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MA# 62677
AWMP # 13001

CLEANmp WEST
Nutrient Management Plan (NMP)
Signature Page

Farm Contact Information: Martin VanBeek
26455 McFarland Road
Monroe, OR 97456
(541) 424-5641

Plan Period: Oct 2012 - Sep 2016

NMP Plan Approval

I certify that I have reviewed this NMP for technical adequacy and that the elements of the documents are technically compatible, reasonable and can be implemented.

Signature: Bruce D. Wilson Date: 07/07/2012
Name: Bruce D. Wilson
Title: Individual TSP Number: TSP-05-4719

Owner/Operator

As the owner/operator of this NMP, I, as the decision maker, have been involved in the planning process and agree that the items/practices listed in each element of the NMP are needed. I understand that I am responsible for keeping all the necessary records associated with the implementation of this NMP. It is my intention to implement/accomplish this NMP in a timely manner as described in the plan.

Signature: Martin VanBeek Date: 8/16/2012
Name: Martin VanBeek for VanBeek Dairy

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OCT 03 2012
NATURAL RESOURCES
DIVISION

Section 1. Background and Site Information

This Nutrient Management Plan (NMP) is an important part of the conservation management system (CMS) for your Animal Feeding Operation (AFO). This NMP documents the planning decisions and operation and maintenance for the animal feeding operation. It includes background information and provides guidance, reference information and Web-based sites where up-to-date information can be obtained.

1.1 Objectives

VanBeek Dairy has the following objectives:

1. Operate the farm in a socially and environmentally acceptable manner to make a profit that financially supports the VanBeek family.
2. Apply manure to obtain maximum nutrient benefit while eliminating runoff and minimizing leaching of nutrients.

1.2 General Site Information

The VanBeek Dairy is located approximately 17 miles southwest of Corvallis, Oregon near the town of Monroe, Oregon. The dairy is located at elevation 330 feet and is in the Muddy Creek watershed which flows north along the east slope of the Coast Range Mountains. The annual precipitation varies from 44 to 48 inches of which 70% falls within a 5 month period from November through March and less than 7% June through August. Winds are generally moderate in the winter (15 to 30mph) from the south to southwest and mild in the summer (5 to 15mph) from the north to northwest. There are approximately 205 frost free days and the average annual temperature is 50 to 55 degrees Fahrenheit. Soils vary from deep to moderately deep loams, silt loams, and silty clay loams which are moderately well drained.

The VanBeek Dairy is owned and operated by the VanBeek Family and is managed by Fred and Martin VanBeek. The dairy is currently permitted for 1,460 total animals consisting of 1,070 milk cows and 200 dry cows, 70 springer heifers and 120 calves. The majority of the replacement livestock for the dairy consisting of heifers and calves are raised on another farm. Fred and Martin VanBeek would like to increase the dairy livestock to 1,500 milk cows, 300 dry cows, 100 springer heifers and 800 calves over the next 4 to 5 years. The total livestock numbers for the dairy may vary by 10 percent up or down depending on the time of year and management of the livestock.

All of the livestock on the dairy are confined 365 days a year and the manure produced from the livestock is collected in the barns where they are housed. Most of the manure is collected in alleyways in the barns which are flushed using recycled wastewater from the waste storage ponds. All wastewater and process water drains to a collection tank and is pumped to a solid/liquid separation facility. All of the wastewater from the solid/liquid separation facility drains to the waste storage ponds for storage prior to application to the crop land fields using traveling big gun sprinkler systems. Some of the livestock are housed on a dry bedded pack in barns which are cleaned using on farm equipment. The solid dry pack consisting of manure and bedding is stored on a uncovered reinforced concrete slab area along with separated solids. Some

solids produced on the dairy are composted and recycled for bedding and some are exported to other farms to be used as a soil amendment and nutrient source.

Any livestock mortalities that occur on the VanBeek Dairy are disposed of by composting and the mortality compost is recycled and mixed with sawdust to be used as bedding.

The VanBeek Dairy owns 369.5 acres of which 29.4 acres consist of the dairy facilities and homes, 271.2 acres is crop and hay land and 68.9 acres is wooded areas along Muddy Creek. VanBeek Dairy also has access to another 594.8 acres of hay and crop land from adjacent farms that are available for manure applications. The crop rotation on all of the fields consists of corn grown for silage, wheat, grass grown for seed and grass grown for hay. The 68.9 acres of wooded area along Muddy Creek provides wildlife habitat and provides a natural vegetated buffer along Muddy Creek. The dairy facilities include the barns, milking facility, solids storage area, and waste storage ponds. All of the wastewater stored in the waste storage ponds is pumped to the crop and hay land fields using pipelines to supply traveling big gun sprinkler systems to apply the wastewater to the fields. Soil concentrations of phosphorus are very low to excessive in the crop and hay land fields and there is a low to medium risk of phosphorus movement off the fields so manure applications are nitrogen based.

VanBeek Dairy is located in the Muddy Creek watershed which drains to Marys River. Marys River and its tributaries are heavily used recreational streams and provide important habitat for endangered fish species and other wildlife. Any runoff containing animal manure or leaching of nutrients from animal manures would have a significant negative impact on water quality and wildlife habitat of Marys River and its tributaries.

1.3 Applicable Permits or Certifications

The VanBeek Dairy is required by Oregon state law to have confined animal feeding operation permit from the Oregon Department of Agriculture and the Oregon Department of Environmental Quality to operate. The VanBeek Dairy is covered by the Oregon Confined Animal Feeding Operation National Pollutant Discharge Elimination System General Permit Number 01-2009. A copy of the last three inspection reports, the Notice of Registration and Oregon Confined animal Feeding Operation (CAFO) General Permit Summary and the Oregon Confined Animal Feeding Operation National Pollutant Discharge Elimination System General Permit Number 01-2009 are located in Appendix A. The following table provides the location of information in this plan in reference to the minimum required elements for an Animal Waste Management Plan (AWMP) as required by the permit in Appendix A:

AWMP Minimum Required Elements	Location
1. Summary of CAFO Operation	
a) Contact name, address, phone number	Cover and Signature Page
b) Facility address	Cover and Signature Page
c) Type of operation	Page 1
(i) Number and size of animals by species, expansion	Page 1, 12
d) Manure, litter and process waste system – provide a general Narrative description of each	Page 11

AWMP Minimum Required Elements	Location
(i) Collection – How is manure, litter and process waste removed from housing, confinement lots? How is clean water diverted from storage?	Page 11
(ii) Storage – Types and size of manure, litter and process waste storage tanks, ponds	Page 11, 20, 20
(iii) Transfer – How is manure, litter and process waste moved to storage, application areas?	Page 11, 23, 168
(iv) Use – How is manure, litter and process waste treated (composted, separated, anaerobic digestion or storage, aeration?) How is manure, litter and process waste water used on crops? If export is utilized, describe that process.	Page 11
2. Specific descriptions and calculations	
a) A narrative of production area and land application locations	Page 1
(i) Aerial photo or topographical map showing numbered field locations, production area facilities, clean water diversions, and surface water features.	Page 6, 7, 47
(ii) Soil maps of all application fields, including those not owned, and map unit descriptions. Indicate areas with application limitations.	Page 97
b) Manure, litter and process waste volumes	Page 11
(i) Manure (feces and urine), litter and process waste output that is collected and stored in this system.	Page 11
(ii) Bedding added and collected.	Page 11
(iii) Process and wash water collected, including footbath use when appropriate	Page 11
(iv) Silage and feed processing leachate	Page 11
c) Contaminated storm water	Page 11
(i) Direct rainfall into storage.	Page 11
(ii) Slab or lot runoff collected.	Page 11
(iii) Overflow from gutters or other diversions.	Page 11
d) Nutrient content of manure, litter and process waste water	Page 83, 139, 141, Appendix G
(i) Content and volume of nutrients in manure, litter and process waste generated – can come from NRCS Animal Waste Field Handbook (Table 6.6 Oregon amendment), land grant university publications, or analyses of manure, litter and process waste. Actual test values are required of large CAFOs.	Page 83, 139, 141, Appendix G
e) Farm nutrient balance	Page 165
(i) Show amount of nutrients (N,P,K) generated, lost in storage, lost during application, used by crops, and/or exported off the farm on an annual basis.	Page 165
(ii) Nutrient application must balance to most limiting nutrient as determined by NRCS Agronomy Technical Note #26 and the NRCS Phosphorus Index.	Page 132, 146
(iii) Include all acres required to balance nutrients owned or leased by the operator.	Page 45
f) Application schedule and limitations	Page 139
(i) Show scheduled applications of solids and liquids. Include date, amount and method of application to identified fields. Describe calibration of equipment used to apply manure, litter and process waste water.	Page 150, 158, 75, 77, 78
(ii) Describe limitations to manure, litter and process waste applications. Indicate buffer areas and management to avoid frozen or saturated soils. Justify buffer width and management.	Page 79
(iii) Using agronomic rates, application limitations, and scheduled applications, calculate the minimum storage required for liquids and solids.	Page 11, 28

AWMP Minimum Required Elements	Location
(iv) How is irrigation water managed relative to manure, litter and process waste water application? Indicate general timing and application rates of irrigation water. Irrigation water management must not allow leaching of soluble nutrients or runoff.	Page 53
g) Animal mortality management	Page 35
(i) Describe how farm handles mortalities	Page 35
3. Record keeping and reporting requirements	
a) Testing – Monitoring	Page 69
(i) Include the protocol for testing manure, litter and process waste.	Page 69
(ii) Include the protocol for testing and measuring crop nutrient removals.	Page 69
(iii) Include the protocol for soil testing to evaluate nutrient applications and crop uptake.	Page 69
b) Record keeping. Include the following:	Page 173
(i) Date and amount of manure, litter and process water applied by field. Calculate N and P applied.	Page 173
(ii) Manure, litter and process waste volume exported.	Page 173
c) Reporting to Oregon Department of Agriculture	Page 173
(i) Any discharge within 24 hours.	Page 39, 173
(ii) Amount of manure, litter and process water applied annually.	Page 173
(iii) Amount of manure, litter and process waste exported annually.	Page 173
4. Additional requirements for large CAFOs	
a) Inspections	Page 173
(i) Storm water diversions, runoff diversions, waste transport, storage structures, storage structure volume weekly.	Page 173
(ii) Water lines daily.	Page 173
(iii) Application equipment leaks periodically.	Page 173
b) Record keeping	Page 173
(i) Results of daily inspections.	Page 173
(ii) Results of weekly inspections.	Page 173
(iii) Results of periodic inspections.	Page 173
(iv) Corrective actions taken, explain those not corrected.	Page 173
(v) Expected crop yields if not in the plan.	Page 173

Table 1-1 provides the general location information for the VanBeek Dairy farm.

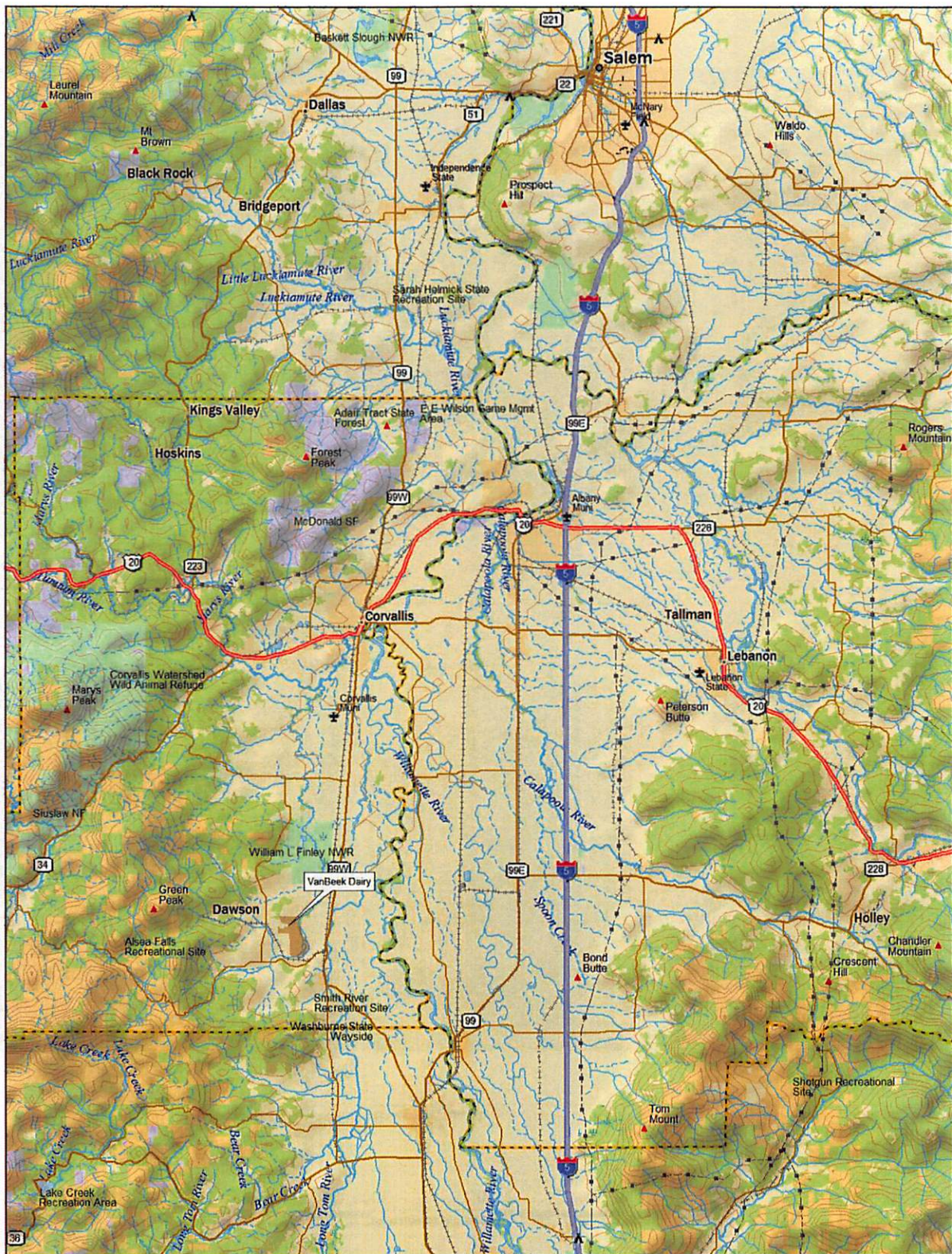
Table 1-1. Geographic Location

Farm	County, State	FSA Tract Number	Legal Description (S-T-R)	UTM Coordinates
VanBeek Dairy	Benton, OR	342, 812, 816, 8252	Sections 17 and 18, T14S, R5W from the Willamette Meridian	UTM Zone 10 UTM Projection: x-0473390 y-4911560

Driving Instructions: (See Farm Location Map)

To get to the VanBeek Dairy travel south on state highway 99W south from Corvallis, Oregon 14 miles to Dawson Road. Turn right on Dawson Road and travel 2.3 miles to McFarland Road. Turn left on McFarland Road and travel 0.2 miles to the entrance of VanBeek Dairy which will be on the left.

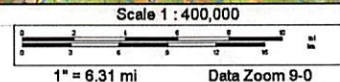
1.4 Location Map for VanBeek Dairy



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1.5 VanBeek Dairy Farm Fields Overview Map

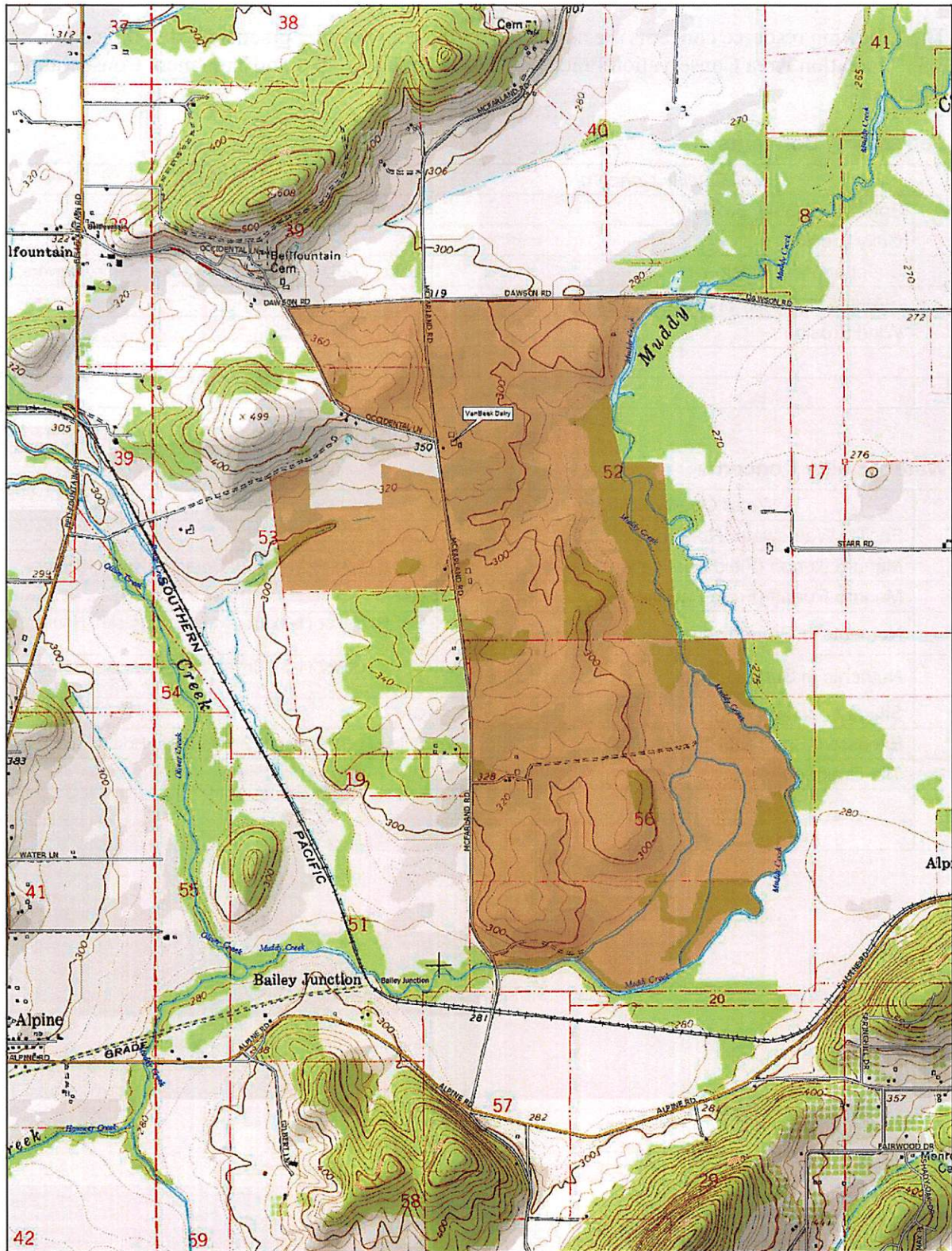


Map Legend

Field Name
Subfield Name
Acres

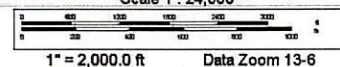
Scale 0 1500 3000 4500 Feet

1.6 Topographic Map for VanBeek Dairy



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1.7 Resource Concerns

The following resource concerns are addressed by the conservation practices listed in Section 2.3, "Operation Area Conservation Practices" and in Section 4.4, "Land Treatment Conservation Practices":

Soil Quality Concerns

	<i>Soil Quality Concern</i>	<i>Fields</i>
	Ephemeral Gully Erosion	NA
	Gully Erosion	NA
	Sheet and Rill Erosion	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Stream/Ditchbank Erosion	NA
	Wind Erosion	NA

Water Quality Concerns

	<i>Water Quality Concern</i>	<i>Fields</i>
	Facility Wastewater Runoff	CAFO
	Manure Runoff (Field Application)	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Manure Runoff (From Facilities)	CAFO
	Nutrients in Groundwater	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Nutrients in Surface Water	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Silage Leachate	CAFO
	Excessive Soil Test Phosphorus	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Tile-Drained Fields	NA

Other Concerns Addressed

	<i>Other Concern</i>	<i>Fields</i>
	Acres Available for Manure Application	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Aesthetics	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Maximize Nutrient Utilization	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Minimize Nutrient Costs	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Neighbor Relations	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Profitability	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Regulations	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Soil Compaction	Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Time Available for Manure Application	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Odors	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Air Quality	CAFO, Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers
	Biosecurity	CAFO

Section 2. Production Information (Manure and Wastewater Handling and Storage)

2.1 Animal and Manure Resources

The VanBeek Dairy is currently being managed by Fred and Martin VanBeek who are the owners. The dairy is currently milking 1,070 cows with 200 dry cows, 70 springers and 120 calves being cared for as replacement livestock for the milk cows. The dairy livestock are confined 365 days a year in barns where manure and bedding is collected. The dairy is permitted for a total of 1,270 adult livestock, 70 heifers and 120 calves. Fred and Martin VanBeek would like to increase the dairy livestock numbers to 1,700 adult livestock, 100 heifers and 800 calves which this plan is based on and are summarized in Table 2-1. The VanBeek Dairy will use the land base described in this plan for producing forage and utilizing the manure and organic by-products produced from the livestock as a nutrient source.

It is estimated that 1,717,983 cubic feet or 44,821 tons of manure, bedding and wasted feed will be collected annually from the VanBeek Dairy. Of the total amount of manure, bedding and wasted feed collected, 1,069,049 cubic feet or 7,996,483 gallons will be collected as a liquid and 648,934 cubic feet or 11,681 tons will be collected as a solid. It is also estimated that 52,255 cubic feet or 390,867 gallons of leachate and rainfall runoff from the silage storage area and 232,082 cubic feet or 1,735,973 gallons of rainfall runoff from exposed lot areas will be collected annually. Rainfall runoff from roofs is collected using gutters and downspouts and directed to drainage ditches using underground pipelines. Approximately 180,548 cubic feet or 1,350,499 gallons of process water will be generated from the VanBeek Dairy annually.

The solids storage area shown on the Operation Map is 14,606 square feet of open reinforced concrete slab where the separated solids and solids removed from the livestock barns can be stored. Solids can be stacked to a height of 8 feet which provides 83,800 cubic feet and 93 days of storage capacity which is less than the NRCS recommended minimum storage period of 154 days computed using Worksheet OR10A-7 located in Section 2.4. Since solids will be exported to other farms and recycled for bedding the storage capacity of the solids storage area will be adequate. There is no record that the solids storage area was constructed in accordance with the NRCS Waste Storage Facility practice standard 313 (PS313). Based on observation the solids storage area is serving as intended and will continue to do so as long as operation and management guidelines are followed.

The wastewater storage facility shown on the Operation Map consists of a settling basin and two waste storage ponds having a total storage capacity of 2,178,000 cubic feet or 16,291,440 gallons. The capacity of the waste storage ponds is estimated to provide 151 days of storage which is less than the recommended minimum storage period of 154 days computed using Worksheet OR10A-7 located in Section 2.4. There is no record that the waste storage ponds were constructed in accordance with the NRCS Waste Storage Facility practice standard 313 (PS313). Based on observation the waste storage ponds are serving as intended and will continue to do so as long as operation and management guidelines are followed.

See Table 2-2 for a list of manure storages and their capacities.

Liquid manure generated by the VanBeek Dairy is applied to the fields as a nutrient source using a traveling big gun sprinkler which applies liquids at a rate of 300 gallons per minute at a wetted diameter of 250 feet. The traveling big gun sprinkler has the capability to apply liquids at a minimum rate of 0.25 inches per acre and a maximum rate of 3 inches per acre. The VanBeek Dairy also has a truck mounted solids spreader with a capacity of 7.3 tons and can apply solids at a minimum rate of 1 ton per acre and a maximum rate of 33 tons per acre.

Table 2-1. Animal Inventory

Animal Group	Type or Production Phase	Number of Animals	Average Weight (Lbs)	Confinement Period	Manure Collected (%)	Storage Where Manure Will Be Stored
Milk Cows(Spring Liq)	Milk cow (dairy)	1,500	1,300	Oct Late - Mar Late	75	Waste Storage Ponds
Milk Cows(Fall Liq)	Milk cow (dairy)	1,500	1,300	Apr Early - Oct Early	75	Waste Storage Ponds
Milk Cows(Solids)	Milk cow (dairy)	1,500	1,300	Jan Early - Dec Late	25	Solids Storage Area
Dry Cows(Liquids)	Dry cow (dairy)	300	1,400	Jan Early - Dec Late	75	Waste Storage Ponds
DryCows(Solids)	Dry cow (dairy)	300	1,400	Jan Early - Dec Late	25	Solids Storage Area
Springers(Liquids)	Breeding heifer (dairy)	100	1,100	Jan Early - Dec Late	75	Waste Storage Ponds
Springers(Solids)	Breeding heifer (dairy)	100	1,100	Jan Early - Dec Late	25	Solids Storage Area
Calves	Calf (dairy)	800	300	Jan Early - Dec Late	100	Solids Storage Area

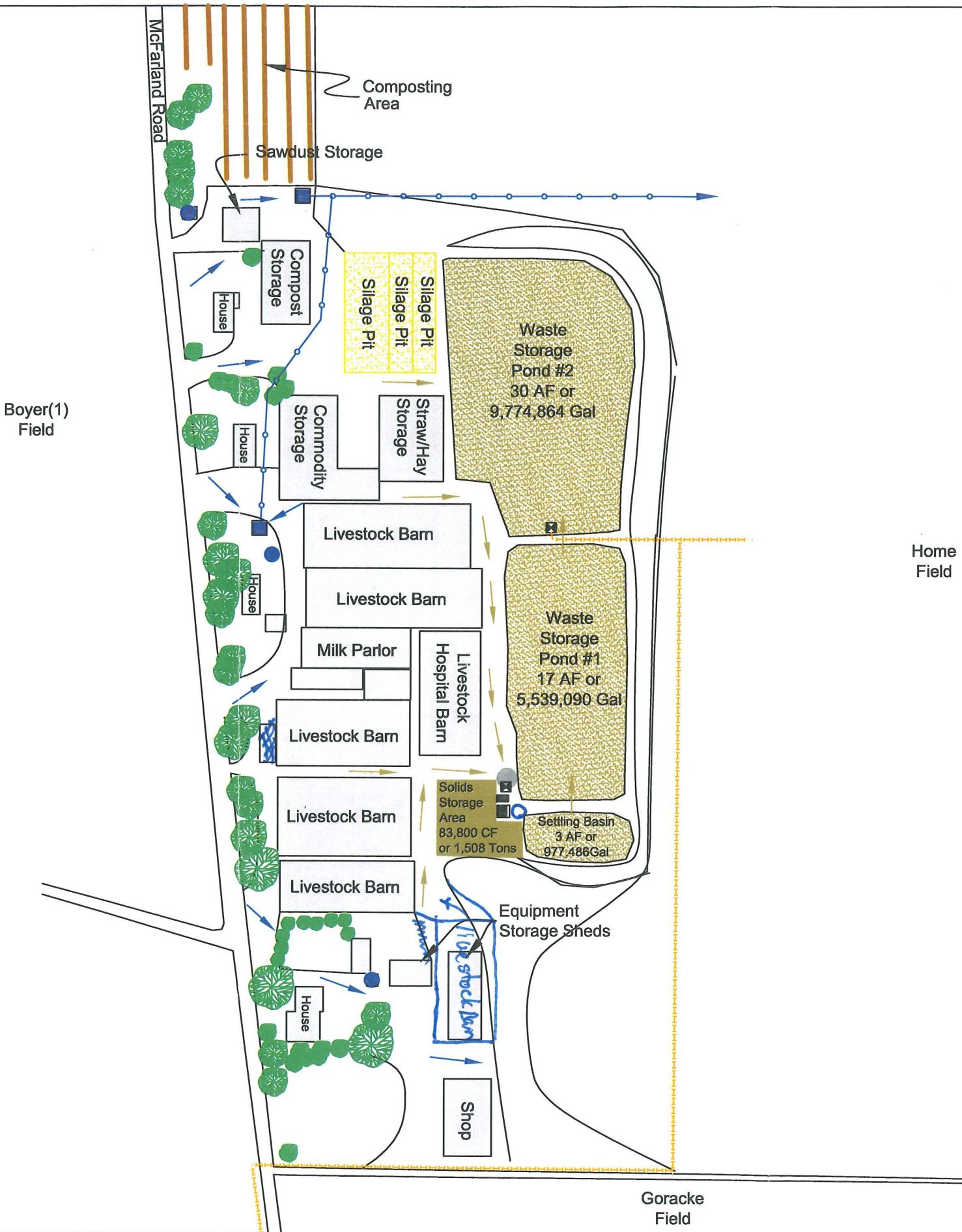
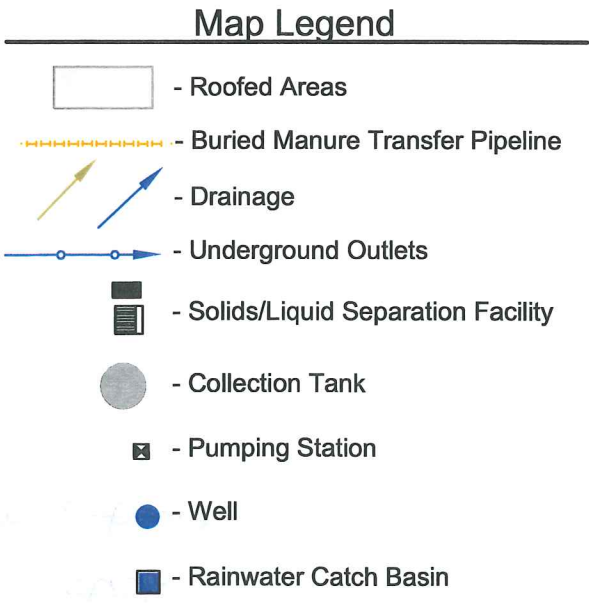
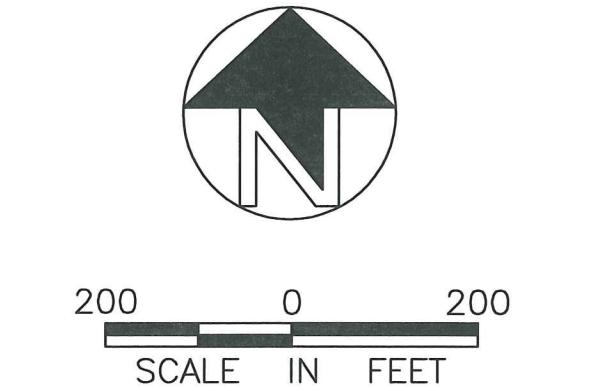
(1) Number of Animals is the average number of animals that are present in the production facility at any one time.

(2) If Manure Collected is less than 100%, this indicates that the animals spend a portion of the day outside of the production facility or that the production facility is unoccupied one or more times during the confinement period.

2.2 Operation Area Map(s)

Owner/Operator: Fred and Martin VanBeek
Farm Name: VanBeek Dairy
County: Benton State: Oregon
Approximate Acres: 29.4 Date: July 2012
Location: Section 17 & 18, T14S, R5W from the W.M.

Assisted By: Bruce D. Wilson, H&R Engineering, Inc.



