	—	—	150	37.5	116	29.5

Adding nutrients from the confinement facility

The last component to account for are the nutrients applied from the confinement facility, including parlor waste and all other manure gathered throughout the year. By calibrating your waste-handling equipment and determining the nutrient content of the waste applied, you can successfully account for the application of manure in your field's nutrient balance.

For example, if you pump 25,000 gallons of manure evenly over Field 1 and your manure has 6 lb of nitrogen per 1,000 gallons, you would apply 150 lb of nitrogen to the 4-acre field, or 37.5 lb N/acre. Since the net balance after grazing in Field 1 was -8.5 lb N/acre, you would have restored the nutrient balance to a positive 29.5 lb N/acre.

Conclusions

You can determine the net balance of nitrogen in grazing situations by calculating the quantity applied and subtracting the quantity removed. It is important to realize the numbers you generate are based on estimates; exact values aren't possible when dealing with nitrogen in dairy pastures. Soil sampling in the fall is an excellent way to monitor success of a balanced fertilization program. See EC 628, *Soil Sampling for Home Gardens and Small Acreages.*

Measuring application and removal of nutrients is important in an effective manure fertilization program. Achieving balance using this method will move you toward agronomic application rates and should both increase productivity and protect the environment from over-application of manure nutrients.

For more information

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

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Sullivan, D., Craig Cogger, and A. Bary. *Which Test Is Best? Customizing Dairy Manure Nutrient Testing,* PNW 505 (1997).

To order copies of these publications, send the complete title and series number, along with a check or money order for the amount listed (payable to Oregon State University), to:

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Water Usage

1.	Cow Preparation	Dry
2.	Bulk Tank (110 gals every other day)	50 gal/day
3.	Misc. Eq.	25 gal/day
4	Pipe Lines (250 gals / milking)	500 gal/day
5	Milkhouse + Parlor	50 gal/day
6	Holding pen (20 minutes - 50 gpm)	2000 gal/day
7	Calf barn (flush)	500 gal/day
	Total	3125 gals/day

Rainfall Runoff Area Contributing To Storage

1.	Roof Area (Holding pen 36' x 12')	432 sq ft
2.	Concrete Slab Area Scraped	(see next page)
3.	Unsurfaced Lots	0

Roof Area	432 sq ft
Concrete slabs	20,520 sq ft
	20,952 sq. ft

Total 1, 2, 3 →

Concrete Slab Area at Dairy that Runs into the Lagoon

1. Front Alley Way:

10' width (96' + 25' + 46' + 30' + 30') + (35' × 34') =

10' (227) + 1190 sq ft = 3460 sq ft

2. Behind Big Shed + Between Scrape barns

60' width (96' + 20' + 10') = 7560 sq ft =

20' × 62' = 1240 sq ft

30' × 160' = 4800 sq ft

17060 sq ft 17060 sq ft

Total Area 20,520 sq ft

3. Separator Storage Pile Area (Its within Total Area)

30' × 75' = 2250 sq ft

Average height 5 ft

2250 sq ft × 5 ft = 11,250 cu ft

Dry Stack Area

A. Heifer Barns

B-1 + B-2 : Bedded Area 46 × 160 = 7360 sq ft
Scraped Area 14 × 160 = 2240 sq ft

B-3 : Bedded Area 46 × 160 = 7360 sq ft
Scraped Area 14 × 160 = 2240 sq ft

Steel pens : Bedded Area 40 × 140 = 5600 sq ft
Scraped Area 10 × 160 = 1600 sq ft

Total bedded = 20,320
Total scraped = 6080
} 26400 sq ft

B. Dairy

Calving barn : Bedded Area 40 × 120 = 4800 sq ft

Calf barn :

A-1 Bedded Area 26 × 60 = 1560 sq ft
Scraped Area 14 × 60 = 840 sq ft

A-2 Bedded Area 26 × 60 = 1560 sq ft
Scraped Area 14 × 60 = 840 sq ft

A-3 Bedded Area 46 × 60 = 2760 sq ft
Scraped Area 14 × 60 = 840 sq ft.

Total Bedded = 10,680
Total Scraped = 2,520
} 13,200 sq ft

Both Dairy + Heifer Barns { Total Bedded Area - 31,000 sq ft
Total Scraped Area - 8,600 sq ft

Dry Stack Areas

A. Heifer barns : Steel pens, B1+B2, B3

26,400 sq ft × 2.5 ft depth = 66,000 cu. ft.

B. Dairy : calf barn, dry cow barn

13,200 sq ft × 2.5 ft depth = 33,000 cu. ft.

Bedding Volumes

A. Dairy:

1. Paper pulp: 6 units or 20 tons / Ld
   18 units or 60 Tons / month

2. Shavings: 7 units / month

3. Straw: winter (Nov, Dec, Jan Feb Mar April) 42 bales / wk
   Summer 25 bales / wk

B. Beef Barns: Winter

	Straw bales	Grass bales
B-3	24	9
B-1+2	24	9
Steel Pens	16	
	64	18

C. Total Straw Used per wk.

1. Winter: 106 straw bales / 18 grass bales = 5 Tons / wk
   80 lbs / bales

2. Summer: 25 straw bales / wk = 1 Ton / wk

Manure Spreader Coverage

A. Beef barn slabs

	N	P_2O_5	K	
Manure Test	8.0#	2.0#	9.5#	per Ton.

Spreader Covers

12 ft width × 900 ft = 10800 sq ft

.25 Acres / Ld.

The spreader hauls on average 5 Tons / Ld.

Total nutrients per Ld. 40# N 10# P_2O_5 47.5# K

Total nutrients per Acre 160# N 40# P_2O_5 190# K

what percent is available

B. Seperator Solids

	N	P_2O_5	K	
Manure Test	5.6#	2.9#	3.0#	per Ton.

Spreader Covers

12 ft width × 900 ft = 10,800 sq ft

.25 Acre / Ld

The spreader hauls on average 5 Tons / Ld.

Total nutrients per Ld. 28# N 14.5# P_2O_5 15# K

Total nutrients per Acre 112# N 58# P_2O_5 60# K

what percent is available

Lagoon Water Application Chart

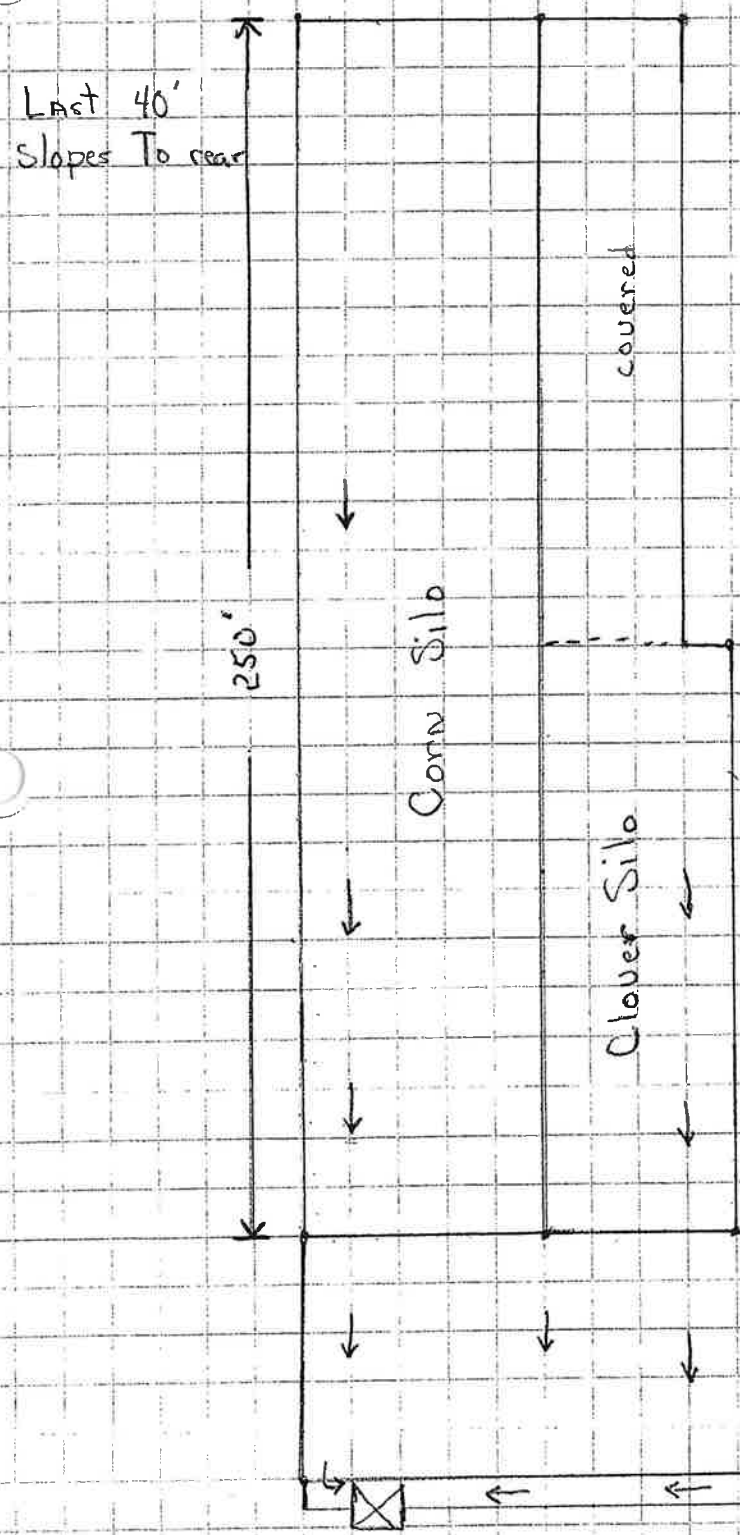
Lagoon Test #/1000gals		N	P_2O_5	K
	2001	7.7	1.5	9.8
	2004	2.0	0.5	4.2
		4.85	1.0	7.0

$$\frac{7.5 \text{ gals}}{1 \text{ cu ft}} \times \frac{43560 \text{ cu ft}}{1 \text{ Acre ft}} \times \frac{.083 \text{ Acre ft}}{1 \text{ Acre in}} = 27214 \text{ gals/Acre in}$$

Application depth	Gals /Acre	#s/Acre N	P_2O_5	K
.25 in/Acre	6800	33	7	48
.5 in /Acre	13,600	66	14	95
.75 in /Acre	20,400	99	21	143
1.0 in /Acre	27,200	132	27	190
1.25 in /Acre	34,000	165	34	238
1.50 in /Acre	40,800	198	41	286
1.75 in/Acre	47,600	231	48	333
2.0 in /Acre	54,400	264	54	381
2.25 in /Acre	61,200	297	61	428
2.50 in/Acre	68,000	330	68	476

Silo Area

1 sq = 10 ft



Silo Area that drains into Lagoon

Clover silo
40 × 132 = 5280 sq ft

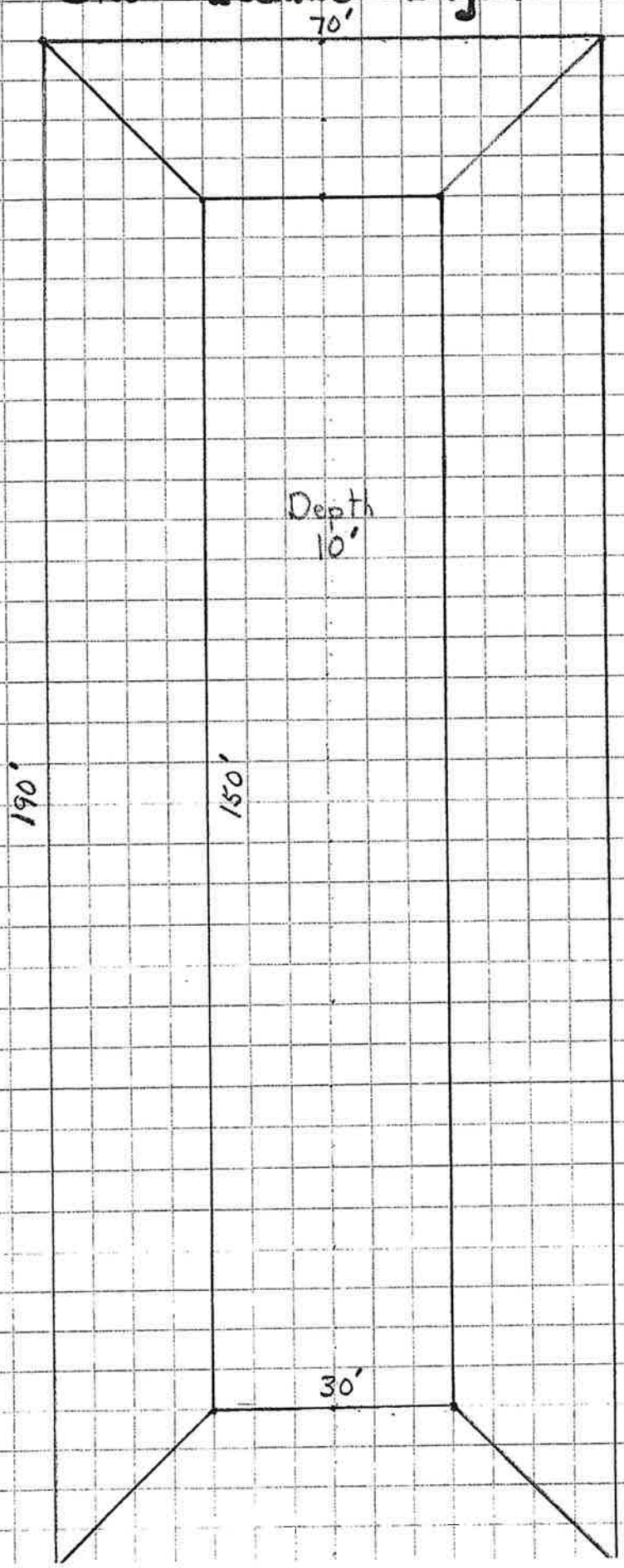
Corn Silo
50 × 210 = 10500 sq ft

Front Apron
50 × 100 = 5000 sq ft

Total 20,780 sq ft

Silo Leachate Lagoon

1 sq = 5 ft

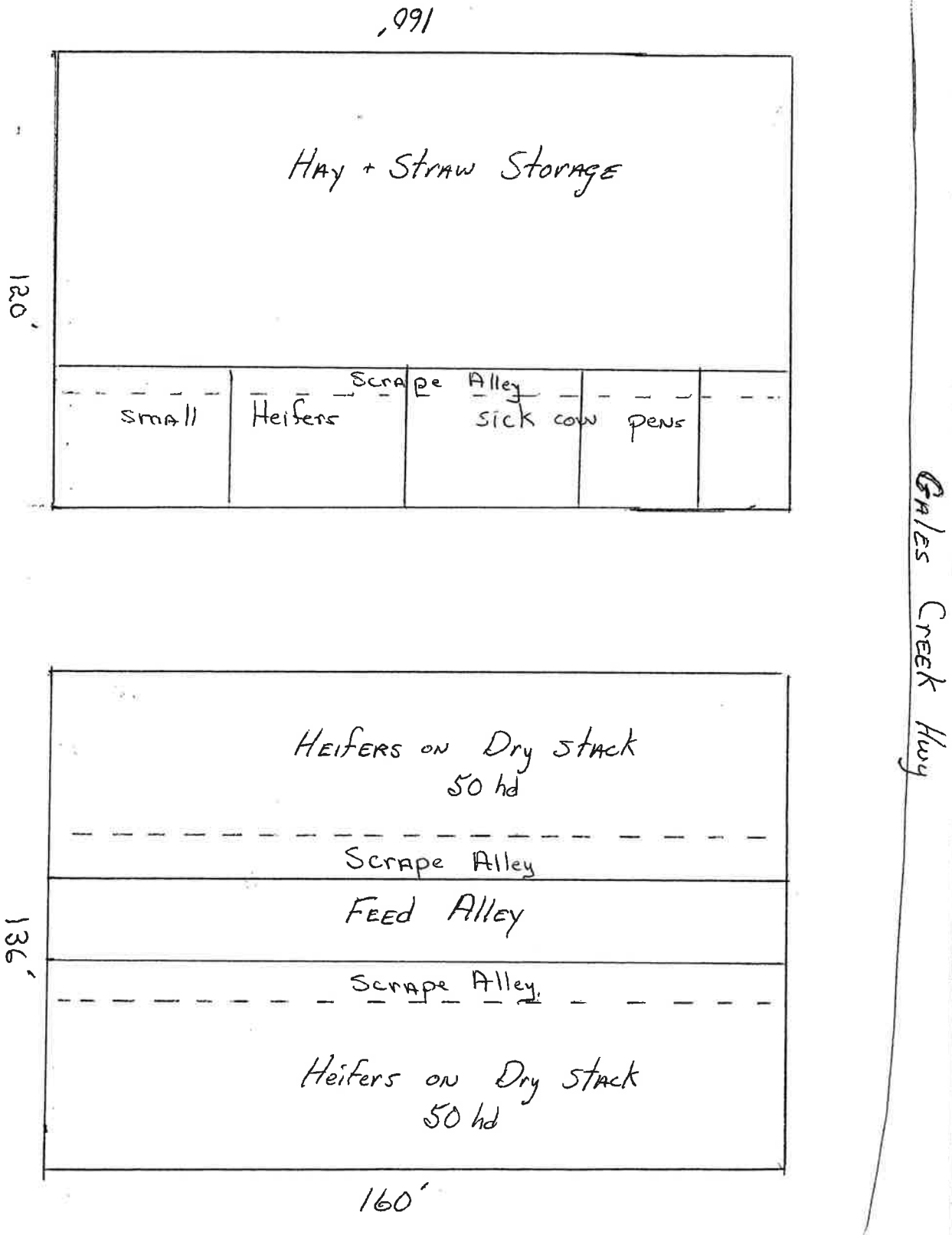


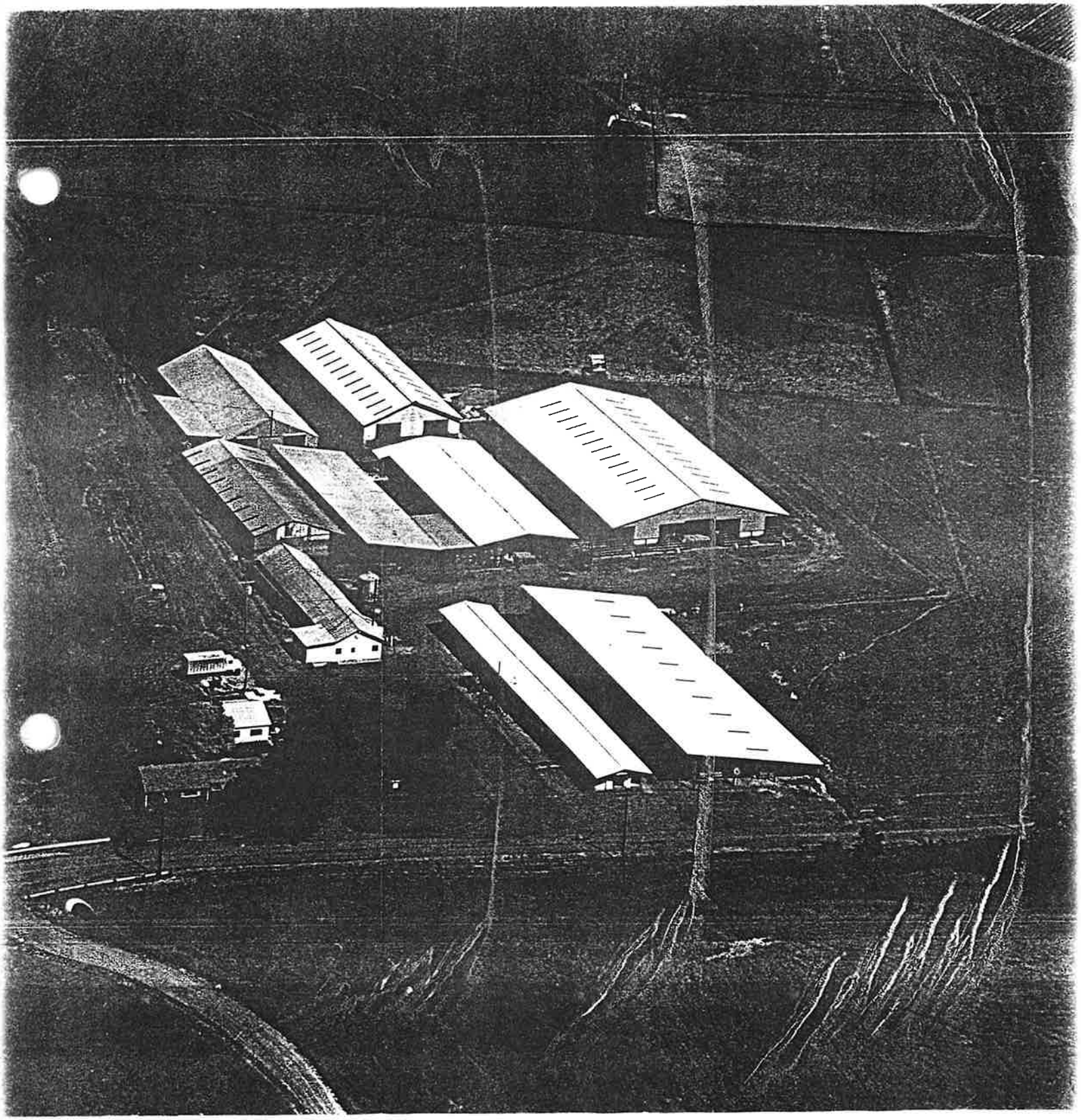
Capacity

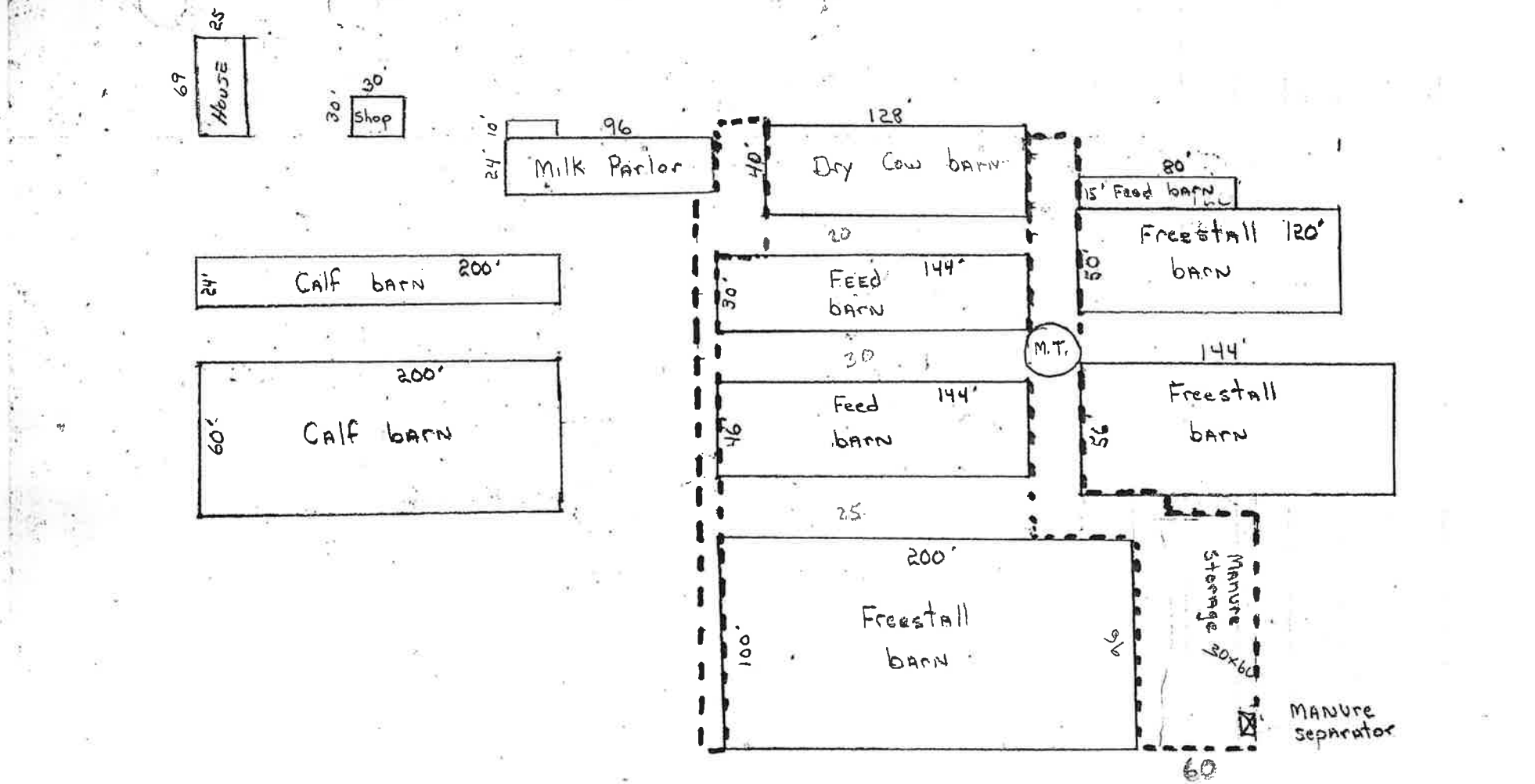
1.95 Acre ft

Heifer Barns

Not To Scale





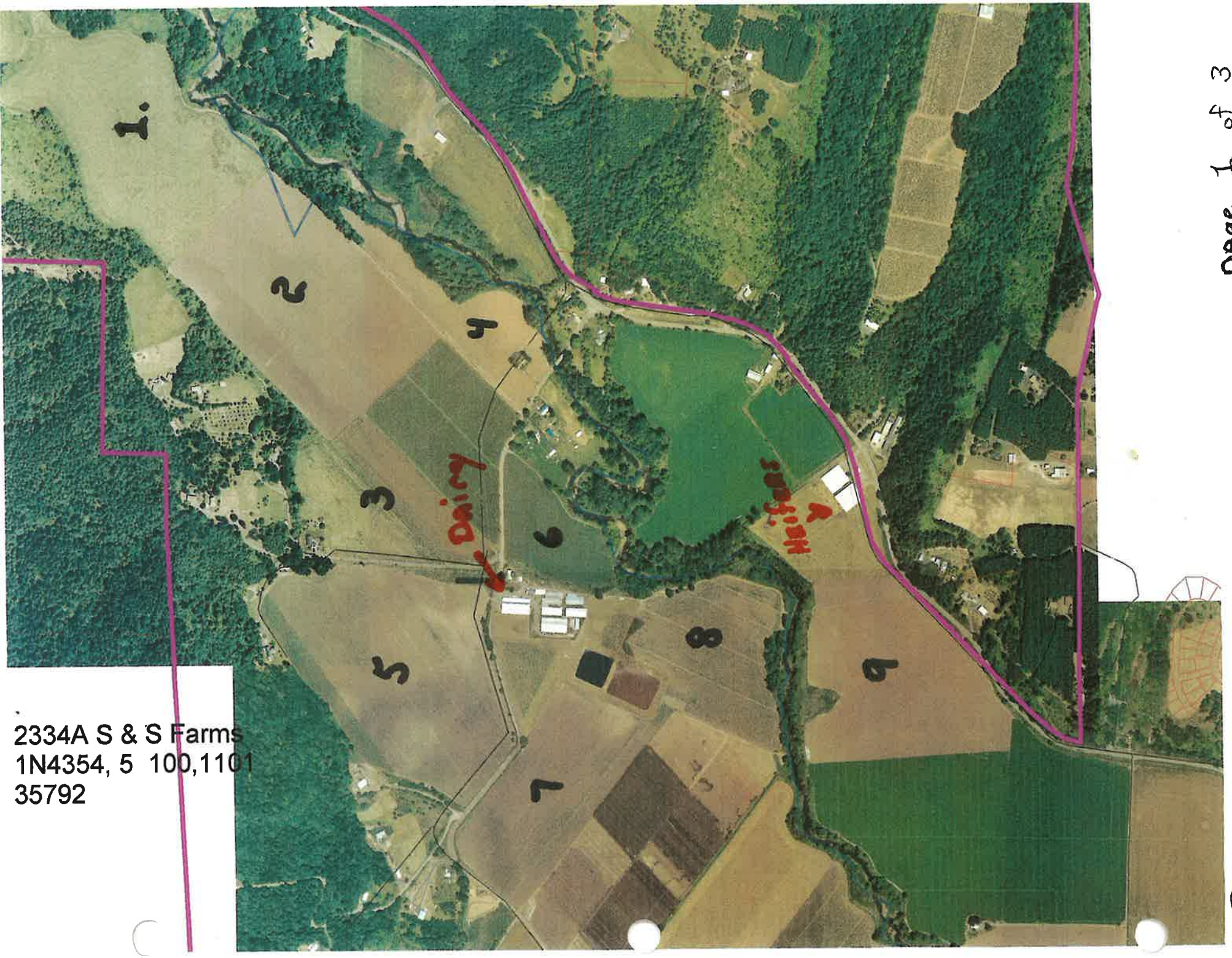

25
69
House
30'
30'
Shop
24'
10'
96
Milk Parlor
128'
40'
Dry Cow barn
80'
15' Feed barn
Freestall barn
120'
50'
20
Feed barn
144'
30'
M.T.
144'
Freestall barn
30
Feed barn
144'
46'
56'
25
200'
Freestall barn
100'
96'
Manure storage
30x60
MANURE separator
60
24'
Calf barn
200'
60'
Calf barn
200'
Lagoon →

Key To Fields

Field No.	Discription	Acres
1	West Oppenlanders	50
2	East Oppenlanders	40
3	Stubbs + Blueberries	20
4	Jason's	15
5	Bagleys	45
6	Raspberry	10
7	Aboue Lagoon	25
8	Behind Dairy	20
9	Beef barns	35
10	West Hopyard	30
11	East Hopyard	30
12	By Pats	30
13	Between Pats + Bens	20
14	Marions	25
15	Near Creek	25
16	By Bens	45
17	East Marions	45
18	Below House	55
19	Ramp	20
20	Below Shop	70
21	South Myrons	30
22	North Myrons	30
23	Duycks	35
24	Knox's	30
25	East Myrons	30
26	Alexanders	35
		845 Acres

Key To Fields

Field No	Acres	2005 Crop	Soil Test P	Soil Test K
1	50	Field Corn	5	95
2	40	Spring Wheat	21	213
3	20	Crimson Clover	10	135
4	15	Crimson Clover	44	246
5	45	Crimson Clover	50	212
6	10	Winter Wheat	38	250
7	25	Winter Wheat	42	380
8	20	Field Corn	54	505
9	35	Red Clover	48	326
10	30	Field Corn	33	368
11	30	Tall Fescue	29	259
12	30	Sweet Corn	9	216
13	20	Red Clover	39	202
14	25	Sweet Corn	12	220
15	25	Tall Fescue	9	140
16	45	Sweet Corn	13	200
17	45	Sweet Corn	17	166
18	55	Crimson Clover	32	110
19	20	Sweet Corn	14	156
20	70	Winter Wheat	12	146
21	30	Red Clover	16	150
22	30	Winter Wheat	19	186
23	35	Winter Wheat	14	209
24	30	Red Clover	42	159
25	30	Tall Fescue	10	134
26	35	Winter Wheat	42	151
	845 Acres			