2.3 **Operation Area Practices**

Following are practices that the VanBeek Dairy has implemented or plans to implement that address resource concerns for the Operation Area identified in Section 1.7:

Access Control	off station
----------------	-------------

Field(s): CAFO

Status: Existing

Description: Fences are used to control animal and human access to the production area and livestock housing facilities.

Operation and Maintenance: Do not allow livestock access to open water courses and drainageways. Provide off stream watering facilities where possible and limit access to designated watering areas.

Inspect fences periodically and repair or replace broken or decayed posts and tighten sagging wire as needed. Broken wire can be spliced or replaced. Replace broken or missing insulators on electric fences as needed and repair or replace inoperative electric fence controllers.

Insure gates and other appurtenances are in good working order. Replace or repair components as needed.

Specification: NA

Access Road	off station
-------------	-------------

Field(s): CAFO

Status: Existing

Description: Existing roadways allow access to farm facilities and fields to perform needed management operations.

Operation and Maintenance: Maintain road, parking lot and pathway surfaces in good condition, which includes periodic grading and addition of surface material when necessary. Prevent surface ponding by localized grading or addition of surface materials to remove depressions. Road base-course rock may be required to stabilize the road and parking lot foundations. If so, remove unstable materials and rebuild travelway. Limit traffic and animal access with fencing or barriers, where needed.

Remove debris, litter or blockages from roads, parking lots and walkways. Also remove debris and maintain capacity of associated drainage ditches, drop inlets, culverts, bridges, waterways and storm water outlets.

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

Immediately repair any vandalism, vehicular, or livestock damage to earthfills, side slopes, drainage facilities, water ways and storm water outlets or other appurtenances.

Maintain good vegetative cover, mulches, and other covering installed for erosion protection.

Specification: NA

Clean Water Pipelines

Field(s): CAFO

Status: Existing

Description: Pipelines are installed to convey water from the well shown on the Operation Area Map to the livestock barns to provide water for livestock and for the dairy milking facilities.

Operation and Maintenance: Check to make sure all valves and air vents are set at the proper operating condition so they can provide protection to the pipeline.

Inspect pipelines for signs of failure. Inspect risers and valves periodically for leaks or worn gaskets. Repair or replace pipeline, risers and valves as needed.

Drain the pipeline and components in areas that are subject to freezing. If parts of the pipeline cannot be drained, a non-toxic antifreeze solution may be added.

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

Specification: NA

Feed Management

Field(s): CAFO

Status: Planned

Units: 2,700 Animals – 2,720 Animal Units

Description: The quantity of available nutrients fed to the livestock will be evaluated to improve efficiency of nutrients fed and excreted.

Operation and Maintenance: See Section 7.

Specification: See Section 7.

Fence

Field(s): CAFO

Status: Existing

Description: Fences are installed to control the movement and access of animals and humans.

Operation and Maintenance: Do not allow livestock access to open water courses and drainageways. Provide off stream watering facilities where possible and limit access to designated watering areas.

Inspect fences periodically and repair or replace broken or decayed posts and tighten sagging wire as needed. Broken wire can be spliced or replaced. Replace broken or missing insulators on electric fences as needed and repair or replace inoperative electric fence controllers.

Insure gates and other appurtenances are in good working order. Replace or repair components as needed.

Specification: NA

Heavy Use Area Protection

Field(s): CAFO

Status: Existing

Description: Travel and confinement areas shown on the Operation Area Map are stabilized with suitable materials to control soil erosion, improve air and water quality, improve aesthetics and improve animal health.

Operation and Maintenance: Periodically inspect concrete and asphalt slabs and curbs and repair or replace broken sections as needed. Prevent manure from building up next to the curbs or over topping them.

Regrade and regravels areas as need to prevent puddling or ponding of rainfall.

Specification: NA

Gutters and Downspouts

Field(s): CAFO

Status: Existing

Description: Gutters and downspouts are installed on the livestock barns to collect, control and transport rainfall runoff away from the manure management system to drainage ditches.

Operation and Maintenance: Annually inspect rain gutters, downspouts, pipelines, trash guards, pumps, structures and appurtenances for proper operation. Keep them free of all foreign material, weeds and sediment. Repair or replace any damaged component as needed.

Keep downspouts and outlets free flowing. Repair or replace broken rodent guards as needed. If the hydraulic capacity is insufficient, replace gutters and downspouts if needed or make provisions for the waste management system to handle the extra water.

Protect downspouts from damage by livestock and equipment and repair any damaged components as needed.

Specification: NA

Pumping Plant

Field(s): CAFO

Status: Existing

Description: Pumping Plants shown on the Operation Area Map are used to transfer wastewater to the crop and hay land fields as a nutrient and irrigation water source.

Operation and Maintenance: Operate and maintain pumps in accordance with good judgment and manufacture's manuals and recommendations.

Drain liquid manure from pumps during cold weather to prevent freezing. If parts of the system cannot be drained, a non-toxic antifreeze solution may be added.

Inspect pumps periodically and remove debris wrapped around shafts and impellers. Maintain foot valves and check valves for proper operation.

For proper operation of electric motors and controls, maintain lubrication for all bearings, keep electric panel free from obstructions and debris. Maintain electrical safety devices, assure all electrical contacts are tight, and lock main electrical switch to "OFF" position during non-use season. Maintain adequate shade and ventilation for pump motors.

For proper operation of pumps, maintain lubrication for all bearings and pump shafts, assure belts are adjusted properly, maintain safety covering devices on open shafts and belt drives, check to make sure all safety valves and devices are set at proper operating conditions so they may provide protection to the pump and power unit. For centrifugal pumps, periodically measure tolerance between pump impeller and pump casing (i.e. wearing) and replace wear ring as needed to help restore new pump operating characteristics.

Use portable pressure gauge (preferably a liquid filled gauge) to monitor pump performance.

Operate and maintain agitators in accordance with the manufacture's manual and recommendations. Inspect all plumbing annually as a minimum.

Replace, tighten, or repair broken or loose connections and lines as needed.

Specification: NA

Solid/Liquid Waste Separation Facility

Field(s): CAFO

Status: Existing

Description: The solids separation facility shown on the Operation Area Map is used for separating solids from the wastewater generated from the livestock facilities. An overall separation efficiency of 25 percent was used to prepare this plan.

Operation and Maintenance: Inspect the solid/liquid separation facility daily to ensure the facility is operating properly and there has been no damage to structural components. Clean screens and outlets if they have become clogged or their capacity is not adequate for proper operation of the facility.

Specification: NA

Underground Outlet

Field(s): CAFO

Status: Existing

Description: Underground pipelines convey water from downspouts connected to gutters on the barns to the drainageways and streams.

Operation and Maintenance: Annually inspect underground outlets for proper operation. Check fields for signs of positive pressure (blow holes) or negative pressure (sink holes) in underground pipelines. Repair or replace damaged or broken pipelines as needed maintaining designed depth of cover.

Keep outlets free of vegetation and sediment. Correct and prevent erosion at outlets by installing riprap or other measures. Repair or replace damaged or broken rodent guards as needed.

Avoid travel over underground pipelines with heavy equipment when the soil is saturated except at crossings designed for this purpose.

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

Immediately repair any damage due to vandalism, vehicular or livestock.

Specification: NA

Waste Storage Facilities

Field(s): CAFO

Status: Existing

Description: The 30 foot diameter by 8 feet deep underground reinforced concrete collection tank shown on the Operation Area Map in Section 2.2 has a capacity of 5,655 cubic feet or 42,299 gallons. This facility is used to collect wastewater, manure and bedding generated from VanBeek Dairy and is considered a collection and temporary storage facility only and was not included in the long term storage calculations.

Approximately 2,891,007 cubic feet or 21,624,732 gallons of wastewater is stored and applied to the crop and hay land fields annually from VanBeek Dairy. The settling basin and waste storage ponds shown on the Operation Area Map in Section 2.2 are used for long term storage and have a total capacity of 2,178,000 cubic feet or 16,291,440 gallons. The settling basin and waste storage ponds are estimated to have an operating capacity of 1,742,400 cubic feet or 13,033,152 gallons after subtracting out sludge storage and the 25 year-24 hour storm volume. The operating capacity of the settling basin and waste storage ponds provides approximately 151 days of storage capacity which is less than the NRCS recommended storage period of 154 days computed using Worksheet 10A-7 found in Section 2.4. Any increase in livestock numbers beyond the planned livestock numbers or additional wastewater would require additional wastewater storage facilities to be constructed.

Approximately 2,533,732 cubic feet or 11,681 tons of solids are produced annually from VanBeek Dairy. Some on farm composting of animal mortalities is expected to be done within the solids storage area as well. The area used for composting animal mortalities will be kept separate from the majority of separated solids. Any feedstock and animal carcasses used in the animal mortality composting process will remain on farm and blended with other compost for use as bedding. The storage capacity of the existing solids storage area is estimated to be 83,800 cubic feet or 3,017 tons and will provide 93 days of storage capacity which is less than the NRCS recommended storage period of 154 days computed using Worksheet 10A-7 found in Section 2.4. The capacity of the solids storage area will be adequate since some of the solids will be composted and recycled for bedding or exported off farm.

All storage facilities for VanBeek Dairy are summarized in Table 2-2.

Table 2-2. Manure Storage

Storage ID	Type of Storage	Pumpable or Spreadable Capacity	Annual Manure Collected	Maximum Days of Storage
Waste Storage Ponds	Storage pond, <50% dilution	13,033,152 Gal	21,624,732 Gal	151
Solids Storage Area	Dry stack	3,017 Tons	11,681 Tons	93

Operation and Maintenance:

WASTEWATER COLLECTION TANK-

The underground reinforced concrete collection tank shown on the Operation Area Map for VanBeek Dairy collects process water, manure, bedding and other liquefied organic waste. Wastewater collected in the underground reinforced concrete collection tank is pumped to the solid/liquid separation facility to separate solids from the wastewater.

Inspect the collection tank weekly to insure structural integrity. If the structural integrity of the collection tank is compromised, immediately empty the facility to determine the cause and make necessary repairs before putting the facility back into service. Do not allow equipment that exceeds the design limit of the facility on or within 20 feet of the structure.

Keep pumps, agitators, piping, valves and all other electrical and mechanical equipment in good condition by following the manufacturer's recommendations. Maintain grounding rods and wiring for all electrical equipment in good condition. Immediately remove all foreign debris within the structure that may cause damage to pumps or agitators.

Pump the wastewater collection tank completely empty during the summer months and cleanout any debris and other solid materials that may have accumulated in the facility. Inspect the collection tank for structural damage and if structural damage is discovered, seek the services of a qualified engineer to assess the damage and recommend necessary repairs before putting the collection tank back into service.

Do not dispose of animal carcasses in the collection tank. It is against the law to do so.

Maintain all fences, railings, and/or warning signs to provide warning and/or prevent unauthorized human or livestock entry. Immediately repair vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances. Maintain lids, grates and shields on openings.

Provide proper ventilation before entering the tank, for any reason what so ever. Provide and use self - contained breathing apparatus (scuba) equipment when entering a tank. No persons should enter the tank unless safety ropes are used and someone else capable of providing rescue assistance is outside the tank.

Do not assume any storage tank, including open top storage tanks, are well ventilated.

SETTLING BASIN AND WASTE STORAGE PONDS-

The settling basin and waste storage ponds shown on the Operation Area Map will serve as the primary storage facilities for wastewater produced from VanBeek Dairy. Emptying of the waste storage pond should begin in February and continue through the spring and summer months as weather conditions permit applying wastewater in accordance with the guidance given the Nutrient Management Specification located in Section 4.4 on page 69. To function properly and have the greatest management flexibility, the waste storage pond must be as empty as possible in October before the fall and winter rainy season begins. Any annual sludge buildup in the settling basin and waste storage ponds must be removed to maintain design capacity and applied to the hay and pasture land fields in accordance with guidance given in the Nutrient Management Specification located in Section 4.4 on page 69.

Inspect the settling basins and waste storage pond weekly to insure structural integrity. Insure that at least 1 foot-6 inches of freeboard is being maintained in the waste storage ponds to

accommodate excess rainfall such as a 25 year-24hour storm and prevent overtopping the embankments. If the structural integrity of the waste storage pond embankment is found to be compromised, immediately draw the liquid level down below the damaged area to determine the cause. Seek the services of a qualified engineer to assess the damage and recommend necessary repairs before allowing wastewater levels above the damaged area.

Pump the waste storage ponds to the lowest level possible during the summer months and inspect the embankments for structural damage. If structural damage to the embankment of the waste storage pond is discovered, seek the services of a qualified engineer to assess the damage and recommend necessary repairs before allowing wastewater levels above the damaged area. Follow the guidance given in the Nutrient Management Specification located on page 69 in Section 4.4 when applying wastewater to fields.

Do not permit livestock access to the pond or on pond embankments. Control undesirable vegetation growth by spraying or mowing. Control rodents as necessary. Check elevations of earthfills periodically and restored to grade and shape as necessary. Fill and reseed eroded embankment areas or repair with well graded rock riprap. Safety features such as signs and fences should be kept in good repair.

Do not dispose of animal carcasses in any wastewater storage pond. It is against the law to do so.

SOLIDS STORAGE AREA-

The solids storage area for the dairy shown on the Operation Area Map is the primary storage facilities to store solid manure, bedding, and wasted feed produced from VanBeek Dairy.

Emptying of the solids storage area should begin as early as possible in the spring. Emptying should continue through the spring and summer months as weather conditions permit applying the solids to the hay and pasture land fields. To function properly and have the greatest management flexibility, the solids storage area must be as empty as possible in October before the fall and winter rainy season begins.

Periodically inspect concrete and asphalt slabs, walls and curbs and repair or replace broken sections as needed. Cleanup any spillage of manure and organics from outside of the solids storage area and place them back in the facility.

Maintain all fences, railings, and/or warning signs to provide warning and/or prevent unauthorized human or livestock entry. Immediately repair vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances.

BUILDING ROOFS-

Inspect building roofs annually as a minimum. Repair and/or replace all rusted sections and secure loose sections as needed. Immediately replace all broken trusses, rafters, beams, poles as needed. Immediately determining the cause and necessary modification(s) to prevent reoccurring structural failure is essential.

Specification: NA

Waste Transfer

Field(s): CAFO

Status: Existing

Description: Process water from milking operations is directed to a catch basin that drains by gravity flow through underground pipelines to the underground reinforced concrete collection tank shown on the Operation Area Map for VanBeek Dairy. Liquefied manure, bedding, and wasted feed cleaned from the livestock barns for VanBeek Dairy and rainfall runoff are directed to the underground reinforced concrete collection tank shown on the Operation Area Map for the dairy.

Any rainfall runoff or seepage from the solids storage area is directed to the underground reinforced concrete collection tank shown on the Operation Area Map.

Wastewater collected in the underground reinforced concrete collection tank for the dairy is periodically pumped to the solid/liquid separation facility shown on the Operation Area Map for VanBeek Dairy. Solids are transferred from the solid/liquid separation facility to the solids storage area and liquids drain from the solid/liquid separation facility to the settling basin.

Wastewater collected in the settling basin drains to the waste storage ponds at VanBeek Dairy and is pumped using underground waste transfer pipelines to the crop and hay land fields during the spring and summer months for utilization as a nutrient source.

Solids containing manure, bedding and wasted feed periodically cleaned from the livestock barns are stored in the solids storage area until they can be composted and recycled as bedding, exported off farm or applied to the crop and hay land fields.

All planned exports, imports and internal transfers of solids and wastewater containing manure are shown in Tables 2-3, 2-4 and 2-5.

Operation and Maintenance: Remove debris and sediment from grates as needed. Annually inspect grates and receiving structures and repair or replace as necessary.

Flush pipelines used for liquid waste applications with clean water following waste application, or as needed, to prevent particle buildup.

Check to make sure all valves and air vents are set at the proper operating condition so they can provide protection to the pipeline.

Inspect pipelines for signs of failure. Inspect risers and valves periodically for leaks or worn gaskets. Repair or replace pipeline, risers and valves as needed.

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

Specification: NA

Table 2-3. Planned Manure Exports off the Farm

Month-Year	Manure Source	Amount	Receiving Operation	Location
Oct 2012	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Nov 2012	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Dec 2012	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jan 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Feb 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Mar 2013	Solids Storage Area	3,000 Tons	Local Farms	Monroe, Oregon
Mar 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Apr 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
May 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jun 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jul 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Aug 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Sep 2013	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Sep 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Oct 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Nov 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Dec 2013	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jan 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Feb 2014	Solids Storage Area	3,000 Tons	Local Farms	Monroe, Oregon
Feb 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Mar 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Apr 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
May 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jun 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jul 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Aug 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Aug 2014	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Sep 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Oct 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Nov 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Dec 2014	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jan 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Feb 2015	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Feb 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Mar 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Apr 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
May 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jun 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jul 2015	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Jul 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Aug 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns

Month-Year	Manure Source	Amount	Receiving Operation	Location
Sep 2015	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Sep 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Oct 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Nov 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Dec 2015	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jan 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Feb 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Feb 2016	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Mar 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Apr 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
May 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jun 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Jul 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Aug 2016	Solids Storage Area	2,000 Tons	Local Farms	Monroe, Oregon
Aug 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns
Sep 2016	Solids Storage Area	1,000 Tons	Local Farms	Monroe, Oregon
Sep 2016	Solids Storage Area	500 Tons	Recycle for Bedding	Livestock Barns

Table 2-4. Planned Manure Imports onto the Farm

Month-Year	Manure's Animal Type	Amount	Originating Operation	Location
(None)				

Table 2-5. Planned Internal Transfers of Manure

Month-Year	Manure Source	Amount	Manure Destination
(None)			

Water Well

Field(s): CAFO

Status: Existing

Description: Wells supply water for livestock and other uses on VanBeek Dairy.

Operation and Maintenance: Protect the area immediately surrounding the well from being damaged by agriculture machinery, vehicles, or livestock.

All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.

Do not allow any foreign debris to accumulate and maintain soil and vegetative covering in the immediate vicinity of the well.

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

Check metal surfaces for rust and other damage especially sections in contact with earthfill and with other materials. Repair or replace damaged section and apply paint as a protective covering.

Keep all surface water from entering or accumulating at the immediate vicinity of the well site.

Immediately repair any vandalism, vehicular, or livestock damage.

Specification: NA

Watering Facility

Field(s): CAFO

Status: Existing

Description: Watering facilities are installed in the barns to provide livestock access to water on VanBeek Dairy.

Operation and Maintenance: Check all above ground connections, valves, gates, rodent guards, inlets and outlets to make sure they are functioning properly. Check troughs and tanks for leaks or cracks and repair or replace immediately, if necessary.

Make certain the area adjacent to the trough is well protected with gravel, paving, or good cover. Be sure that the outlet pipe has a free outlet and is not causing any serious erosion problems. Check periodically to see if debris has fallen into the trough or tank which may restrict inflow or planned functions of the outflow system.

Clean the entire system periodically and remove moss, algae growth, and/or sludge. Chemicals such as copper sulfate and chlorine can be used to prevent moss and algae growth. Local rules and regulations are to be followed when using chemicals to make sure they are safe for animals.

Where necessary maintain coverings and insulation to prevent damage by freezing.

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

Immediately repair any vandalism, vehicular or livestock damage.

Specification: NA

2.4 Storage Period Worksheet 10A-7

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

7/7/2012

Version 4.1

CLIENT: VanBeek Dairy

ASSISTED BY: Bruce D. Wilson, H&R Engineering

Worksheet OR10A-7--Waste storage period determination

Basic Storage Period, SPb = 213 Days

Enter average monthly Evapotranspiration(ET) from OSU Extension Publication 8530,
Oregon Crop Water Use and Irrigation Requirements, and Precipitation(Ppt) Data from

Climatic Station- CORVALLIS STATE UNIV

Day of Year	MONTH	Crop ET, Inches	Accum ET, Inches	Ppt, Inches
1-31	January	0.39	0.39	6.46
32-59	February	0.75	1.14	5.71
60-90	March	1.69	2.83	4.59
91-120	April	3.39	6.22	2.98
121-151	May	5.12	11.34	2.30
152-181	June	5.98	17.32	1.46
182-212	July	7.13	24.45	0.57
213-243	August	5.91	30.36	0.73
244-273	September	4.02	34.38	1.47
274-304	October	2.48	36.86	3.02
305-334	November	0.63	37.49	6.94
335-365	December	0.35	37.84	7.43

a. Determine last day for the month of the year when 3/4 of Annual ET is exceeded-

$$3/4 \text{ of Annual ET} = 0.75 \times 37.84 = 28.38 \text{ Inches}$$

L = Last Day for Month Accum ET exceeds 3/4 of Annual ET

$$L = 243 \text{ Days}$$

b. Determine first day for the month of the year when ET >= Ppt-

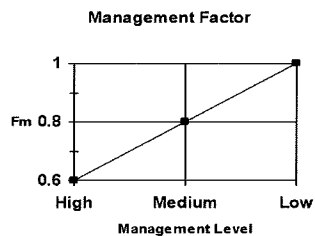
E = First Day of Month ET >= Ppt

$$E = 91 \text{ Days}$$

$$c. SPb = 365 - (L - E) = 365 - (243 - 91) = 213 \text{ Days}$$

Management Factor, Fm =

0.8



Low Level, Fm = 1.0

...The operator does not utilize a waste management plan.
...Proper operation and maintenance may not be performed.

Medium Level, Fm = 0.8

...The operator utilizes an up-to-date waste management plan.
...Manure application equipment is calibrated for nutrient applications.
...Maintains adequate soil moisture for crop growth.
...Agronomic treatments which would maximize crop nutrient uptake are not fully utilized.
...Proper operation and maintenance is planned.

High Level, Fm = 0.6

...The operator utilizes an up-to-date waste management plan.
...Soil fertility testing is performed annually.
...Manure in storage is tested for nutrient concentrations.
...Records of time, rate and location of manure applications are maintained.
...Manure application equipment is calibrated for nutrient applications.
...Irrigation water management techniques are practiced.
...Crop nutrient uptake is maximized with appropriate agronomic treatments such as residue management, conservation crop rotation, crop variety selection, prescribed grazing, and pest management.
...Proper operation and maintenance is planned.

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM) Version 4.1

7/7/2012

CLIENT: **VanBeek Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering**

Worksheet OR10A-7--Waste storage period determination

Soils Factor: $F_{s\text{LIQUID}} = 0.90$ $F_{s\text{SOLID}} = 0.70$

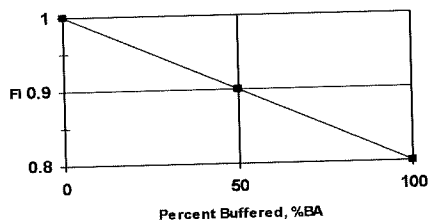
Soils must meet the following criteria for F_s to be less than 1.0:
 ... The average water holding capacity for the profile greater than 3.0 inches.
 ... A cation exchange capacity greater than 5 meq/100g of soil.
 ... Depth to a thin layer/cemented pan greater than 20 inches.
 ... Depth to high water table greater than 2 feet.
 ... A permeability greater than 0.06 inches/hr but less than 6 inches/hr.
 ... Cobbles less than 35% by weight in the surface layer.
 ... Stones and boulders less than 15% by weight in the surface layer.
 ... A pH greater than 5.0.
 ... Sodium Adsorption Ratio less than 13.
 ... Land slope less than 15%.

HSG	Soils Factor (F_s)			
	Consistency of Waste			
	Liquid	Slurry	Semi-Solid	Solid
A	1	0.95	0.9	0.8
B	0.8	0.75	0.7	0.6
C	0.9	0.85	0.8	0.7
D	1	1	0.95	0.85

HSG	Area	$F_{s\text{LIQUID}}$	Wtd $F_{s\text{LIQUID}}$	$F_{s\text{SOLID}}$	Wtd $F_{s\text{SOLID}}$
C	100	0.9	90.00	0.7	70.00
		$F_{s\text{LIQUID}} = 0.90$		$F_{s\text{SOLID}} = 0.70$	

Location Factor: $FI = 1.00$

Location Factor



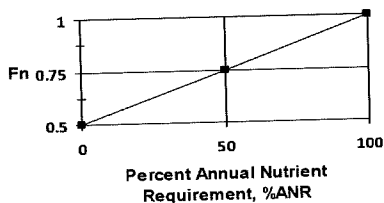
For an application area to be considered buffered there must be a 0 to 5 percent chance of flooding and the area must be at least 50 feet from water bodies, ground water sources(wells), and areas of concentrated flow. The percent buffered area(%BA) is determined by taking the total buffered area(TBA) and dividing it by the total land area(TLA) available for manure application.

$$\%BA = \frac{TBA}{TLA} \times 100\%$$

$$\%BA = \frac{0}{846} \times 100\% = 0\%$$

Nutrient Loading Factor: $F_n = 1.00$

Nutrient Loading Factor



In order for the Nutrient Loading Factor, F_n to be less than 1, the Location Factor, FI must be 0.95 or less.

The percent of annual nutrient requirement(%ANR) is determined by taking the total nutrients applied(TNA) annually and dividing it by the total nutrient requirements(TNR) of all of the crops grown.

$$\%ANR = \frac{TNA}{TNR} \times 100\%$$

$$\%ANR = \frac{4,013}{2,694} \times 100\% = 149\%$$

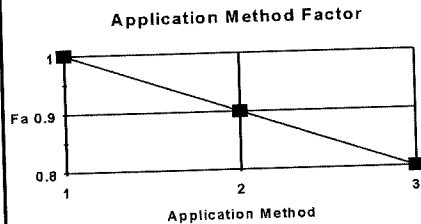
OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM) Version 4.1

7/7/2012

CLIENT: **VanBeek Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering**

Worksheet OR10A-7--Waste storage period determination

Application Method Factor: $F_{a\text{LIQUID}} = 0.90$ $F_{a\text{SOLID}} = 1.00$



Method 1 - Surface applied solid manure, no incorporation.
Method 2 - Surface applied liquid manure, no incorporation.
Method 3 - Injection or immediate incorporation.

Adjusted Storage Period: $ASP_{\text{LIQUID}} = 138$ Days $ASP_{\text{SOLID}} = 119$ Days

$$ASP = SP_b \times F_m \times F_s \times F_l \times F_n \times F_a$$

$$ASP_{\text{LIQUID}} = 213 \times 0.8 \times 0.9 \times 1 \times 1 \times 0.9$$

$$ASP_{\text{SOLID}} = 213 \times 0.8 \times 0.7 \times 1 \times 1 \times 1$$

Adjusted earliest Day of Year for application, $E_a = ASP - (365 - L)$

$$E_{a\text{LIQUID}} = 16$$

$$E_{a\text{SOLID}} = -3$$

Storage Period: $SP_{\text{LIQUID}} = 154$ Days $SP_{\text{SOLID}} = 154$ Days

The storage period must span the seasonal flooding conditions and must also span frozen ground and snow conditions where the land slope exceeds 5% and a buffer strip of less than 100 feet exists next to open water courses that affect the application area-

a. Enter L from Sheet 1 and determine the Day of Year L_1 when seasonal frozen ground, snow or flooding conditions are first anticipated for the application area-

$$L = 243 \text{ Days} \quad L_1 = 365 \text{ Days}$$

If L_1 comes before L then $L_{sp} = L_1$

If L_1 comes after L or there is no seasonal frozen ground, snow or flooding then $L_{sp} = L$

$$L_{sp} = 243 \text{ Days}$$

b. Determine the Day of Year E_1 when seasonal frozen ground, snow or flooded conditions are no longer anticipated for the application area-

$$E_1 = 32 \text{ Days}$$

If E_1 comes after E_a then $E_{sp} = E_1$

If E_1 comes before E_a or there is no seasonal frozen ground, snow or flooding then $E_{sp} = E_a$

$$E_{sp\text{LIQUID}} = 32 \text{ Days} \quad E_{sp\text{SOLID}} = 32 \text{ Days}$$

$$c. SP_{\text{LIQUID}} = 365 - (L_{sp} - E_{sp\text{LIQUID}}) = 154 \text{ Days}$$

$$SP_{\text{SOLID}} = 365 - (L_{sp} - E_{sp\text{SOLID}}) = 154 \text{ Days}$$

d. Earliest date (E_{sp}) for manure application (month-day):

$$E_{sp\text{LIQUID}} = \text{February 4}$$

$$E_{sp\text{SOLID}} = \text{February 1}$$

$$e. \text{ Latest date } (L_{sp}) \text{ for manure application (month-day)} = \text{September 31}$$

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.1

CLIENT: VanBeek Dairy
 ASSISTED BY: Bruce D. Wilson, H&R Engineering

Worksheet OR10A-7--Waste storage period determination

Day of Year Calendar

Day of month	Jan	Feb	Mar	Apr	May	Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	32	60	91	121	152	182	213	244	274	305	335	
2	2	33	61	92	122	153	183	214	245	275	306	336	
3	3	34	62	93	123	154	184	215	246	276	307	337	
4	4	35	63	94	124	155	185	216	247	277	308	338	
5	5	36	64	95	125	156	186	217	248	278	309	339	
6	6	37	65	96	126	157	187	218	249	279	310	340	
7	7	38	66	97	127	158	188	219	250	280	311	341	
8	8	39	67	98	128	159	189	220	251	281	312	342	
9	9	40	68	99	129	160	190	221	252	282	313	343	
10	10	41	69	100	130	161	191	222	253	283	314	344	
11	11	42	70	101	131	162	192	223	254	284	315	345	
12	12	43	71	102	132	163	193	224	255	285	316	346	
13	13	44	72	103	133	164	194	225	256	286	317	347	
14	14	45	73	104	134	165	195	226	257	287	318	348	
15	15	46	74	105	135	166	196	227	258	288	319	349	
16	16	47	75	106	136	167	197	228	259	289	320	350	
17	17	48	76	107	137	168	198	229	260	290	321	351	
18	18	49	77	108	138	169	199	230	261	291	322	352	
19	19	50	78	109	139	170	200	231	262	292	323	353	
20	20	51	79	110	140	171	201	232	263	293	324	354	
21	21	52	80	111	141	172	202	233	264	294	325	355	
22	22	53	81	112	142	173	203	234	265	295	326	356	
23	23	54	82	113	143	174	204	235	266	296	327	357	
24	24	55	83	114	144	175	205	236	267	297	328	358	
25	25	56	84	115	145	176	206	237	268	298	329	359	
26	26	57	85	116	146	177	207	238	269	299	330	360	
27	27	58	86	117	147	178	208	239	270	300	331	361	
28	28	59	87	118	148	179	209	240	271	301	332	362	
29	29		88	119	149	180	210	241	272	302	333	363	
30	30		89	120	150	181	211	242	273	303	334	364	
31	31		90		151	181	212	243		304		365	