2334A S & S Farms
1N4354, 5 100,1101
35792

main

neighbors


W1-37
W1F-5
W1C2-1
2334 S & S Farms
1N435-xx, 1S401-1400
35792 = 438.4 Acres

R. Mar Farms

Soils Map

Date: 3/7/2005

Customer(s): RICK SHEELAR

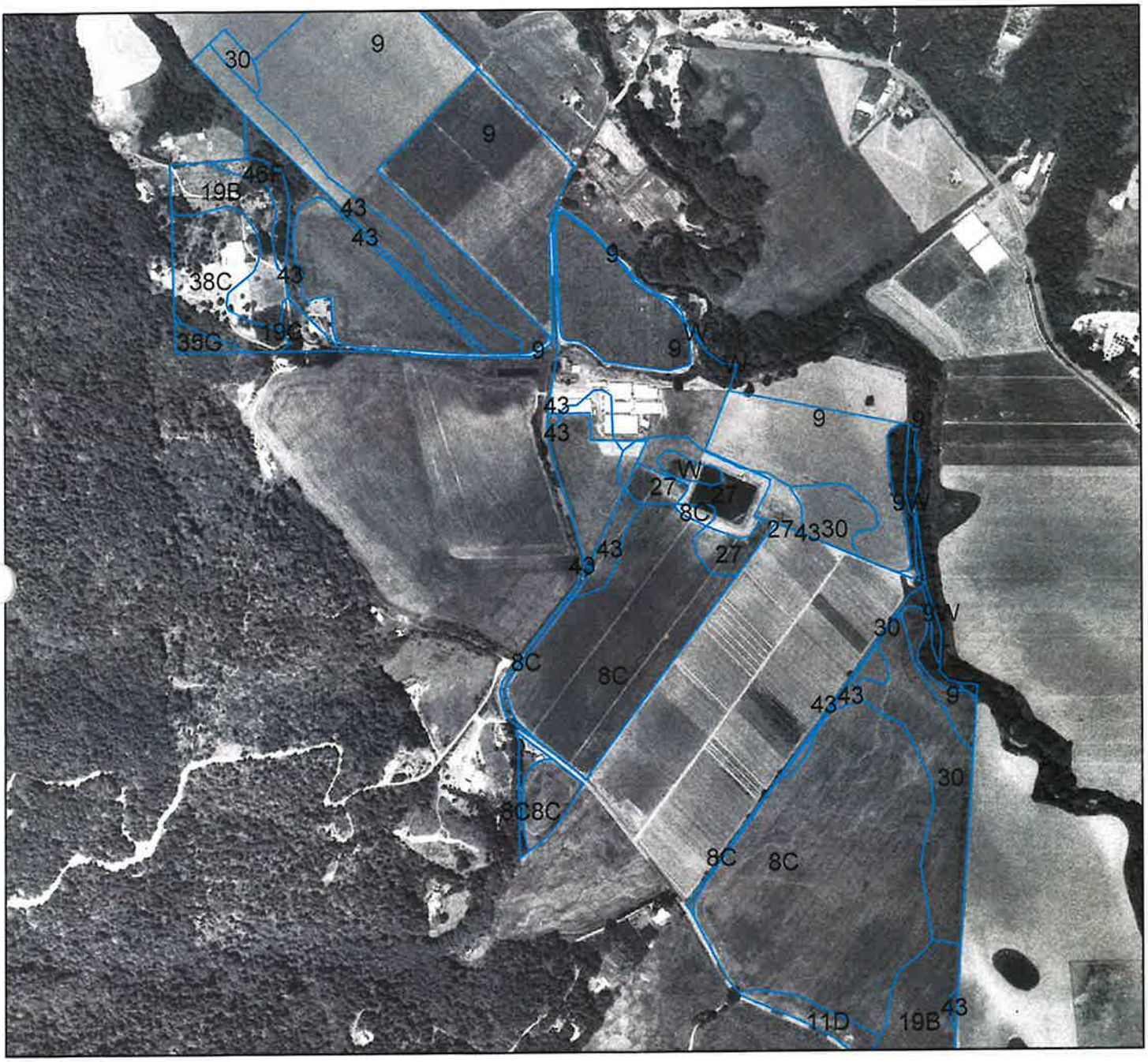
District: Tualatin

Field Office: Hillsboro

Agency: USDA, NRCS

Assisted By: Robert App

Legal Description: T1NR4W, Sections 27 &34



Legend

Soils Map

Image: drg_or067.sid

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

N

Barn roofs are guttered to divert clean water away from storage.

Soil Descriptions

Chehalem Series

The Chehalem series consists of somewhat poorly drained soils that have formed in alluvium. These soils have slopes of 2 to 12 percent. They occur on alluvial fans at elevations of 150 to 300 feet. The average annual precipitation is 40 to 45 inches, the average annual air temperature is 52° to 54° F., and the length of the frost-free season is 200 to 210 days. In noncultlvated areas the vegetation is mainly ash, cottonwood, willow, oak, sedges, reeds, and grasses. Chehalem soils are associated with Woodburn soils.

In a typical profile, the surface layer is very dark brown silt loam about 16 inches thick. The subsoil is mottled silty clay about 44 inches thick. The upper part of the subsoil is very dark grayish brown, the middle part is dark grayish brown, and the lower part is olive brown. The Chehalem soils are used mainly for small grains, pasture, hay, and native hardwoods. Mainly irrigated, a small acreage is used for vegetables, improved pasture, and caneberries.

Chehalem silt loam, 2 to 12 percent slopes (CeC).This is the only soil of the Chehalem series mapped in the survey area. It occupies small areas on foot slopes of the Salem and Waldo Hills.

Representative profile (SE1/4SW1/4 sec. 23, T. 9 S., R. 3 W.).

Included with this soil in mapping were small areas of a soil along Butte Creek that has a lighter colored surface layer and a more permeable subsoil than this soil. The subsoil of the included soil is silty clay loam.

The available water capacity is 10 to 11 inches. Permeability is slow, and fertility is moderate. Runoff is medium, and the hazard of erosion is slight. This soil is subject to seepage and runoff from higher areas. The depth to which roots can penetrate is restricted by wetness during winter and spring. Workability is fair.

This soil is used mainly for small grains, pasture, hay, and native hardwoods. When irrigated, a small acreage is used for vegetables, improved pasture, and caneberries.

Chehalis Series

The Chehalis series consists of well-drained soils that have formed in alluvium. These soils are nearly level or gently undulating, and they occur on bottom lands that are traversed by old overflow channels and sloughs. Elevations range from 100 to 650 feet. The average annual precipitation is 40 to 45 inches, the average annual air temperature is about 52° to 54° F., and the length of the frost-free season is 200 to 210 days. In areas that are not cultivated, the vegetation is mainly alder, ash bigleaf maple, oak, and an understory of vine maple, wild blackberry, vines, and shrubs. Chehalis soils are associated with Cloquato and Newberg soils.

In a typical profile, the surface layer is dark-brown silty clay loam about 9 inches thick. The subsoil is also dark-brown silty clay loam and is about 28 inches thick. The substratum is silty clay loam that is dark brown in the upper part and dark yellowish brown in the lower part. It extends to a depth of 80 inches or more.

The Chehalis soils are used mainly for pasture, hay, cereal grains, grass grown for seed, and orchards. When irrigated, they are used extensively for vegetables and berries.

Chehalis silty clay loam (Ch).-This is the only soil of the Chehalis series mapped in the survey area. It occupies the higher parts of bottom lands along the larger streams. Overflow occurs only about once in 50 years.

Representative profile (W1/2SE1/4NE1/4 sec. 20, T. 6 S., R. 1 W.)

Included with this soil in mapping were small areas of Cloquato, Newberg, and Camas soils, and small areas of a steep soil on breaks.

The available water capacity is 11 to 12 inches. Permeability is moderate, and fertility is high. Runoff is slow, and the hazard of erosion is slight. Depth to which roots can penetrate is not restricted. This soil is generally in good tilth if regular additions of organic matter are provided.

This soil is used mainly for pasture, hay, cereal grains, grass grown for seed, and orchards. When irrigated, it is used extensively for vegetables and berries, but it is also used for all the crops commonly grown in the survey area, except potatoes and carrots. (Capability unit I-1; not placed in a woodland suitability group)

Labish Series

The Labish series consists of poorly drained soils that have formed in mixed mineral and organic material. These soils have slopes of 0 to 1 percent. They occur on the bottoms of former shallow lakes at elevations of 150 to 175 feet. The average annual precipitation is between 40 and 45 inches, the average annual air temperature is 53° F., and the length of the frost-free season is 200 to 210 days. In areas that are not cultivated, the vegetation is mainly sedges, tussocks, and . willows. Labish soils are associated with Semiahmoo soils.

In a typical profile the surface layer is black and is about 7 inches tick. It consists of silty clay loam in the upper part and of silty clay in the lower part. The next layer is very dark brown silty clay about 9 inches thick. Below this is very dark gray clay that extends to a depth of 60 inches or more.

The Labish soils are used mainly for onions, small grains, pasture, and hay.

Labish silty clay loam (La).-This is the only soil of the Labish series mapped in the survey area. Nearly all of the acreage is in Lake Labish Bottom and in intermittent drainageways that have their outlets in Lake Labish Bottom.

Representative profile (NE1/4SW1/4 sec. 14, T. 6 S., R. 2 W.)

Included with this soil in mapping were small areas of Wapato and Semiahmoo soils.

The available water capacity is 12 to 15 inches. Permeability

is slow, and fertility is high. Workability is only fair. Runoff is very slow to ponded, and erosion is not a hazard or is only a slight hazard. Depth to which roots can penetrate is limited by the high water table. Annual flooding is a hazard to crops. This soil is used mainly for onions, small grains, pasture, and hay. When irrigated, drained areas are used for vegetables and specialty crops. (Capability unit IIIw-2; not placed in a woodland suitability group)

McBee Series

The McBee series consists of moderately well drained, undulating soils that formed in mixed alluvium. These soils have slopes of 0 to 3 percent. They occur on flood plains that are traversed by sloughs and old overflow channels. Elevations range from 100 to 650 feet. The average annual precipitation is 40 to 45 inches, the average annual air temperature is 52° to 54° F., and the length of the frost-free season is 200 to 210 days. In areas that are not cultivated, the vegetation is mainly Douglas-fir, alder, ash, big-leaf maple, oak, and an understory of vine maple, blackberry, shrubs, and grasses. McBee soils are associated with Wapato and Chehalis soils.

In a typical profile, the surface layer is very dark brown silty clay loam about 10 inches thick. The subsoil is about 32 inches thick and is mottled throughout. It is very dark brown silty clay loam in the upper part; dark brown, very dark brown, and very dark grayish-brown silty clay loam in the middle part; and dark grayish-brown clay loam in the lower part. The substratum is mottled, dark gray clay loam that extends to a depth of 65 inches or more.

McBee soils that are not irrigated are used mainly for small grains, orchards, pasture, hay, and grass grown for seed. They are used mostly for row crops when irrigated.

McBee silty clay loam (Mb).-This is the only soil of the McBee series mapped in the survey area. It occurs along Butte Creek and along the Willamette, Pudding, and Santiam Rivers, and it is subject to frequent overflow.

Representative profile (SE1/4SE1/4 sec. 6, T. 6 S., R. 1 E.) .

Included with this soil in mapping were small areas of a soil that has a layer of gravelly material below a depth of 3 feet. Also included were small areas of Wapato and Chehalis soils.

The available water capacity is 12 to 14 inches or more. In many places the drainage has been improved by lowering the water table and by improving outlets. Depth to which roots can penetrate is still restricted, however, by a seasonal high water table. Permeability and fertility are both moderate, and runoff is slow. Because of the frequent overflow, erosion is a moderate hazard. Workability is good, but regular additions of organic matter are needed to keep the soil structure from deteriorating and to keep tillage from becoming more difficult.

When not irrigated, this soil is used mainly for small grains, orchards, pasture, hay, and grass grown for seed. When irrigated, it is used for caneberries, sweet corn, beans, and hops. Drainage is not necessary for many crops, but it is needed if maximum use is to be made of this soil and if best returns are to be realized.

Where this soil is drained, it is suited to all the crops commonly grown in the survey area. (Capability unit IIw-5; not placed in a woodland suitability group)

Wapato Series

The Wapato series consists of poorly drained soils that have formed in mixed alluvium. These soils are nearly level. They occur in depressions and overflow channels on flood plains at elevations of 100 to 650 feet. The average annual precipitation is 40 to 45 inches, the average annual air temperature is about 53° F., and the length of the frost-free season is 200 to 210 days. In areas that are not cultivated, the vegetation is mainly willow, ash, tussocks, sedges, and grasses. Wapato soils are associated with McBee and Bashaw soils.

In a typical profile, the surface layer is mottled very dark brown silty clay loam about 16 inches thick. The subsoil is mottled very dark grayish-brown silty clay loam about 20 inches thick. The substratum is mottled dark-brown silty clay loam that extends to a depth of 60 inches or more.

The Wapato soils are used mainly for pasture, hay, small grains, vegetables, and caneberries.

Wapato silty clay loam (Wc).-This is the only soil of the Wapato series mapped in the survey area. It occurs in backwater areas of the flood plains, in most places adjacent to the terraces. Representatives profile (SE1/4NE1/4 sec. 15, T. 6 S., R. 1 W.).

26 inches. Effective rooting depth is more than 60 inc

These soils are used for irrigated vegetable crops, orchards, small grain, irrigated berries, irrigated hay, irrigated pasture, wildlife habitat, and recreation.

Representative profile of Chehalis silty clay loam, located southeast of bridge over the Tualatin River in the SW¼SE¼NE¼ section 9, R. 1 S., R. 3 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many, very fine, tubular pores; slightly acid (pH 6.2); abrupt, smooth boundary. 4 to 10 inches thick.

A12—8 to 16 inches, dark-brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many, very fine, tubular pores; slightly acid (pH 6.2); clear, smooth boundary. 2 to 10 inches thick.

B21—16 to 38 inches, dark-brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate, fine, subangular blocky structure; slightly hard, firm, sticky and plastic; moderate fine roots; common, fine, tubular pores; medium acid (pH 6.0); clear, smooth boundary. 10 to 22 inches thick.

B22—38 to 45 inches, dark-brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate, medium, subangular blocky structure; slightly hard, firm, sticky and plastic; few fine roots; common, fine, tubular pores; medium acid (pH 6.0); clear, smooth boundary. 7 to 30 inches thick.

C—45 to 60 inches, dark yellowish-brown (10YR 3/4) silt loam, brown (10YR 5/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few, very fine and fine roots; few, very fine, tubular pores; medium acid (pH 6.0).

The A horizon has moist colors of very dark grayish brown or dark brown to a depth of 20 inches or more. The dry colors are brown, grayish brown, or dark grayish brown. Texture is silt loam to silty clay loam. Texture of the B horizon is silty clay loam, but thin, stratified layers of silt loam occur in places. In some places silt loam horizons are at a depth of more than 40 inches.

9—Chehalis silty clay loam, occasional overflow. This nearly level soil is on smooth flood plains. This soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Chehalis silt loam, McBee soils, and Wapato soils, which make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. The hazard of streambank erosion is severe (fig. 4). Capability unit IIw–3; wildlife group 1.

10—Chehalis silt loam, occasional overflow. This nearly level soil is on smooth flood plains. It has a profile similar to the one described as representative of the series, but it has a silt loam surface layer and a heavy silt loam subsoil.

Included with this soil in mapping were areas of Chehalis silty clay loam, McBee soils, and Wapato soils, which make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. The hazard of streambank erosion is severe. Capability unit IIw–3; wildlife group 1.

Cornelius series

The Cornelius series consists of moderately well drained soils that formed in loesslike material over fine-silty, old alluvium of mixed origin on uplands. Slope is 2 to 60 percent. Elevation is 350 to 800 feet. Where these soils are not cultivated, vegetation is Douglas-fir, bigleaf maple, shrubs, and grasses. Average annual precipitation is 40 to 60 inches. Average annual air temperature is 52° to 54° F, and the frost-free period is 165 to 210 days.

In a representative profile the surface layer is dark-brown silt loam about 6 inches thick. The upper part of the subsoil is brown silt loam about 32 inches thick, and the lower part is a brown, mottled silt loam fragipan about 20 inches thick. The profile is medium acid in the surface layer, medium to strongly acid in the upper part of the subsoil, and strongly acid in the fragipan.

Permeability is slow. Available water capacity is 8 to 10 inches. Water-supplying capacity is 18 to 20 inches. Effective rooting depth is 30 to 40 inches.

These soils are used for irrigated berries, irrigated vegetable crops, orchards, small grain, legume and grass seed, irrigated hay, irrigated pasture, timber, recreation, and wildlife habitat.

Representative profile of Cornelius silt loam in an area of Cornelius and Kinton silt loams, 2 to 7 percent slopes, located about 2,000 feet east and 300 feet south of Midway-Vandeschuere Road junction in the NW¼ NE¼SE¼ section 17, T. 2 S., R. 2 W.:

Ap—0 to 6 inches, dark-brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common, fine, and few, medium roots; many, very fine, tubular pores; many fine concretions; medium acid (pH 5.6); abrupt, smooth boundary. 5 to 6 inches thick.

B11—6 to 11 inches, brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate, fine, subangular blocky structure; hard, firm, slightly sticky and plastic; common fine roots and few medium roots; many, very fine, tubular pores; thin silt coatings on some peds; 2 percent fine hard concretions; medium acid (pH 5.9); clear, smooth boundary. 4 to 6 inches thick.

B12—11 to 17 inches, brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate, fine and medium, suban-

fragipan in some pedons. Clay films on most ped faces are common, nearly continuous, and thin to moderately thick. The depth to the fragipan ranges from 30 to 40 inches. The fragipan is very firm to firm and very brittle, and it has few to many, thin to moderately thick clay films on most peds. It is a silt loam to silty clay loam and is commonly 2 feet or more in thickness. The fragipan overlies dark reddish-brown (2.5YR 3/4) clay in some areas.

11B—Cornelius and Kinton silt loams, 2 to 7 percent slopes. This undifferentiated group consists of about 50 to 65 percent Cornelius soils and 25 to 35 percent Kinton soils. These soils occur in a variable pattern. The Cornelius soil and the Kinton soil have the profile described as representative of their respective series.

Included with this undifferentiated group in mapping were areas of Cascade, Laurelwood, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIIe–3; woodland suitability group 2o2; wildlife group 3.

11C—Cornelius and Kinton silt loams, 7 to 12 percent slopes. This undifferentiated group consists of about 50 to 65 percent Cornelius soils and 25 to 35 percent Kinton soils. These soils occur in a variable pattern.

Included with this undifferentiated group in mapping were areas of Cascade, Laurelwood, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–3; woodland suitability group 2o2; wildlife group 3.

11D—Cornelius and Kinton silt loams, 12 to 20 percent slopes. This undifferentiated group consists of about 50 to 65 percent Cornelius soils and 25 to 35 percent Kinton soils. These soils occur in a variable pattern.

Included with this undifferentiated group in mapping were areas of Cascade, Laurelwood, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–3; woodland suitability group 2o2; wildlife group 3.

11E—Cornelius and Kinton silt loams, 20 to 30 percent slopes. This undifferentiated group consists of about 50 to 65 percent Cornelius soils and 25 to 35 percent Kinton soils. These soils occur in a variable pattern.

Included with this undifferentiated group in mapping were areas of Cascade, Laurelwood, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used mainly for irrigated pasture, legume and grass seed, timber, and wildlife habitat. Capability unit IVe–6; woodland suitability group 2o2; wildlife group 3.

11F—Cornelius and Kinton silt loams, 30 to 60 percent slopes. This undifferentiated group consists of about 50 to 65 percent Cornelius soils and 25 to 35 percent Kinton soils. These soils occur in a variable pattern.

Included with this undifferentiated group in mapping were areas of Cascade, Laurelwood, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used mainly for timber and wildlife habitat. Capability unit VIe; woodland suitability group 2r2; wildlife group 3.

Cornelius Variant

The Cornelius Variant consists of somewhat poorly drained soils that formed in lacustrine silts on broad valley terraces. Slope is 0 to 12 percent. Elevation is 200 to 300 feet. Where these soils are not cultivated, the vegetation is Douglas-fir, Oregon white oak, shrubs, and grasses. Average annual precipitation is 40 to 50 inches, average annual air temperature is 51° to 53° F, and the frost-free period is 165 to 210 days.

In a representative profile the surface layer is dark-brown silt loam about 10 inches thick. The upper part of the subsoil is dark brown silt loam about 13 inches thick, and the lower part is brown silty clay loam about 16 inches thick over a brown, brittle silty clay loam substratum about 21 inches thick. The profile is medium acid in the upper part and slightly acid in the lower part of the subsoil and in the substratum.

Permeability is moderately slow. Available water capacity is 11 to 13 inches. Water-supplying capacity is 18 to 20 inches. Effective rooting depth is 30 to 40 inches.

These soils are used for orchards, pasture, and small grain. Other uses include wildlife habitat, recreation, and homesites.

Representative profile of Cornelius Variant silt loam, 0 to 3 percent slopes, located in the SW¼NE¼ SW¼ section 29, T. 1 N., R. 1 W.:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few 2 millimeter to 5 millimeter concretions; many very fine roots; many, very fine, irregular pores; medium acid (pH 5.8); abrupt, smooth boundary. 0 to 10 inches thick.

B11—10 to 15 inches, dark-brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common black manganese stains on peds; common, fine, reddish-brown (5YR 4/4) mottles; few very fine roots; many, very fine, tubular pores; medium acid (pH 6.0); clear, smooth boundary. 5 to 9 inches thick.

B12—15 to 23 inches, dark-brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; brown (7.5YR 4/4) and grayish-brown (10YR 5/2) coatings on peds; moderate, medium, subangular blocky structure;

loam, pink (7.5YR 7/4) dry; few grayish-brown (10YR 5/2) and brown (10YR 5/3) mottles; moderate, medium, angular and subangular blocky structure; very hard, very firm, slightly sticky and slightly plastic; common black manganese stains on peds; thick clay films in pores; few fine roots; many, fine, tubular pores.

The A horizon is very dark grayish brown, dark brown, or brown. The B horizon is brown, dark yellowish brown, or dark brown. Depth to the fragipan ranges from 30 to 45 inches. None to few faint mottles may occur near the upper boundary of the fragipan. Clay films on prism faces and fractures are thin and patchy to continuous.

17B—Goble silt loam, 2 to 7 percent slopes. This gently sloping soil is on ridgetops of uplands. The soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Cascade, Melby, Olyic, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit VIe; woodland suitability group 3o1; wildlife group 4.

17C—Goble silt loam, 7 to 12 percent slopes. This moderately sloping soil is on ridgetops of uplands.

Included with this soil in mapping were areas of Cascade, Melby, Olyic, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit VIe; woodland suitability group 3o1; wildlife group 4.

17D—Goble silt loam, 12 to 20 percent slopes. This moderately steep soil is on uplands.

Included with this soil in mapping were areas of Cascade, Melby, Olyic, and Delena soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit VIe; woodland suitability group 3o1; wildlife group 4.

17E—Goble silt loam, 20 to 30 percent slopes. This steep soil is on uplands.

Included with this soil in mapping were areas of Cascade, Melby, Olyic, and Delena soils, which make up as much as 20 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 3o1; wildlife group 4.

18E—Goble silt loam, 2 to 30 percent slopes. This gently sloping to steep soil is on uplands.

Included with this soil in mapping were areas of Cascade, Melby, Delena, and Olyic soils, which make up as much as 20 percent of this mapping unit.

Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Capability unit VIe; woodland suitability group 3o1; wildlife group 4.

18F—Goble silt loam, 30 to 60 percent slopes. This steep to very steep soil is on uplands.

Included with this soil in mapping were areas of Cascade, Melby, Delena, and Olyic soils, which make up as much as 20 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 3r1; wildlife group 4.

Helvetia series

The Helvetia series consists of moderately well drained soils that formed in old alluvium of mixed origin on old terraces. Slope is 3 to 20 percent. Elevation is 250 to 500 feet. Where these soils are not cultivated, the vegetation is Douglas-fir, bigleaf maple, hazelbrush, poison-oak, shrubs, and grasses. Average annual precipitation is 40 to 50 inches, average annual air temperature is 52° to 54° F, and the frost-free period is 165 to 210 days.

In a representative profile the surface layer is dark-brown silt loam and silty clay loam about 10 inches thick. The upper part of the subsoil is dark yellowish-brown silty clay about 38 inches thick, and the lower part is dark yellowish-brown light silty clay that has distinct mottles and is about 12 inches or more thick. The profile is slightly acid in the surface layer and slightly acid to medium acid in the subsoil.

Permeability is moderately slow. Available water capacity is 11 to 13 inches. Water-supplying capacity is 19 to 20 inches. Effective rooting depth is more than 60 inches.

These soils are used for irrigated berries, irrigated vegetable crops, orchards (fig. 6), small grain, grass and legume seed crops, irrigated hay, irrigated pasture, recreation, and wildlife habitat.

Representative profile of Helvetia silt loam, 2 to 7

Figure 6.—Prune orchard on a Helvetia silt loam.

ercent slopes, located in the SE¼NE¼NW¼ section
l, T. 2 S., R. 2 W.:

Ap1—0 to 5 inches, dark-brown (10YR 3/3) heavy silt loam, grayish brown (10YR 5/2) dry; moderate, fine and very fine, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; abundant fine roots; many very fine pores; slightly acid (pH 6.4); abrupt, smooth boundary. 5 to 6 inches thick.

Ap2—5 to 10 inches, dark-brown (10YR 3/3) light silty clay loam, grayish brown (10YR 5/2) dry; moderate, medium, fine, and very fine subangular blocky structure; slightly hard, friable, slightly sticky, plastic; many fine roots; many very fine pores; slightly acid (pH 6.2); abrupt, smooth boundary. 5 to 8 inches thick.

B1t—10 to 16 inches, dark yellowish-brown (10YR 3/4) light silty clay, brown (10YR 5/3) dry; moderate, medium and fine, subangular blocky structure; hard, friable, sticky, very plastic; common fine roots; many very fine pores; common thin clay films on ped surfaces, thick continuous clay films in pores and channels; slightly acid (pH 6.2); clear, smooth boundary. 4 to 8 inches thick.

B21t—16 to 28 inches, dark yellowish-brown (10YR 3/4) silty clay, brown (10YR 5/3) dry; moderate, coarse and medium, subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots; many very fine pores; medium continuous clay films on ped surfaces, thick in pores and channels; medium acid (pH 6.0); clear, smooth boundary. 8 to 14 inches thick.

B22t—28 to 48 inches, dark yellowish-brown (10YR 4/4) light silty clay, pale brown (10YR 6/3) dry; moderate, coarse and medium, subangular blocky structure; hard, firm, very sticky and very plastic; few fine roots; common very fine pores; common thin clay films on ped surfaces, medium and continuous in channels and pores; medium acid (pH 5.8); clear, smooth boundary. 14 to 22 inches thick.

B3—48 to 60 inches, dark yellowish-brown (10YR 4/4) light silty clay loam, pale brown (10YR 6/3) dry; few, fine, faint, gray (10YR 6/1) and dark-brown (10YR 3/2) mottles; few black stains; weak, medium and fine, subangular blocky structure; hard, firm, sticky and very plastic; few fine roots; common fine pores; medium acid (pH 5.8).

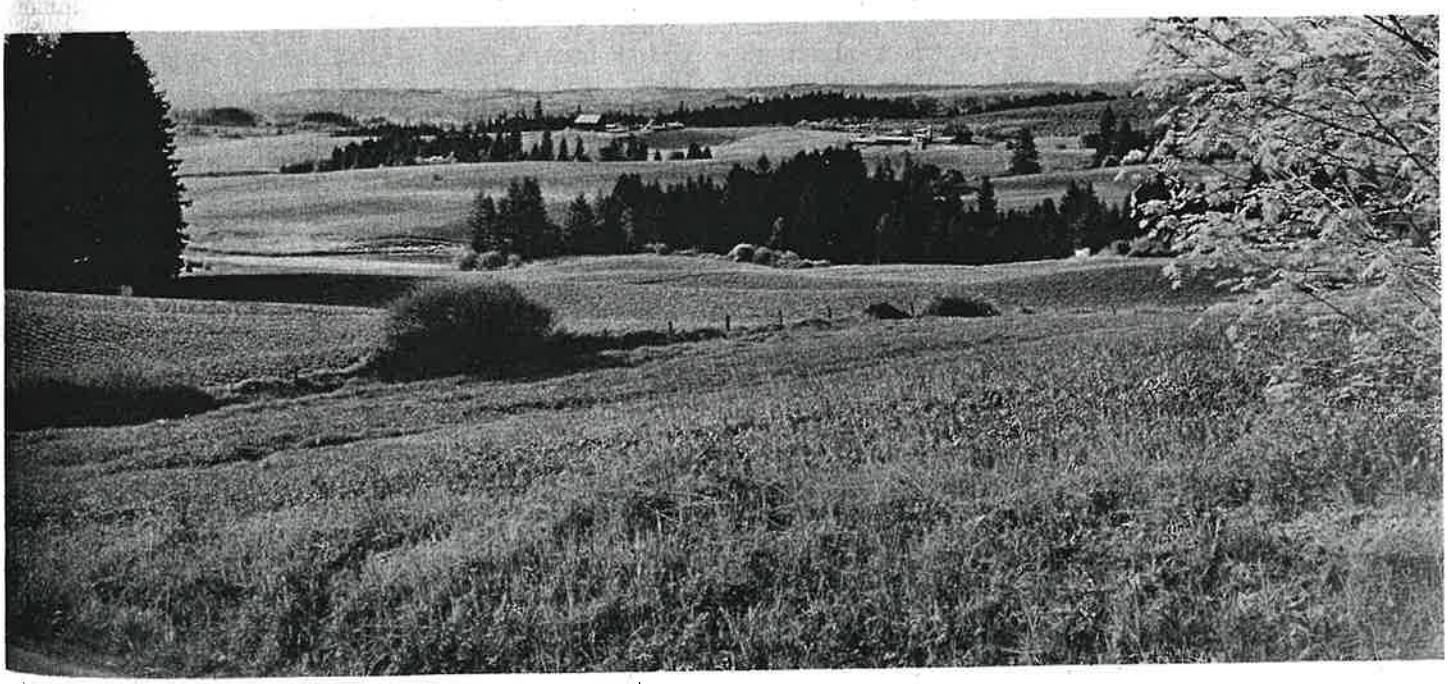
The A horizon is silt loam or light silty clay loam. Faint mottles and black stains below a depth of 30 inches in places. Clay films are thin or moderately thick and common or continuous on peds.

19B—Helvetia silt loam, 2 to 7 percent slopes. This gently sloping soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Laurelwood, Kinton, Cornelius, Woodburn, and Cascade soils, which make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–2; wildlife group 2.

19C—Helvetia silt loam, 7 to 12 percent slopes. This soil is moderately sloping (fig. 7).



igure 7.—**Moderately sloping Helvetia silt loam in foreground and center background; moderately steep Laurelwood soils in background.**

Included with this soil in mapping were areas of Laurelwood, Kinton, Cornelius, Woodburn, and Cascade soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIe–2; wildlife group 2.

19D—Helvetia silt loam, 12 to 20 percent slopes. This soil is moderately steep.

Included with this soil in mapping were areas of Laurelwood, Kinton, Cornelius, Woodburn, and Cascade soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–5; wildlife group 2.

19E—Helvetia silt loam, 20 to 30 percent slopes. This steep soil is on uplands.