2.5 Livestock Manure Storage Assessment Worksheet

Ground & Surface Water Contaminants - Nutrients, Organics & Pathogens					
Rating Item	Low Risk 4 Points	Low-Mod Risk 3 Points	Mod-High Risk 2 Points	High Risk 1 Point	Score
1. No on-farm storage facilities	Wastes hauled off farm for proper storage and disposal			Daily spreading of livestock wastes	NA
2. On-farm storage Manure stack	Manure stack covered; on impermeable surface; rainfall and runoff diverted; built to NRCS standards.	Manure covered; on low permeable soil; rainfall and runoff diverted.	Manure partially covered; on slightly permeable soils; some runoff collected.	Manure not covered; runoff not collected.	3
and/or Liquid/Slurry storage	Concrete, clay lined, or other liquid tight design; designed and built to NRCS standards; properly maintained; no cracks and leaks.	Earthen structure built to NRCS standards and properly maintained.	Not designed to NRCS standards; on slightly permeable soils; poorly maintained, some evidence of cracks and leaks.	Not designed to NRCS standards; on permeable soils; not maintained; leaks and cracks.	3
3. Storage volume	Not full at end of rainy season; if liquid/slurry adequate capacity to hold 25-year, 24-hour storm; solids removed to avoid loss of storage capacity.	Not full at end of rainy season; if liquid/slurry not adequate capacity to hold 25-year, 24-hour storm.	Storage facility requires occasional emptying during the rainy season; if liquid/slurry not adequate capacity to hold 25-year, 24-hour storm.	Storage facility requires regular emptying during the rainy season; if liquid/slurry not adequate capacity to hold 25-year, 24-hour storm.	4
4. Storage location	Manure stack or earthen pond located more than 500 feet from well, stream, pond, or drainageway. Or Liquid/slurry storage located more than 200 feet from well, stream, pond, or drainageway or has emergency containment dike for accidental spills or leaks.	Manure stack or earthen pond located between 250-500 feet from well, stream, pond, or drainageway. Or Liquid/slurry storage located between 100-200 feet from well, stream, pond, or drainageway	Manure stack or earthen pond located less than 250 feet downslope from well, stream, pond, or drainageway. Or Liquid/slurry storage located more than 100 feet downslope from well, stream, pond, or drainageway	Manure stack or earthen pond located less than 250 feet upslope from well, stream, pond, or drainageway. Or Liquid/slurry storage located 100 feet from upslope well, stream, pond, or drainageway	4
Livestock Waste Storage Rating for Ground & Surface Waters		Accumulative Score (sum of above ratings)			14.00
		Average Score (sum of ratings / number of items rated)			3.5
Overall Risk Rating-		Low to Moderate Risk			

Ratings: 3.6-4=Low risk, 2.6-3.5=Low to moderate risk, 1.6-2.5=Moderate to high risk, 1-1.5=High Risk

Source: Modification of Oregon Home*A*Syst, EM 8546, Worksheet #7, Livestock Waste Storage

2.6 Livestock Yard Management Assessment Worksheet

Ground & Surface Water Contaminants – Nutrients, Organics & Pathogens					
Rating Item	Low Risk 4 Points	Low-Moderate Risk 3 Points	Mod-High Risk 2 Points	High Risk 1 Point	Score
1. Location	More than 200 feet from well and more than 500 feet from stream, pond, or drainageway	Between 100-200 feet of well and between 250-500 feet from stream, pond, or drainageway	Between 50-100 feet of well and between 100-250 feet from stream, pond, or drainageway	Less than 50 feet of well and less than 100 feet from stream, pond, or drainageway	4
2. Livestock water source	Stock water in troughs, with overflow diverted to wastewater system	Stock water in troughs with overflow diverted from lot area. Stock excluded from streams or ditches.	Live water fenced, with stock water provided in water gap.	Stock water provided by live stream or irrigation ditch.	4
3. Surface water diversion	All upslope and roof water diverted. Diversion and gutters well maintained.	Most upslope surface and roof water diverted. Diversions and gutters occasionally maintained.	No surface water diverted. Some roof water collected and redirected. Gutters and diversions not maintained.	All water (surface and roof water) runs through the yard.	4
4. Lot runoff control system	No yard runoff. Fully covered area or runoff from surfaced lot directed to waste storage facility.	All runoff collected from compacted, earthen lot. Solids mounded and collected or stored.	Most of lot runoff diverted to filter strip and collected. Some solids removed.	Lot runoff uncontrolled. Solids rarely collected.	4
5. Yard cleaning and scraping	No yard (animals confined)	Every month or two lot smoothed, leveled, and regularly shaped.	Quarterly. Lot rough and irregular in shape.	Rarely. Lot poorly sited and developed for cleaning and scraping.	4
6. Dairy cow concentration on yard	No yard. Confined to barn, roofed yard or pasture.	75 sf/a or more on fenced, curbed concrete pad and/or 400 sf/a on graded earthen surface. More than 1800 sf/a in exercise area.	50 sf/a or more on concrete pad and/or 200-300 sf/a on earthen surface. More than 1200 sf/a in exercise area.	Some concrete, less than 50 sf/a and less than 200 sf/a on earthen surface.	4
7. Dairy replacements concentration	No yard. Confined to barn, roofed yard, or pasture.	More than 40 sf/a on fenced, curbed concrete pad and/or more than 150 sf/a on earthen yard.	40-20 sf/a on concrete and/or 75-150 sf/a on earthen surface.	Less than 75 sf/a on earth.	4

Ground & Surface Water Contaminants – Nutrients, Organics & Pathogens					
Rating Item	Low Risk 4 Points	Low-Moderate Risk 3 Points	Mod-High Risk 2 Points	High Risk 1 Point	Score
8. Beef feeder concentrations	No yard. Confined to barn.	Barn and/or paved lot more than 50 sf/a. Earthen lot with mound more than 300 sf/a, or without mound more than 500 sf/a.	No shelter. Paved lot with 30-50 sf/a. Earthen lot with mound 150-300 sf/a or earthen without mound 250-500 sf/a.	Paved less than 30 sf/a. Earthen less than 250 sf/a.	NA
9. Beef cows/heifers concentrations	Barn, roofed yard, or pasture.	Barn with paved lot more than 60 sf/a. Earthen with mound 400 sf/a or without mound 600 sf/a.	Paved lot more than 30 sf/a. Earthen with mound 200-400 sf/a or without mound 300-600 sf/a.	Paved less than 30 sf/a. Earthen without mound less than 200 sf/a.	NA
10. Sheep/ewes concentrations	No yard. Confined to barn, roofed yard, or pasture.	Barn and paved lot more than 20 sf/a. Earthen more than 40 sf/a.	Barn and paved lot 15-20 sf/a. Earthen 25-40 sf/a.	Barn and paved lot less than 15 sf/a. Earthen less than 25 sf/a.	NA
11. Feeder lambs concentrations	No yard. Confined to barn, roofed yard, or pasture.	Barn and paved lot more than 10 sf/a. Earthen more than 25 sf/a.	Barn and paved lot 5-10 sf/a. Earthen 10-25 sf/a.	Barn and paved lot less than 5 sf/a. Earthen less than 10 sf/a.	NA
12. Hogs/sows Concentrations	No yard. Confined to barn.	Shed and paved lot more than 30 sf/a.	Shed and earthen lot more than 10 sf/a	Shed and earthen lot less than 10 sf/a.	NA
13. Horses concentrations	No yard. Confined to barn, roofed yard, or pasture.	Earthen exercise lot more than 2,500 sf/a.	Earthen exercise lot 1,000-2,500 sf/a.	Earthen exercise lot less than 1,000 sf/a	NA
14. Poultry concentrations	No lot. In building.	.	Earthen lot of more than 4 sf/a.	Earthen lot of less than 4 sf/a.	NA
Livestock Yard Rating		Accumulative Score (sum of above ratings)			28.00
		Average Score (sum of ratings / number of items rated)			4.00
Overall Rating-		Low Risk			

Ratings: 3.6-4=Low risk, 2.6-3.6=Low to moderate risk, 1.6-2.5=Moderate to high risk, 1-1.5=High Risk

Note: sf/a = square feet per animal

Source: Modification of Oregon Home*A*Syst, EM 8546, Worksheet #8, Livestock Yards Management

2.7 Mortality Management

Currently mortalities for VanBeek Dairy are disposed of by composting.

Having dead animals sent to an acceptable disposal site is the best method to deal with animal mortalities. A list of landfills and phone numbers can be found on the internet at <http://www.deq.state.or.us/lq/sw/disposal/permittedfacilities.html>. If a local landfill is not permitted to accept animal carcasses, the Oregon Department of Environmental Quality (DEQ) may grant an exception. Phone numbers to local DEQ offices can be found in most phone books or on the internet at <http://www.deq.state.or.us/about/locations.html>.

Under no circumstances are animal mortalities to be disposed of in any type of liquid manure storage facility.

Refer to Section 3 for guidance on steps to take for a catastrophic animal mortality event.

Guidance for various methods for disposing of animal mortalities are:

Composting- Components of this plan are considered adequate to meet the requirement for having a composting plan for the Oregon Department of Agriculture, Natural Resources Division. The composting facility for animal mortalities must have a concrete floor or similar impervious surface to prevent nutrient leaching. A roof covering the animal mortality composting facility is recommended to control moisture added by rainfall and rainfall runoff. A permit is also needed from the Department of Environmental Quality (DEQ) if animal mortalities will be imported from other farms for composting.

Rapid composting of dead animals occurs when the carbon to nitrogen (C:N) ratio of the compost mix ranges between 10 and 20 to 1. To achieve the recommended C:N ratio, build the initial compost pile by placing 18 inches of sawdust or other bulking agent on the floor of the composting area. The bulking agent should extend beyond the perimeter of the animal to be composted by at least 2 feet. If using a compost bin the bulking material should extend at least 1 foot beyond the perimeter of the animal being composted. Using a bulking agent such as sawdust will absorb any liquids as the animal decomposes during the composting process.

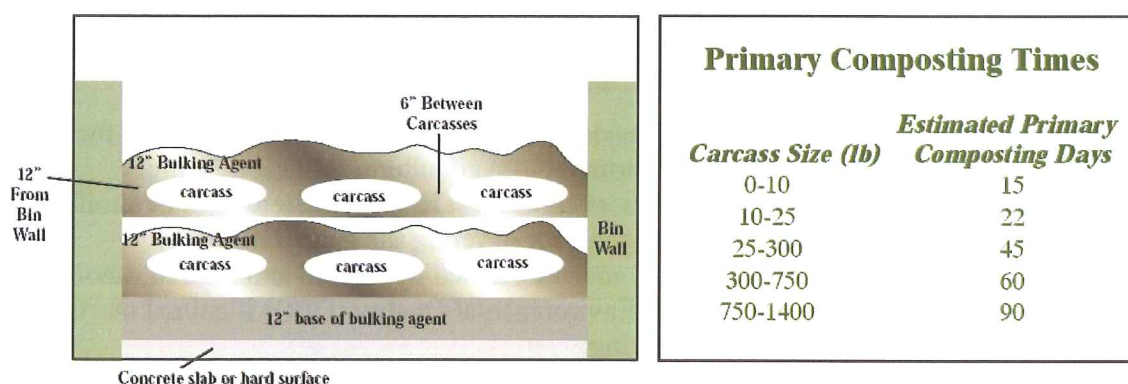
Once the bulking agent has been placed on the floor of the composting area, place the animal carcass on top. To decrease composting time and prevent bloating the body cavity should be cut open. Cover the carcass with 1 to 3 feet of separated manure solids or other material that has a moisture content between 30 to 60 percent and a C:N ratio of not more than 30 to 1. Use 1 foot of material for small carcasses and 3 feet for large carcasses such as cattle. Be careful not to add material that is too wet as it will hinder the composting process and cause odors. Small animals can be layered in a compost pile by placing 12 inches of the bulking agent between layers as shown in the figure below. Be sure the total height of the compost pile does not exceed 7 feet in height as it may spontaneously combust causing a fire.

The first heating or primary composting cycle will take approximately 15 to 90 days depending on the size of the animal being composted. Refer to the table below for estimated primary composting times. Check pile temperature using thermometer probe on a daily basis. The pile temperature should be checked at multiple points around the compost pile and at a point approximately 3 feet into the pile. The temperature of the compost pile should reach 130 degrees Fahrenheit (F) within a few days. Temperatures should peak between 130 and 150 degrees F in 3 to 4 days. When the temperature of the compost pile falls below 130 degrees F, the compost

needs to be aerated by turning or other means. Be sure carcasses remain covered with the bulking agent after being aerated. It is important to maintain a temperature above 130 degrees F for at least 7 days during the primary composting cycle as failure to do so may result in the incomplete destruction of pathogens and can cause fly and odor problems. After aerating the compost pile, the secondary composting times will be similar to the first.

CAUTION: It is unclear whether prions that are the proteins that cause Bovine Spongiform Encephalitis (BSE or Mad Cow Disease) are destroyed in the composting process. Animals showing signs of Mad Cow Disease and those with anthrax should not be composted and must be reported to the Oregon Department of Agriculture, Animal Health and Identification Division at (503) 986-4680 for guidance on disposal.

After aerating the compost pile by turning or other means, be sure to check the moisture content and add water if necessary being careful not to add too much water. The compost pile should feel moist to the touch but you should not be able to squeeze any water out of it.



Odors given off by the composting operation is a good indicator of how the compost operation is proceeding. Foul odors may mean that the process has turned from aerobic to anaerobic. Anaerobic conditions are the result of insufficient oxygen in the compost. This may be caused by excessive moisture in the compost or the need for turning or aerating of the compost pile.

After the composting process is finished, it may be used as a bulking agent for a new compost pile. A rule of thumb is to use 50 percent of the composted material for a bulking agent but you may want to use more or less depending on how degraded the bulking agent is in the finished compost. Using finished compost in a new compost pile reduces the amount of bulking agent needed for the new pile and provides microbial inoculants to get the composting process started.

Finished compost can also be applied to crop and pasture land fields for utilization of the nutrients and organics in the composted material. Compost from animal mortalities should not be applied to crops that will be consumed directly by humans. The nutrient content of the composted material should be determined and application equipment calibrated to ensure nutrients contained in the composted material are not over applied.

Natural Disposal- To allow nature to take its course the dead animal needs to be transported to a location at least ½ mile from any off-farm dwelling and at least ¼ mile from any water way in accordance with ORS 601.140. Once this criteria is met the carcass can be left to degrade naturally with the help of scavengers. This method is not an acceptable means of disposal for a large number of animal mortalities or for byproducts generated during butchering.

Landfill- Dead animals may be transported to a permitted landfill that accepts animal carcasses for disposal. Be sure to call the chosen landfill first to insure a landfill will accept your animal

carcasses. Refer to the website given previously for permitted landfills to call. Contact the landfill operator and the DEQ at (800) 452-4011 if the landfill you would like to use is not a permitted facility to see if an exception may be granted for the disposal of animal carcasses.

Incineration- Dead animals may be burned as a method of disposal and as a method to control diseases. The economics of incineration and availability of incineration units usually make this option undesirable. A permit is needed from the Oregon Department of Environmental Quality (DEQ) Air Quality program to operate an incineration unit. Contact your DEQ at (800) 452-4011 for guidance on incineration of animal carcasses.

Burial- Dead animals may be buried in accordance with ORS 601.090(7) as a method of disposal. Large animals such as an adult cow will require a hole approximately 2 feet by 7 feet by 8 feet deep. Be sure to select a site that doesn't have a water table to insure the bottom of the hole will be dry. The animal carcass should be covered with hydrated lime and covered with at least 4 feet of soil mounded 2 feet above the natural ground line to allow for settling as the carcass decomposes. Burial sites should be located at least 500 feet down slope from surface waters or wells.

Burial is not an acceptable method of disposal for animal byproducts generated from butchering. Burial of large numbers of animal mortalities is not acceptable unless performed in accordance with a Catastrophic Animal Mortality Management Plan. Burial of imported animal mortalities is subject to disposal regulations and the Oregon Department of Environmental Quality (DEQ), the Oregon Department of Agriculture (ODA) and the local land use planning authority should be contacted.

Section 3. Farmstead Safety and Security

3.1 Emergency Response Plan

In Case of an Emergency Storage Facility Spill, Leak or Failure

Implement the following steps:

- a. Stop all other activities to address the spill.
- b. Stop all flow into the facility.
- c. If the storage facility is at maximum capacity or overtopping, draw the waste level in the facility down by making an application to the emergency application area shown on the Land Treatment Area Map.
- d. Assess the extent of the emergency and determine how much help is needed to correct the problem.
- e. Call for help (See Table 3.1 and 3.2) and excavator if needed.
- f. If possible, use a skid loader or tractor with blade to contain or divert spill or leak away from environmentally sensitive areas.
- g. If containment material is needed, excavate soil from appropriate areas away from the storage facility.
- h. Complete the clean-up and repair the necessary components.
- i. Assess the extent of the emergency and request additional help if needed.
- j. If a Discharge to ground or surface waters occurs, the Oregon Department of Agriculture is to be Notified within 24 hours (See Table 3.3) and a Written Report is to be made by the Owner or Operator to Oregon Department of Agriculture within 5 Days that contains the following information:
 - (1) A description and cause of the discharge.
 - (2) The period of discharge including exact dates, times and duration of discharge.
 - (3) An estimate of discharge volume.
 - (4) Name or location of receiving water.
 - (5) Corrective steps taken, if appropriate, to reduce, eliminate or prevent reoccurrence of the discharge.

In Case of an Emergency Spill, Leak or Failure During Transport or Land Application

Implement the following first containment steps:

- a. Stop all other activities to deal with the emergency.
- b. Call sheriff's office (See Table 3.1) if manure is spilled on road for traffic control and clean the spill immediately from the road and roadside if needed.
- c. Contain the spill or runoff from entering surface waters using straw bales, saw dust, soil or other appropriate materials.
- d. If flow is coming from a tile, plug the tile with a tile plug immediately.
- e. Assess the extent of the emergency and request additional help if needed.
- k. If a Discharge to ground or surface waters occurs, the Oregon Department of Agriculture is to be Notified within 24 hours (See Table 3.3) and a Written Report is to be made by the Owner or Operator to Oregon Department of Agriculture within 5 Days that contains the following information:
 - (1) A description and cause of the discharge.
 - (2) The period of discharge including exact dates, times and duration of discharge.
 - (3) An estimate of discharge volume.
 - (4) Name or location of receiving water.
 - (5) Corrective steps taken, if appropriate, to reduce, eliminate or prevent reoccurrence of the discharge.

The land application equipment will be constantly monitored by the person conducting the land application of manure. In order to prevent an accident or spill during land application, operator should complete an inspection of the land application equipment to ensure proper function prior to performing land application. In addition, weather conditions (wind speed and direction, precipitation, etc.) and field conditions (proper setbacks noted, soil moisture, etc.) should be verified prior to land application.

Table 3-1. Department/Agency Phone Numbers

Department / Agency	Phone Number
Fire Emergency	911
Fire Non-Emergency	(541) 847-5170
Ambulance	911
Sheriff Emergency	911
Sheriff Non-Emergency	(541) 766-6858

Table 3-2. Available equipment/supplies for responding to emergency

Equipment Type	Contact Person	Phone Number
Nearest excavation equipment	Martin VanBeek	(541) 424-5641

Table 3-3. Contacts to be made by the Owner or Operator within 24 hours of Manure Spill, Leak or Facility Failure.

Organization	Phone Number
Oregon Department of Agriculture Confined Animal Feeding Program 635 Capitol Street N.E. Salem, OR 97301-2532	(503) 986-4700 TTD (503) 986-4762
Oregon Emergency Response System (ORES)	(800) 452-0311
County Environmental Health Department	(541) 766-6841

Be prepared to provide the following information:

- Your name and contact information.
- Farm location and other pertinent identification information.
- Description of the emergency.
- Estimate of the amounts, area covered, and distance traveled.
- Whether manure has reached surface waters or major field drains.
- Whether there is any obvious damage; i.e., employee injury, fish kill, or property damage.
- Current status of containment efforts.

In Case of an Catastrophic Animal Mortality Event

- Remove animal mortality from the livestock production area and place in an area designated for mortality storage.
- Contact a veterinarian if animal death is suspicious or animal displayed unusual symptoms before death.
- If it is determined that a disease outbreak is eminent, implement procedures as directed by the State Veterinarian. This may include killing exposed animals, burning there carcasses and burial of their ashes in a predetermined catastrophic mortality burial area.

Table 3-4. Catastrophic Mortality Management Contacts

Organization	Phone Number
Oregon Department of Agriculture Natural Resources Division 635 Capitol St. N.E. Salem, OR 97301-2532	(503) 986-4700 TTD (503) 986-4762
Oregon Emergency Response (System ORES)	(800) 452-0311
County Environmental Health Department	(541) 766-6841
State Veterinarian	(503) 986-4680

Be prepared to provide the following information:

- Your Name and phone number.
- Farm Identification (See Above).
- Cause of catastrophic animal mortality event.
- Estimate of the number of current and projected animal mortalities.
- What is currently in progress to deal with the situation?

3.2 Safety

Waste collection and management facilities should be kept in a state of good repair and safe operating condition at all times. Warning signs, ladders, ropes, bars, rails, and other safety devices should be provided, as appropriate, to help insure the safety of humans and livestock. Each device should be structurally adequate to support anticipated loads. (A rope may be adequate sight warning, but inappropriate to support a person who accidentally slips on wet concrete.)

At least four noxious gasses are generated when organic waste is subject to anaerobic processes. They are: Methane (CH₄), Hydrogen Sulfide (H₂S), Ammonia (NH₃) and Carbon Dioxide (CO₂). In high enough concentrations, all can be lethal through lack of oxygen or poisoning. (Three gases are heavier than air and will exclude oxygen from depressed areas.) All but carbon dioxide can be explosive. Ventilation and warning signs must be provided for enclosed waste holding structures to help prevent explosions, poisoning or asphyxiation. Pipelines from an enclosed tank(s) in a building should be provided with a water - sealed trap and vent to prevent gas entry into the building.

Entry into pits, ponds or tanks should not be allowed but if entry cannot be avoided the following procedures should be adhered to:

- 1) Ventilate the facility before and during occupancy and use a self-contained breathing apparatus. Do not assume any storage tank, including open top storage tanks, are well ventilated.**
- 2) Attach a tether or lead capable of supporting the weight of the person entering the facility and have a person outside the facility at all times tend the tether or lead.**

When inspecting or working on machinery, the following procedures should be adhered to:

- 1) Disconnect all power connections and provide lockouts whenever possible.**
- 2) Use blocks in front and behind rolling equipment to prevent movement.**

Obey all warning signs posted around manure storage structures.

Beware of vehicle traffic and avoid travel paths of rapidly moving equipment.

Beware of slip, trip and fall hazards such as extension cords, wet or manure coated floors, and rotted wood or loose boards.

Avoid equipment without proper safe guards such as tractor power take offs, grain augers, feed grinders, mowers and ventilation fans.

Wear a dust mask in dusty environments both indoors and outdoors.

Stay away from any loose electrical wiring or electrical fence wiring unless power has been turned off.

3.3 Biosecurity Measures

In order to reduce or prevent the spread of disease causing organisms (pathogens) a few simple guidelines should be followed:

1. Ask visitors to give advance notice before visiting the farm and be prepared to provide biosecurity practices they will have to follow during their visit. As a minimum it is recommended that visitors to the farm that will be entering the production area wash and disinfect their vehicle and boots prior to their visit. It is also a good idea to have visitors wait 24 hours before visiting the farm if they plan to visit other farms just prior to their scheduled visit.
2. If at all possible have visitors avoid livestock housing and feed storage areas. If visitors must enter livestock housing and feed storage areas make sure their boots are washed and disinfected before entering or have disposable boots on and are wearing clean clothes or disposable overalls.
3. Do not allow visitors to drive their vehicles through livestock housing and feed storage areas after driving through areas containing animal manure.
4. If potential visitors have visited a farm with Foot-and-Mouth Disease (FMD) make sure they disinfect all clothing and personal items and make them wait at least five days before visiting your farm.

3.4 Chemical and Petroleum Handling, Use and Storage

No hazardous chemicals are stored on the VanBeek Dairy. All hazardous chemicals such as herbicides and fertilizers are stored on the Joe Boyer property and are applied by Joe Boyer. Joe Boyer is responsible for the proper storage and disposal of all hazardous chemicals used by the VanBeek Dairy.

The VanBeek Dairy maintains a 500 gallon above ground tank for gasoline and a 4,000 gallon above ground tank for diesel to fuel vehicles and equipment used on the dairy. Lubricants for vehicles and equipment used on the VanBeek Dairy are stored in containers located in the shop building shown on the Operation Area Map. Any fuel or lubricant spills would be contained in and around the shop building area shown on the Operation Area Map and would not be a threat to any surface or ground water sources.

All veterinary supplies are kept in the herdsman's office under lock and key. All syringes are disposed of in a sharps container which is taken to a suitable disposal facility once the container is full.

The following measures shall be taken to prevent chemicals from contaminating process water or storm water storage and treatment systems:

1. Make sure all chemicals are stored in proper containers. Expired chemicals and empty containers are to be properly disposed of in accordance with state and federal regulations. Pesticides and associated refuse are to be disposed of in accordance with the FIFRA label.
2. Chemical storage areas are to be self-contained with no drains or other pathways that will allow spilled chemicals to exit the storage area.
3. Chemical storage areas are to be covered to prevent chemical contact with rain or snow.
4. Emergency procedures and equipment are to be in place to contain and clean up chemical spills.
5. Chemical handling and equipment wash areas are to be designed and constructed to prevent contamination of surface waters, waste water, and storm water storage and treatment systems.

Section 4. Land Application Site Information (Land Treatment)

4.1 Land Inventory

There are 271.2 acres of hay land area owned by VanBeek Dairy and another 594.8 acres of adjacent crop and hay land that are available to utilize nutrients and organics produced by VanBeek Dairy. The amount of spreadable acres for utilization of the nutrients and organics produced from VanBeek Dairy are shown in the following table:

Table 4-1. Field Information

Field ID	Sub-field ID	Total Acres	Spreadable Acres	County	Predominant Soil Type	Slope (%)	Watershed Code	FSA Farm	FSA Tract	FSA Field
Baker	1	131.0	129.1	Benton	140 (Santiam SIL)	3.0	170900030208		342	
Baker	2	171.4	161.4	Benton	140 (Santiam SIL)	3.0	170900030208		342	
Baker	3	10.7	10.3	Benton	155 (Waldo SICL)	1.5	170900030208		343	
Boyer	1	72.9	72.9	Benton	140 (Santiam SIL)	4.0	170900030208			
Boyer	2	119.7	111.8	Benton	140 (Santiam SIL)	3.0	170900030208			
Goracke		151.5	151.5	Benton	140 (Santiam SIL)	3.0	170900030208		8252	
Home		119.7	119.7	Benton	140 (Santiam SIL)	3.0	170900030208		816	
Sievers		89.1	89.1	Benton	140 (Santiam SIL)	4.0	170900030208		812	
Wildlife1		10.8	0	Benton	155 (Waldo SICL)	1.0	170900030208		816	
Wildlife2		8.0	0	Benton	155 (Waldo SICL)	1.0	170900030208		816	
Wildlife3		50.1	0	Benton	155 (Waldo SICL)	1.0	170900030208		8252	
Baker Wildlife	1	4.7	0	Benton	140 (Santiam SIL)	3.0	170900030208		342	
Baker Wildlife	2	37.3	0	Benton	155 (Waldo SICL)	1.0	170900030208		342	
Baker Wildlife	3	6.2	0	Benton	141 (Santiam SIL)	3.0	170900030208		342	
Baker Wildlife	4	5.2	0	Benton	155 (Waldo SICL)	1.0	170900030208		342	
Baker Wildlife	5	13.3	0	Benton	155 (Waldo SICL)	1.0	170900030208		342	
Baker	HQ	10.4	0	Benton	140 (Santiam SIL)	1.0	170900030208		342	
VanBeek	HQ	1.6	0	Benton	140 (Santiam SIL)	1.0	170900030208		816	
Sievers	HQ	5.1	0	Benton	140 (Santiam SIL)	5.0	170900030208		812	
CAFO		29.4	0	Benton	140 (Santiam SIL)	1.0	170900030208		816	

The land application fields and spreadable acres are shown on the Land Treatment Area Map in Section 4.3.

4.2 Environmental Inventory (Sensitive Areas)

The VanBeek Dairy is located in the Muddy Creek watershed having an twelve-digit Hydrologic Unit Code (HUC) of 170900030208. All rainfall runoff from VanBeek Dairy will be captured by drainage ditches that flow to unnamed drainageways that drain to Muddy Creek. The Land Treatment Area Map located in Section 4.3 shows all surface water bodies that would receive rainfall runoff from the VanBeek Dairy. The Topographic Maps located in Section 1.6 shows the farm locations and watershed(s).

Muddy Creek drains to Marys River that provides important habitat for birds, fish and animals and provides critical food sources for endangered salmonid species of fish. Any polluted runoff entering these surface water sources would negatively impact wildlife habitat and water quality which are used by salmonids for spawning and rearing fry and for city water supplies downstream.

The Farm Fields Overview Map located in Section 1.5 and Topography Map located in Section 1.6 show the boundaries of VanBeek Dairy and the relation to Muddy Creek. The Oregon Confined Animal Feeding Operation National Pollutant Discharge Elimination System General Permit Number 01-2009 requires a minimum vegetated setback of 35 feet and a 100 foot nonvegetated setback from any water course to prevent pollution of surface waters from polluted runoff due to land application of manure and runoff from production facilities. Minimum manure application setback distances from water features are shown in Table 4-1. VanBeek Dairy is planning to maintain the vegetated setbacks along open water courses to help enhance wildlife habitat and reduce the risk of polluted runoff from the land application and production areas from reaching Muddy Creek and Marys River.

The wells shown on the Operation Area Map provide water as a drinking water source for the residences and barn facilities on VanBeek Dairy operations. The wells are built to state standards so the risk for animal manures to pollute the wells is low.

4.4 Land Treatment Practices

Following are practices that VanBeek Dairy has implemented or plans to implement that address resource concerns for the land treatment areas identified in Section 1.7:

Access Road

Field(s): Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers

Status: Existing

Description: Existing roadways allow access to farm facilities and fields to perform needed management operations.

Operation and Maintenance: Maintain road, parking lot and pathway surfaces in good condition, which includes periodic grading and addition of surface material when necessary. Prevent surface ponding by localized grading or addition of surface materials to remove depressions. Road base-course rock may be required to stabilize the road and parking lot foundations. If so, remove unstable materials and rebuild travelway. Limit traffic and animal access with fencing or barriers, where needed.

Remove debris, litter or blockages from roads, parking lots and walkways. Also remove debris and maintain capacity of associated drainage ditches, drop inlets, culverts, bridges, waterways and storm water outlets.

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

Immediately repair any vandalism, vehicular, or livestock damage to earthfills, side slopes, drainage facilities, water ways and storm water outlets or other appurtenances.

Maintain good vegetative cover, mulches, and other covering installed for erosion protection.

Specification: NA

Forage and Biomass Planting

Field(s): Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers

Status: Planned

Units: 866 Acres

Description: As hay and pasture land fields need renovating, adapted and compatible species, varieties, or cultivars will be established in the fields as shown on the Land Treatment Area Map to provide forage and hay for livestock.

Operation and Maintenance: Evaluate pasture and hay land fields annually to determine what fields need to be reseeded. Generally if the pasture or hay lands are below a fair condition rating and the yields from the previous grazing or haying season were less than 50 percent of yield goals, the pasture or hay land field should be reseeded.