Included with this soil in mapping were areas of Laurelwood, Kinton, Cornelius, Woodburn, and Cascade soils, which make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. The soil is used mainly for pasture, orchards, recreation, and wildlife habitat. Capability unit IVe–5; wildlife group 2.

Hembre series

The Hembre series consists of well-drained soils that formed in residuum weathered from basalt or breccia on uplands. Slope is 3 to 90 percent. Elevation is 500 to 2,600 feet. Vegetation is Douglas-fir, western hemlock, red alder, vine maple, swordfern, and salal. Average annual precipitation is 80 to 100 inches, average annual air temperature is 48° to 51° F, and the frost-free period is 145 to 200 days.

In a representative profile the surface layer is dark reddish-brown silt loam about 13 inches thick. The subsoil is dark reddish-brown, reddish-brown, and yellowish-red silty clay loam about 29 inches thick. Hard, fractured bedrock is at a depth of about 42 inches. The profile is strongly acid and very strongly acid in the surface layer and very strongly acid in the subsoil.

Permeability is moderate. Available water capacity is 7 to 10 inches. Water-supplying capacity is 22 to 24 inches. Effective rooting depth is 40 to 50 inches.

These soils are used for timber, recreation, wildlife habitat, and water supply.

Representative profile of Hembre silt loam, 3 to 30 percent slopes, located 300 feet north of road in the SE¼NE¼NW¼ section 21, T. 1 S., R. 6 W.:

O—⅛ inch to 0, needles, twigs, grass stems.

A1—0 to 6 inches, dark reddish-brown (5YR 3/2) silt loam, dark brown (7.5YR 4/4) dry; strong, fine, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; many, very fine, irregular pores; 5 percent fine pebbles; many fine concretions; strongly acid (pH 5.2); clear, smooth boundary. 4 to 6 inches thick.

A3—6 to 13 inches, dark reddish-brown (5YR 3/2) silt loam, brown (7.5YR 5/4) dry; moderate, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine roots; many, very fine, tubular pores; 5 percent fine pebbles; many fine concretions; very strongly acid (pH 5.0); clear, smooth boundary. 6 to 8 inches thick.

B21—13 to 18 inches, dark reddish-brown (5YR 3/4) silty clay loam, reddish brown (7.5YR 6/6) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many, very fine, tubular pores; 5 percent fine pebbles; common, fine concretions; very strongly acid (pH 5.0); clear, smooth boundary. 4 to 7 inches thick.

B22—18 to 27 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; many, very fine, tubular pores; 10 percent pebbles; few fine concretions; very strongly acid (pH 4.8); clear, smooth boundary. 8 to 12 inches thick.

B3—27 to 42 inches, yellowish-red (5YR 4/6) gravelly silty clay loam; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; common, fine, tubular pores; 20 percent pebbles and cobbles; very strongly acid (pH 4.8); abrupt, wavy boundary. 12 to 16 inches thick.

R—42 inches, basalt bedrock.

The thickness of the solum and depth to bedrock are commonly 40 to 44 inches but range from 40 to 49 inches. The A horizon is dark brown, very dark brown, or dark reddish brown. Fragments of rock and concretions of 1 to 2 millimeters in size are common to many in the A horizon. The B horizon is brown, reddish brown, dark reddish brown, yellowish red, or strong brown. Texture in the B horizon is silty clay loam to heavy silt loam. The content, by volume, of basalt cobblestones ranges from none to 15 percent in the A and B2 horizons and increases to a maximum of 40 percent in the B3 horizon.

20E—Hembre silt loam, 3 to 30 percent slopes. This mostly moderately steep to steep soil is on rolling ridgetops and canyon side slopes in the Coast Range. It has the profile described as representative of this series.

Included with this soil in mapping were areas of Klickitat, Kilchis, and Astoria soils, which make up as much as 15 percent of this mapping unit.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

20F—Hembre silt loam, 30 to 60 percent slopes. This steep to very steep soil is on canyon side slopes in the Coast Range.

Included with this soil in mapping were areas of Klickitat, Kilchis, and Astoria soils, which make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 2r1; wildlife group 4.

Goble, Olyic, Tolke, and Pervina soils, which make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

33E—Melby silt loam, 2 to 30 percent slopes. This gently sloping to steep soil is on side slopes in the Coast Range. This soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Goble, Olyic, Tolke, and Pervina soils, which make up as much as 20 percent of this mapping unit. Areas of moderately deep loamy soils over sandstone are also included.

Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

33F—Melby silt loam, 30 to 60 percent slopes. This steep to very steep soil is on side slopes in the Coast Range.

Included with this soil in mapping were areas of Goble, Olyic, Tolke, and Pervina soils, which make up as much as 20 percent of this mapping unit. Areas of moderately deep loamy soils over sandstone are also included.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 2r1; wildlife group 4.

33G—Melby silt loam, 60 to 90 percent slopes. This very steep soil is on side slopes in the Coast Range.

Included with this soil in mapping were areas of Goble, Olyic, Tolke, and Pervina soils, which make up as much as 20 percent of this mapping unit. Areas of moderately deep loamy soils over sandstone are also included.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIIe; woodland suitability group 2r1; wildlife group 4.

Olyic series

The Olyic series consists of well-drained soils that formed in residuum and colluvium weathered from basalt on uplands. Slope is 5 to 90 percent. Elevation is 500 to 2,000 feet. Vegetation is Douglas-fir, red alder, bigleaf maple, vine maple, swordfern, and salal. Average annual precipitation is 60 to 70 inches, average annual air temperature is 48° to 52° F, and the frost-free period is 145 to 200 days.

In a representative profile the surface layer is dark reddish-brown and dark-brown silt loam about 12 inches thick. The subsoil is reddish-brown and yellowish-red silty clay loam about 29 inches thick. It is underlain by basalt bedrock. The profile is medium acid in the surface layer and very strongly acid in the subsoil.

Permeability is moderately slow. Available water capacity is 7.5 to 12 inches. Water-supplying capacity is 22 to 24 inches. Effective rooting depth is 40 to 60 inches.

These soils are used mainly for timber, recreation, water supply, and wildlife habitat.

Representative profile of Olyic silt loam, 5 to 30 percent slopes, located about 100 feet north of Seine Creek Road, in the NE¼SE¼NW¼ section 14, T. 1 S., R. 5 W.:

A11—0 to 3 inches, dark reddish-brown (5YR 3/2) silt loam, reddish gray (5YR 5/2) dry; strong, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many, very fine, irregular pores; 25 percent fine shot and pebbles; medium acid (pH 5.6); abrupt, wavy boundary. 2 to 5 inches thick.

A12—3 to 12 inches, dark reddish-brown (5YR 3/3) silt loam, reddish brown (5YR 5/3) dry; weak, fine, subangular blocky structure parting to strong, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many, very fine, irregular pores; 15 percent fine pebbles and concretions; medium acid (pH 5.6); abrupt, smooth boundary. 4 to 14 inches thick.

B1—12 to 19 inches, reddish-brown (5YR 4/4) silty clay loam, yellowish red (5YR 5/6) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; many, very fine, tubular pores; very strongly acid (pH 4.8); clear, smooth boundary. 0 to 10 inches thick.

B21t—19 to 38 inches, yellowish-red (5YR 4/6) silty clay loam, yellowish red (5YR 5/6) dry; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; few fine roots; many, very fine, tubular pores; few thin and moderately thick clay films on peds and in pores; few black manganese stains; very strongly acid (pH 4.8); clear, wavy boundary. 12 to 25 inches thick.

B22t—38 to 41 inches, yellowish-red (5YR 4/6) silty clay loam, yellowish red (5YR 5/6) dry; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; few fine roots; many, very fine, tubular pores; few moderately thick clay films on peds and in pores; common black manganese stains; few basalt pebbles; very strongly acid (pH 4.8); abrupt, wavy boundary. 3 to 10 inches thick.

R—41 inches, basalt bedrock.

Depth to bedrock is 40 to 60 inches. The A horizon is silt loam to loam and has hue of 5YR or 7.5YR. It is 5 to 15 percent concretions and fine pebbles. The Bt horizon is silty clay loam to clay loam. It is 27 to 35 percent clay and has moist value of 3 or 4 and chroma of 4 to 6.

34C—Olyic silt loam, 5 to 12 percent slopes. This moderately sloping soil is on uplands.

Included with this soil in mapping were areas of Melby, Goble, Tolke, and Pervina soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

34D—Olyic silt loam, 12 to 20 percent slopes. This moderately steep soil is on uplands.

Included with this soil in mapping were areas of Melby, Goble, Tolke, and Pervina soils, which make up as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

34E—Olyic silt loam, 20 to 30 percent slopes. This steep soil is on uplands.

Included with this soil in mapping were areas of Melby, Goble, Tolke, and Pervina soils, which make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

35E—Olyic silt loam, 5 to 30 percent slopes. This gently sloping to steep soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping were areas of Melby, Goble, Tolke, and Pervina soils, which make up as much as 20 percent of this mapping unit.

Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Capability unit VIe; woodland suitability group 2o1; wildlife group 4.

35F—Olyic silt loam, 30 to 60 percent slopes. This steep to very steep soil is on uplands.

Included with this soil in mapping were areas of Melby, Goble, Tolke, and Pervina soils, which make up as much as 20 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIe; woodland suitability group 2r1; wildlife group 4.

35G—Olyic silt loam, 60 to 90 percent slopes. This very steep soil is on uplands.

Included with this soil in mapping were areas of Melby, Goble, Tolke, and Pervina soils, which make up as much as 20 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit VIIe; woodland suitability group 2r1; wildlife group 4.

Pervina series

The Pervina series consists of well-drained soils that formed in residuum and colluvium from sedimentary rock on uplands. Slope is 2 to 60 percent. Elevation is 400 to 1,500 feet. Where these soils are not cultivated, the vegetation is Douglas-fir, red alder, bigleaf maple, some western redcedar, and western hemlock, swordfern, brackenfern, salal, red huckleberry, and hazelbrush. Average annual precipitation is 60 to 80 inches, average annual air temperature is 48° to 52° F, and the frost-free period is 145 to 200 days.

In a representative profile the surface layer is dark-brown silty clay loam about 8 inches thick. The subsoil is yellowish-red silty clay loam and silty clay about 47 inches thick. The substratum is yellowish-red silty clay loam within fractures in partially consolidated siltstone bedrock. The profile is medium acid in the surface layer, medium acid to strongly acid in the subsoil, and strongly acid in the substratum.

Permeability is moderately slow. Available water capacity is 9 to 11 inches. Water-supplying capacity is 20 to 24 inches. Effective rooting depth is more than 60 inches.

These soils are used mainly for timber. Some areas have been cleared and are used for pasture. Other uses include water supply, recreation, and wildlife habitat.

Representative profile of Pervina silty clay loam, 20 to 30 percent slopes, located about 40 feet west of Bacona Road, SW¼NE¼NE¼ section 33, T. 3 N., R. 4 W.:

A1—0 to 4 inches, dark-brown (7.5YR 3/2) silty clay loam, brown (10YR 5/3) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common, medium, fine and very fine roots; many, very fine, irregular pores; few, 2 to 5 millimeter concretions; medium acid (pH 6.0); abrupt, smooth boundary. 3 to 7 inches thick.

A3—4 to 8 inches, dark-brown (7.5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common, fine and very fine roots; many, very fine, tubular pores; few, 2 to 5 millimeter concretions; medium acid (pH 5.8); clear, smooth boundary. 0 to 7 inches thick.

B1—8 to 16 inches, reddish-brown (5YR 4/5) silty clay loam, brown (7.5YR 5/4) dry; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; few, fine and very fine roots; many, very fine, tubular pores; medium acid (pH 5.8); clear, smooth boundary. 0 to 15 inches thick.

B21t—16 to 29 inches, yellowish-red (5YR 4/6) silty clay loam, light brown (7.5YR 6/4) dry; moderate coarse structure parting to medium, subangular blocky; slightly hard, friable, sticky and plastic; few fine roots; many, very fine, tubular pores; few thin clay films on peds; few, firm, weathered siltstone fragments; medium acid (pH 5.6); clear, smooth boundary. 10 to 20 inches thick.

B22t—29 to 41 inches, yellowish-red (5YR 5/6) silty clay, strong brown (7.5YR 5/6) dry; moderate, medium, subangular blocky structure; hard, firm, sticky and very plastic; few fine roots; many very fine tubular pores; common moderately thick clay films on peds and in pores; 10 percent weathered siltstone fragments; medium acid (pH 5.6); clear, smooth boundary. 8 to 15 inches thick.

B3t—41 to 55 inches, brown (7.5YR 4/4) silty clay, brown (7.5YR 5/4) dry; moderate, fine, subangular blocky structure; hard, friable, sticky and very plastic; few fine roots; many, very fine, tubular pores; common thin clay films on peds; 15 percent weathered siltstone fragments; strongly acid (pH 5.4); clear, smooth boundary. 6 to 20 inches thick.

reddish-brown (5YR 4/3) mottles; weak, hard, firm, slightly sticky and plastic; very few roots; many, coarse, medium, and fine, tubular pores; continuous clay films in pores and on peds; common manganese stains; medium acid (pH 5.9); gradual irregular boundary. 6 to 18 inches thick.

B3t—30 to 43 inches, dark yellowish-brown (10YR 3/4) loam, pale brown (10YR 6/3) dry; common, fine, dark grayish-brown (10YR 4/2) mottles; massive in places parting to weak, coarse, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common, large and medium, tubular pores; thin continuous clay films on peds and in pores; medium acid (pH 6.0); gradual, irregular boundary. 10 to 20 inches thick.

C—43 to 62 inches, dark yellowish-brown (10YR 3/4) loam, yellowish brown (10YR 5/4) dry; common grayish-brown (10YR 6/2 & 5/8) mottles; massive; hard, firm, slightly sticky and slightly plastic; common, fine, tubular pores; medium acid (pH 6.0).

e thickness of the solum ranges from 40 to 60 s. Texture of the A horizon is silt loam to loam. Bt horizon ranges in texture from loam to clay Structure in the Bt horizon ranges from moder- oarse to fine, subangular blocky in the upper part rom nearly massive to weak, coarse, subangular y the lower part. Clay films are thin to moder- tnick, and they are in channels, in pores, and on al and horizontal ped faces. Stratified layers of loam to loamy sand occur below a depth of 40 s in places.

—Quatama loam, 0 to 3 percent slopes. This level soil is on terraces. It has the profile des- l as representative of the series.

luded with this soil in mapping were areas of , Hillsboro, and Huberly soils, which make up as as 15 percent of this mapping unit.

ıoff is slow, and the hazard of erosion is slight. ıility unit IIw-1; wildlife group 2.

—Quatama loam, 3 to 7 percent slopes. This sloping soil is on terraces.

uded with this soil in mapping were areas of , Hillsboro, and Huberly soils, which make up as as 15 percent of this mapping unit.

ıoff is slow, and the hazard of erosion is slight. ility unit IIe-2; wildlife group 2.

—Quatama loam, 7 to 12 percent slopes. This ately sloping soil is on terraces.

uded with this soil in mapping were areas of Hillsboro, and Huberly soils, which make up as as 15 percent of this mapping unit.

off is medium, and the hazard of erosion is ate. Capability unit IIe-2; wildlife group 2.

—Quatama loam, 12 to 20 percent slopes. This ately steep soil is on dissected terraces.

ıded with this soil in mapping were areas of sboro, and Huberly soils, which make up as as percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe-5; wildlife group 2.

Saum series

The Saum series consists of well-drained soils that formed in mixed eolian material, old alluvium, and residuum from basalt on uplands. Slope is 2 to 60 percent. Elevation is 250 to 1,200 feet. Where these soils are not cultivated, the vegetation is Douglas-fir, Oregon white oak, hazelbrush, poison-oak, grasses, and forbs. Average annual precipitation is 40 to 50 inches, average annual air temperature is 51° to 54° F, and the frost-free period is 165 to 210 days.