Take a soil sample of the top 12 inches of soil and have it analyzed for pH, Lime requirement(SMP), Phosphorus(P), Potassium(K), Calcium(Ca), and Magnesium(Mg) prior to seed bed preparation. See Oregon State University (OSU) Extension Publication PNW 570-E, Monitoring Soil Nutrients Using a Management Unit Approach, in Appendix H for more guidance on soil sampling.

Prior to October 15th: Prepare seed bed (including weed control and tillage) and add fertilizer and other amendments according to soil test recommendations.

Prior to October 15th: Seed pastures. It is best to seed a pasture or hay land between September 1st and October 15th so no irrigation will be needed.

Specification:

PLANTING PLAN-

Fertilizer: Refer to Oregon State University fertilizer guide (FG63) for pastures and soil test recommendations for the amounts of fertilizer and other amendments to add while preparing the seed bed.

Seedbed Preparation: Till the soil lightly with a disk and harrow to prepare for seeding the pasture or hay land. *The seedbed should be very firm (your foot should not sink into the soil more than 1/2 inch), weed-free and free of ruts.* Small clods are okay (they help prevent erosion).

Weed Control: The tillage will probably be sufficient weed control, however application of a labeled herbicide is optional if weeds remain.

Seeding dates: It is generally best to seed the pasture or hay land between September 1 and October 15 to ensure adequate grass establishment before the winter erosion period. Seedings can be made during other times when the soil is suitable for tillage operations but the new seeding will have to be irrigated to insure good germination and establishment.

Seed depth: Generally seeding depths should be 0.75 – 1.5 inch however actual seeding depths should be determined for the variety and species of the seed being planted.

Seeding method: Broadcast or use a grain drill and harrow lightly after seeding.

SEED-

Contact the local OSU Extension Service for recommendations on what varieties of grass to plant based on forage production goals and site conditions for the pasture or hay land.

Note: Be sure to use seed that is at least 72% Pure Live Seed (PLS). PLS is calculated by multiplying % Germination X % Purity. For example, seed that is 90% Pure and has 70% Germination has $PLS = 90\% \times 70\% = 63\%$. This seed would be considered too low in quality to produce adequate forage for pasture or hay land .

PASTURE AND HAY LAND ESTABLISHMENT:

Allow the pasture or hay land planting to grow throughout the rainy season and defer grazing of the new seeding until it is well established.

Control growth of volunteer plants and shading to reduce competition to the pasture or hay land.

Control weeds and volunteer plants in the pasture or hay land by mowing or by using herbicides. Do not allow noxious weeds to go to seed. Information on noxious weeds can be obtained from the Oregon Department of Agriculture website: http://egov.oregon.gov/ODA/PLANT/WEEDS/county_events.shtml or by calling (503) 986-4621.

Forage Harvest Management

Field(s): Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers

Status: Planned

Units: 866 Acres

Description: Forages harvested from the fields shown on the Land Treatment Area Map for hay or silage shall be cut and stored in a timely manner to provide high quality feed for the livestock. Care should be taken when feeding grass haylage harvested from fields testing high in soil concentrations of potash as the high amounts of potassium in the soil may be taken up by the hay crop and cause grass tetany if fed to lactating and dry cows.

Operation and Maintenance: Before forage harvest, clear fields of debris that could damage machinery, or if ingested by livestock lead to sickness (for example, hardware disease) or death. Monitor Weather conditions and take action accordingly before and after cutting to optimize forage wilting or curing time to preserve feed quality and prevent forage swaths or windrows from smothering underlying plants.

Select equipment sizes and capacities that will handle the acreage planned for harvest economically and in a timely manner.

Operate all forage harvesting equipment at the optimum settings and speeds to minimize loss of leaves.

Set shear-plate on forage chopper to the proper theoretical cut for the crop being harvested. Keep knives well sharpened. Do not use recutters or screens unless forage moisture levels fall below recommended levels for optimum chopping action.

Regardless of silage/haylage storage method, ensure good compaction and an air-tight seal to exclude oxygen on mold formation.

Inspect and repair harvesting equipment following the manufacturer's preventative maintenance procedures. All shields shall be in place during machine operation to prevent injury or death. Shut off machinery before working on or unplugging moving parts.

Specification: Apply animal waste in accordance with the guidance given in the Nutrient Management specification.

Apply irrigation water in accordance with the guidance given in the Irrigation Water Management specification.

The pasture shall be clipped and dragged a minimum of twice annually to promote uniform grazing and avoid damage to the plants and/or a reduction in forage production. Clipping and dragging after each grazing period will promote optimum pasture conditions.

If rodent, insect or weed control becomes a problem, a pest management program may need to be included. See your local OSU Extension Agent for recommended pest control methods.

When making hay, cut grasses when they are in the boot stage to produce hay with high quality protein and insure the minimum plant height after cutting is 3 inches to maximize production. Before harvest, clear fields of debris that could damage machinery, or if ingested by livestock, lead to sickness or death.

Delay harvest if prolonged or heavy precipitation is forecast that would seriously damage cut forage or forage swaths or windrows would smother underlying plants before removal from the field. Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile. When harvested for ensilage forage should be chopped to a size that allows adequate packing to produce the anaerobic conditions necessary to ensure the proper ensiling process.

Harvest silage/haylage crops at the ideal moisture range for the type of storage planned. Treat direct cut hay crop silage with chemical preservatives or add dry feed stuffs to avoid fermentation and seepage digestible dry matter losses. For optimal forage quality, rake, ted, or invert swaths, and bale when hay has sufficient moisture to prevent leaf loss. Bale at optimum moisture levels to preserve forage quality and quantity. Approximate percent moisture should be as follows:

- * Bale field cured hay at 15 to 20 percent moisture.
- * Bale forced air dried hay at 20 to 35 percent moisture.
- * Rake hay at 30 to 40 percent moisture.
- * Ted or invert swaths when moisture is above 40 percent.

Keep records of forage harvest to document yields.

Irrigation System-Sprinkler

Field(s): Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers

Status: Existing

Description: Traveling big gun and center pivot sprinkler irrigation systems are used to apply wastewater and irrigation water to the crop and hay land fields. The irrigation system(s) apply water and wastewater in an efficient manner to the fields as shown on the Land Treatment Area Map to manage soil moisture and apply nutrients and organics to promote plant growth without causing excessive runoff and leaching.

The traveling big gun sprinkler irrigation system has a nozzle diameter of 1.0 inch which can be expected to produce 300 gallons per minute at an operating pressure of 80 to 90 pounds per square inch. Traveling big gun sprinkler systems must be well managed to prevent excess percolation, surface runoff, wind drift and evaporation losses.

The center pivot sprinkler irrigation system uses nozzles with varying diameters which produce up to 800 gallon per minute flow rates at pressures between 50 to 60 pounds per square inch. The sprinklers are mounted on a long elevated traveling boom with wheels. The booms vary in length depending on field size but usually do not exceed 1,320 feet in length. These systems usually apply 0.7 to 8 inches of water depending on the travel speed used and have an efficiency of 80 percent. Center pivot sprinkler systems must be well managed to prevent excess percolation, surface runoff, wind drift and evaporation losses.

Operation and Maintenance: Maintain mechanical parts of the irrigation systems by oiling and greasing moving parts and the engine in accordance with the manufacturer's recommendations to help ensure trouble free operation. Prevent livestock access to equipment during operation.

Clean plugged nozzles and replace if worn or defective.

Promptly repair all leaks by replacing valves, fittings, gaskets, worn or damaged parts.

Specification: NA

Irrigation Water Management

Field(s): Goracke, Home

Status: Planned

Units: 271.2 Acres

Description: Irrigation Water Management is applied to the irrigated fields as shown on the Land Treatment Area Map to manage soil moisture to promote the desired crop response, optimize the available water supplies, minimize irrigation induced erosion, decrease non-point source pollution of surface and groundwater sources, manage salts in the crop root zone and manage the crop micro climate. Irrigation water is supplied by wells using pumps through underground pvc pipelines to sprinkler irrigation systems. The average amount of irrigation water to be applied per application and total annual amount needed for irrigated crops with guidance on when and how much irrigation water to apply can be found in the specification.

Operation and Maintenance:

Permits: Under Oregon law all water is publicly owned and anyone planning to store or divert surface or groundwater for the purpose of irrigation must obtain a permit or water right from the Oregon Water Resources Department. These permits or water rights must be obtained prior to the use of the water. It is the responsibility of the Farmer to file for the necessary permits or water rights.

Irrigation Water Flows, Volumes, and Relationships

$$Q \times T = D \times A$$

where:

Q = flow rate (acre-in/hr or cfs)

T = time (hr)

D = gross depth applied (in)

A = area (acres)

$$Q = \frac{453 \times A \times D}{F \times H}$$

where:

Q = flow rate (gpm)

A = area (acres)

D = gross application depth (in)

F = irrigation period (days)

H = hours of operation per day

Water Flow Rates:

1 cubic foot per second (cfs)

= 448.8 gallons per minute

1 cfs for 1 hour = 0.99 acre-inch

1 cfs for 24 hr = 1.98 acre-ft

1,000 gpm = 2.23 cfs

1,000 gpm for 24 hr = 4.42 ac-ft

1 gpm/acre = 0.053 ac-in/ac/day

1 cfs = 40 miner's inches in OR, No CA

1 cfs = 50 miner's inches in ID, WA

1 miner's inch = 11.22 gpm in OR

1 miner's inch = 9 gpm in ID, WA

1 cfs = 28.32 liters/sec

1 cubic meter/sec = 35.3 cfs

1 liter/sec = 15.85 gpm

$Q \times T = D \times A$ where:

Q = cfs, T = hr; D = inches depth; A = acres

Gpm for 5 ft/s velocity in PVC pipe

6"	8"	10"	12"	14"
480	800	1250	1750	2150

Water Volumes & Weights:

1 cubic foot = 7.48 gallons

= 62.4 lb = 28.3 liters

1 acre-foot = 43,560 cubic feet

(1 acre covered 1 ft deep)

12 acre-in = 1 acre-ft = 325,829 gal

1 million gallons = 3.07 acre-ft

1 acre-ft = 1,234 cubic meters

1 cu meter = 1,000 liters = 35.3 cu ft

Pressure and Pressure Head:

1 psi = 2.31 ft of pressure head

1 atmosphere (sea level)

= 14.7 psi = 33.9 ft of head

Lengths and Areas:

1 mile = 5,280 ft = 1.61 km

1 meter = 3.28 ft = 39.37 inches

1 acre = 43,560 square ft

1 hectare = 2.47 acres

Pump Power Requirement

$$\text{Horsepower} = \frac{\text{Pump Head in ft} \times \text{gpm}}{39.6 \times \% \text{ Pump Efficiency}}$$

SOILS-

Refer to Section 5 for soils information.

CROPS-

CROP	MATURE ROOT DEPTH (INCHES)	MAXIMUM ALLOWED DEPLETION	CRITICAL PERIOD
Grass Seed	30	50%	July
Corn Silage	48	50%	July

Above data are from EM8713, *Western Oregon Irrigation Guides*, June 1998, OSU: Corvallis, OR and NRCS *Irrigation Guide (National Engineering Handbook, Part 652)*.

IRRIGATION WATER SUPPLY-

Description of Oregon Water Right:	Certificates: 68528, 68529, 79448 Permits: 26014, 28597, 50183, 68529
Description of Irrigation Water Supply (Well, Stream, Irrigation District, etc.):	Wells and Muddy Creek
Supply Flowrate (gpm or cfs):	753.5 gpm or 1.68 cfs
Annual Volume Available (Acre-ft.):	336
Water Delivery Schedule:	On Demand
Method(s) of Water Measurement:	Water Budget

IRRIGATION SYSTEM-

System	System Capacity (gpm)	Nozzle Size (in)	Pressure (psi)	Spacing (ft)	Application Rate (in/hr)	System Efficiency (%)
Traveling Big Gun Sprinkler	300	1.0	80 to 90	180 to 250	0.4 to 0.5	65
Center Pivot Sprinkler	800	Varies	50 to 60	NA	0.7 to 0.8	80

Specification:

TYPES OF MONITORING SYSTEMS-

- Radio-relayed (remote access) capacitance probes.
- Gypsum blocks (recorded at least twice per week during irrigation season).
- Check-book method using daily data from Agri-met.
- Monitoring of plant appearance.
- "Feel and Appearance Method" is digging soil in the root zone and then physically squeezing the soil to determine moisture level.

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

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

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

FEEL AND APPEARANCE METHOD OF DETERMINING SOIL MOISTURE

Fine Sand and Loamy Fine Sand Soils

Appearance of Sandy Loam and Fine Sandy Loam Soils at Various Soil Moisture Conditions

Available Water Capacity = 0.6 to 1.2 inches per foot

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

Inches per Foot Depleted: Inches of water needed to refill a foot of soil to field capacity.

0 to 25 percent available 1.2 to 0.5 inches per foot depleted

Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure (Not pictured)

25 to 50 percent available 0.9 to 0.3 inches per foot depleted

Slightly moist, forms a very weak ball with well-defined finger marks, light coating of loose and aggregated sand grains remains on fingers.



50 to 75 percent available 0.6 to 0.2 inches per foot depleted

Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon.



75 to 100 percent available 0.3 to 0.0 inches per foot depleted

Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color heavy water staining on fingers, will not ribbon.



Go to <http://www.wy.nrcs.usda.gov/technical/soilmoisture/spanishsoilmoisture.html> to get this information in Spanish.

FEEL AND APPEARANCE METHOD OF DETERMINING SOIL MOISTURE

Sandy Loam, and Fine Sandy Loam Soils

Appearance of Sandy Loam and Fine Sandy Loam Soils at Various Soil Moisture Conditions

Available Water Capacity = 1.3 to 1.7 inches per foot

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

Inches per Foot Depleted: Inches of water needed to refill a foot of soil to field capacity.

0 to 25 percent available 1.7 to 1.0 inches per foot depleted

Dry, forms a very weak ball, aggregated soil grains break away easily from ball. (Not pictured)

25 to 50 percent available 1.3 to 0.7 inches per foot depleted

Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away.



50 to 75 percent available 0.9 to 0.3 inches per foot depleted

Moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color, will not slick.



75 to 100 percent available 0.4 to 0.0 inches per foot depleted

Wet, forms a ball with wet outline left on hand, light to medium staining on fingers, makes a weak ribbon between the thumb and forefinger.



Go to <http://www.wy.nrcs.usda.gov/technical/soilmoisture/spanishsoilmoisture.html> to get this information in Spanish.

FEEL AND APPEARANCE METHOD OF DETERMINING SOIL MOISTURE

Sandy Clay, Loam, and Silt Loam Soils

Appearance of Sandy Clay, Loam, and Silt Loam Soils at Various Soil Moisture Conditions

Available Water Capacity = 1.5 to 2.1 inches per foot

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

Inches per Foot Depleted: Inches of water needed to refill a foot of soil to field capacity.

0 to 25 percent available 2.1 to 1.1 inches per foot depleted

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

25 to 50 percent available 1.6 to 0.8 inches per foot depleted

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



50 to 75 percent available 1.1 to 0.4 inches per foot depleted

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



75 to 100 percent available 0.5 to 0.0 inches per foot depleted

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



Go to <http://www.wy.nrcs.usda.gov/technical/soilmoisture/spanishsoilmoisture.html> to get this information in Spanish.

FEEL AND APPEARANCE METHOD OF DETERMINING SOIL MOISTURE

Clay, Clay Loam, and Silty Clay Loam Soils

Appearance of Clay, Clay Loam, and Silty Clay Loam Soils at Various Soil Moisture Conditions

Available Water Capacity = 1.6 to 2.4 inches per foot

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

Inches per Foot Depleted: Inches of water needed to refill a foot of soil to field capacity.

0 to 25 percent available 2.4 to 1.2 inches per foot depleted

Dry, soil aggregations separate easily, clods are hard to crumble with applied pressure.
(Not pictured)

25 to 50 percent available 1.8 to 0.8 inches per foot depleted

Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure.



50 to 75 percent available 1.2 to 0.4 inches per foot depleted

Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger.



75 to 100 percent available 0.6 to 0.0 inches per foot depleted

Wet, forms a ball, uneven medium to heavy soil/water coating on fingers, ribbons easily between thumb and forefinger.



Go to <http://www.wy.nrcs.usda.gov/technical/soilmoisture/spanishsoilmoisture.html> to get this information in Spanish.

IRRIGATION WATER MANAGEMENT OPERATIONS:

Irrigation Water Management Worksheet						
Crop Name:	Corn Silage					
Managed Rooting Depth:	48 inches					
Management Allowed Depletion, MAD:	50 %					
Irrigated Acres:	119.7					
Soil Name:	Linslaw, Santiam					
Soil Depth (inches):	48					
Available Water Capacity (in/in):	0.18					
Soil Intake Rate (in/hr) :	0.5					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	Month					
	April	May	June	July	August	Sept
Total Plant Available Water Capacity (in): Soil or Root Depth * Available Water Capacity	8.64	8.64	8.64	8.64	8.64	8.64
Net Irrigation Application (in): Total Plant Available Water Capacity * MAD	4.32	4.32	4.32	4.32	4.32	4.32
Irrigation System Application Rate (in/hr): Determined based on the type of Irrigation System	0.38	0.38	0.38	0.38	0.38	0.38
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in): (From OSU Extension Miscellaneous Pub 8530, 1992)	0	0.47	3.62	7.13	5.83	1.06
Average Daily Crop Water Use (in/day):	0.00	0.02	0.12	0.23	0.19	0.04
Irrigation Frequency (days): Net Irrigation Application / Daily Crop Water Use	0	31	30	19	23	30
Irrigation System Set Time (hours):	7.5	7.5	7.5	7.5	7.5	7.5
Actual Net Irrigation Application (in): Gross Application * System Application Efficiency	2.28	2.28	2.28	2.28	2.28	2.28
Actual Irrigation Frequency (days): Actual Net Irrigation Application / Daily Crop Water Use	0	31	19	10	12	30
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%): Water Required / Water Applied	80	80	80	80	80	80
Gross Irrigation Application (in): System Application Rate * System Set Time	2.85	2.85	2.85	2.85	2.85	2.85
Volume of Water per Irrigation (acre-in): Gross Irrigation Application * Irrigated Acres	341	341	341	341	341	341
Irrigation System Operation (hours/day):	16	16	16	16	16	16
Required System Flow Rate (gpm): (Equation 2)	0	312	508	966	805	322
Compare Required system flow rate with Measured flow noted on Irrigation Application Record						

Irrigation Water Management Worksheet						
Crop Name:	Grass Hay					
Managed Rooting Depth:	30 inches					
Management Allowed Depletion, MAD:	50 %					
Irrigated Acres:	151.5					
Soil Name:	Dayton, Linslaw, Santiam					
Soil Depth (inches):	60					
Available Water Capacity (in/in):	0.18					
Soil Intake Rate (in/hr) :	0.3					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	Month					
	April	May	June	July	August	Sept
Total Plant Available Water Capacity (in): Soil or Root Depth * Available Water Capacity	5.40	5.40	5.40	5.40	5.40	5.40
Net Irrigation Application (in): Total Plant Available Water Capacity * MAD	2.70	2.70	2.70	2.70	2.70	2.70
Irrigation System Application Rate (in/hr): Determined based on the type of Irrigation System	0.38	0.38	0.38	0.38	0.38	0.38
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in): (From OSU Extension MiscelYamhillous Pub 8530, 1992)	1.57	3.15	4.57	6.22	5.12	3.46
Average Daily Crop Water Use (in/day):	0.05	0.10	0.15	0.20	0.17	0.12
Irrigation Frequency (days): Net Irrigation Application / Daily Crop Water Use	30	27	18	14	16	23
Irrigation System Set Time (hours):	16	16	16	16	16	16
Actual Net Irrigation Application (in): Gross Application * System Application Efficiency	3.95	3.95	3.95	3.95	3.95	3.95
Actual Irrigation Frequency (days): Actual Net Irrigation Application / Daily Crop Water Use	30	31	26	20	23	30
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%): Water Required / Water Applied	65	65	65	65	65	65
Gross Irrigation Application (in): System Application Rate * System Set Time	6.08	6.08	6.08	6.08	6.08	6.08
Volume of Water per Irrigation (acre-in): Gross Irrigation Application * Irrigated Acres	921	921	921	921	921	921
Irrigation System Operation (hours/day):	16	16	16	16	16	16
Required System Flow Rate (gpm): (Equation 2)	869	841	1,003	1,304	1,134	869
Compare Required system flow rate with Measured flow noted on Irrigation Application Record						

IRRIGATION SYSTEM WALK-THROUGH INSPECTION EVALUATION

This form may be used to identify and evaluate those components of an irrigation system that directly affect irrigation system operation and water management. Other aspects not directly affecting irrigation water management, such as energy-use efficiency, may also be noted. Make additional copies as needed.

ITEM	OK	Needs attention	Comments
Irrigation water supply			
Adequate water supply for area irrigated	_____	_____	_____
Suitable quality of irrigation water supply	_____	_____	_____
Inflow controlled by valve and/or gate	_____	_____	_____
Inflow is measured easily and accurately	_____	_____	_____
Type of water measuring device: _____			
Source of irrigation water: _____			
Type of delivery schedule if applicable: _____			
Irrigation water conveyance			
Adequate capacity in ditch and/or pipe	_____	_____	_____
Ditch or pipe free of leaks	_____	_____	_____
Adequate water control devices	_____	_____	_____
Irrigation water application			
Adequate water control for uniform application	_____	_____	_____
Uniformity of application throughout field	_____	_____	_____
Wet and/or dry spots	_____	_____	_____
Excessive runoff Note: There should be no runoff from sprinkler-irrigated areas.	_____	_____	_____
Overall system condition			
General maintenance			
Other (note):			

Farmer's Name:			Field:		
Nickname:			Crop:		
Managed Soil:			Rooting Depth:		inches
Irrigation system provides:		Inches at speed of:		Feet per minute	

	Big gun speed			Irrigation	Rainfall
DATE	Weather	(ft/min)	X	(inches)	(inches)
/ /					
/ /					
/ /					
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[illegible]

SENSOR INSTALLATION:

If soil moisture sensors will be used for soil moisture monitoring, install them according to the following schedule:

FIELD	SOIL	CROP	ACRES	# OF SITES	SENSORS/ SITE	TOTAL SENSORS	DEPTHS

Notes:

SOIL WATER OBSERVATIONS AND MEASUREMENTS
Record Results of Soil Probing and/or Sensor Readings from Tensiometers or Resistance Blocks at Least Twice per Week

SOIL WATER OBSERVATIONS AND MEASUREMENTS
Record Results of Soil Probing and/or Sensor Readings from Tensiometers or Resistance Blocks at Least Twice per Week

[illegible]

Nutrient Management

Field(s): Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers

Status: Planned

Units: 866 Acres

Description: The site vulnerability rating for phosphorus movement off the listed fields is based on the Western Oregon Phosphorus Index. The crop and hay land fields have very low to excessive soil concentrations of phosphorus. Applications of manure will be made on a nitrogen basis on all fields and the soil phosphorus concentrations are not expected to increase significantly over the next 4 years. The site vulnerability rating for phosphorus runoff will be low and medium for crop and hay land fields and is not expected to change over the next 4 years. Phosphorus will be monitored on all fields using soil tests and if soil phosphorus concentrations significantly increase, manure applications will be reduced which may result in some of the manure and wastewater to be exported off farm. It is estimated that 2,891,007 cubic feet or 21,624,732 gallons of wastewater and a maximum of 1,200 tons or 66,667 cubic feet of solids containing manure will be applied annually to the crop and hay land fields. The total nutrients applied to the fields are 550,048 pounds of nitrogen, 268,104 pounds of phosphate, and 976,204 pounds of potash with 598,444 pounds of nitrogen, 248,891 pounds of phosphate and 483,049 pounds of potash removed in the plant biomass. It is anticipated that no additional nutrients will have to be applied to meet target yields. If additional nutrients are applied it should only be done based on soil tests and in accordance with crop fertilizer guides.

The sprinkler system and solids spreader will be calibrated to apply wastewater from the waste storage pond and solids storage area at the rate needed to meet the nitrogen needs for the crops grown. The measured nutrient concentrations in the waste storage ponds used in developing this plan are 8.9 pounds per 1,000 gallons (lbs/th Gal) of Nitrogen, 3.0 lbs/th Gal of Phosphate and 11.1 lbs/th Gal of Potash. The estimated nutrient concentrations for the solids from the solids storage area used in developing this plan are 10.5 lbs/Ton of Nitrogen, 4.6 lbs/Ton of Phosphate and 6.5 lbs/Ton of Potash. No manure applications are to be made to the setback buffer shown on the Land Treatment Area Map.

The soil test nutrient concentrations are based on soil tests taken in 2009 and 2012. Manure test nutrient concentrations are based on estimates from the MMP computer program in 2012 as this plan was being written. The protocol for soil and manure testing, fall soil nitrate testing, guidance for making emergency applications, protocol and schedule for calibrating application equipment, and the months manure will be applied are contained in the specification.

Operation and Maintenance:

Phosphorus: Many streams and rivers are polluted with excessively high phosphorus levels. This phosphorus causes algae blooms, which cause dissolved oxygen levels and pH to fluctuate greatly, thus harming fish and other aquatic organisms. Most crops do not respond to phosphorus fertilizer unless soil test P levels are low (below 50 ppm P).

Phosphorus fertilizer comes from mines. There is a limited supply of high quality phosphorus ores to make phosphorus fertilizer (a consideration for future generations of farmers).

Nitrogen: Nitrogen loss reduces profits. Nitrogen runoff to streams from cropland, however, is usually not a major environmental issue, except where manure is applied at a high rate or ammonium type fertilizers are applied between May 1 to October 31 and excessive irrigation water washes them into the stream. Well and moderately well drained soils have a moderate to high risk of nitrate leaching. Poorly and somewhat poorly drained soils have a very low to low risk of nitrate leaching.

Excessive N fertilization can increase de-nitrification, which produces nitrous oxide (a greenhouse gas). Due to the local climate, most soil nitrogen in the nitrate form going into winter will be lost from the field and not be available for crop uptake. Nitrogen fertilizer is manufactured by the Haber process, which involves burning natural gas (a non-renewable resource).

Specification:

SCHEDULE FOR SAMPLING AND ANALYSIS

In order to effectively implement nutrient management samples of feed, soils, crops, irrigation water, manure, wastewater, and solids need to be obtained and analyzed in accordance with the following criteria-

SAMPLE	NUMBER	NOTES
Total Ration	2	See Section 7 in the NMP for guidance on sampling feed rations.
Solid Manure	2	Sample solids during applications in early spring and late summer if possible and have each sample analyzed for Total Nitrogen (TKN), Ammonium Nitrogen (NH ₄ -N), Phosphorus (P) and Potassium (K) plus percent moisture. Ask lab to report results in pounds per ton.
Liquid manure	2	Sample liquids during applications in early spring and late summer if possible and have each sample analyzed for Total Nitrogen (TKN), Ammonium Nitrogen (NH ₄ -N), Phosphorus (P) and Potassium (K) plus percent moisture. Ask lab to report results in pounds per thousand gallons.
Normal soil tests	All Fields within a 4 year period	Collect soil samples from fields in accordance with Oregon State University Extension publication PNW570-E, "Monitoring Soil Nutrients Using a Management Unit Approach" located in Section 10.3. Have the soil samples analyzed for Nitrates (NO ₃ -N)*, Ammonium (NH ₄ -N)*, P, K, pH, SMP (optional: test for B, Ca, Mg and % Organic Matter) and ask the lab to report results in parts per million (ppm). This test can be done during any month.
Corn pre-sidedress nitrate soil tests	All Corn Fields Annually	Collect soil samples from fields growing corn at the V5 stage (when corn is approx. 12" tall) in accordance with Oregon State University Extension publication EM 8650, "The Pre Side Dress Soil Nitrate Test" located in Section 10.3. Have the soil samples analyzed for Nitrates (NO ₃ -N) and ask the lab to report results in parts per million (ppm)
Fall nitrate soil tests	All Manured Fields within a 4 year period	Collect soil samples from the manure application areas every fall (September 15-October 15) in accordance with Oregon State University Extension publication EM8832-E, "Post Harvest Soil Nitrate Testing" located in Section 10.3. Have the soil samples analyzed for Nitrates (NO ₃ -N), Phosphorus (P) and Potassium (K) and ask the lab to report results in parts per million (ppm).

* Check crop fertilizer guide for what depth the soil sample should be taken for these tests.

Manure analyses should be performed by a laboratory that meets the requirements and performance standards of the Manure Testing Laboratory Certification Program (MTLCP), <http://www.mda.state.mn.us/licensing/pestfert/manurelabs.htm>.

To develop a cumulative manure analysis history as a basis for nutrient allocation to the fields, manure should be analyzed annually for a minimum of three (3) consecutive years during the plan period beginning in October 2012.

Soil test analyses should be performed by laboratories that meet the requirements and performance standards of the North American Proficiency Testing Program (NAPT) Proficiency Assessment Program (PAP); <http://www.naptprogram.org/pap/>.

SAMPLING LIQUID MANURE

Liquid manure samples submitted for analysis should meet the following requirements:

- Manure samples submitted to a laboratory should represent the average composition of the material that will be applied to the field.
- Place sample in a sealed, clean plastic container with about a 1-pint volume. Glass is not suitable because it is breakable and may contain contaminants.
- Leave at least 1 inch of air space in the plastic container to allow for expansion caused by the release of gas from the manure material.
- Refrigerate or freeze samples that cannot be shipped on the day they are collected, minimizing chemical reactions and pressure buildup from gases.

Following are guidelines for obtaining liquid manure samples:

Wastewater: Premixing the surface liquid in the storage structure is not needed, provided it is the only component that is being pumped. Operators with multistage systems should draw samples from the storage structure they intend to pump for application to crops.

Samples should be collected using a clean, plastic container similar to the one shown in figure for liquid manure sampling on the next page. One pint of material should be taken from at least eight sites around the storage structure and then mixed in the larger clean, plastic container. Effluent should be collected at least 6 feet from the storage structure's edge at a depth of about a foot. Shallower samples from storage structure may be less representative than deep samples because oxygen transfer near the surface sometimes alters the chemistry of the solution. Floating debris and scum should be avoided.

One pint of mixed material should be sent to the lab. Galvanized containers should never be used for collection, mixing, or storage due to the risk of contamination from metals like zinc in the container. These recommendations are adequate for making applications that draw the liquid level in the storage structure down a few feet. If an entire storage structure is to be emptied, more frequent sampling with many more sampling points is recommended.

Slurry: Manure materials applied as a slurry from a storage structure should be mixed prior to sampling. A liquid sampling device can be used to obtain a sample from agitated storage structure. If you wish to sample a storage structure without agitation, you must use a composite sampling device as the one shown in the figure on the next page.

Samples should be collected from approximately eight areas around the storage structure and mixed thoroughly in a clean, plastic container. An 8- to 10-foot section of 0.5- to 0.75-inch plastic pipe can also be used: extend the pipe into the pit with ball plug open, pull up the ball plug (or press your thumb over the end to form an air lock), and remove the pipe from the manure, releasing the air lock to deposit the manure in the plastic container.