In a representative profile the surface layer is dark reddish-brown silt loam and silty clay loam about 14 inches thick. The subsoil is dark reddish-brown and reddish-brown silty clay loam about 18 inches thick. The substratum is yellowish-red silty clay loam about 18 inches thick. Basalt bedrock is at a depth of 50 inches. The profile is medium acid throughout.

Permeability is moderately slow. Available water capacity is 8 to 10.5 inches. Water-supplying capacity is 16 to 22 inches. Effective rooting depth is 20 to 40 inches.

These soils are used for irrigated strawberries, orchards, small grain, hay, pasture, timber, homesites, recreation, and wildlife habitat.

Representative profile of Saum silt loam, 2 to 7 percent slopes, located about 25 feet north of the road in the SW¼SE¼SW¼ section 7, T. 3 S., R. 1 W.:

Ap—0 to 8 inches, dark reddish-brown (5YR 3/2) silt loam, reddish brown (5YR 5/3) dry; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many, very fine, irregular pores; 5 percent fine concretions; medium acid (pH 6.0); abrupt, smooth boundary. 5 to 8 inches thick.

A12—8 to 14 inches, dark reddish-brown (5YR 3/3) silty clay loam, reddish brown (5YR 5/4) dry; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine roots; many, fine, tubular pores; 5 percent fine concretions; medium acid (pH 5.8); clear, smooth boundary. 5 to 8 inches thick.

B2—14 to 23 inches, dark reddish-brown (5YR 3/4) silty clay loam, reddish brown (5YR 5/4) dry; moderate, medium and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine roots; many, fine, tubular pores; few pebbles; medium acid (pH 5.8); clear, smooth boundary. 8 to 15 inches thick.

IIB3—23 to 32 inches, reddish-brown (5YR 4/4) silty clay loam, yellowish red (5YR 5/6) dry; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many, fine, tubular pores; 20 percent weathered pebbles and 10 percent stones; few,

black, manganese stains; medium acid (pH 5.6); clear, smooth boundary. 7 to 12 inches thick.

IIC—32 to 50 inches, yellowish-red (5YR 4/6) silty clay loam, yellowish red (5YR 5/6) dry; massive, hard, firm, slightly sticky and plastic; many fine pores; 15 percent pebbles, 5 percent weathered cobbles, and 10 percent stones; thick continuous clay films on fragments; medium acid (pH 5.6). 5 to 20 inches thick.

IIIR—50 inches, basalt bedrock.

Depth to bedrock ranges from 40 to 60 inches. The A horizon ranges in texture from silt loam to silty clay loam. The clay content of the B2 horizon ranges from 30 to 40 percent. The B3 horizon is 35 to 50 percent clay and 10 to 35 percent pebbles, cobbles, and stones.

38B—Saum silt loam, 2 to 7 percent slopes. This gently sloping soil is on uplands. The soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Jory, Laurelwood, Cornelius, Kinton, and moderately deep stony soils, which make up as much as 20 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–3; woodland suitability group 3o1; wildlife group 3.

38C—Saum silt loam, 7 to 12 percent slopes. This moderately sloping soil is on uplands.

Included with this soil in mapping were areas of Jory, Laurelwood, Cornelius, Kinton, and moderately deep stony soils, which make up as much as 20 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIe–3; woodland suitability group 3o1; wildlife group 3.

38D—Saum silt loam, 12 to 20 percent slopes. This moderately steep soil is on uplands.

Included with this soil in mapping were areas of Jory, Laurelwood, Cornelius, Kinton, and moderately deep stony soils, which make up as much as 20 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–2; woodland suitability group 3o1; wildlife group 3.

38E—Saum silt loam, 20 to 30 percent slopes. This steep soil is on uplands. It has a profile similar to the one described as representative of the series.

Included with this soil in mapping were areas of Jory, Laurelwood, Cornelius, Kinton, and moderately deep stony soils, which make up as much as 25 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit IVe–2; woodland suitability group 3o1; wildlife group 3.

38F—Saum silt loam, 30 to 60 percent slopes. This steep to very steep soil is on uplands.

Included with this soil in mapping were areas of Jory, Laurelwood, Cornelius, Kinton, Cascade, and moderately deep stony soils, which make up as much as 25 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used mainly for recreation, timber, and wildlife habitat. Capability unit VIe; woodland suitability group 3r1; wildlife group 3.

Tolke series

The Tolke series consists of well-drained soils that formed in mixed eolian materials high in volcanic ash. Slope is 5 to 60 percent. Elevation is 800 to 2,500 feet. Where these soils are not cultivated, the vegetation is Douglas-fir, western hemlock, red alder, vine maple, oregongrape, salal, and swordfern. Average annual precipitation is 80 to 100 inches, average annual air temperature is 45° to 50° F, and the frost-free period is 145 to 200 days.

The surface layer is dark-brown silt loam and heavy silt loam about 10 inches thick. The subsoil is dark-brown and strong-brown silty clay loam 51 inches thick. The profile is strongly acid in the surface layer and very strongly acid in the subsoil. The profile throughout has a slightly or moderately smeary feel when moist or wet.

Permeability is moderate. Available water capacity is 11 to 13 inches. Water-supplying capacity is 20 to 26 inches. Effective rooting depth is 60 inches.

These soils are used for timber, recreation, wildlife habitat, and water supply.

Representative profile of Tolke silt loam, 5 to 30 percent slopes, located 100 feet east of State forest road in the SW¼SW¼NW¼ section 9, T. 1 N., R. 5 W.:

A1—0 to 6 inches, dark-brown (7.5YR 3/2) silt loam, brown (7.5YR 5/4) dry; strong, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many, very fine, irregular pores; 15 percent very fine concretions; strongly acid (pH 5.2); clear, smooth boundary. 2 to 6 inches thick.

A3—6 to 10 inches, dark-brown (7.5YR 4/4) heavy silt loam, yellowish red (5YR 5/6) dry; strong, very fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many, very fine, tubular pores; common fine concretions; strongly acid (pH 5.2); clear, smooth boundary. 0 to 10 inches thick.

B1—10 to 17 inches, dark-brown (7.5YR 4/4) silty clay loam, reddish yellow (5YR 6/6) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many, very fine, tubular pores; very strongly acid (pH 4.8); clear, smooth boundary. 0 to 11 inches thick.

B21—17 to 26 inches, strong-brown (7.5YR 4/6) silty clay loam, reddish yellow (5YR 6/6) dry; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; many, very fine, tubular pores; very strongly acid (pH 4.8); clear, smooth boundary. 9 to 18 inches thick.

B22—26 to 45 inches, strong-brown (7.5YR 4/6) silty clay loam, reddish yellow (5YR

medium acid (pH 5.6); gradual, smooth boundary. 0 to 7 inches thick.

B21t—16 to 26 inches, dark-brown (10YR 4/3) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate, fine, and very fine, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine roots; many, very fine, tubular pores; thick clay films on peds and in pores; medium acid (pH 5.8); clear, smooth boundary. 7 to 10 inches thick.

B22t—26 to 31 inches, dark-brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; common fine, distinct, dark grayish-brown (10YR 4/2) and grayish-brown (2.5YR 5/2) mottles; weak, medium, and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many, fine and very fine, tubular pores; common thick clay films in pores and on peds; few, fine, black manganese stains; medium acid (pH 6.0); gradual, smooth boundary. 4 to 10 inches thick.

B3—31 to 41 inches, dark grayish-brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; common, fine, distinct, dark grayish-brown (10YR 4/2) and grayish-brown (2.5YR 5/2) mottles; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common, fine and very fine, tubular pores; few thick clay films in larger pores; medium acid (pH 6.0); gradual, smooth boundary. 0 to 12 inches thick.

C—41 to 60 inches, dark grayish-brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; many, distinct, grayish-brown (2.5YR 5/2), dark grayish-brown (10YR 4/3), and dark yellowish-brown (10YR 4/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; very few, fine, tubular pores; medium acid (pH 6.0).

The A horizon has moist value of 2 or 3, chroma of 2 or 3, and hue of 10YR. Dry value is 4 or 5, and chroma is 2 or 3. Between depths of 10 and 20 inches, moist value and chroma range to 4. Distinct mottles are within a depth of 30 inches. The B2 horizon ranges from heavy silt loam to silty clay loam. Horizons below a depth of 30 inches are firm to very firm and are brittle. The solum is slightly acid to medium acid.

45A—Woodburn silt loam, 0 to 3 percent slopes. This nearly level soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Aloha, Amity, Willamette, Helvetia, and Dayton soils, which occupy as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIw–1; wildlife group 2.

45B—Woodburn silt loam, 3 to 7 percent slopes. This soil is gently sloping.

Included with this soil in mapping were areas of Aloha, Amity, Willamette, Helvetia, and Dayton soils, which occupy as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–2; wildlife group 2.

45C—Woodburn silt loam, 7 to 12 percent slopes. This soil is moderately sloping.

Included with this soil in mapping were areas of Aloha, Amity, Willamette, Helvetia, and Dayton soils, which occupy as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIe–2; wildlife group 2.

45D—Woodburn silt loam, 12 to 20 percent slopes. This moderately steep soil is along terrace escarpments.

Included with this soil in mapping were areas of Aloha, Amity, Willamette, Helvetia, and Dayton soils, which occupy as much as 15 percent of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–5; wildlife group 2.

Xerochrepts and Haploxerolls, very steep

46F—Xerochrepts and Haploxerolls, very steep. This undifferentiated group is about 45 percent Xerochrepts and about 45 percent Haploxerolls. It occurs as steep to very steep escarpments along the small streams that have cut deeply into the valley terraces and where the terraces meet the bottom lands and flood plains along major streams and rivers. These soils are well drained. They formed in a mixture of silt, sand, and an accumulation of material that has moved downslope. The short slopes range from 20 to 60 percent. Elevation is 50 to 450 feet. Vegetation is Douglas-fir, Oregon white oak, shrubs, forbs, and grasses. The average annual precipitation is 40 to 60 inches, average annual air temperature is 50° to 54° F, and the frost-free period is 165 to 210 days.

Included in mapping were areas of Hillsboro, Quatama, Willamette, and Woodburn soils, which make up as much as 15 percent of this mapping unit. Small seep spots and wet-season springs are also included.

Permeability is moderate to moderately slow. Available water capacity is 10 to 12 inches. Water-supplying capacity is 22 to 26 inches. Effective rooting depth is more than 60 inches.

Runoff is rapid, and the hazard of erosion is severe.

These soils are used for pasture, recreation, homesites, and wildlife habitat. Capability unit VIe; wildlife group 2.

Xerochrepts-Rock outcrop complex

47D—Xerochrepts-Rock outcrop complex. This complex is about 50 percent Xerochrepts and 30 percent Rock outcrop. It occurs in irregularly shaped areas southeast of Sherwood and is composed of shallow and very shallow soils and barren exposures of basalt bedrock. Slope is 5 to 30 percent. The Xerochrepts formed in a mixture of silt and sand too variable to map. Vegetation is low shrubs, Oregon white oak, Douglas-fir, grasses, and forbs. The average annual precipitation is

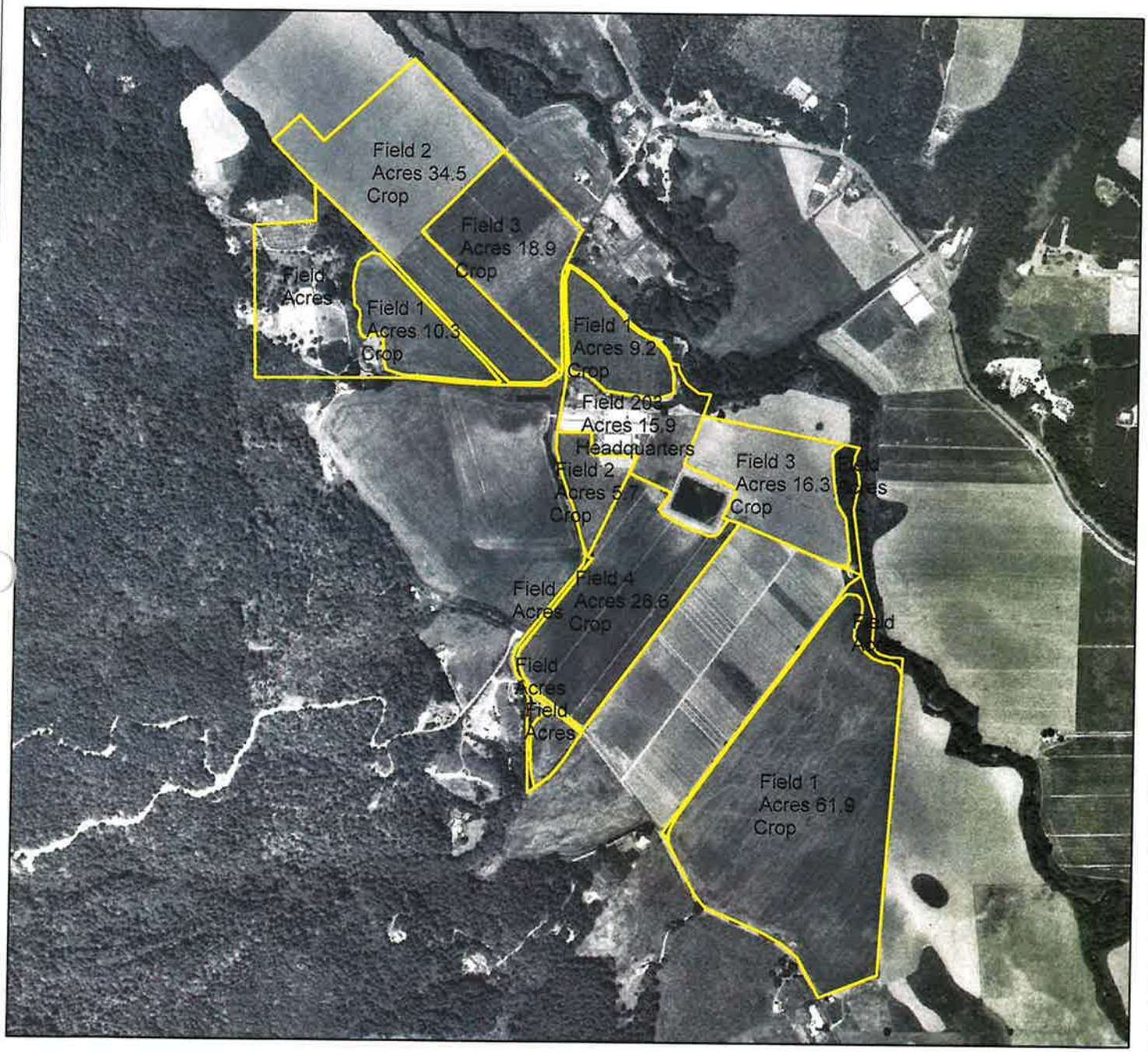
CNMP

Date: 3/7/2005

Customer(s): RICK SHEELAR
District: Tualatin

Field Office: Hillsboro
Agency: USDA, NRCS
Assisted By: Robert App

Legal Description: T1NR4W, Sections 27 &34



Legend

Consplan3

Image: drg_or067.sid

510 0 510 1,020 1,530 2,040 Feet

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ANIMAL WASTE MANAGEMENT PLAN

AMENDMENT/S TO THE ANIMAL WASTE MANAGEMENT PLAN

RiMar Farms — CONFINED ANIMAL FEEDING OPERATION

Rick Sheelar — CAFO OPERATOR'S NAME

2180 NW Stringtown Rd, Forest Grove, OR 97116 — FACILITY STREET ADDRESS, CITY, STATE, ZIP

3-329-7304 — PHONE NUMBER

On August 27, 2015, Charlene Troost — INSPECTOR'S NAME

of the Oregon Department of Agriculture discussed modifications to Animal Waste Management Plan (AWMP) # 05079.