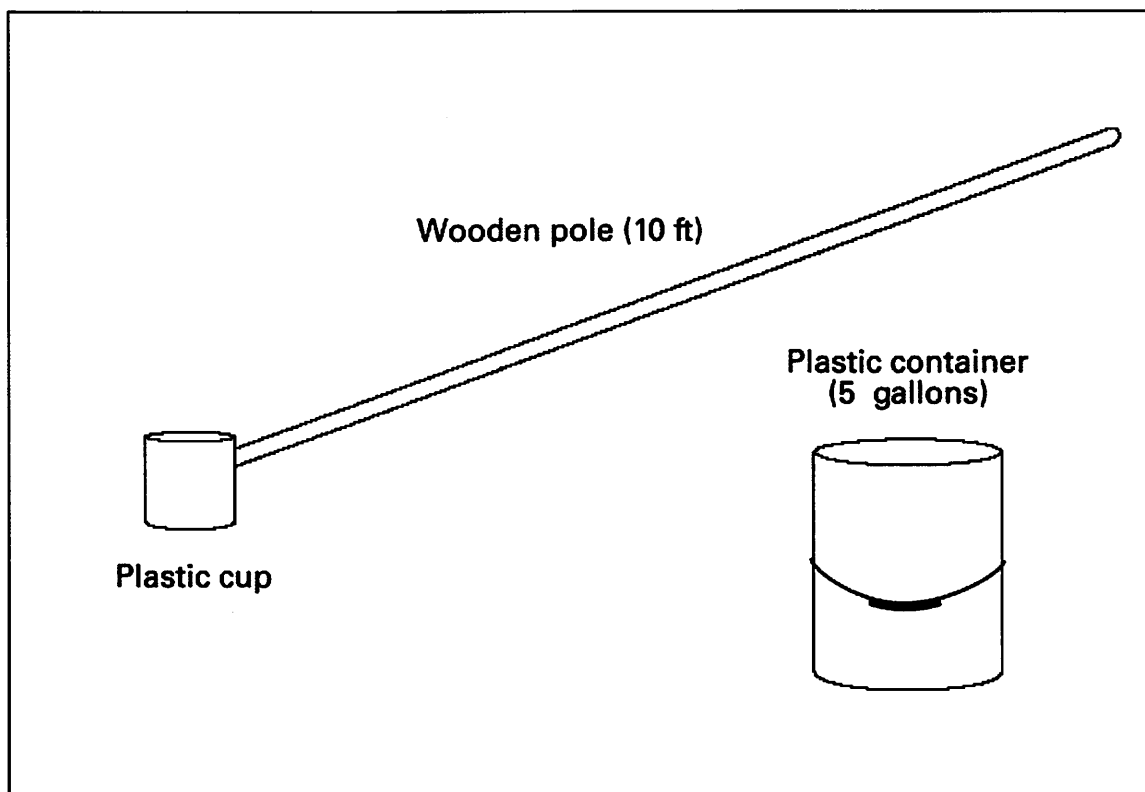
One pint of mixed material should be sent to the lab. Galvanized containers should never be used for collection, mixing, or storage due to the risk of contamination from metals like zinc in the container.

Sludge: Sludge is somewhat more difficult to obtain a representative sample. Two common methods are used.

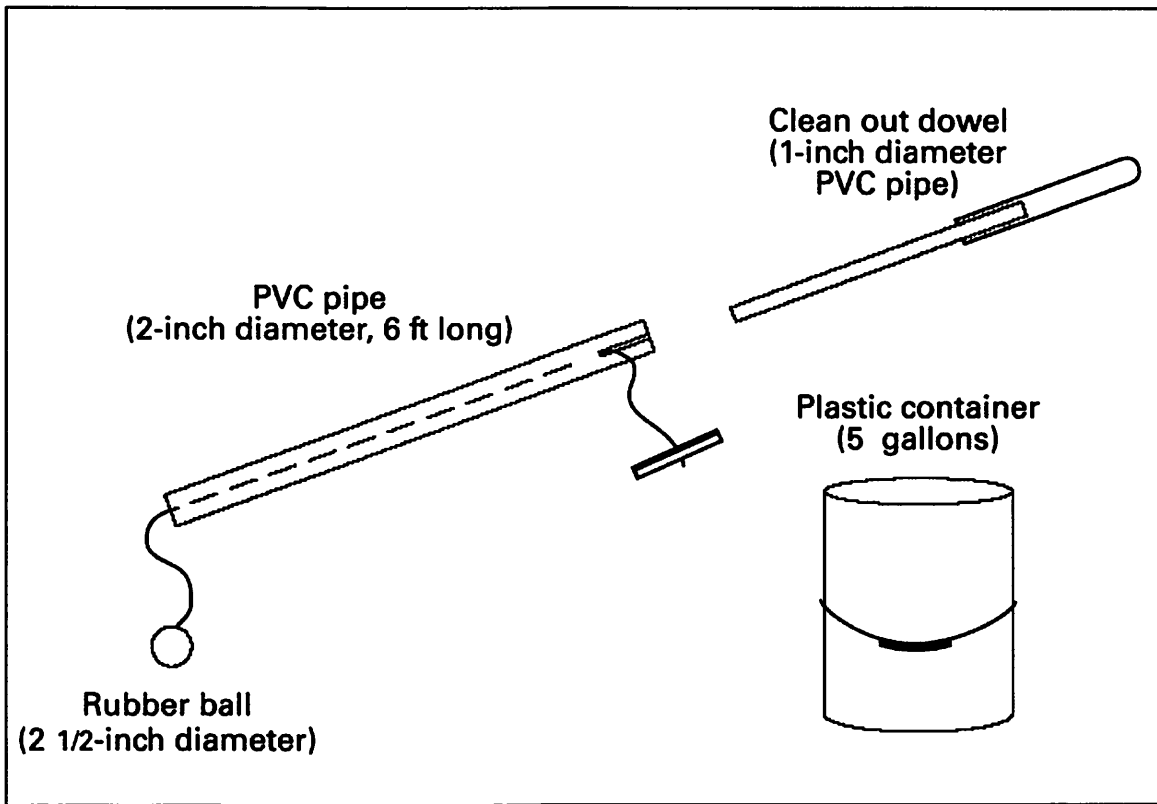
One method requires pumping the storage structure down to the sludge layers. Then, during sludge agitation, a composite sampling device as shown in the figure on the next page can be used to obtain a sample.

The other method requires insertion of a probe to the bottom of the storage structure to obtain a column of material. The sludge component of this column is then released into a clean plastic bucket, and several (12-20) other sampling points around the storage structure are likewise collected to obtain a composite, representative sample.

For analysis, most labs require at least 1 pint of material in a plastic container. The sample should not be rinsed into the container because doing so dilutes the mixture and distorts nutrient evaluations. However, if water is typically added to the manure prior to land application, a proportionate quantity of water should be added to the sample.



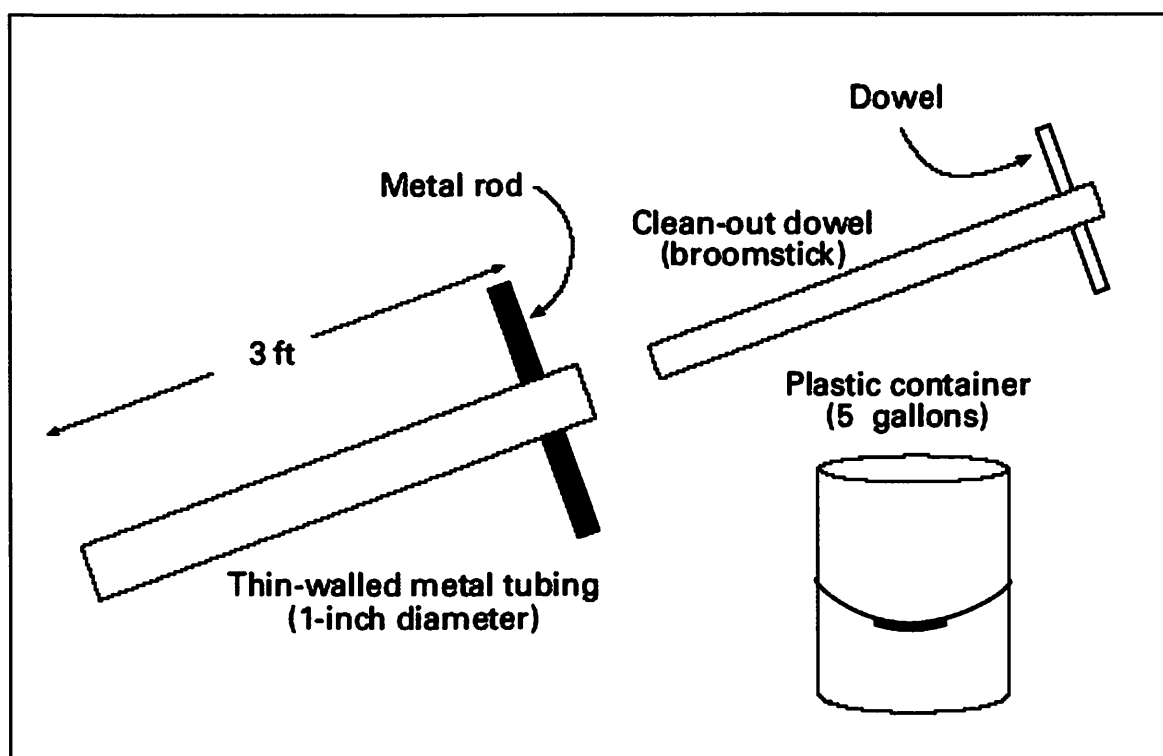
Typical Sampling Equipment for Liquids



Typical Sampling Equipment for Obtaining Composite Samples

SAMPLING SOLID MANURE

Solid manure samples should represent the manure's average moisture content. A 1-quart sample is adequate for analysis. Samples should be taken from approximately eight different areas in the manure pile at a depth of 18 inches, placed in a clean plastic container, and thoroughly mixed. Approximately 1 quart of the mixed sample should be placed in a plastic bag, sealed, and shipped directly to the lab. It is recommended to ship the samples early in the week so it doesn't sit in a post office or shipping area of the laboratory for several days. Samples stored for more than two days should be refrigerated. The figure below shows a device that can be constructed and used for sampling solid manure.



Typical Solids Sampling Equipment

APPLICATION EQUIPMENT CALIBRATION

The worksheets on the following pages can be used to calibrate manure application equipment so that manure is applied at the proper rate to achieve the planned application rates.

(Using Bucket, Pan or Tarp)

Name: _____ Date: _____

[illegible]

TANK EQUIPMENT CALIBRATION

(Using a Full Tank Load)

Name: _____ Date: _____

Perform the following operations to calibrate the tank equipment:

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

Data and Calculations:

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

Additional Notes:

TRAVELING BIG GUN SPRINKLER CALIBRATION

Name: _____ Date: _____

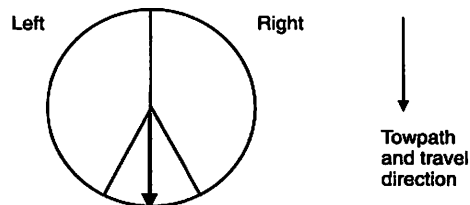
Perform the following operations to calibrate the traveling big gun sprinkler:

- ✓ Use 5 to 10 catch cans to collect the sprinkler-irrigated waste. Use straight-sided buckets for catch cans. Two pound coffee cans work well. Make sure all of the catch cans have the same diameter.
- ✓ Place one of the catch cans on a level surface and fill it with water to a known depth (1-3 inches). Pour the water from the catch can into a large measuring cup. Determine how many measuring cups of water are equal to an inch of water in the catch can.
- ✓ Place at least five catch cans across the towpath of the big gun sprinkler. Try to space the catch cans uniformly from the center of the towpath to the outer edge of the wetted area of the sprinkler. Stake the catch can in place or put a rock in the bottom of the catch can to keep it upright. Allow the traveling big gun sprinkler to completely pass over the catch cans. Use the measuring cup previously used to calibrate the catch cans to measure the amount of liquid collected in each can and convert the volume to inches. Be sure to add together the amount measured from the catch cans that would receive overlap from the adjacent towpath. For example, if catch can #4 will receive liquids from the adjacent towpaths, add the amount from container #4 on the left to container #4 on the right side to compute the total amount applied at the location of container #4 on the right and left sides of the towpath.

Catch Can Calibration:

Example: 1 inch = $\frac{5}{0.2}$ Cups
 1 cup = 0.2 Inches

Your Catch 1 inch = _____ Cups
 Cans: 1 cup = _____ Inches



Travel Rate Setting During Test:

Data and Calculations:

Catch Can ID	Volume of Liquid							
	Cups	Inches	Cups	Inches	Cups	Inches	Cups	Inches
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
Average =								

APPLICATIONS

Always perform the following tasks annually to make applications of wastewater and solids containing manure and inorganic fertilizer:

- Review the Planned Crops and Fertilizer Recommendations table on page 85 and make adjustments as needed to determine how much manure to apply. Nutrient applications must be based on soil and/or tissue tests and a nutrient budget prepared before application begins. Credit must be taken for nutrients supplied by previous legume crops, manure applications and sludge applications. Nitrogen (N) applications must be based on OSU recommendations or N nutrient uptake in harvested portion of crop. Phosphorus (P) applications must be based on OSU recommendations or P uptake in harvested portion of crop if the P Index is high or very high.
- Fields that are subsurface (TILE) drained require additional precautions when manure is applied. Manure applied to these fields can follow soil macropores directly to the tile drains creating a surface water pollution hazard from direct tile discharge. Tillage prior to manure application that can disrupt/close (using horizontal fracturing) the preferential flow paths (worm holes, cracks, root channels) in the soil will reduce the risk of a manure discharge to surface waters. Any pre-application tillage should leave as much residue as possible on the soil surface. Water control structures installed in subsurface drainage systems should be managed to prevent discharge of manure and wastewater during periods of application.
- Inspect and repair manure hauling and application equipment to minimize potential of accidental spillage.
- Avoid unnecessary exposure to wastewater and solids containing manure and wear protective clothing when necessary.
- Be aware of the location of sensitive areas, concerns of neighbors or concerns of the public, which require special application procedures. To reduce odor problems, apply wastewater and solids containing manure in mid morning when temperatures are warming and air is rising rather than in the afternoon or evening when air is cooling and settling. Avoid applications during periods of fog.
- Calibrate application equipment to insure uniform distribution and accurate application rates in accordance with guidance given in the nutrient budget for the field applying wastewater and solids containing manure to. Refer to the previous pages for calibration worksheets and make copies as necessary to document the calibration of application equipment.
- Use the worksheets on the following pages to determine how much wastewater and solids containing manure to apply based on the current nutrient budget. Use copies of the worksheets or other tools to document calculations made to determine application rates based on current nutrient budgets and calibrations of application equipment.
- Apply wastewater and solids containing manure in a manner that will cover no more than 25 percent of the leaf surface with solids unless clean water applications are planned immediately after wastewater or solids containing manure is applied. For pasture/hay land it is best to apply manure 7 days after harvesting forage by haying or grazing.
- Maintain a **35 foot** setback on vegetated areas or **100 foot** setback on nonvegetated areas from down-gradient surface waters, open tile line intake structures, sinkholes, well heads or other sensitive areas when applying wastewater and solids containing manure to prevent a prohibited discharge.

- Record applications, transfers or exports of wastewater and solids containing manure and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.
- Record date, amount and form of inorganic fertilizer applications and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.
- Clean up residual materials from equipment and dispose of them properly.

March 15th – August 30th: Apply wastewater and solids containing manure and inorganic fertilizer at agronomic rates shown on the Planned Crops and Fertilizer Recommendations table on page 85 using the following guidelines:

- Apply to land being prepared for crops. Till manure into soil within 3 days of application if possible or apply to actively growing crops such as grass, clover or alfalfa after cutting.
- *Do not apply* within **35 feet** of vegetated areas or **100 feet** of nonvegetated areas next to open water courses, seeps, ditches, tile inlets or wetlands.
- *Do not apply* wastewater and solids containing manure within the setback areas shown on the Land Treatment Area Map in Section 4.3 and described on page 88 and in Section 6.2 of the Nutrient Management Section.
- Record applications, transfers or exports of wastewater and solids containing manure and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.
- Record date, amount and form of inorganic fertilizer applications and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.

September 1st – October 31st: Apply wastewater and solids containing manure and inorganic fertilizer at minimum rates, using the following guidelines:

- Apply to land being prepared for crops. Till manure into soil within 3 days of application if possible or apply to actively growing crops such as grass, clover or alfalfa after cutting.
- *Do not apply* within **35 feet** of vegetated areas or **100 feet** of nonvegetated areas next to open water courses, seeps, ditches, tile inlets or wetlands.
- *Do not apply* within the setback areas shown on the Land Treatment Area Map in Section 4.3 and described on page 88 and in Section 6.2 of the Nutrient Management Section.
- Record applications, transfers or exports of wastewater and solids containing manure and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.
- Record date, amount and form of inorganic fertilizer applications and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.

November 1st – March 15th: Avoid application of manure. If manure application is needed because of an emergency situation during this period, use the following guidelines- ***NOTE: THE FOLLOWING GUIDELINES ARE GOOD IDEAS, BUT SPREADING MANURE DURING THIS PERIOD MAY STILL VIOLATE STATE AND FEDERAL LAW:***

- Call the ODA CAFO Program at (503) 986-4700 and report why an application is needed and the field where the application will be made. Refer to the Land Treatment Area Map in Section 4.3 to identify the field where the application will be made.
- Apply wastewater or solids containing manure only to actively growing crops such as grass, clover or alfalfa.
- Minimize application rates by using the maximum travel rates for the application equipment.
- *Do not apply* within **35 feet** of vegetated areas or **100 feet** of nonvegetated areas next to open water courses, seeps, ditches, tile inlets or wetlands.
- *Do not apply* within the setback areas shown on the Land Treatment Area Map in Section 4.3 and described on page 88 and in Section 6.2 of the Nutrient Management Section.
- *Do not apply* during rainfall events.
- *Do not apply* to saturated or flooded soils. See the Water Features Report, Flood Boundary Map and Flood Frequency Class Report for VanBeek Dairy in Section 5. Soil and Risk Assessment Analysis. It is recommended that emergency application(s) be limited to soils (areas) where the flooding frequency class rating is None, Very Rare or Rare.
- *Do not apply* to slopes greater than 5%. See the Soil Map for VanBeek Dairy in Section 5. Soil and Risk Assessment Analysis for the location of soil map units that have slopes less than 5%..
- *Applications of wastewater or solids containing manure to frozen soils should be avoided.* Do the following if an application of wastewater, slurry or solids containing manure is to be made to frozen soils:
 - Apply only enough wastewater, slurry or solids containing manure to address storage limitations until suitable soil conditions for application are available.
 - Minimize applications to 5 wet tons per acre or less of solids containing manure and 6,788 gallons per acre or less of wastewater.
 - Apply to alternating strips to reduce the risk of contaminated runoff reaching surface water sources.
 - Apply to fields of established hay, pasture or fields containing at least 90% cover and are the furthest from open water sources.
 - Do not apply wastewater, slurry or solids containing manure within 200 feet of surface water sources, drainageways, wells, or inlets to subsurface drainage systems.
 - Runoff control systems such as earthen dikes must be in place where applications will be made to fields with slopes greater than 5%.
- Record applications, transfers or exports of wastewater and solids containing manure and maintain them for at least 5 years. There are forms in Section 9 that may be used to record this information.
- *Do not apply* manure or inorganic fertilizer to fields receiving emergency applications unless soil tests indicate to do so.

The timing and frequency of applications of wastewater and solids containing manure for utilization by crops shown in the Planned Crops and Fertilizer Recommendations table on page 85 are based on information provided in Oregon State University Extension publications located in Appendix H.

The following table shows the potential crops that may be grown on this farm. The formulas for determining the total nutrient application rate per unit yield for each crop shown in following table are as follows:

Total N to apply in pounds = N in pounds per ton (lb/t) from the table for the crop grown X percent (%) dry matter (DM) of harvested crop/100 X planned or measured yield in tons

Total P₂O₅ to apply in pounds = P in pounds per ton (lb/t) from the table for the crop grown X 2.291 P₂O₅/P X percent (%) dry matter (DM) of harvested crop/100 X planned or measured yield in tons

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

Crop*	Cuttings (no.)	DM ¹ (%)	CP ¹ (%)	N (lb/t)	P (lb/t)	K (lb/t)	AH ¹ (t/a)
Red clover	1	100	18	58	8	48	16
Alfalfa hay	3	100	20	64	8	42	16
Perennial grass (low intensity)	1-2	100	10	32	6	38	13
Perennial grass (medium to low intensity)	2-3	100	12	38	6	38	15
Perennial grass (medium intensity)	4-5	100	15	48	7	38	17
Perennial grass (medium to high intensity)	5-6	100	18	58	8	40	20
Perennial grass (high intensity)	6-8	100	20	64	8	40	23
Annual ryegrass	1	100	12	38	6	38	13
Annual ryegrass	2	100	15	48	7	40	20
Corn silage	1	100	8	25	4	20	30
Small grains (boot stage)	2	100	12	38	5	32	16
Small grains (soft dough)	1	100	8	25	5	20	13
Sudangrass	1	100	6	40	5	12	16
Triticale	1	100	6	51	7	12	16

*Crop removal information taken from OSU Extension Publications EM 8585-E, PNW 331, and EM 8793.

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

Since the fields on this farm have received applications of wastewater and solids containing manure in the past they will have a certain amount of nitrogen available in the current year based on the mineralization of the organic matter applied in previous years. The planned applications shown on the following pages assume that the amount of nitrogen unavailable to the plant from the organic fraction of the manure analysis will be supplied by the organic fraction of manure applied in previous years that will mineralize into a plant available form of nitrogen (PAN) for the current year. Some of the nitrogen applied in the manure for the current year will be lost due to environmental conditions (e.g. evaporation, denitrification) so some adjustments to the planned applications of wastewater and solids containing manure have been made to account for these losses.

The following table shows the amount of wastewater and solids containing manure that would have to be applied to supply the given amount of nitrogen and phosphorus based on the manure nutrient analysis and application losses shown in the tables on the next page:

Pounds of Nutrient to be applied-	Application amount is based on 25% of the Nitrogen being lost and no Phosphorus being lost to environmental factors-					
	Wastewater Application from Waste Storage Pond				Manure Solids Application	
	Nitrogen (N)		Phosphorus (P2O5)		Nitrogen (N)	Phosphorus (P2O5)
	Inches/Acre	Gallons/Acre	Inches/Acre	Gallons/Acre	Tons/Acre	Tons/Acre
50	0.28	7,491	0.61	16,667	6.35	10.87
100	0.55	14,981	1.23	33,333	12.70	21.74
150	0.83	22,472	1.84	50,000	19.05	32.61
200	1.10	29,963	2.46	66,667	25.40	43.48

The worksheets and charts on pages 90 and 91 can be used to develop other application rates for other analysis values of wastewater and solids containing manure.

Manure Nutrient Analyses

Manure Source	Dry Matter (%)	Total N	NH ₄ -N	Total P ₂ O ₅	Total K ₂ O	Avail. P ₂ O ₅	Avail. K ₂ O	Units	Analysis Source and Date
Waste Storage Ponds	1.8	8.9	6.2	3.0	11.1	3.0	11.1	Lb/1000Gal	VanBeek Dairy 2001-2009 Records
Solids Storage Area	30.0	10.5	2.1	4.6	6.5	4.6	6.5	Lb/Ton	MMP Estimate 2012

(1) Entered analysis may be the average of several individual analyses.

(2) Oregon assumes that 100% of manure phosphorus and 100% of manure potassium is crop available. First-year per-acre nitrogen availability for individual manure applications is given in the Planned Nutrient Applications table. For more information about nitrogen availability in Oregon, see Waste Utilization Jobsheet 633 OR-JS, Oregon USDA-NRCS, May 2003 (<http://efotg.sc.egov.usda.gov/references/public/OR/633js042707.pdf>).

Typical Nutrient Retention After Application Losses

Application Method	Percent of original nutrient content of manure retained after application losses		
	N	P ₂ O ₅	K ₂ O
Injection	95%	100%	100%
Sprinkling	75%	100%	100%
Broadcast (Incorporated 1 day after application)	90%	100%	100%
Broadcast (Incorporated 4 days after application)	80%	100%	100%
Broadcast (Incorporated 7 or more days after application)	70%	100%	100%

Planned Crops and Fertilizer Recommendations

Field	Crop Year	Planned Crop	Yield Goal (per Acre)	N Rec (Lbs/A)	P ₂ O ₅ Rec (Lbs/A)	K ₂ O Rec (Lbs/A)	N Removed (Lbs/A)	P ₂ O ₅ Removed (Lbs/A)	K ₂ O Removed (Lbs/A)	Custom Fert. Rec. Source
Baker (1)	2013	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Baker (1)	2014	Wheat,winter, grain+straw	Bu	174 ^a	81 ^a	101 ^a				OSU Extension Publication em8963-e
Baker (1)	2015	Annual ryegrass seed	Lb	146 ^a	43	43 ^a				OSU Extension Publication FG5-e
Baker (1)	2016	Annual ryegrass seed	Lb	146 ^a	43	43 ^a				OSU Extension Publication FG5-e
Baker (2)	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43	43 ^a	32	9	10	OSU Extension Publication FG5-e
Baker (2)	2014	Corn, silage	30.0 Ton	203	74	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Baker (2)	2015	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101	124	58	79	OSU Extension Publication em8963-e
Baker (2)	2016	Annual ryegrass seed	2,000.0 Lb	146 ^a	43	43 ^a	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2015	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2016	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101 ^a	124	58	79	OSU Extension Publication em8963-e
Boyer (1)	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (1)	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (1)	2015	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (1)	2016	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (2)	2013	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101	124	58	79	OSU Extension Publication em8963-e
Boyer (2)	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (2)	2015	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (2)	2016	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Goracke	2013	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E
Goracke	2014	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E
Goracke	2015	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E
Goracke	2016	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E

Field	Crop Year	Planned Crop	Yield Goal (per Acre)	N Rec (Lbs/A)	P ₂ O ₅ Rec (Lbs/A)	K ₂ O Rec (Lbs/A)	N Removed (Lbs/A)	P ₂ O ₅ Removed (Lbs/A)	K ₂ O Removed (Lbs/A)	Custom Fert. Rec. Source
Home	2013	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Home	2014	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Home	2015	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Home	2016	Corn, silage	2,000.0 Ton	203 ^a	74 ^a	195 ^a				OSU Extension Publication EM 8585-E
Sievers	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Sievers	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Sievers	2015	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Sievers	2016	Wheat, winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101 ^a	124	58	79	OSU Extension Publication em8963-e

* Unharvested cover crop or first crop in double-crop system.

^a Custom fertilizer recommendation.

Planned Nutrient Applications (Manure-spreadable Area)

Field	App. Month	Target Crop	Nutrient Source	Application Method	Rate Basis	Rate/Acre	Loads, Speed or Time	Total Amount Applied	Acres Cov.	Avail N (Lbs/A)	Avail P ₂ O ₅ (Lbs/A)	Avail K ₂ O (Lbs/A)
Baker (1)	May 2013	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,195,776 Gal	129.1	202	98	361
Baker (1)	May 2014	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	2,949,960 Gal	129.1	142	69	254
Baker (1)	Jun 2015	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	2,949,960 Gal	129.1	142	69	254
Baker (1)	Apr 2016	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	2,949,960 Gal	129.1	142	69	254
Baker (2)	May 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	3,286,764 Gal	143.8	142	69	254
Baker (2)	May 2014	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	5,245,500 Gal	161.4	202	98	361
Baker (2)	May 2015	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	3,687,996 Gal	161.4	142	69	254
Baker (2)	Apr 2016	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	3,687,996 Gal	161.4	142	69	254
Baker (3)	Sep 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	20,364 Gal	806.8 Lds	209,768 Gal	10.3	126	61	226
Baker (3)	Sep 2014	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	905.3 Lds	235,378 Gal	10.3	142	69	254
Baker (3)	Sep 2015	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	905.3 Lds	235,378 Gal	10.3	142	69	254
Baker (3)	Sep 2016	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	905.3 Lds	235,378 Gal	10.3	142	69	254
Boyer (1)	Sep 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	20,364 Gal	5709.8 Lds	1,484,548 Gal	72.9	126	61	226
Boyer (1)	Sep 2014	Annual ryegrass seed	Solids Storage Area	Truck Spreader, Not incorporated	Custom	15 Ton	149.8 Lds	1,094 Ton	72.9	111	69	98
Boyer (1)	Sep 2015	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	6406.8 Lds	1,665,768 Gal	72.9	142	69	254
Boyer (2)	Sep 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	20,364 Gal	8756.6 Lds	2,276,716 Gal	111.8	126	61	226
Boyer (2)	Sep 2014	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	9825.6 Lds	2,554,656 Gal	111.8	142	69	254
Boyer (2)	Jun 2016	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	9825.6 Lds	2,554,656 Gal	111.8	142	69	254
Boyer (2)	Sep 2016	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	9825.6 Lds	2,554,656 Gal	111.8	142	69	254
Goracke	Feb 2013	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361

Field	App. Month	Target Crop	Nutrient Source	Application Method	Rate Basis	Rate/Acre	Loads, Speed or Time	Total Amount Applied	Acres Cov.	Avail N (Lbs/A)	Avail P ₂ O ₅ (Lbs/A)	Avail K ₂ O (Lbs/A)
Goracke	Feb 2014	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361
Goracke	Feb 2015	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361
Goracke	Feb 2016	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361
Home	Apr 2013	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Home	Apr 2014	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Home	Apr 2015	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Home	Mar 2016	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Sievers	May 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	7830.6 Lds	2,035,956 Gal	89.1	142	69	254
Sievers	Jun 2014	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	7830.6 Lds	2,035,956 Gal	89.1	142	69	254
Sievers	Mar 2015	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	2,895,750 Gal	89.1	202	98	361
Sievers	Apr 2016	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	7830.6 Lds	2,035,956 Gal	89.1	142	69	254

Manure Application Setback Distances

Setback Requirements: CAFO

Feature	Setback Criteria	Setback Distance (Feet)
Lakes and ponds	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Impounding reservoirs	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Wells	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Rivers and canals	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Streams and creeks	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Estuaries	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Pacific Ocean	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
All other bodies of surface water, natural or artificial	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Other conduits to surface waters	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Open tile line intake	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Sinkholes	Applied upgradient, permanent vegetated setback ≥ 35 feet	35

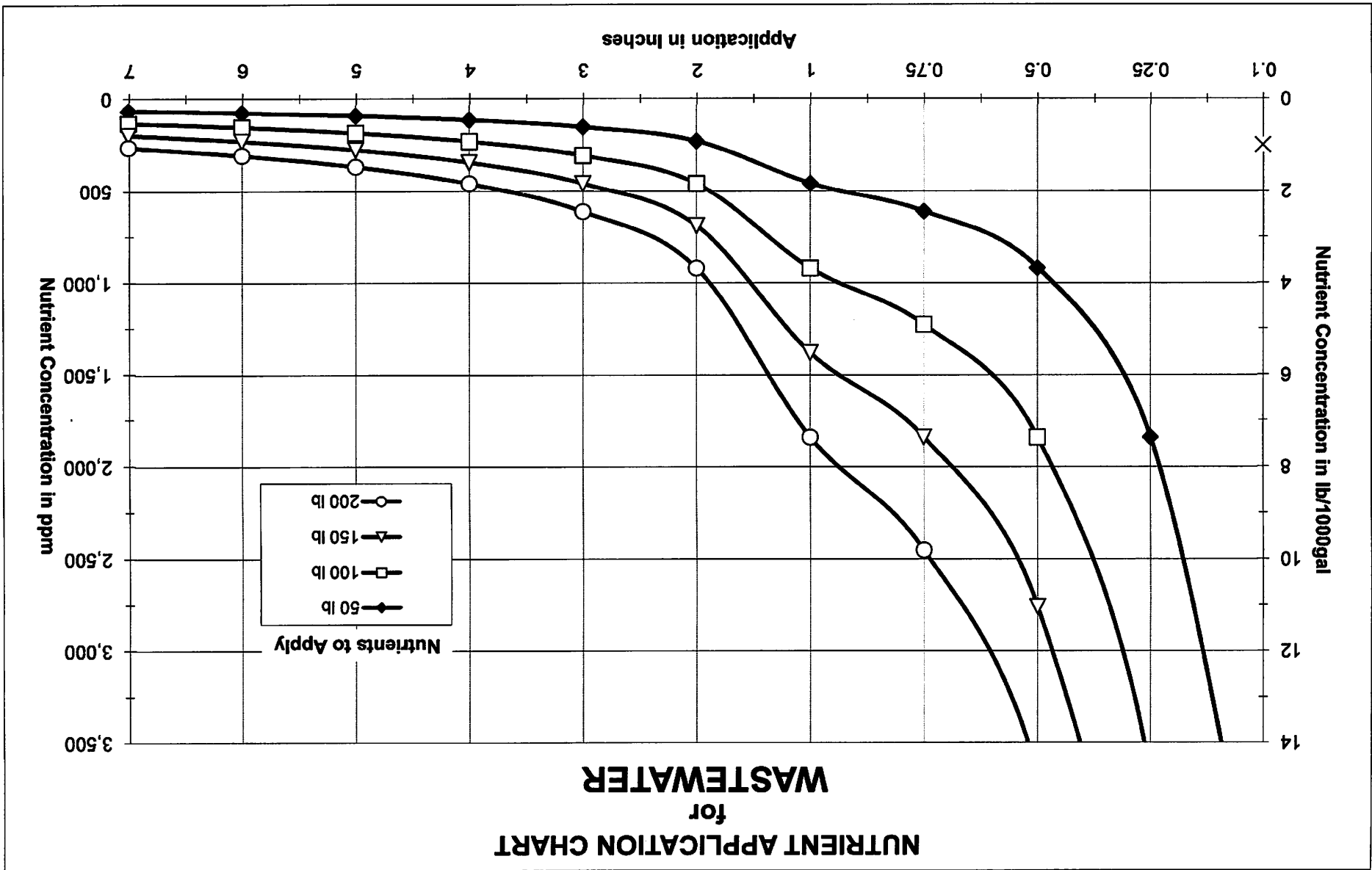
Source: CAFO General Permit #1 (http://oregon.gov/ODA/NRD/docs/pdf/cafo_gnlpmt.pdf)

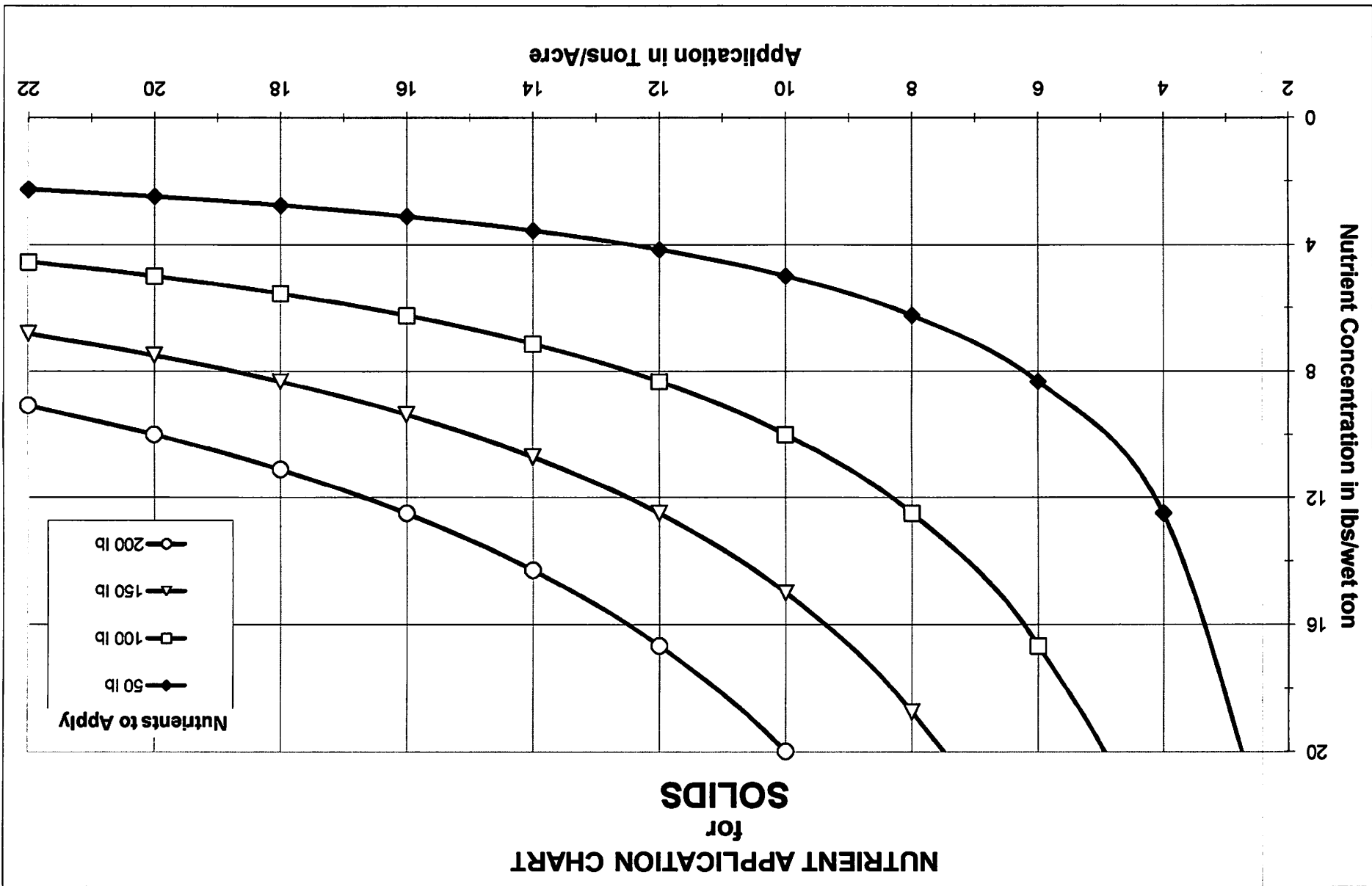
Setback Requirements: NRCS Standard

Feature	Setback Criteria	Setback Distance (Feet)
Open water courses	Application June through September	25
Open water courses	Application October through May	50

Source: Waste Utilization 633 Operation and Maintenance Worksheet (<http://efotg.nrcs.usda.gov/references/public/OR/633om.doc>)

The worksheets and charts on the following pages can be used to develop other application rates for different manure analyses





RECORD KEEPING

- Record keeping forms in Section 9 or other forms may be used document manure and fertilizer applications and exports.
- The following information is to be recorded and maintained for 5 years:
 - ☐ Nutrient and manure application records including soil, water plant and organic nitrogen, phosphorus and potassium test results.
 - ☐ Manure export records including organic nitrogen, phosphorus and potassium test results.
 - ☐ Documentation showing date, crop, amount, rate, form and application method of nutrients applied.
 - ☐ Calibration records for manure application equipment.
 - ☐ Annual review of nutrient management including adjustments made.

Wastewater and Irrigation Water Transfer Pipelines

Field(s): Baker (1-3), Boyer(1, 2), Goracke, Home, Sievers

Status: Existing

Description: Existing pipelines convey irrigation water and wastewater to hay and pasture land fields in an efficient manner to prevent contamination of ground and surface water sources.

Operation and Maintenance: Flush pipelines used for liquid waste applications with clean water following waste application, or as needed, to prevent particle buildup.

Drain the pipeline and components in areas that are subject to freezing. If parts of the pipeline cannot be drained, a non-toxic antifreeze solution may be added.

Check to make sure all valves and air vents are set at the proper operating condition so they can provide protection to the pipeline.

Inspect pipelines for signs of failure. Inspect risers and valves periodically for leaks or worn gaskets. Repair or replace pipeline, risers and valves as needed.

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

Specification: NA

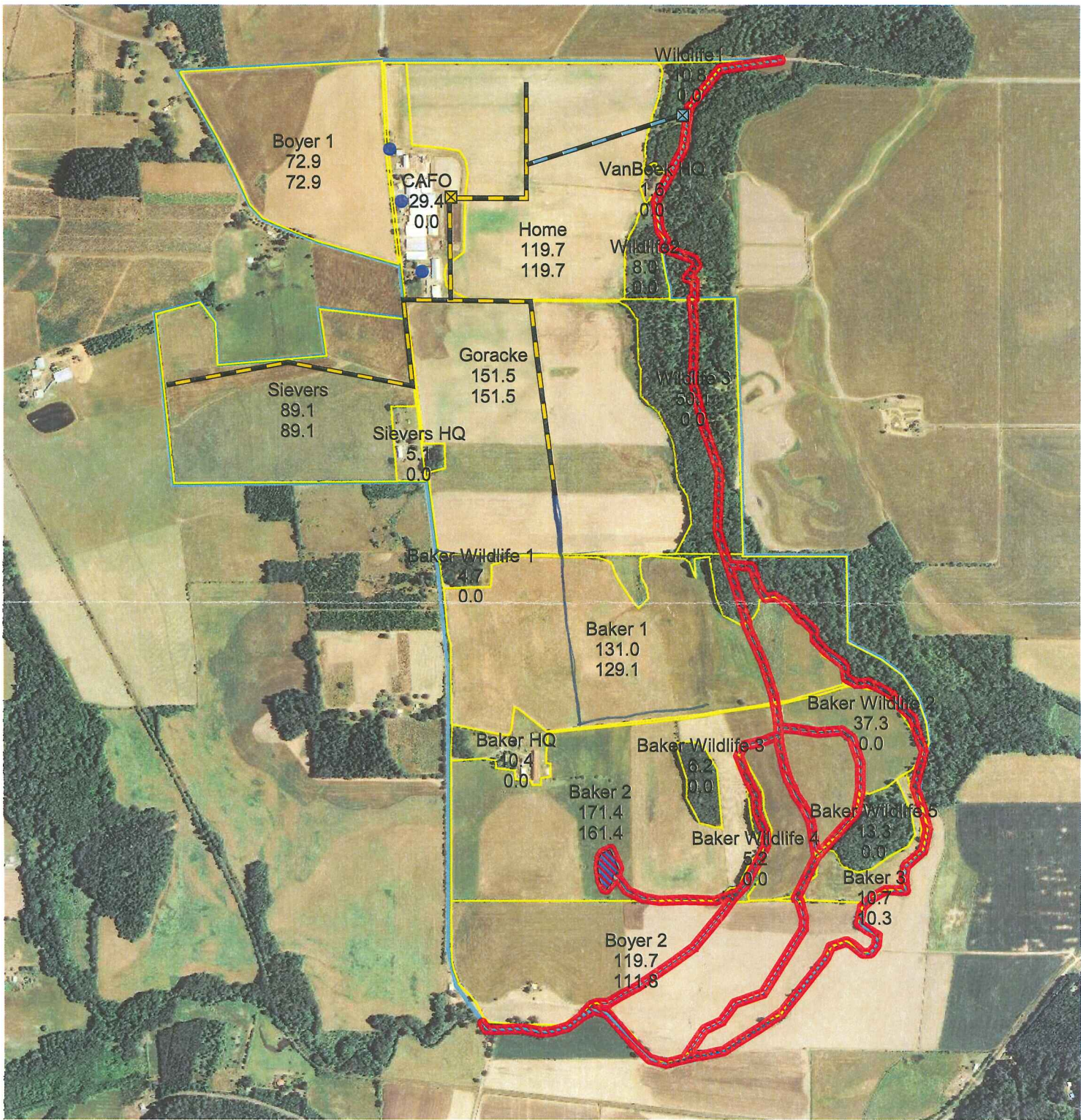
4.5 Odors

The major source of odor on VanBeek Dairy will occur mainly in the spring and fall months when liquids from the waste storage pond is being applied to the adjacent crop and hay land fields. Martin VanBeek maintains good relations with nearby neighbors and considers the impact of odors on nearby neighbors when making applications.

The prevailing winds during the winter months are from the south and southwest and during the summer months from the north and northwest. The closest rural residences that may be impacted negatively by odor from the application of manure are within a few hundred feet of the field boundaries where manure is applied.

VanBeek Dairy

Sections 17,18,19 & 20, Township 14 South, Range 5 West from the Willamette Meridian



Field ID	Landuse, Acres	Map Legend
CAFO Vanbeek HQ Sievers HQ Baker HQ	Headquaters, 46.5 acres ✓	Field Name Acres Spreadable Acres - Field Boundary, Field ID, Acres, Spreadable Acres
Baker 1 Baker 2 Baker 3 Boyer 1 Boyer 2 Goracke - owned Home - owned Sievers	Hay & Pasture Land, 866.0 acres ✓ 845.8 spreadable	- 35 foot Vegetated Buffer - Buried PVC Manure Transfer Pipeline - Buried PVC Irrigation Water Mainline - Manure Pumping Plant - Irrigation Pumping Plant - Well
Baker Wildlife 1 Baker Wildlife 2 Baker Wildlife 3 Baker Wildlife 5 Wildlife 1 Wildlife 2 Wildlife 3	Wildlife, 135.6 acres ✓ # Baker wildlife 4	

N
W
S
E

Scale 0 1500 3000 4500 Feet

Section 5. Soil and Risk Assessment Analysis

5.1 Soils

The predominate soil types located in the fields for the VanBeek Dairy are shown in the following table.

Table 5.1. Soil Information

	Field	Soil Survey	Map Unit	Soil Component Name	Surface Texture	Slope Range (%)	OM Range (%)	Bedrock Depth (in.)	Drainage	Annual Flooding	Hydrologic Group
Baker (1)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Baker (2)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Baker (3)		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Boyer (1)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Boyer (2)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Goracke		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Home		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Sievers		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Wildlife1		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Wildlife2		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Wildlife3		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Baker Wildlife (1)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Baker Wildlife (2)		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Baker Wildlife (3)		003	141	Santiam	SIL	8-20%	1-3%		MWell	None	C
Baker Wildlife (4)		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Baker Wildlife (5)		003	155	Waldo	SICL	0-3%	5-10%		Poor	Occas	D
Baker (HQ)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
VanBeek (HQ)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
Sievers (HQ)		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C
CAFO		003	140	Santiam	SIL	2-8%	1-3%		MWell	None	C

5.3 Soil Reports

Following are descriptions and rating tables for agricultural uses of the soils.

General Description of the Soil Map Units:

Map Unit Description (Brief, Generated)—Benton County, Oregon VanBeek Dairy

Map Unit Description (Brief, Generated)

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

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

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

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

Report—Map Unit Description (Brief, Generated)

Benton County, Oregon

Map Unit: 52—Conser silty clay loam, 0 to 3 percent slopes

Component: Conser (86%)

The Conser component makes up 86 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces, valleys. The parent material consists of silty and clayey alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is rarely flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil meets hydric criteria.

Component: Awbrig (4%)

Generated brief soil descriptions are created for major components. The Awbrig soil is a minor component.

Component: Courtney (3%)

Generated brief soil descriptions are created for major components. The Courtney soil is a minor component.

Map Unit: 53—Dayton silt loam, 0 to 2 percent slopes

Component: Dayton (93%)

The Dayton component makes up 77 percent of the map unit. Slopes are 0 to 2 percent. This component is on terraces. The parent material consists of silty and clayey glaciolacustrine deposits. Depth to a root restrictive layer, abrupt textural change, is 12 to 24 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is high. Shrink-swell potential is high. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil meets hydric criteria.

Map Unit: 105—Linslaw loam, 0 to 3 percent slopes

Component: Linslaw (91%)

The Linslaw component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces. The parent material consists of loamy glaciolacustrine deposits over clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 16 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Noti (5%)

Generated brief soil descriptions are created for major components. The Noti soil is a minor component.

Map Unit: 106—Linslaw loam, 3 to 8 percent slopes

Component: Linslaw (92%)

The Linslaw component makes up 84 percent of the map unit. Slopes are 3 to 8 percent. This component is on terraces. The parent material consists of loamy glaciolacustrine deposits over clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 16 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Noti (4%)

Generated brief soil descriptions are created for major components. The Noti soil is a minor component.

Map Unit: 114—McAlpin silty clay loam, 3 to 6 percent slopes

Component: McAlpin (84%)

The McAlpin component makes up 84 percent of the map unit. Slopes are 3 to 6 percent. This component is on alluvial fans, valleys. The parent material consists of clayey alluvium derived from basalt. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water

saturation is at 23 inches during January, February, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Cove (2%)

Generated brief soil descriptions are created for major components. The Cove soil is a minor component.

Map Unit: 140—Santiam silt loam, 2 to 8 percent slopes

Component: Santiam (91%)

The Santiam component makes up 80 percent of the map unit. Slopes are 2 to 8 percent. This component is on terraces. The parent material consists of silty glaciolacustrine deposits over clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 22 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Noti (2%)

Generated brief soil descriptions are created for major components. The Noti soil is a minor component.

Map Unit: 141—Santiam silt loam, 8 to 20 percent slopes

Component: Santiam (93%)

The Santiam component makes up 79 percent of the map unit. Slopes are 8 to 20 percent. This component is on terraces. The parent material consists of silty glaciolacustrine deposits over clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 22 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Noti (1%)

Generated brief soil descriptions are created for major components. The Noti soil is a minor component.

Map Unit: 155—Waldo silty clay loam, 0 to 3 percent slopes

Component: Waldo (95%)

The Waldo component makes up 76 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of Clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is very high. This soil is occasionally flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil meets hydric criteria.

Map Unit: 163—Willakenzie loam, 2 to 12 percent slopes

Component: Willakenzie (83%)

The Willakenzie component makes up 83 percent of the map unit. Slopes are 2 to 12 percent. This component is on hillslopes, hills. The parent material consists of loamy colluvium and residuum derived

from sandstone and siltstone. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Panther (1%)

Generated brief soil descriptions are created for major components. The Panther soil is a minor component.

Map Unit: 177—Woodburn silt loam, 0 to 3 percent slopes

Component: Woodburn (92%)

The Woodburn component makes up 78 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces. The parent material consists of silty glaciolacustrine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 25 inches during January, February, March, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Dayton (2%)

Generated brief soil descriptions are created for major components. The Dayton soil is a minor component.

Component: Huberly (1%)

Generated brief soil descriptions are created for major components. The Huberly soil is a minor component.

Data Source Information

Soil Survey Area: Benton County, Oregon
Survey Area Data: Version 9, Feb 5, 2010

Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge Ratings:

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

This table shows the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. In the context of this table, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

The ratings in the table are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include saturated hydraulic conductivity (Ksat), depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include Ksat, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

Report—Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge—Benton County, Oregon					
Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
108—Linslaw loam, 3 to 8 percent slopes					
Linslaw	92	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Too acid	0.27		
177—Woodburn silt loam, 0 to 3 percent slopes					
Woodburn	92	Somewhat limited			
		Depth to saturated zone	0.99		
		Too acid	0.08		
114—McAlpin silty clay loam, 3 to 6 percent slopes					
McAlpin	84	Very limited			
		Depth to saturated zone	1.00		
		Slow water movement	0.50		
		Too acid	0.22		
52—Conser silty clay loam, 0 to 3 percent slopes					
Conser	86	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Ponding	1.00		
		Runoff	0.40		
		Too acid	0.02		

Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge—Benton County, Oregon					
Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
140—Santiam silt loam, 2 to 8 percent slopes					
Santiam	91	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Too acid	0.18		
141—Santiam silt loam, 8 to 20 percent slopes					
Santiam	93	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Slope	0.98		
		Too acid	0.18		
183—Willakenzie loam, 2 to 12 percent slopes					
Willakenzie	83	Somewhat limited			
		Slow water movement	0.50		
		Depth to bedrock	0.29		
		Too acid	0.08		
		Droughty	0.01		
105—Linslow loam, 0 to 3 percent slopes					
Linslow	91	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Too acid	0.27		
155—Waldo silty clay loam, 0 to 3 percent slopes					
Waldo	95	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Ponding	1.00		
		Flooding	0.80		
		Runoff	0.40		

Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge— Benton County, Oregon					
Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
53—Dayton silt loam, 0 to 2 percent slopes					
Dayton	93	Very limited			
		Slow water movement	1.00		
		Depth to saturated zone	1.00		
		Strongly contrasting textural stratification	1.00		
		Ponding	1.00		
		Too acid	0.43		

Data Source Information

Soil Survey Area: Benton County, Oregon
Survey Area Data: Version 9, Feb 5, 2010

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (*K_{sat}*), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (K_{sat}) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (*K_{sat}*) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is

reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (K_w and K_f) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and K_{sat}. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor K_w indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor K_f indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service.
National soil survey handbook, title 430-VI. (<http://soils.usda.gov>)

Report—Physical Soil Properties

Physical Soil Properties— Benton County, Oregon														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/in	Pct	Pct					
52—Conser silty clay loam, 0 to 3 percent slopes														
Conser	0-9	5-10- 15	45-57- 65	27-33- 40	1.10-1.30	4.00-14.00	0.19-0.25	6.0-8.9	4.0-8.0	.20	.24	5	6	48
	9-14	5-10- 15	35-45- 60	35-45- 50	1.20-1.40	0.42-1.40	0.14-0.24	6.0-8.9	2.0-5.0	.15	.20			
	14-27	5-10- 15	30-38- 60	35-52- 60	1.30-1.50	0.42-1.40	0.13-0.23	6.0-8.9	1.0-3.0	.15	.20			
	27-41	5-10- 15	30-42- 60	35-48- 60	1.30-1.50	0.42-1.40	0.13-0.21	6.0-8.9	0.3-0.7	.24	.28			
	41-49	25-40- 60	20-35- 50	15-25- 30	1.20-1.40	4.00-42.00	0.10-0.21	0.0-5.9	0.2-0.4	.28	.37			
	49-60	25-55- 65	20-27- 50	15-18- 30	1.20-1.40	4.00-42.00	0.10-0.21	0.0-5.9	0.1-0.2	.32	.43			
53—Dayton silt loam, 0 to 2 percent slopes														
Dayton	0-9	2- 5- 10	70-75- 80	15-21- 25	1.25-1.45	4.00-14.00	0.19-0.23	0.5-2.9	2.0-4.5	.37	.37	3	6	48
	9-12	2- 6- 10	60-70- 78	20-24- 30	1.40-1.50	4.00-14.00	0.18-0.23	0.5-2.9	0.8-4.0	.49	.49			
	12-15	2- 6- 10	60-70- 78	20-24- 30	1.40-1.50	4.00-14.00	0.18-0.22	0.5-2.9	0.5-2.0	.49	.49			
	15-22	2- 3- 11	39-53- 58	40-44- 50	1.20-1.35	0.01-0.42	0.15-0.17	9.0-15.0	0.4-0.7	.37	.37			
	22-29	2- 3- 11	39-53- 58	40-44- 50	1.20-1.35	0.01-0.42	0.15-0.17	9.0-15.0	0.3-0.5	.43	.43			
	29-40	2- 3- 11	39-53- 58	40-44- 50	1.20-1.35	0.01-0.42	0.15-0.17	9.0-15.0	0.2-0.4	.43	.43			
	40-53	2- 5- 15	60-69- 75	20-26- 35	1.25-1.45	1.40-14.00	0.19-0.21	1.5-5.9	0.1-0.3	.55	.55			
	53-64	5-15- 25	50-62- 75	15-23- 30	1.25-1.45	4.00-14.00	0.19-0.21	1.5-5.9	0.1-0.2	.55	.55			
	64-76	5-15- 25	50-62- 75	15-23- 30	1.25-1.45	4.00-14.00	0.19-0.21	1.5-5.9	0.0-0.1	.55	.55			

Physical Soil Properties— Benton County, Oregon														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/in	Pct	Pct					
105—Linslaw loam, 0 to 3 percent slopes														
Linslaw	0-5	35-40- 45	30-40- 45	15-20- 25	1.15-1.30	4.00-14.00	0.17-0.20	0.0-2.9	2.0-4.0	.24	.28	5	6	48
	5-16	35-40- 45	30-40- 45	15-20- 25	1.20-1.35	4.00-14.00	0.16-0.20	0.0-2.9	1.0-3.0	.32	.37			
	16-28	30-35- 40	20-26- 35	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.5-1.0	.24	.24			
	28-42	30-35- 40	20-26- 35	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.3-0.7	.24	.24			
	42-56	10-17- 25	20-30- 40	50-53- 55	1.30-1.50	0.42-1.40	0.13-0.16	6.0-8.9	0.2-0.4	.24	.28			
	56-60	50-55- 65	20-25- 30	10-20- 25	1.50-1.60	4.00-42.00	0.10-0.16	0.0-2.9	0.1-0.3	.37	.43			
106—Linslaw loam, 3 to 8 percent slopes														
Linslaw	0-5	35-40- 45	30-40- 45	15-20- 25	1.15-1.30	4.00-14.00	0.17-0.20	0.0-2.9	2.0-4.0	.24	.28	5	6	48
	5-16	35-40- 45	30-40- 45	15-20- 25	1.20-1.35	4.00-14.00	0.16-0.20	0.0-2.9	1.0-3.0	.32	.37			
	16-28	30-35- 40	20-26- 35	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.5-1.0	.24	.24			
	28-42	30-35- 40	20-26- 35	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.3-0.7	.24	.24			
	42-56	10-17- 25	20-30- 40	50-53- 55	1.30-1.50	0.42-1.40	0.13-0.16	6.0-8.9	0.2-0.4	.24	.28			
	56-60	50-55- 65	20-25- 30	10-20- 25	1.50-1.60	4.00-42.00	0.10-0.16	0.0-2.9	0.1-0.3	.37	.43			

	Physical Soil Properties— Benton County, Oregon													
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/in	Pct	Pct					
114—McAlpin silty clay loam, 3 to 6 percent slopes														
McAlpin	0-5	10-17- 20	45-49- 63	27-34- 35	1.10-1.30	4.00-14.00	0.18-0.23	3.0-5.9	3.0-6.0	.15	.20	5	6	48
	5-8	10-16- 20	40-48- 55	30-36- 40	1.10-1.30	4.00-14.00	0.17-0.22	3.0-5.9	2.5-4.0	.15	.24			
	8-14	10-16- 20	40-48- 55	30-36- 40	1.10-1.30	4.00-14.00	0.17-0.22	3.0-5.9	2.0-3.5	.15	.24			
	14-23	10-15- 20	30-46- 55	30-39- 50	1.20-1.40	1.40-14.00	0.13-0.22	3.0-5.9	1.0-2.5	.20	.28			
	23-37	10-15- 20	30-40- 50	40-45- 50	1.20-1.40	1.40-4.00	0.12-0.17	6.0-8.9	0.5-1.5	.20	.28			
	37-51	10-15- 20	30-40- 50	40-45- 50	1.20-1.40	1.40-4.00	0.12-0.17	6.0-8.9	0.3-0.5	.20	.28			
	51-65	10-15- 25	30-40- 50	40-45- 50	1.20-1.40	1.40-4.00	0.07-0.17	6.0-8.9	0.1-0.3	.10	.32			
140—Santiam silt loam, 2 to 8 percent slopes														
Santiam	0-6	15-22- 30	50-55- 60	18-23- 27	1.15-1.30	4.00-14.00	0.19-0.23	0.0-2.9	1.0-3.0	.32	.37	5	6	48
	6-13	10-15- 20	50-59- 65	20-26- 35	1.20-1.35	4.00-14.00	0.18-0.22	0.0-2.9	0.5-1.0	.37	.43			
	13-22	10-16- 20	35-45- 50	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.4-0.8	.28	.32			
	22-30	10-16- 20	35-45- 50	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.2-0.7	.28	.32			
	30-60	10-15- 20	30-40- 50	40-45- 50	1.30-1.50	0.42-1.40	0.13-0.17	6.0-8.9	0.2-0.6	.28	.32			

Physical Soil Properties— Benton County, Oregon														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
141—Santiam silt loam, 8 to 20 percent slopes														
Santiam	0-6	15-22- 30	50-55- 60	18-23- 27	1.15-1.30	4.00-14.00	0.19-0.23	0.0-2.9	1.0-3.0	.32	.37	5	6	48
	6-13	10-15- 20	50-59- 65	20-26- 35	1.20-1.35	4.00-14.00	0.18-0.22	0.0-2.9	0.5-1.0	.37	.43			
	13-22	10-16- 20	35-45- 50	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.4-0.8	.28	.32			
	22-30	10-16- 20	35-45- 50	35-39- 45	1.20-1.40	1.40-4.00	0.13-0.21	3.0-5.9	0.2-0.7	.28	.32			
	30-60	10-15- 20	30-40- 50	40-45- 50	1.30-1.50	0.42-1.40	0.13-0.17	6.0-8.9	0.2-0.6	.28	.32			
155—Waldo silty clay loam, 0 to 3 percent slopes														
Waldo	0-2	5- 9- 15	40-59- 65	27-32- 40	1.05-1.15	4.00-14.00	0.19-0.26	1.0-2.9	5.0-10.0	.15	.24	5	6	48
	2-7	5- 9- 15	40-56- 65	27-35- 40	1.10-1.30	4.00-14.00	0.17-0.24	1.5-5.9	3.0-7.0	.15	.24			
	7-10	5- 8- 15	40-54- 65	27-38- 40	1.10-1.35	4.00-14.00	0.17-0.23	1.5-5.9	2.5-4.5	.15	.24			
	10-15	5- 7- 15	30-39- 55	35-54- 55	1.10-1.35	0.42-4.00	0.14-0.23	6.0-11.9	1.0-4.0	.15	.15			
	15-23	5- 7- 15	30-39- 55	40-54- 55	1.10-1.35	0.42-1.40	0.14-0.18	6.0-15.0	0.5-2.5	.20	.20			
	23-37	5- 7- 15	30-39- 55	40-54- 55	1.10-1.35	0.42-1.40	0.14-0.17	6.0-15.0	0.4-1.0	.20	.20			
	37-46	5- 7- 15	30-46- 55	40-47- 55	1.10-1.35	0.42-1.40	0.14-0.17	6.0-15.0	0.2-0.9	.28	.28			
	46-60	5- 7- 15	30-46- 55	40-47- 55	1.10-1.35	0.42-1.40	0.14-0.17	6.0-15.0	0.2-0.5	.32	.32			

Physical Soil Properties— Benton County, Oregon														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	<i>In</i>	<i>Pct</i>	<i>Pct</i>	<i>Pct</i>	<i>g/cc</i>	<i>micro m/sec</i>	<i>ln/ln</i>	<i>Pct</i>	<i>Pct</i>					
163— Willakenzie loam, 2 to 12 percent slopes														
Willakenzie	0-5	30-35- 40	40-44- 50	15-21- 27	1.25-1.45	4.00-14.00	0.17-0.21	1.0-2.9	2.0-6.0	.24	.24	3	6	48
	5-11	30-35- 40	35-41- 50	20-24- 30	1.25-1.45	4.00-14.00	0.16-0.22	1.0-2.9	0.8-2.5	.32	.32			
	11-19	30-34- 40	25-35- 45	24-31- 35	1.35-1.55	1.40-4.00	0.14-0.21	1.0-4.0	0.5-1.0	.28	.28			
	19-32	30-35- 40	25-37- 45	24-28- 35	1.35-1.55	1.40-4.00	0.13-0.21	1.5-4.0	0.1-0.8	.37	.37			
	32-42	—	—	—	—	—	—	—	—					
177— Woodburn silt loam, 0 to 3 percent slopes														
Woodburn	0-9	3- 7- 25	60-72- 80	15-21- 25	1.25-1.45	4.00-14.00	0.19-0.24	0.5-2.9	2.5-6.5	.32	.32	5	6	48
	9-17	3- 7- 25	60-71- 80	15-22- 25	1.25-1.45	4.00-14.00	0.18-0.23	0.5-2.9	1.5-4.5	.37	.37			
	17-25	2- 5- 20	60-66- 75	20-29- 35	1.30-1.55	1.40-14.00	0.19-0.21	1.0-5.9	0.3-1.0	.49	.49			
	25-32	2- 5- 20	60-67- 75	20-28- 35	1.30-1.55	1.40-14.00	0.19-0.21	1.0-5.9	0.2-0.6	.55	.55			
	32-39	2- 5- 25	60-69- 75	20-26- 35	1.25-1.45	1.40-14.00	0.19-0.21	1.5-5.9	0.2-0.4	.55	.55			
	39-54	2- 5- 25	60-69- 75	20-26- 35	1.25-1.45	1.40-14.00	0.19-0.21	1.5-5.9	0.1-0.3	.55	.55			
	54-68	5-15- 25	50-62- 75	15-23- 30	1.25-1.45	4.00-14.00	0.19-0.21	1.5-5.9	0.1-0.2	.55	.55			
	68-80	30-55- 60	25-30- 60	10-15- 20	1.25-1.55	4.00-42.00	0.13-0.21	0.0-2.9	0.0-0.1	.49	.49			
	80-92	30-55- 60	25-30- 60	10-15- 20	1.25-1.55	4.00-42.00	0.13-0.21	0.0-2.9	0.0-0.1	.49	.49			

Data Source Information

Soil Survey Area: Benton County, Oregon
Survey Area Data: Version 9, Feb 5, 2010

Soil Water Features:

The following table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (upper limit) and base (lower limit) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates surface water depth and the duration and frequency of ponding. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, long if 7 to 30 days, and very long if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. None means that ponding is not probable; rare that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); occasional that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and frequent that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

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

Duration and frequency are estimated. Duration is expressed as extremely brief if 0.1 hour to 4 hours, very brief if 4 hours to 2 days, brief if 2 to 7 days, long if 7 to 30 days, and very long if more than 30 days.

Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent:

None means that flooding is not probable; very rare that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year).

Rare means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year).

Occasional means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year).

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

Very frequent means that flooding is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Report—Water Features

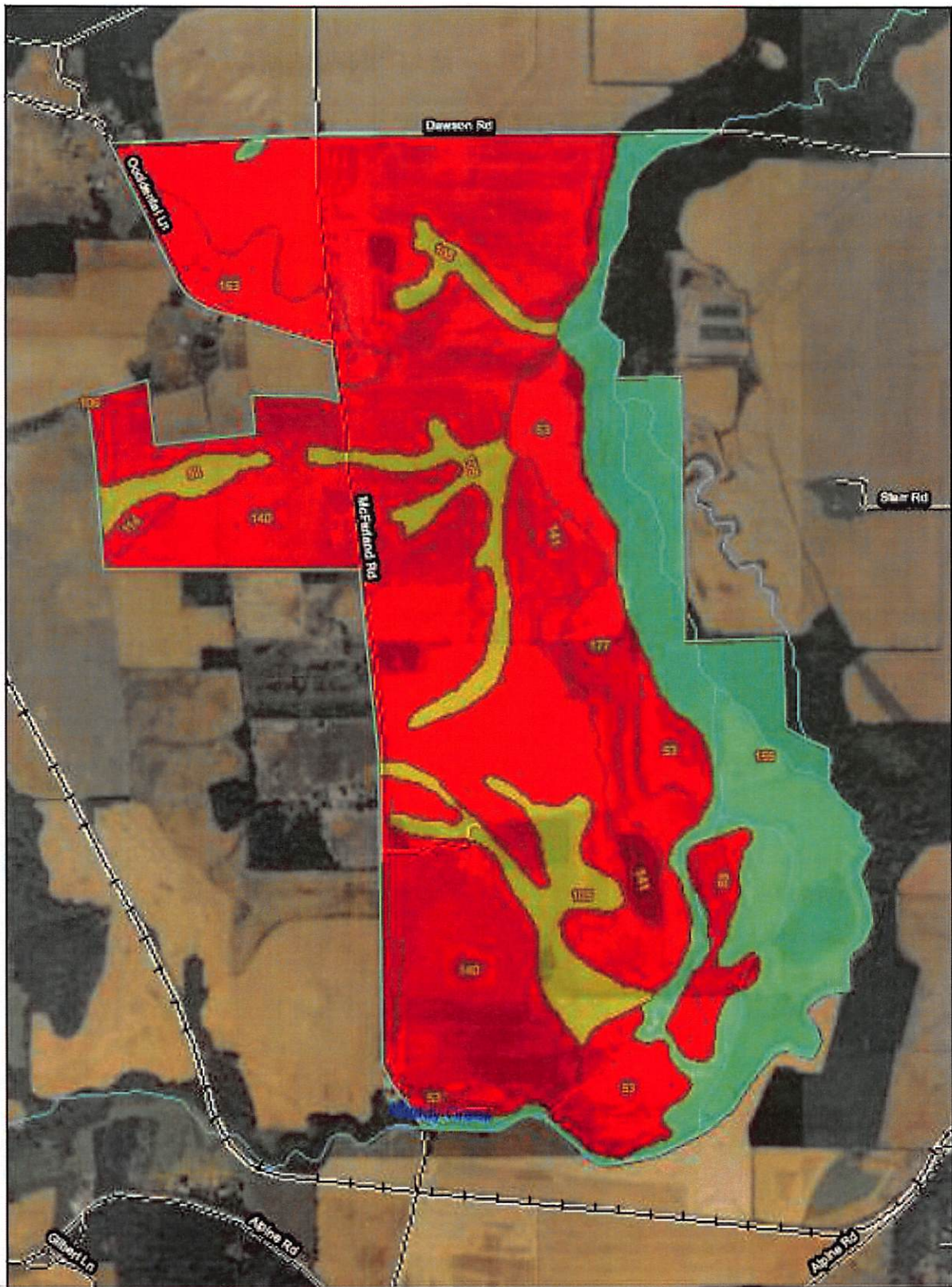
Water Features—Benton County, Oregon										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				<i>Ft</i>	<i>Ft</i>	<i>Ft</i>				
52—Conser silty clay loam, 0 to 3 percent slopes										
Conser	D	—	January	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	Rare
	D	—	February	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	Rare
	D	—	March	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	Rare
	D	—	April	0.0-0.8	>6.0	—	—	None	—	Rare
	D	—	May	1.2-2.3	>6.0	—	—	None	—	None
	D	—	June	3.4-4.1	>6.0	—	—	None	—	None
	D	—	July	4.1-6.0	>6.0	—	—	None	—	None
	D	—	November	3.4-4.1	>6.0	—	—	None	—	None
	D	—	December	0.0-0.8	>6.0	—	—	None	—	Rare
53—Dayton silt loam, 0 to 2 percent slopes										
Dayton	D	—	January	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	None
	D	—	February	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	None
	D	—	March	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	None
	D	—	April	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	None
	D	—	May	1.2-1.8	>6.0	—	—	None	—	None
	D	—	June	3.3-4.4	>6.0	—	—	None	—	None
	D	—	November	0.0-1.2	1.0-2.0	—	—	None	—	None
	D	—	December	0.0-0.8	>6.0	0.0-0.5	Long	Frequent	—	None

Water Features—Benton County, Oregon											
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding		
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency	
				<i>Ft</i>	<i>Ft</i>	<i>Ft</i>					
105—Linslaw loam, 0 to 3 percent slopes											
Linslaw	C	—	January	1.3-2.3	>6.0	—	—	None	—	Rare	
	C	—	February	1.3-2.3	>6.0	—	—	None	—	Rare	
	C	—	March	1.3-2.3	>6.0	—	—	None	—	Rare	
	C	—	April	1.3-2.3	>6.0	—	—	None	—	None	
	C	—	May	3.5-4.7	>6.0	—	—	None	—	None	
	C	—	December	1.3-2.3	>6.0	—	—	None	—	Rare	
106—Linslaw loam, 3 to 8 percent slopes											
Linslaw	C	—	January	1.3-2.3	>6.0	—	—	None	—	Rare	
	C	—	February	1.3-2.3	>6.0	—	—	None	—	Rare	
	C	—	March	1.3-2.3	>6.0	—	—	None	—	Rare	
	C	—	April	1.3-2.3	>6.0	—	—	None	—	None	
	C	—	May	3.5-4.7	>6.0	—	—	None	—	None	
	C	—	December	1.3-2.3	>6.0	—	—	None	—	Rare	
114—McAlpin silty clay loam, 3 to 6 percent slopes											
McAlpin	C	—	January	1.9-3.1	>6.0	—	—	None	—	None	
	C	—	February	1.9-3.1	>6.0	—	—	None	—	None	
	C	—	March	3.1-4.3	>6.0	—	—	None	—	None	
	C	—	April	4.3-6.0	>6.0	—	—	None	—	None	
	C	—	December	1.9-3.1	>6.0	—	—	None	—	None	

Water Features— Benton County, Oregon										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				<i>Ft</i>	<i>Ft</i>	<i>Ft</i>				
140—Santiam silt loam, 2 to 8 percent slopes										
Santiam	C	—	January	1.8-2.5	>6.0	—	—	None	—	None
	C	—	February	1.8-2.5	>6.0	—	—	None	—	None
	C	—	March	1.8-2.5	>6.0	—	—	None	—	None
	C	—	April	2.5-6.0	>6.0	—	—	None	—	None
	C	—	December	1.8-2.5	2.1-4.2	—	—	None	—	None
141—Santiam silt loam, 8 to 20 percent slopes										
Santiam	C	—	January	1.8-2.5	>6.0	—	—	None	—	None
	C	—	February	1.8-2.5	>6.0	—	—	None	—	None
	C	—	March	1.8-2.5	>6.0	—	—	None	—	None
	C	—	April	2.5-6.0	>6.0	—	—	None	—	None
	C	—	December	1.8-2.5	2.1-4.2	—	—	None	—	None

Water Features—Benton County, Oregon											
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding		
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency	
				<i>Ft</i>	<i>Ft</i>	<i>Ft</i>					
155—Waldo silty clay loam, 0 to 3 percent slopes											
Waldo	D	—	January	0.0-0.2	>6.0	0.0-0.5	Long	Frequent	Brief	Occasional	
	D	—	February	0.0-0.2	>6.0	0.0-0.5	Long	Frequent	Brief	Occasional	
	D	—	March	0.0-0.2	>6.0	0.0-0.5	Long	Frequent	Brief	Occasional	
	D	—	April	0.0-0.2	>6.0	—	—	None	Brief	Occasional	
	D	—	May	1.2-1.9	>6.0	—	—	None	—	None	
	D	—	June	1.9-3.1	>6.0	—	—	None	—	None	
	D	—	July	3.8-6.0	>6.0	—	—	None	—	None	
	D	—	August	3.8-6.0	>6.0	—	—	None	—	None	
	D	—	September	3.8-6.0	>6.0	—	—	None	—	None	
	D	—	October	3.8-6.0	>6.0	—	—	None	—	None	
	D	—	November	3.8-6.0	>6.0	—	—	None	Brief	Occasional	
	D	—	December	0.0-0.2	>6.0	—	—	None	Brief	Occasional	
163—Willakenzie loam, 2 to 12 percent slopes											
Willakenzie	B	—	Jan-Dec	—	—	—	—	None	—	—	
177—Woodburn silt loam, 0 to 3 percent slopes											
Woodburn	B	—	January	2.1-2.7	>6.0	—	—	None	—	None	
	B	—	February	2.1-2.7	>6.0	—	—	None	—	None	
	B	—	March	2.1-2.7	>6.0	—	—	None	—	None	
	B	—	April	2.7-3.2	>6.0	—	—	None	—	None	
	B	—	May	4.5-5.7	>6.0	—	—	None	—	None	
	B	—	December	2.1-2.7	>6.0	—	—	None	—	None	

Flood Boundary Map for VanBeek Dairy



Flood Boundary Map Legend and Information

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Ratings

-  None
-  Very Rare
-  Rare
-  Occasional
-  Frequent
-  Very Frequent

Political Features

Municipalities

-  Cities
-  Urban Areas

Water Features

-  Water
-  Oceans
-  Streams and Canals

Transportation

-  Rails

Roads

-  Interstate Highways
-  US Routes
-  State Highways
-  Local Roads
-  Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 10N

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

Date(s) aerial images were photographed: 5/23/1994; 6/20/1994

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.

Irrigated and Nonirrigated Yields by Map Unit Component:

The average yields per acre that can be expected of the principal crops under a high level of management are shown in this table. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

If yields of irrigated crops are given, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

Pasture yields are expressed in terms of animal unit months. An animal unit month (AUM) is the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

The land capability classification of map units in the survey area is shown in this table. This classification shows, in a general way, the suitability of soils for most kinds of field crops (United States Department of Agriculture, Soil Conservation Service, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, 2e. The letter e shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by w, s, or c because the soils in class 5 are subject to little or no erosion.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

Reference:

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

Report—Irrigated and Nonirrigated Yields by Map Unit Component

Irrigated and Nonirrigated Yields by Map Unit Component—Benton County, Oregon								
Map symbol and soil name	Land capability		Annual ryegrass		Corn silage		Winter wheat	
	Irrigated	Nonirrigated	Irrigated	Nonirrigated	Irrigated	Nonirrigated	Irrigated	Nonirrigated
			<i>Lbs</i>				<i>Bu</i>	
52—Conser silty clay loam, 0 to 3 percent slopes								
Conser	3w	3w	—	2720	—	—	—	65
53—Dayton silt loam, 0 to 2 percent slopes								
Dayton	4w	4w	—	2000	—	—	—	45
105—Linslaw loam, 0 to 3 percent slopes								
Linslaw	2w	2w	—	—	—	—	—	70
106—Linslaw loam, 3 to 8 percent slopes								
Linslaw	3e	3e	—	—	—	—	—	65
114—McAlpin silty clay loam, 3 to 6 percent slopes								
McAlpin	2e	2e	—	—	—	—	—	85
140—Santiam silt loam, 2 to 8 percent slopes								
Santiam	2e	2e	—	—	—	—	—	80
141—Santiam silt loam, 8 to 20 percent slopes								
Santiam	3e	3e	—	—	—	—	—	80
155—Waldo silty clay loam, 0 to 3 percent slopes								
Waldo	3w	3w	—	2100	—	—	—	—

Irrigated and Nonirrigated Yields by Map Unit Component—Benton County, Oregon								
Map symbol and soil name	Land capability		Annual ryegrass		Corn silage		Winter wheat	
	Irrigated	Nonirrigated	Irrigated	Nonirrigated	Irrigated	Nonirrigated	Irrigated	Nonirrigated
			<i>Lbs</i>				<i>Bu</i>	
163—Willakenzie loam, 2 to 12 percent slopes								
Willakenzie	3e	3e	—	—	—	—	—	80
177—Woodburn silt loam, 0 to 3 percent slopes								
Woodburn	2w	2w	—	—	—	—	—	100

Data Source Information

Soil Survey Area: Benton County, Oregon
Survey Area Data: Version 9, Feb 5, 2010

5.4 Soil Loss

Table 5-2 Predicted Soil Erosion

Average water, wind, irrigation, gully and ephemeral soil loss

Field	Predominant Soil Type	Slope (%)	Water (Ton/A/Yr)	Wind (Ton/A/Yr)	Irrigation (Ton/A/Yr)	Gully (Ton/A/Yr)	Ephemeral (Ton/A/Yr)	Total (Ton/A/Yr)	T Factor (Ton/A/Yr)
Baker (1)	140 (Santiam SIL)	3.0	4.3	0.0	0.0	0.0	0.0	4.3	5
Baker (2)	140 (Santiam SIL)	3.0	4.3	0.0	0.0	0.0	0.0	4.3	5
Baker (3)	155 (Waldo SICL)	1.5	3.0	0.0	0.0	0.0	0.0	3.0	5
Boyer (1)	140 (Santiam SIL)	4.0	5.0	0.0	0.0	0.0	0.0	5.0	5
Boyer (2)	140 (Santiam SIL)	3.0	4.3	0.0	0.0	0.0	0.0	4.3	5
Goracke	140 (Santiam SIL)	3.0	4.3	0.0	0.0	0.0	0.0	4.3	5
Home	140 (Santiam SIL)	3.0	4.3	0.0	0.0	0.0	0.0	4.3	5
Sievers	140 (Santiam SIL)	4.0	5.0	0.0	0.0	0.0	0.0	5.0	5
Wildlife1	155 (Waldo SICL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Wildlife2	155 (Waldo SICL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Wildlife3	155 (Waldo SICL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Baker Wildlife (1)	140 (Santiam SIL)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Baker Wildlife (2)	155 (Waldo SICL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Baker Wildlife (3)	141 (Santiam SIL)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Baker Wildlife (4)	155 (Waldo SICL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Baker Wildlife (5)	155 (Waldo SICL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Baker (HQ)	140 (Santiam SIL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
VanBeek (HQ)	140 (Santiam SIL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5
Sievers (HQ)	140 (Santiam SIL)	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5
CAFO	140 (Santiam SIL)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5

5.5 Highly Erodible Lands

The following table shows the highly erodible land (HEL) class for each field:

HEL Soil Class

Field	Soil Survey	Map Unit	Soil Component Name	Surface Texture	Slope Range (%)	OM Range (%)	Hydrologic Group	HEL Class
Baker (1)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Baker (2)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Baker (3)	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Boyer (1)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Boyer (2)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Goracke	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Home	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Sievers	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Wildlife1	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Wildlife2	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Wildlife3	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Baker Wildlife (1)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Baker Wildlife (2)	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Baker Wildlife (3)	003	141	Santiam	SIL	8-20%	1-3%	C	3-NHEL
Baker Wildlife (4)	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Baker Wildlife (5)	003	155	Waldo	SICL	0-3%	5-10%	D	3-NHEL
Baker (HQ)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
VanBeek (HQ)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
Sievers (HQ)	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL
CAFO	003	140	Santiam	SIL	2-8%	1-3%	C	3-NHEL

- * 1-HEL- Highly Erodible Land
- 2-PHEL- Potentially Highly Erodible Land
- 3-NHEL- Not Highly Erodible Land

All of the fields owned by VanBeek Dairy are classified as Not Highly Erodible Land (NHEL) due to flat slopes and soil texture. The fields will be kept well within the tolerable annual soil loss limits since most fields will be in 5 to 7 years of grass hay/pasture or have a cover crop of grass.

The Revised Universal Soil Loss Equation ver. 2.0 (RUSLE2) calculations located in Appendix D indicate the most severe erosion will occur when fields are planted as shown in Table 5-2. Even though more erosion will occur during planting the average annual soil loss is still less than the tolerable soil loss of 5 tons per acre per year.

5.6 Risk Assessment-Phosphorus Index

The CLEANmp West program, the Oregon Department of Agriculture Confined Animal Feeding Program, and the Oregon Natural Resources Conservation Service (NRCS) Nutrient Management conservation practice standard 590 all require that a phosphorus (P) index be prepared to determine the potential for phosphorus transport off of the fields used for manure application. Soil concentrations of phosphorus in the the crop and hay land fields VanBeek Dairy applies manure to are very low to excessive. The crop and hay land fields have a low to medium risk for phosphorus runoff so manure can be applied on a nitrogen basis.

The P index ratings for all fields are show in Table 5-3 and are based on the western Oregon phosphorus index described in Appendix E. The P index ratings indicate that there is currently a low risk of phosphorus transport from all fields if no additional manure is applied over the next 4 years. Based on the application plan for manure over the next 4 years, the P index ratings indicate that there is currently a low to medium risk of phosphorus transport from the crop and hay land fields.

The RUSLE2 calculations indicate that the erosion in the fields where manure will be applied is within the average annual soil loss tolerance (T) therefore erosion will not contribute significantly to phosphorus transport.

According to the Oregon NRCS Nutrient Management conservation practice standard 590, fields ranked in the low or medium risk category may receive organic (manure) or inorganic (commercial fertilizer) applications at nitrogen-based rates. Fields ranked in the high risk category may receive organic (manure) applications at phosphorus-based rates and no inorganic (commercial fertilizer) phosphorus shall be applied.

Table 5-3. Oregon Phosphorus Index (West)

Field	Crop Year	Transport Factor Sum	Source Factor Sum	P Index w/o P Apps	P Index w/ P Apps	P Loss Risk
Baker (1)	2013	5.00	3.96	5.00	8.96	Low
Baker (1)	2014	5.00	3.38	5.00	8.38	Low
Baker (1)	2015	5.00	3.38	5.00	8.38	Low
Baker (1)	2016	5.00	3.38	5.00	8.38	Low
Baker (2)	2013	5.00	3.23	5.00	8.23	Low
Baker (2)	2014	5.00	3.96	5.00	8.96	Low
Baker (2)	2015	5.00	3.38	5.00	8.38	Low
Baker (2)	2016	5.00	3.38	5.00	8.38	Low
Baker (3)	2013	5.00	0.00	5.00	5.00	Low
Baker (3)	2014	5.00	5.22	5.00	10.22	Low
Baker (3)	2015	5.00	5.38	5.00	10.38	Low
Baker (3)	2016	5.00	5.38	5.00	10.38	Low
Boyer (1)	2013	5.00	1.50	6.50	6.50	Low
Boyer (1)	2014	5.00	6.72	6.50	11.72	Low
Boyer (1)	2015	5.00	6.88	6.50	11.88	Low
Boyer (1)	2016	5.00	6.88	6.50	11.88	Low
Boyer (2)	2013	5.00	0.00	5.00	5.00	Low
Boyer (2)	2014	5.00	5.22	5.00	10.22	Low
Boyer (2)	2015	5.00	5.38	5.00	10.38	Low
Boyer (2)	2016	5.00	3.38	5.00	8.38	Low
Goracke	2013	5.00	10.46	5.50	15.46	Medium
Goracke	2014	5.00	10.46	5.50	15.46	Medium
Goracke	2015	5.00	10.46	5.50	15.46	Medium
Goracke	2016	5.00	10.46	5.50	15.46	Medium
Home	2013	5.00	11.46	12.50	16.46	Medium
Home	2014	5.00	11.46	12.50	16.46	Medium
Home	2015	5.00	11.46	12.50	16.46	Medium
Home	2016	5.00	11.46	12.50	16.46	Medium
Sievers	2013	5.00	9.98	11.60	14.98	Medium
Sievers	2014	5.00	9.98	11.60	14.98	Medium
Sievers	2015	5.00	10.56	11.60	15.56	Medium
Sievers	2016	5.00	9.98	11.60	14.98	Medium
Wildlife1	2013	Unable to calculate P Index. See notes for details.				
Wildlife1	2014	Unable to calculate P Index. See notes for details.				
Wildlife1	2015	Unable to calculate P Index. See notes for details.				
Wildlife1	2016	Unable to calculate P Index. See notes for details.				
Wildlife2	2013	Unable to calculate P Index. See notes for details.				
Wildlife2	2014	Unable to calculate P Index. See notes for details.				
Wildlife2	2015	Unable to calculate P Index. See notes for details.				
Wildlife2	2016	Unable to calculate P Index. See notes for details.				
Wildlife3	2013	Unable to calculate P Index. See notes for details.				

Field	Crop Year	Transport Factor Sum	Source Factor Sum	P Index w/o P Apps	P Index w/ P Apps	P Loss Risk
Wildlife3	2014	Unable to calculate P Index. See notes for details.				
Wildlife3	2015	Unable to calculate P Index. See notes for details.				
Wildlife3	2016	Unable to calculate P Index. See notes for details.				
Baker Wildlife (1)	2013	Unable to calculate P Index. See notes for details.				
Baker Wildlife (1)	2014	Unable to calculate P Index. See notes for details.				
Baker Wildlife (1)	2015	Unable to calculate P Index. See notes for details.				
Baker Wildlife (1)	2016	Unable to calculate P Index. See notes for details.				
Baker Wildlife (2)	2013	Unable to calculate P Index. See notes for details.				
Baker Wildlife (2)	2014	Unable to calculate P Index. See notes for details.				
Baker Wildlife (2)	2015	Unable to calculate P Index. See notes for details.				
Baker Wildlife (2)	2016	Unable to calculate P Index. See notes for details.				
Baker Wildlife (3)	2013	Unable to calculate P Index. See notes for details.				
Baker Wildlife (3)	2014	Unable to calculate P Index. See notes for details.				
Baker Wildlife (3)	2015	Unable to calculate P Index. See notes for details.				
Baker Wildlife (3)	2016	Unable to calculate P Index. See notes for details.				
Baker Wildlife (4)	2013	Unable to calculate P Index. See notes for details.				
Baker Wildlife (4)	2014	Unable to calculate P Index. See notes for details.				
Baker Wildlife (4)	2015	Unable to calculate P Index. See notes for details.				
Baker Wildlife (4)	2016	Unable to calculate P Index. See notes for details.				
Baker Wildlife (5)	2013	Unable to calculate P Index. See notes for details.				
Baker Wildlife (5)	2014	Unable to calculate P Index. See notes for details.				
Baker Wildlife (5)	2015	Unable to calculate P Index. See notes for details.				
Baker Wildlife (5)	2016	Unable to calculate P Index. See notes for details.				
Baker (HQ)	2013	Unable to calculate P Index. See notes for details.				
Baker (HQ)	2014	Unable to calculate P Index. See notes for details.				
Baker (HQ)	2015	Unable to calculate P Index. See notes for details.				
Baker (HQ)	2016	Unable to calculate P Index. See notes for details.				
VanBeek (HQ)	2013	Unable to calculate P Index. See notes for details.				
VanBeek (HQ)	2014	Unable to calculate P Index. See notes for details.				
VanBeek (HQ)	2015	Unable to calculate P Index. See notes for details.				
VanBeek (HQ)	2016	Unable to calculate P Index. See notes for details.				
Sievers (HQ)	2013	Unable to calculate P Index. See notes for details.				
Sievers (HQ)	2014	Unable to calculate P Index. See notes for details.				
Sievers (HQ)	2015	Unable to calculate P Index. See notes for details.				
Sievers (HQ)	2016	Unable to calculate P Index. See notes for details.				
CAFO	2013	Unable to calculate P Index. See notes for details.				
CAFO	2014	Unable to calculate P Index. See notes for details.				
CAFO	2015	Unable to calculate P Index. See notes for details.				
CAFO	2016	Unable to calculate P Index. See notes for details.				

Notes:

Field Baker (1):

Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).

Field Baker (2):

Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Baker (3):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Boyer (1):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Boyer (2):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Goracke:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Home:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Sievers:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Field Wildlife1:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Wildlife2:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Wildlife3:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Baker Wildlife (1):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Baker Wildlife (2):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Baker Wildlife (3):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Baker Wildlife (4):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Baker Wildlife (5):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Baker (HQ):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field VanBeek (HQ):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field Sievers (HQ):
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.
 Field CAFO:
 Warning: RUSLE2 soil loss not available (RUSLE2 climate not selected.).
 Error: Soil test P not entered; cannot calculate P Index.

Oregon Phosphorus Index (West) Risk Interpretation

P Index rating	Interpretation	Recommended Nutrient Limitation
PI Score <13	Low potential for P movement from this site given current management practices and site characteristics. There is a low probability of an adverse impact to surface waters from P losses on this site. Soil test P and P losses are likely to increase in future due to N-based nutrient management from animal manure.	Nitrogen
PI Score 13-25	Medium potential for P movement from this site given current management practices and site characteristics. Practices should be introduced to reduce P losses by surface runoff, subsurface flow, and erosion. Soil test P and P losses are likely to increase in future due to N-based nutrient management from animal manure.	Nitrogen
PI Score >25-50	High potential for P movement from this site given current management practices and site characteristics. All practicable management practices to reduce P losses through surface runoff, subsurface flow, or erosion should be implemented.	Phosphorus
PI Score >50	Very high potential for P movement from this site given current management practices and site characteristics. Active remediation techniques should be implemented in an effort to reduce the P loss potential from this site.	No manure

5.7 Leaching Index

Water that moves through soils can contain soluble nutrients that can degrade groundwater sources. The leaching index provides a way to determine if soils in a management area or field are susceptible to leaching nutrients to groundwater sources. The methodology for the Oregon leaching index was based on research done by J.R. Williams and D.E. Kissel which is published in the book "Managing Nitrogen for Groundwater Quality and Farm Profitability" edited by R.F. Follet. Appropriate management considerations and land treatment practices should be established based on the leaching index rating to limit the amount of soluble nutrients that could be leached to groundwater in a management area or field.

The leaching index ratings shown in Table 5.4 are taken from Leaching Index Interpretations Table and indicate the soils in the fields where manure will be applied from the VanBeek Dairy have a medium to high potential for leaching soluble nutrients. To minimize the leaching potential of soluble nutrients intensive nutrient and irrigation water management should be practiced on these fields. In addition cover crops should be planted immediately after the annual crops are harvested to capture excess soluble nutrients contained in the soils.