The following modifications were made to this AWMP:

1) Farm added application/crop land
15 acres are tillable; rest of acreage is in CREP

2)

3)

CONCLUSION:

X The above amendment/s will be approved.

Charlene Troost
INSPECTOR'S SIGNATURE

9-9-15 Date approved

Rick Sheelar Pres.
OPERATOR'S SIGNATURE

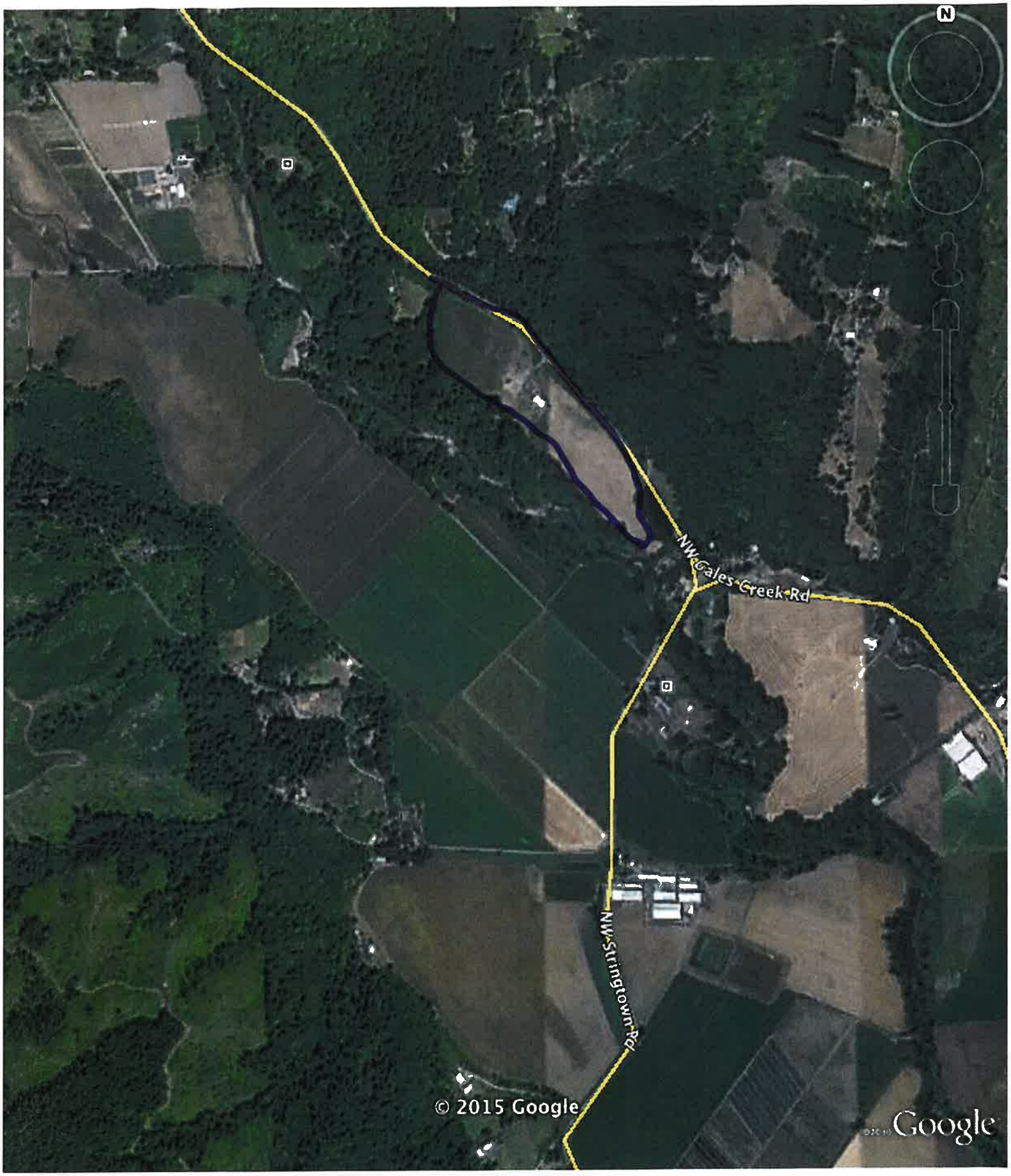
Effective date

Immediately

RECEIVED

SEP 08 2015

NATURAL RESOURCES


N
NW Gales Creek Rd
NW Stringtown Rd
© 2015 Google
Google

MA# 71338

REPORT NUMBER
15-224-0170
COMPLETED DATE
Aug 14, 2015
ACCOUNT
12754
RECEIVED DATE
Aug 12, 2015

Midwest Laboratories Inc.®

13611 "B" Street • Omaha, Nebraska 68144-3693 • (402) 334-7770 • FAX (402 334-9121
www.midwestlabs.com

TODAY'S DATE
Aug 13, 2015

IDENTIFICATION
RI-MAR FARMS

WILCO AGRILIANCE LLC
KEN MATSON
986 NORTH HOLLADAY STREE
CORNELIUS OR 97113-

SOIL ANALYSIS REPORT

INFO SHEET: 52946

LAB NUMBER *283*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE) POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
11149	BAGLEY U	5.8	VH	26	H	32	M			208	M	451	VH	4076	M	45		5.8	6.4	30.7	1.7	12.2	66.4	19.1	0.6
11150	A LAGOON	4.9	VH	62	VH	72	VH			396	VH	627	VH	3973	M	40		5.2	5.5	40.1	2.5	13.0	49.5	34.6	0.4
11151	B DAIRY	5.5	VH	59	VH	80	VH			383	VH	644	VH	3732	M	25		5.4	6.1	35.1	2.8	15.3	53.2	28.4	0.3

LAB NUMBER *283*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
11149	61	110	0-6							110	42	VH	4.5	H	23	H	67	VH	2.7	VH	0.6	L	L	0.6	L
11150	10	18	0-6							18	30	VH	5.9	H	38	VH	136	VH	6.1	VH	0.6	L	L	0.3	L
11151	56	101	0-6							101	26	VH	6.4	VH	35	VH	105	VH	3.4	VH	0.5	L	L	0.5	L

→ had applied N for corn

REV. 12/03

CC

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Washington County, Oregon

September 9, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

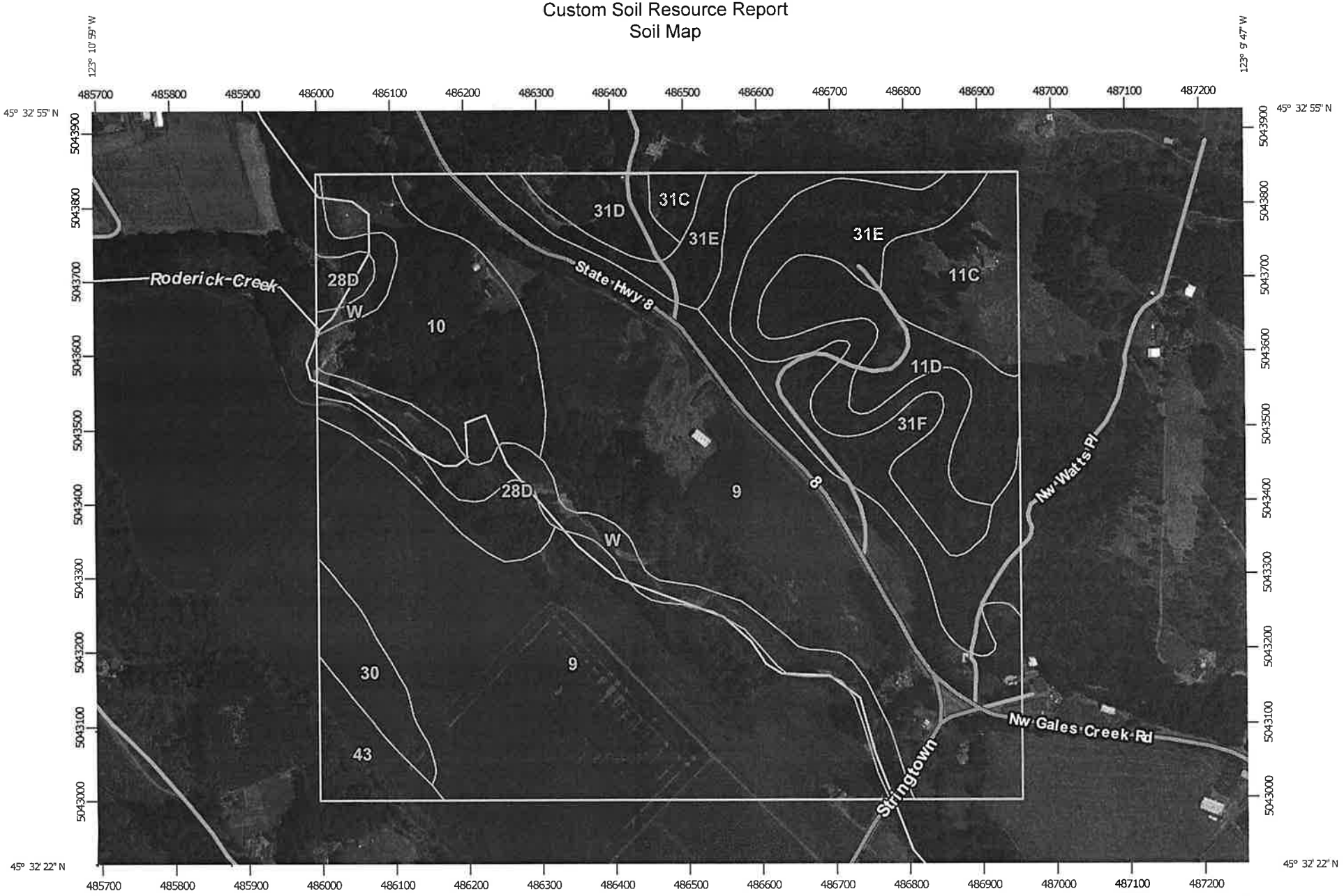
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,160 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 12, Sep 19, 2014

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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

Map Unit Legend

Washington County, Oregon (OR067)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
9	Chehalis silty clay loam, occasional overflow	104.2	51.9%
10	Chehalis silt loam, occasional overflow	16.6	8.3%
11C	Cornelius and Kinton silt loams, 7 to 12 percent slopes	8.2	4.1%
11D	Cornelius and Kinton silt loams, 12 to 20 percent slopes	9.5	4.8%
28D	Laurelwood silt loam, 12 to 20 percent slopes	5.6	2.8%
30	McBee silty clay loam	4.2	2.1%
31C	Melbourne silty clay loam, 7 to 12 percent slopes	1.3	0.6%
31D	Melbourne silty clay loam, 12 to 20 percent slopes	3.6	1.8%
31E	Melbourne silty clay loam, 20 to 30 percent slopes	18.7	9.3%
31F	Melbourne silty clay loam, 30 to 60 percent slopes	13.5	6.7%
43	Wapato silty clay loam	4.0	2.0%
W	Water	11.3	5.6%
Totals for Area of Interest		**200.7**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called

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

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

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

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

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

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

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

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

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

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

Washington County, Oregon

9—Chehalis silty clay loam, occasional overflow

Map Unit Setting

National map unit symbol: 220v
Elevation: 100 to 300 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chehalis, occasional flooding, and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehalis, Occasional Flooding

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 16 inches: silty clay loam
H2 - 16 to 45 inches: silty clay loam
H3 - 45 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)

Minor Components

Wapato

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Other vegetative classification: Poorly Drained (G002XY006OR)

10—Chehalis silt loam, occasional overflow

Map Unit Setting

National map unit symbol: 21x9
Elevation: 100 to 300 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chehalis, occasional flooding, and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehalis, Occasional Flooding

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 45 inches: silt loam
H3 - 45 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)

Minor Components

Wapato

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)

11C—Cornelius and Kinton silt loams, 7 to 12 percent slopes

Map Unit Setting

National map unit symbol: 21xc
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cornelius and similar soils: 45 percent
Kinton and similar soils: 40 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cornelius

Setting

Landform: Hills
Landform position (two-dimensional): Toeslope, shoulder
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over fine-silty old alluvium

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 7 to 12 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)

Description of Kinton

Setting

Landform: Hills
Landform position (two-dimensional): Toeslope, shoulder
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over fine-silty old alluvium

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 11 inches: silt loam
H2 - 11 to 31 inches: silt loam
H3 - 31 to 61 inches: silt loam

Properties and qualities

Slope: 7 to 12 percent
Depth to restrictive feature: 31 to 41 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)

Minor Components

Delena

Percent of map unit: 4 percent
Landform: Swales
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)

11D—Cornelius and Kinton silt loams, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 21xd
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cornelius and similar soils: 45 percent
Kinton and similar soils: 40 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cornelius

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over fine-silty old alluvium

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained >15% Slopes (G002XY003OR)

Description of Kinton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over fine-silty old alluvium

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 11 inches: silt loam
H2 - 11 to 31 inches: silt loam
H3 - 31 to 61 inches: silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 31 to 41 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained >15% Slopes (G002XY003OR)

Minor Components

Delena

Percent of map unit: 4 percent
Landform: Swales
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)

28D—Laurelwood silt loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 21yr
Elevation: 200 to 1,500 feet

Mean annual precipitation: 45 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Laurelwood and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laurelwood

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 52 inches: silty clay loam
H3 - 52 to 72 inches: silty clay

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)

30—McBee silty clay loam

Map Unit Setting

National map unit symbol: 21yw
Elevation: 100 to 300 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Mcbee and similar soils: 85 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcbee

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 11 inches: silty clay loam
H2 - 11 to 45 inches: silty clay loam
H3 - 45 to 65 inches: clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)

Minor Components

Cove

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Wapato

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)

31C—Melbourne silty clay loam, 7 to 12 percent slopes

Map Unit Setting

National map unit symbol: 21yy
Elevation: 300 to 800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 160 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Melbourne and similar soils: 80 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melbourne

Setting

Landform: Hills
Landform position (two-dimensional): Toeslope, shoulder
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum and colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 66 inches: silty clay

Properties and qualities

Slope: 7 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)

Minor Components

Aqualfs, poorly drained
Percent of map unit: 2 percent
Landform: Depressions

31D—Melbourne silty clay loam, 12 to 20 percent slopes

Map Unit Setting
National map unit symbol: 21yz
Elevation: 300 to 800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Melbourne and similar soils: 80 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melbourne

Setting
Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum and colluvium derived from sedimentary rock

Typical profile
H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 66 inches: silty clay

Properties and qualities
Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)

Minor Components

Aqualfs, poorly drained
Percent of map unit: 2 percent
Landform: Depressions

31E—Melbourne silty clay loam, 20 to 30 percent slopes

Map Unit Setting
National map unit symbol: 21z0
Elevation: 300 to 800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Melbourne and similar soils: 80 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melbourne

Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum and colluvium derived from sedimentary rock

Typical profile
H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 66 inches: silty clay

Properties and qualities
Slope: 20 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)

Minor Components

Aqualfs, poorly drained

Percent of map unit: 1 percent
Landform: Depressions

31F—Melbourne silty clay loam, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 21z1
Elevation: 300 to 800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Melbourne and similar soils: 80 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melbourne

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum and colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 66 inches: silty clay

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: High (about 11.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C

Minor Components

Aqualfs, poorly drained
Percent of map unit: 1 percent
Landform: Depressions

43—Wapato silty clay loam

Map Unit Setting
National map unit symbol: 2203
Elevation: 100 to 300 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition
Wapato and similar soils: 85 percent
Labish and similar soils: 3 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wapato

Setting
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium

Typical profile
H1 - 0 to 14 inches: silty clay loam
H2 - 14 to 42 inches: silty clay loam
H3 - 42 to 60 inches: silty clay

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)

Description of Labish

Setting

Landform: Lakebeds (relict), flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits over organic material

Typical profile

H1 - 0 to 13 inches: mucky clay
H2 - 13 to 36 inches: clay
H3 - 36 to 60 inches: mucky peat

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 18.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)

Minor Components

Cove, silty clay loam surface

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

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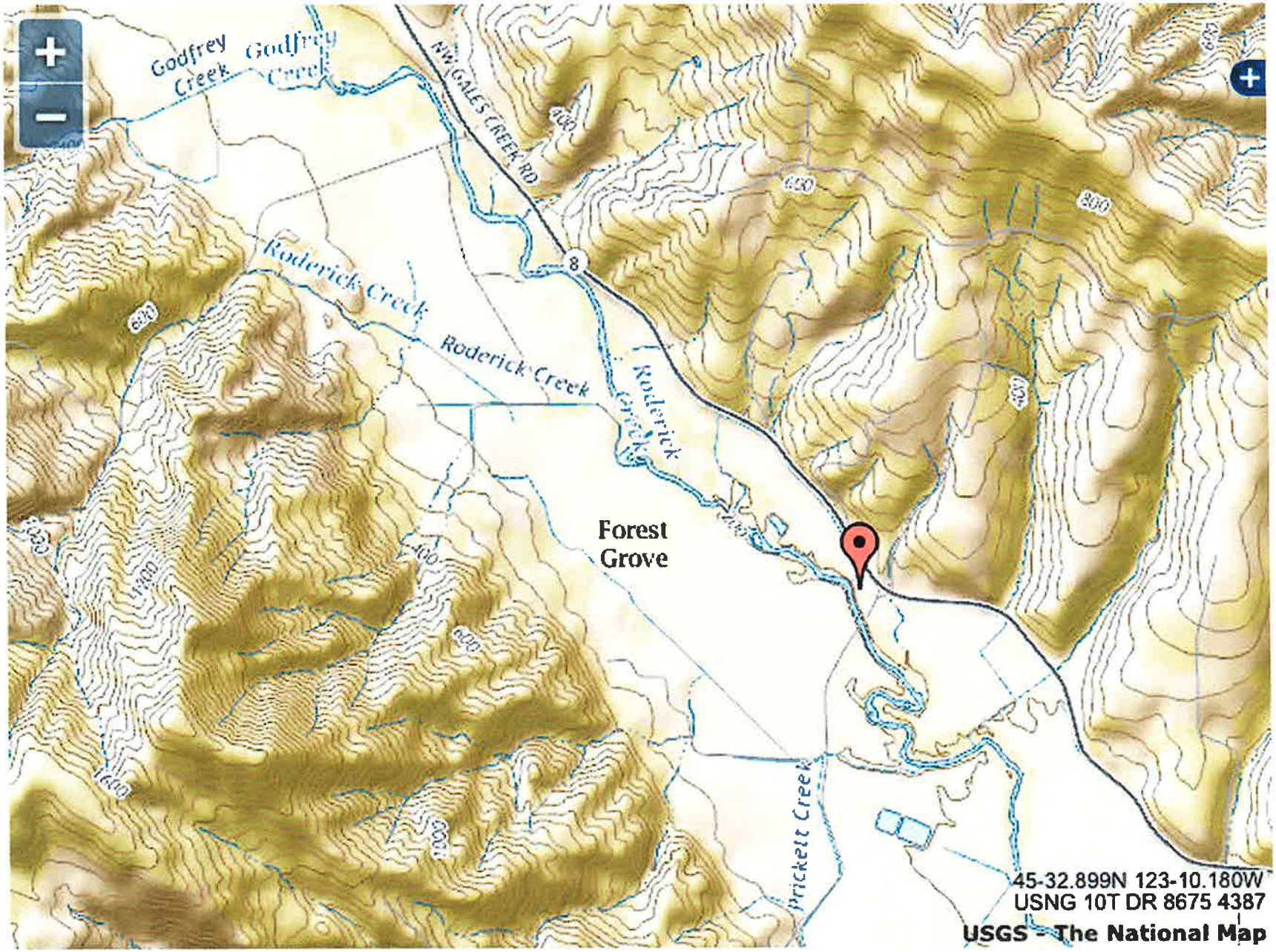

Godfrey Creek
Godfrey Creek
NW GALES CREEK RD
8
Roderick Creek
Roderick Creek
Roderick Creek
Forest Grove
Prickett Creek
45-32.899N 123-10.180W
USNG 10T DR 8675 4387
USGS - The National Map

PHOSPHORUS INDEX WORKSHEET – **WESTERN** OREGON

Producer: Rick Shoolar County: Wa Tract No. _____ Field No(s). 27 Date: 2015

Soil Map Unit(s): _____ Soil Test P: 26 ppm Lab. Method: _____ Sample Depth: _____

Crop Rotation: _____ Nutrient Application Method(s) _____

Planner: _____ Notes: Chehalis Silty Clay Loam

		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) X	4 – 6 (3.0)	7 – 15 (6.0)	> 15 (12.0)	1.5	
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation (0)	Application rate < infiltration rate OR No visible runoff at field borders X (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)	.75	
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0) X	High (4.0)	Very High (8.0)	2	
Flooding Frequency Class	0.75	None or very rare (0)	Rare (0.75)	Occasional (1.5) X	Frequent (3.0)	Very Frequent (6.0)	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) X	< 100 feet AND No buffer next to surface waters (6.0)	3	
Subsurface Drainage	0.50	No Tile Drains (0)	Tile drains present Soil Test P (Bray P1) < 60 ppm (0.5) X	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)	.5	
						Transport Factors Subtotal (TFS)	9.75	

PHOSPHORUS INDEX WORKSHEET – **WESTERN** OREGON

Tract _____ Fields _____

SOURCE FACTORS	Factor Weight	PHOSPHORUS LOSS RATING None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Weighted Rating Value Current	Planned
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) x 0.10	(26 (Soil Test P) - 40) x 0.10 = 0			Assign 0 points if Soil Test P < 40 ppm	0	
Commercial P Fertilizer Application Rate	1.00	lbs/ac P_2O_5 x 0.02	/ (lbs/ac P_2O_5) x 0.02 =				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	
Organic P Source Application Rate	1.00	lbs/ac P_2O_5 x 0.02	79 (lbs/ac P_2O_5) x 0.02 =				1.58	
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) X	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)	1	

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

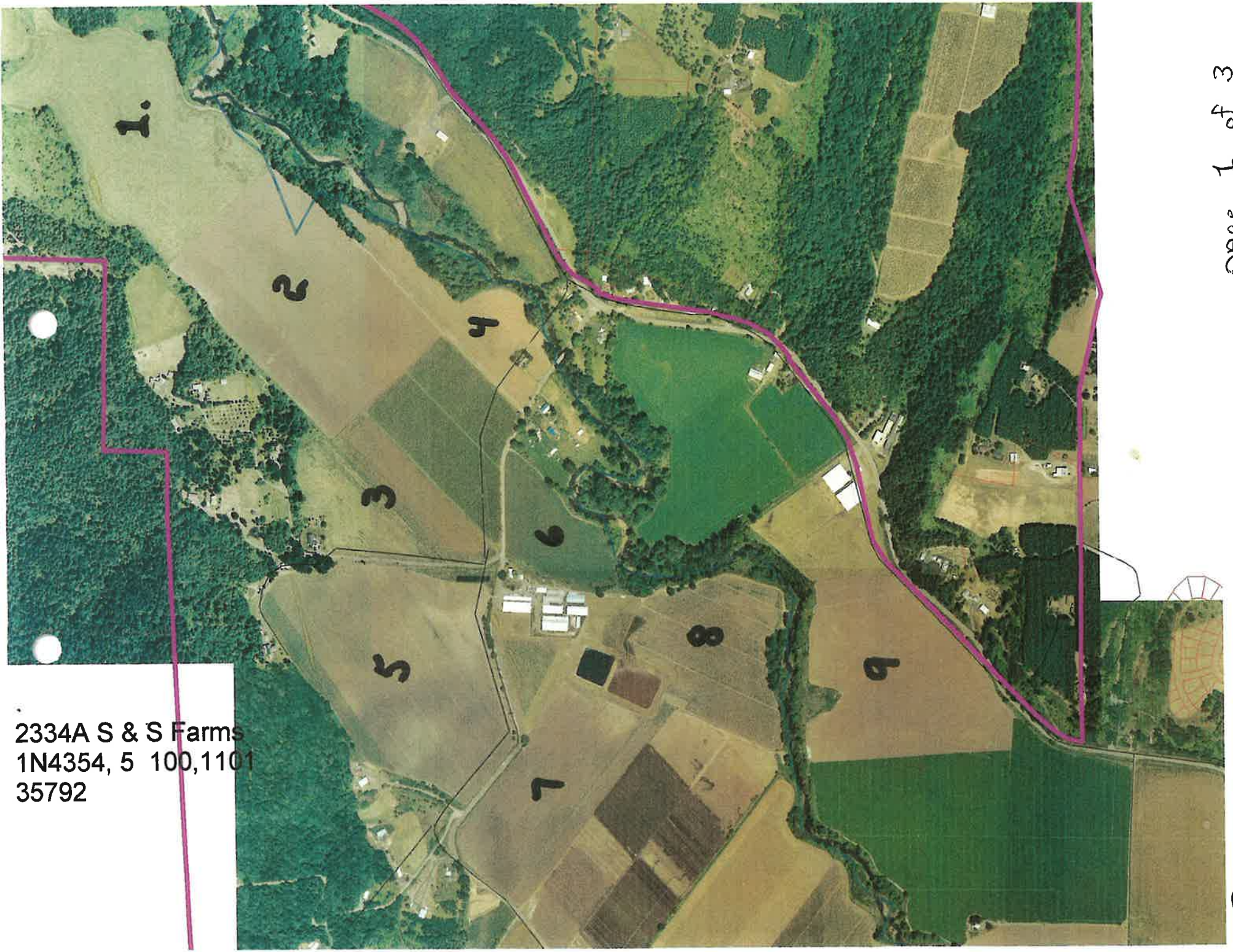
	Current	Planned
Transport Factors Subtotal (TFS)	9.25	
Source Factors Subtotal (SFS)	2.58	
Total Rating Value (TFS + SFS)	11.83	
Site Vulnerability Class	Low	

Key To Fields

Field No	Acres	2005 Crop	Soil Test P	Soil Test K
1	50	Field Corn	5	95
2	40	Spring Wheat	21	213
3	20	Crimson Clover	10	135
4	15	Crimson Clover	44	246
5	45	Crimson Clover	50	212
6	10	Winter Wheat	38	250
7	25	Winter Wheat	42	380
8	20	Field Corn	54	505
9	35	Red Clover	48	326
10	30	Field Corn	33	368
11	30	Tall Fescue	29	259
12	30	Sweet Corn	9	216
13	20	Red Clover	39	202
14	25	Sweet Corn	12	220
15	25	Tall Fescue	9	140
16	45	Sweet Corn	13	200
17	45	Sweet Corn	17	166
18	55	Crimson Clover	32	110
19	20	Sweet Corn	14	156
20	70	Winter Wheat	12	146
21	30	Red Clover	16	150
22	30	Winter Wheat	19	186
23	35	Winter Wheat	14	209
24	30	Red Clover	42	159
25	30	Tall Fescue	10	134
26	35	Winter Wheat	42	151
	845 Acres			

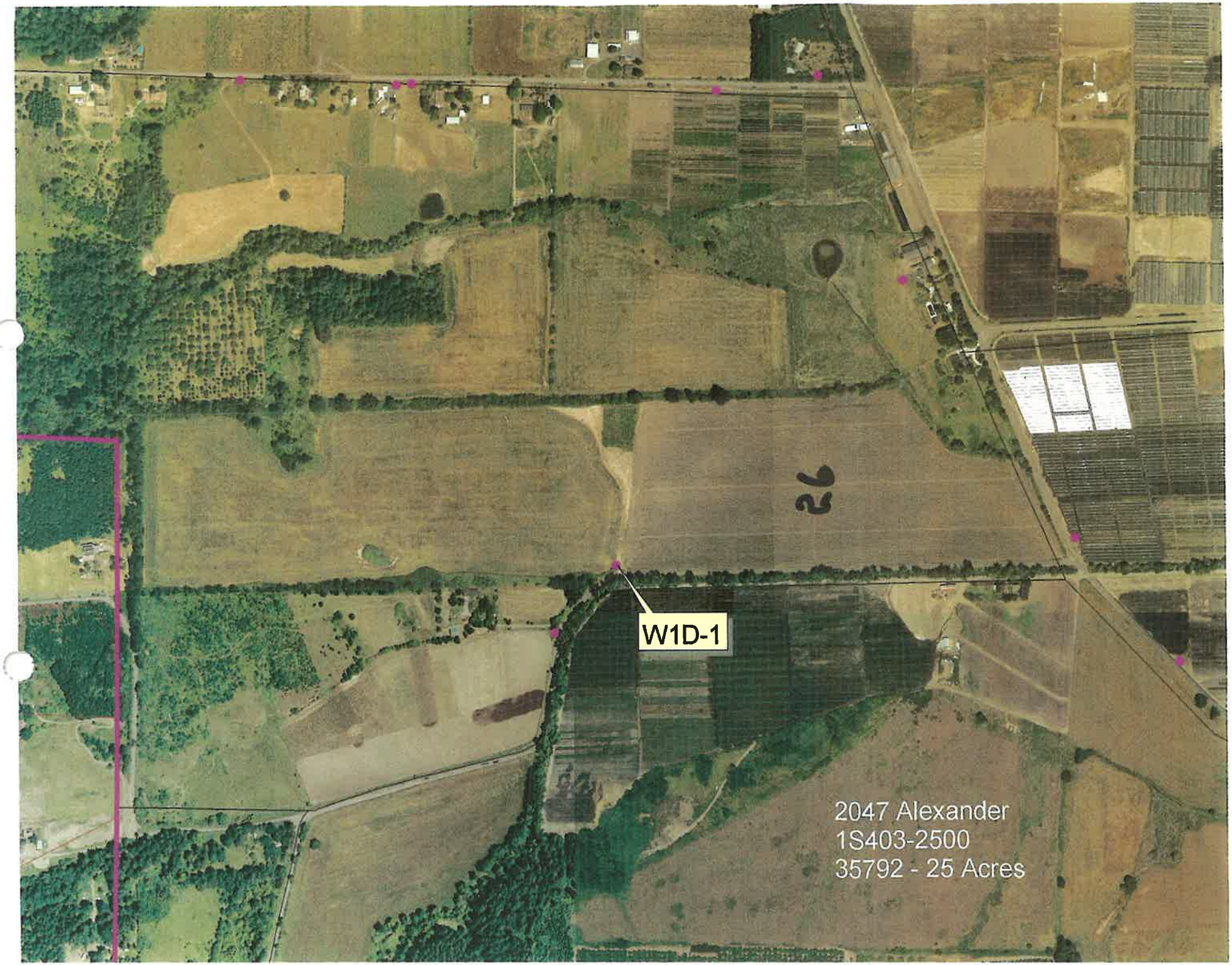
Key To Fields

Field No.	Discription	Acres
1	West Oppenlanders	50
2	East Oppenlanders	40
3	Stubbs + Blueberries	20
4	Jason's	15
5	Bagley's	45
6	Raspberry	10
7	Aboue Lagoon	25
8	Behind Dairy	20
9	Beef barns	35
10	West Hopyard	30
11	East Hopyard	30
12	By Pats	30
13	Between Pats + Bens	20
14	Marions	25
15	Near Creek	25
16	By Bens	45
17	East Marions	45
18	Below House	55
19	Ramp	20
20	Below Shop	70
21	South Myrons	30
22	North Myrons	30
23	Duycks	35
24	Knox's	30
25	East Myrons	30
26	Alexanders	35
		845 Acres



2334A S & S Farms
1N4354, 5 100,1101
35792


W1-37
W1F-5
W1C2-1
2334 S & S Farms
1N435-xx, 1S401-1400
35792 = 438.4 Acres



R. Mar Farms