Table 5.4. Soil Leaching Index

Field	Soil Survey	Map Unit	Soil Component Name	Surface Texture	Slope Range (%)	Bedrock Depth (in.)	Drainage	Hydro-logic Group	Leaching Index
Baker (1)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Baker (2)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Baker (3)	003	155	Waldo	SICL	0-3%		Poor	D	<8
Boyer (1)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Boyer (2)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Goracke	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Home	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Sievers	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Wildlife1	003	155	Waldo	SICL	0-3%		Poor	D	<8
Wildlife2	003	155	Waldo	SICL	0-3%		Poor	D	<8
Wildlife3	003	155	Waldo	SICL	0-3%		Poor	D	<8
Baker Wildlife (1)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Baker Wildlife (2)	003	155	Waldo	SICL	0-3%		Poor	D	<8
Baker Wildlife (3)	003	141	Santiam	SIL	8-20%		MWell	C	<8
Baker Wildlife (4)	003	155	Waldo	SICL	0-3%		Poor	D	<8
Baker Wildlife (5)	003	155	Waldo	SICL	0-3%		Poor	D	<8
Baker (HQ)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
VanBeek (HQ)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
Sievers (HQ)	003	140	Santiam	SIL	2-8%		MWell	C	12.5
CAFO	003	140	Santiam	SIL	2-8%		MWell	C	12.5

Leaching Index Interpretations

Rating	Interpretation
Low (<2)	Soils have a low potential to leach mobile nutrients below the root zone unless irrigation applications are not managed properly.
Medium (2 to 10)	Soils may leach mobile nutrients below the root zone. Irrigation water management should be practiced on these soils if crops are irrigated and land treatments to minimize the potential for leaching losses should be considered.
High (>10)	Soils have a high potential to leach mobile nutrients below the root zone. Intensive irrigation water management should be practiced on these soils if crops are irrigated. Intensive nutrient management should also be practiced on these soils with special considerations for the method, rate, and timing of nutrient applications to reduce the potential of nutrient losses to ground water. Land treatments to minimize the potential for leaching losses should also be considered.



Section 6. Nutrient Management

6.1 Soil Tests

Soil sampling shall be done in accordance with Pacific Northwest Land Grant University (PNLGU) guidance or industry practice if recognized by the PNLGU to monitor phosphorus, potassium, calcium, magnesium, pH, organic matter and the cation exchange capacity (CEC) levels. Guidance for soil sampling can be found in Pacific Northwest (PNW) Extension publication 570-E, "Monitoring Soil Nutrients Using a Management Unit Approach" which is located in Appendix H. If no significant changes have occurred in the manure and wastewater production, storage, collection, transport, or utilization systems for the farm, current soil tests are those that are less than 5 years old. The Oregon State University Extension publication EC1478, "Soil Test Interpretation Guide" located in Appendix H provides guidance on how to determine soil nutrient concentrations levels and how to adjust soil pH to improve nutrient availability.

Soil test analyses should be performed by laboratories that meet the requirements and performance standards of the North American Proficiency Testing Program (NAPT) Proficiency Assessment Program (PAP); <http://www.naptprogram.org/pap/>.

Dates of when soil samples were taken and analytical results are shown in Table 6-1. The original laboratory soil test reports are located in Appendix F.

A map showing soil pH levels in all fields is located on page 143 and show that pH levels are low. Fields with very low pH levels should have soil amendments applied to raise soil pH levels and soil samples taken and analyzed for pH levels every other year to insure adequate nutrient availability from applied nutrients.

A map showing soil concentrations of phosphorus for all fields is located on page 144 and show that soil concentrations of phosphorus are very low to excessive. Soil samples should be taken and analyzed for soil concentrations of phosphorus every 4 years on all fields to insure soil phosphorus concentrations do not increase further and restrict manure applications. Efforts should be made to reduce phosphorus applications whenever possible to try and reduce soil phosphorus concentrations on all fields that have high to excessive soil phosphorus concentrations.

A map showing soil concentrations of potassium for all fields is located on page 145 and show that soil concentrations of potassium are very low to excessive. Soil samples should be taken and analyzed for soil concentrations of potassium every 4 years on all fields and applications of potassium should be limited or reduced to try and reduce soil concentrations in fields with very high to excessive concentrations of potassium.

Unless otherwise specified refer to the Nutrient Management Specification in Section 4.4 on page 69 for guidance on when to take soil samples and what to have the samples analyzed for. The Nutrient Management Specification in Section 4.4 on page 69 also provides guidance on taking soil tests at specific times of the year to address if additional nutrient applications are needed for the crop being grown and if nutrient applications made did not supply enough or too much nutrients for the targeted crop yields.

6.2 Manure Nutrient Content

Dates, source of manure samples and analytical results are shown in Table 6-2 which are for manure samples taken annually in 2009. The original laboratory manure test reports are located in Appendix G.

Normally manure tests are taken in early fall and spring to provide a representative assessment of nutrient concentrations in the manure to be used in determining the amount of manure to be applied. Refer to the Nutrient Management Specification in Section 4.4 on page 69 for guidance on when to take manure samples and what to have the samples analyzed for.

Table 6-1. Soil Test Data

Field	Test Year	OM (%)	P Test Used	P	K	Mg	Ca	Na	Units	Soil pH	Buffer pH	CEC (meq/100g)	NO ₃ -N (ppm)	EC (mmhos/cm)
Baker (1)	2012		Bray P1	12	160	73	760	207	ppm	5.0		16.9		
Baker (2)	2012		Bray P1	5	95	278	1,260	32	ppm	5.6		19.6		
Baker (3)	2012		Bray P1	23	43	48	480	14	ppm	4.8		12.3		
Boyer (1)	2009	3.6	Bray P1	55	261	121	1,420		ppm	6.1	6.5	14.8		
Boyer (2)	2012		Bray P1	22	86	48	420	16	ppm	4.9		12.6		
Goracke	2009	5.1	Bray P1	45	621	411	1,860		ppm	6.3	6.7	17.9		
Home	2009	5.2	Bray P1	115	817	484	2,180		ppm	6.4	6.8	19.4		
Sievers	2009	5.5	Bray P1	106	806	436	1,520		ppm	6.2	6.6	18.1		
Wildlife1									ppm					
Wildlife2									ppm					
Wildlife3									ppm					
Baker Wildlife (1)									ppm					
Baker Wildlife (2)									ppm					
Baker Wildlife (3)									ppm					
Baker Wildlife (4)									ppm					
Baker Wildlife (5)									ppm					
Baker (HQ)									ppm					
VanBeek (HQ)									ppm					
Sievers (HQ)									ppm					
CAFO									ppm					

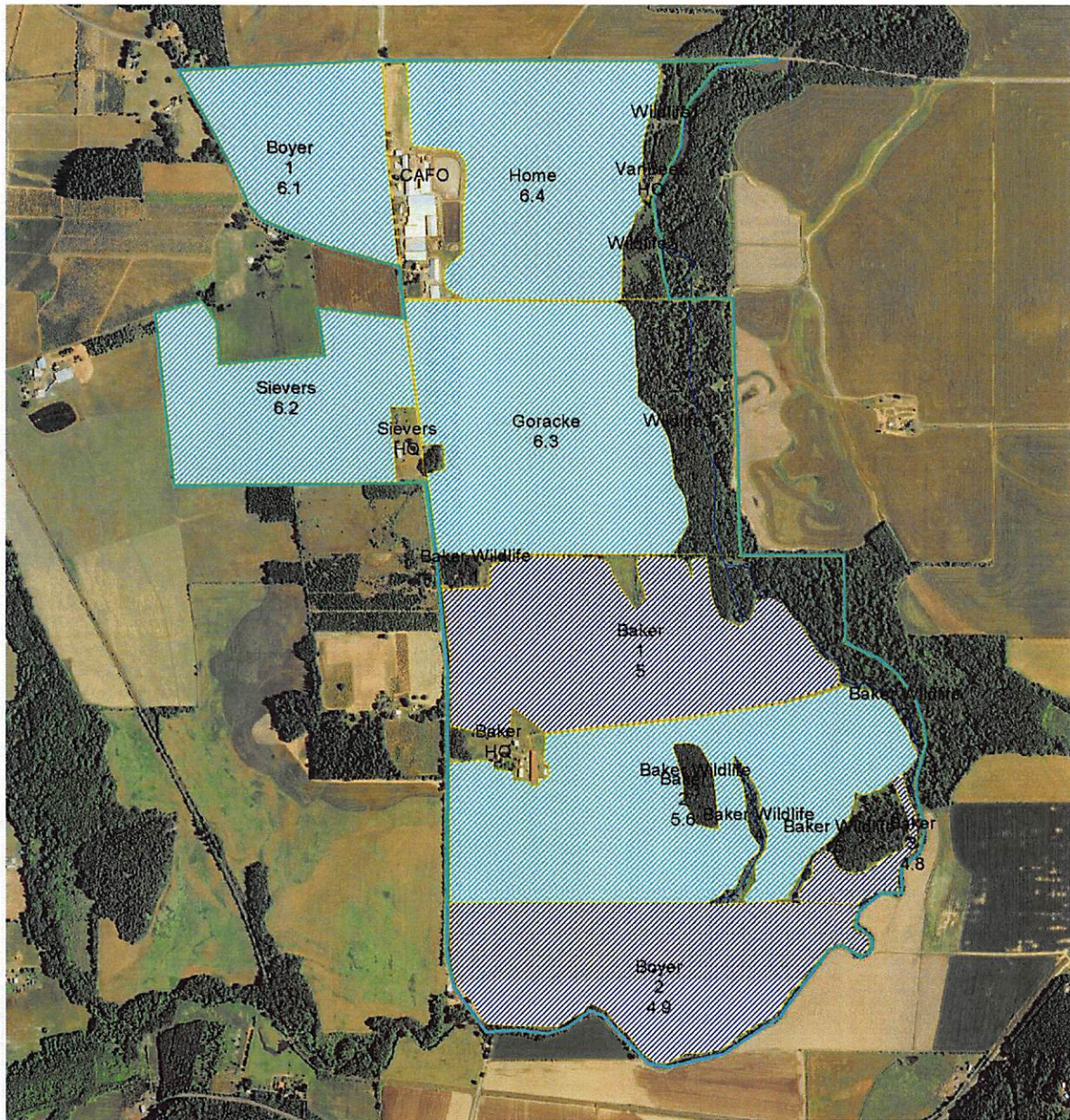
Table 6-2. Manure Nutrient Analyses

Manure Source	Dry Matter (%)	Total N	NH ₄ -N	Total P ₂ O ₅	Total K ₂ O	Avail. P ₂ O ₅	Avail. K ₂ O	Units	Analysis Source and Date
Waste Storage Ponds	1.8	8.9	6.2	3.0	11.1	3.0	11.1	Lb/1000Gal	VanBeek Dairy 2001-2009 Records
Solids Storage Area	30.0	10.5	2.1	4.6	6.5	4.6	6.5	Lb/Ton	MMP Estimate 2012

(1) Entered analysis may be the average of several individual analyses.

(2) Oregon assumes that 100% of manure phosphorus and 100% of manure potassium is crop available. First-year per-acre nitrogen availability for individual manure applications is given in the Planned Nutrient Applications table. For more information about nitrogen availability in Oregon, see Waste Utilization Jobsheet 633 OR-JS, Oregon USDA-NRCS, May 2003 (<http://efotg.sc.egov.usda.gov/references/public/OR/633js042707.pdf>).

6.3 VanBeek Dairy Soil Test pH (Water) Map



Soil Test: pH

0 1500 3000 4500 Feet

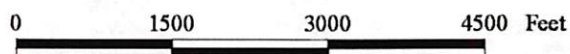


Current Fields

- Very Low
- Low
- Medium
- High
- Very High
- Excessive
- None



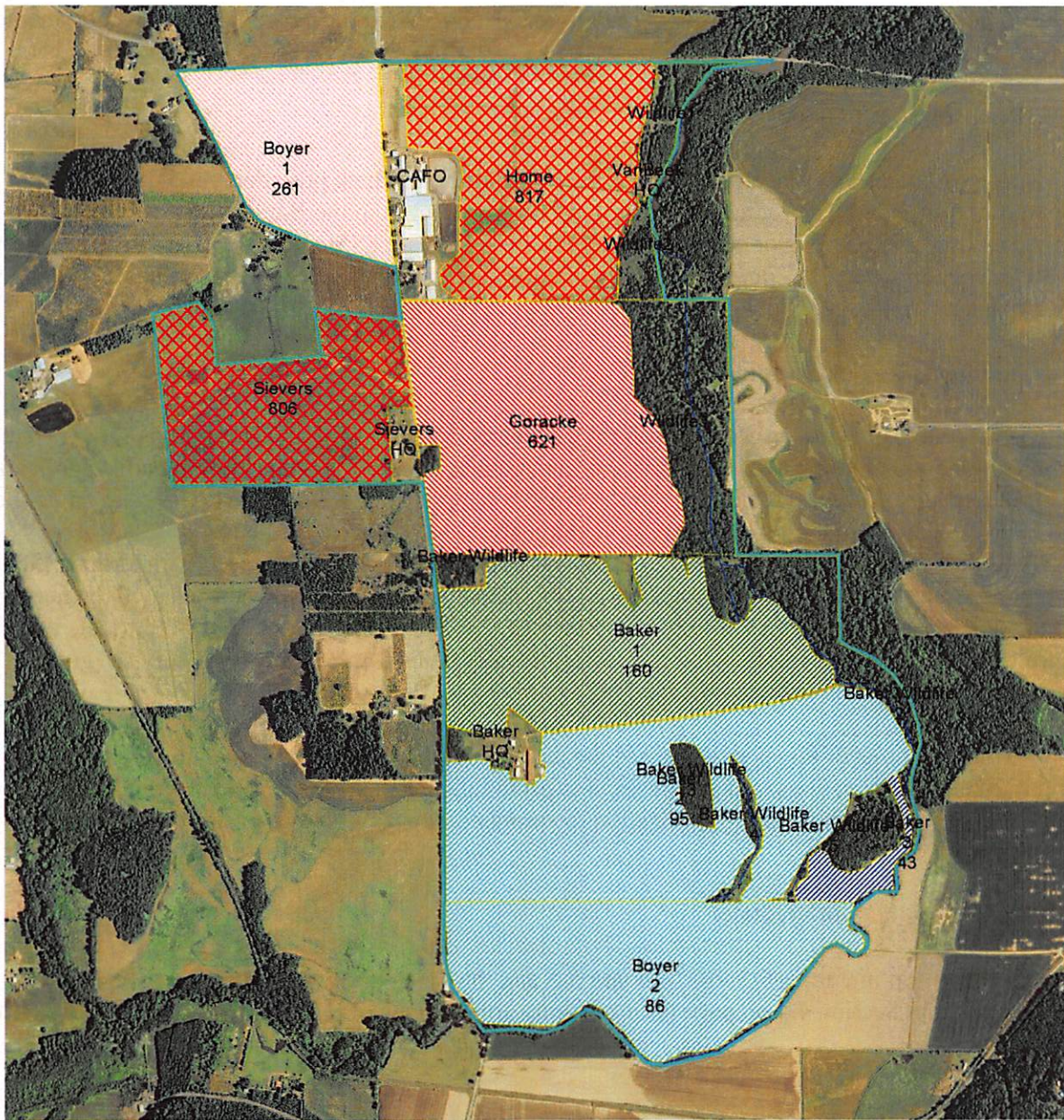
Soil Test: Bray P1 Phosphorus (ppm)



Current Fields

	Very Low
	Low
	Medium
	High
	Very High
	Excessive
	None

6.5 VanBeek Dairy Soil Test K (ppm) Map



Soil Test: Potassium (ppm)

0 1500 3000 4500 Feet



Current Fields

Very Low
Low
Medium
High
Very High
Excessive
None

6.6 Cropping System

Fields are planted to grass for hay and seed, annual field corn for silage and wheat for a cleanup crop. The rotation of crops in the fields are governed by the need for feed for the dairy livestock and market for crops so the acres of the type of crop grown can vary from year to year.

6.7 Realistic Yield Goals

The owner and operator of VanBeek Dairy, Fred and Martin VanBeek provided yield data that was compared to the vegetative productivity information for soil types in the Benton County soil survey. Crop yields used in this plan for each field are 5.0 tons/acre/year at 85% dry matter for irrigated grass hay, 30 tons/acre/year at 30% dry matter for field corn, 2,000 pounds of grass seed as harvested and 90 bushel wheat as harvested.

6.8 Nutrient Application Plans

Where appropriate, the Oregon State University Extension fertilizer guides for the crops grown were used in conjunction with the nutrient analysis of the manure to determine the recommended application rates of the manure. Where the fertilizer guides were not appropriate to use, nutrient uptake guidelines taken from Oregon State University Extension publications or chapter 6 of the Natural Resource Conservation Service Agricultural Waste Management Field Handbook were used to determine the recommended application rates of manure. It is anticipated that no additional nutrients will be needed to meet the nutrient requirements of the crops grown based on the estimated amounts of nutrients that the manure will supply. The recommended manure application rates for the VanBeek Dairy are given in Nutrient Management Specification located in Section 4.4 on page 69.

The following sections of this plan described the nutrient requirements, additional amendments and timing of manure applications to meet the yield expectations for the crops being grown. Tables 6-5 through 6-7 summarize the manure application recommendations by field and crop year for the four-year planning cycle.

6.9 Land Application Strategy

Use the information in Tables 6-3, 6-4, 6-5 and 6-6 and the guidance in the Nutrient Management practice located in Section 4.4 on page 68 for making applications of manure generated by the VanBeek Dairy.

6.10 Nutrient Balance

The low and medium site vulnerability class for the crop and hay land fields are based on the Western Oregon Phosphorus Index. The Oregon Phosphorus Index requires manure, bedding and runoff from the waste storage facility to be applied on phosphorus based rates on fields with a high site vulnerability and allows nitrogen based rates on fields with low and medium site vulnerability ratings. Soil tests will be used to monitor phosphorus levels in the soils where manure is applied. If the soil tests show significant increases in soil phosphorus concentrations, on farm manure applications may have to be reduced which may require some manure to be exported off farm. See Table 6-7 for planned field nutrient balance based on recommended manure applications and Table 6-8 for projected soil concentration values of phosphorus and potassium at the end of the planning period. See Table 6-6 for planned manure applications.

Table 6-3. Planned Crops and Fertilizer Recommendations

Field	Crop Year	Planned Crop	Yield Goal (per Acre)	N Rec (Lbs/A)	P ₂ O ₅ Rec (Lbs/A)	K ₂ O Rec (Lbs/A)	N Removed (Lbs/A)	P ₂ O ₅ Removed (Lbs/A)	K ₂ O Removed (Lbs/A)	Custom Fert. Rec. Source
Baker (1)	2013	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Baker (1)	2014	Wheat,winter, grain+straw	Bu	174 ^a	81 ^a	101 ^a				OSU Extension Publication em8963-e
Baker (1)	2015	Annual ryegrass seed	Lb	146 ^a	43	43 ^a				OSU Extension Publication FG5-e
Baker (1)	2016	Annual ryegrass seed	Lb	146 ^a	43	43 ^a				OSU Extension Publication FG5-e
Baker (2)	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43	43 ^a	32	9	10	OSU Extension Publication FG5-e
Baker (2)	2014	Corn, silage	30.0 Ton	203	74	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Baker (2)	2015	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101	124	58	79	OSU Extension Publication em8963-e
Baker (2)	2016	Annual ryegrass seed	2,000.0 Lb	146 ^a	43	43 ^a	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2015	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43	32	9	10	OSU Extension Publication FG5-e
Baker (3)	2016	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101 ^a	124	58	79	OSU Extension Publication em8963-e
Boyer (1)	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (1)	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (1)	2015	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (1)	2016	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (2)	2013	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101	124	58	79	OSU Extension Publication em8963-e
Boyer (2)	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (2)	2015	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Boyer (2)	2016	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Goracke	2013	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E
Goracke	2014	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E
Goracke	2015	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E

Field	Crop Year	Planned Crop	Yield Goal (per Acre)	N Rec (Lbs/A)	P ₂ O ₅ Rec (Lbs/A)	K ₂ O Rec (Lbs/A)	N Removed (Lbs/A)	P ₂ O ₅ Removed (Lbs/A)	K ₂ O Removed (Lbs/A)	Custom Fert. Rec. Source
Goracke	2016	Peren ryegr forage,maint	5.0 Ton	204	68 ^a	195 ^a	167	62	171	OSU Extension Publication EM 8585-E
Home	2013	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Home	2014	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Home	2015	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Home	2016	Corn, silage	2,000.0 Ton	203 ^a	74 ^a	195 ^a				OSU Extension Publication EM 8585-E
Sievers	2013	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Sievers	2014	Annual ryegrass seed	2,000.0 Lb	146 ^a	43 ^a	43 ^a	32	9	10	OSU Extension Publication FG5-e
Sievers	2015	Corn, silage	30.0 Ton	203	74 ^a	195 ^a	231	120	276	OSU Extension Publication EM 8585-E
Sievers	2016	Wheat,winter, grain+straw	90.0 Bu	174 ^a	81 ^a	101 ^a	124	58	79	OSU Extension Publication em8963-e

* Unharvested cover crop or first crop in double-crop system.

^a Custom fertilizer recommendation.

Table 6-4. Manure Application Setback Distances**Setback Requirements: CAFO**

Feature	Setback Criteria	Setback Distance (Feet)
Lakes and ponds	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Impounding reservoirs	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Wells	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Rivers and canals	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Streams and creeks	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Estuaries	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Pacific Ocean	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
All other bodies of surface water, natural or artificial	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Other conduits to surface waters	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Open tile line intake	Applied upgradient, permanent vegetated setback ≥ 35 feet	35
Sinkholes	Applied upgradient, permanent vegetated setback ≥ 35 feet	35

Source: CAFO General Permit #1 (http://oregon.gov/ODA/NRD/docs/pdf/cafo_gnlpmt.pdf)

Setback Requirements: NRCS Standard

Feature	Setback Criteria	Setback Distance (Feet)
Open water courses	Application June through September	25
Open water courses	Application October through May	50

Source: Waste Utilization 633 Operation and Maintenance Worksheet (<http://efotg.nrcs.usda.gov/references/public/OR/633om.doc>)

Table 6-5. Manure Application Planning Calendar – October 2012 through September 2013

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2013 Crop (Prev. Primary Crop)	Oct '12	Nov '12	Dec '12	Jan '13	Feb '13	Mar '13	Apr '13	May '13	Jun '13	Jul '13	Aug '13	Sep '13
Baker (1)	131.0	129.1	Santiam SIL (140 2-8%)	Corn, silage (Annual ryegrass seed)								X				
Baker (2)	171.4	161.4	Santiam SIL (140 2-8%)	Annual ryegrass seed (Wheat,winter, grain+straw)								X				
Baker (3)	10.7	10.3	Waldo SICL (155 0-3%)	Annual ryegrass seed (Wheat,winter, grain+straw)												806.8
Boyer (1)	72.9	72.9	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)												5,709.8
Boyer (2)	119.7	111.8	Santiam SIL (140 2-8%)	Wheat,winter, grain+straw (Corn, silage)												8,756.6
Goracke	151.5	151.5	Santiam SIL (140 2-8%)	Peren ryegr forage,maint (Peren ryegr forage,maint)					X							
Home	119.7	119.7	Santiam SIL (140 2-8%)	Corn, silage (Corn, silage)							X					
Sievers	89.1	89.1	Santiam SIL (140 2-8%)	Annual ryegrass seed (Wheat,winter, grain+straw)								7,830.6				
Wildlife1	10.8	0.0	Waldo SICL (155 0-3%)	()												
Wildlife2	8.0	0.0	Waldo SICL (155 0-3%)	()												
Wildlife3	50.1	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (1)	4.7	0.0	Santiam SIL (140 2-8%)	()												
Baker Wildlife (2)	37.3	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (3)	6.2	0.0	Santiam SIL (141 8-20%)	()												
Baker Wildlife (4)	5.2	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (5)	13.3	0.0	Waldo SICL (155 0-3%)	()												
Baker (HQ)	10.4	0.0	Santiam SIL (140 2-8%)	()												
VanBeek (HQ)	1.6	0.0	Santiam SIL (140 2-8%)	()												
Sievers (HQ)	5.1	0.0	Santiam SIL (140 2-8%)	()												
CAFO	29.4	0.0	Santiam SIL (140 2-8%)	()												

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2013 Crop (Prev. Primary Crop)	Oct '12	Nov '12	Dec '12	Jan '13	Feb '13	Mar '13	Apr '13	May '13	Jun '13	Jul '13	Aug '13	Sep '13
Total	1,048.1	845.8							X		X	7,83 0.6 X				15,2 73.2

Crop in field	No. indicates total loads "X" indicates other manure apps
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Manure Application Planning Calendar – October 2013 through September 2014

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2014 Crop (Prev. Primary Crop)	Oct '13	Nov '13	Dec '13	Jan '14	Feb '14	Mar '14	Apr '14	May '14	Jun '14	Jul '14	Aug '14	Sep '14
Baker (1)	131.0	129.1	Santiam SIL (140 2-8%)	Wheat,winter, grain+straw (Corn, silage)								X				
Baker (2)	171.4	161.4	Santiam SIL (140 2-8%)	Corn, silage (Annual ryegrass seed)								X				
Baker (3)	10.7	10.3	Waldo SICL (155 0-3%)	Annual ryegrass seed (Annual ryegrass seed)												905.3
Boyer (1)	72.9	72.9	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)												149.8
Boyer (2)	119.7	111.8	Santiam SIL (140 2-8%)	Annual ryegrass seed (Wheat,winter, grain+straw)												9,825.6
Goracke	151.5	151.5	Santiam SIL (140 2-8%)	Peren ryegr forage,maint (Peren ryegr forage,maint)					X							
Home	119.7	119.7	Santiam SIL (140 2-8%)	Corn, silage (Corn, silage)							X					
Sievers	89.1	89.1	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)									7,830.6			
Wildlife1	10.8	0.0	Waldo SICL (155 0-3%)	()												
Wildlife2	8.0	0.0	Waldo SICL (155 0-3%)	()												
Wildlife3	50.1	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (1)	4.7	0.0	Santiam SIL (140 2-8%)	()												
Baker Wildlife (2)	37.3	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (3)	6.2	0.0	Santiam SIL (141 8-20%)	()												
Baker Wildlife (4)	5.2	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (5)	13.3	0.0	Waldo SICL (155 0-3%)	()												
Baker (HQ)	10.4	0.0	Santiam SIL (140 2-8%)	()												
VanBeek (HQ)	1.6	0.0	Santiam SIL (140 2-8%)	()												
Sievers (HQ)	5.1	0.0	Santiam SIL (140 2-8%)	()												
CAFO	29.4	0.0	Santiam SIL (140 2-8%)	()												

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2014 Crop (Prev. Primary Crop)	Oct '13	Nov '13	Dec '13	Jan '14	Feb '14	Mar '14	Apr '14	May '14	Jun '14	Jul '14	Aug '14	Sep '14
Total	1,048.1	845.8							X		X	X	7,830.6			10,880.7

Crop in field	No. indicates total loads "X" indicates other manure apps
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Manure Application Planning Calendar – October 2014 through September 2015

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2015 Crop (Prev. Primary Crop)	Oct '14	Nov '14	Dec '14	Jan '15	Feb '15	Mar '15	Apr '15	May '15	Jun '15	Jul '15	Aug '15	Sep '15
Baker (1)	131.0	129.1	Santiam SIL (140 2-8%)	Annual ryegrass seed (Wheat,winter, grain+straw)									X			
Baker (2)	171.4	161.4	Santiam SIL (140 2-8%)	Wheat,winter, grain+straw (Corn, silage)								X				
Baker (3)	10.7	10.3	Waldo SICL (155 0-3%)	Annual ryegrass seed (Annual ryegrass seed)												905.3
Boyer (1)	72.9	72.9	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)												6,406.8
Boyer (2)	119.7	111.8	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)												
Goracke	151.5	151.5	Santiam SIL (140 2-8%)	Peren ryegr forage,maint (Peren ryegr forage,maint)					X							
Home	119.7	119.7	Santiam SIL (140 2-8%)	Corn, silage (Corn, silage)							X					
Sievers	89.1	89.1	Santiam SIL (140 2-8%)	Corn, silage (Annual ryegrass seed)						X						
Wildlife1	10.8	0.0	Waldo SICL (155 0-3%)	()												
Wildlife2	8.0	0.0	Waldo SICL (155 0-3%)	()												
Wildlife3	50.1	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (1)	4.7	0.0	Santiam SIL (140 2-8%)	()												
Baker Wildlife (2)	37.3	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (3)	6.2	0.0	Santiam SIL (141 8-20%)	()												
Baker Wildlife (4)	5.2	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (5)	13.3	0.0	Waldo SICL (155 0-3%)	()												
Baker (HQ)	10.4	0.0	Santiam SIL (140 2-8%)	()												
VanBeek (HQ)	1.6	0.0	Santiam SIL (140 2-8%)	()												
Sievers (HQ)	5.1	0.0	Santiam SIL (140 2-8%)	()												
CAFO	29.4	0.0	Santiam SIL (140 2-8%)	()												

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2015 Crop (Prev. Primary Crop)	Oct '14	Nov '14	Dec '14	Jan '15	Feb '15	Mar '15	Apr '15	May '15	Jun '15	Jul '15	Aug '15	Sep '15
Total	1,048.1	845.8							X	X	X	X	X			7,312.1

Crop in field	No. indicates total loads "X" indicates other manure apps
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Manure Application Planning Calendar – October 2015 through September 2016

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2016 Crop (Prev. Primary Crop)	Oct '15	Nov '15	Dec '15	Jan '16	Feb '16	Mar '16	Apr '16	May '16	Jun '16	Jul '16	Aug '16	Sep '16
Baker (1)	131.0	129.1	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)							X					
Baker (2)	171.4	161.4	Santiam SIL (140 2-8%)	Annual ryegrass seed (Wheat,winter, grain+straw)							X					
Baker (3)	10.7	10.3	Waldo SICL (155 0-3%)	Wheat,winter, grain+straw (Annual ryegrass seed)												
Boyer (1)	72.9	72.9	Santiam SIL (140 2-8%)	Annual ryegrass seed (Annual ryegrass seed)												
Boyer (2)	119.7	111.8	Santiam SIL (140 2-8%)	Corn, silage (Annual ryegrass seed)									9.82 5.6			
Goracke	151.5	151.5	Santiam SIL (140 2-8%)	Peren ryegr forage,maint (Peren ryegr forage,maint)					X							
Home	119.7	119.7	Santiam SIL (140 2-8%)	Corn, silage (Corn, silage)						X						
Sievers	89.1	89.1	Santiam SIL (140 2-8%)	Wheat,winter, grain+straw (Corn, silage)							7.83 0.6					
Wildlife1	10.8	0.0	Waldo SICL (155 0-3%)	()												
Wildlife2	8.0	0.0	Waldo SICL (155 0-3%)	()												
Wildlife3	50.1	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (1)	4.7	0.0	Santiam SIL (140 2-8%)	()												
Baker Wildlife (2)	37.3	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (3)	6.2	0.0	Santiam SIL (141 8-20%)	()												
Baker Wildlife (4)	5.2	0.0	Waldo SICL (155 0-3%)	()												
Baker Wildlife (5)	13.3	0.0	Waldo SICL (155 0-3%)	()												
Baker (HQ)	10.4	0.0	Santiam SIL (140 2-8%)	()												
VanBeek (HQ)	1.6	0.0	Santiam SIL (140 2-8%)	()												
Sievers (HQ)	5.1	0.0	Santiam SIL (140 2-8%)	()												
CAFO	29.4	0.0	Santiam SIL (140 2-8%)	()												

Field	Total Acres	Spread Acres	Predominant Soil Type	Primary 2016 Crop (Prev. Primary Crop)	Oct '15	Nov '15	Dec '15	Jan '16	Feb '16	Mar '16	Apr '16	May '16	Jun '16	Jul '16	Aug '16	Sep '16
Total	1,048.1	845.8							X	X	7,83 0.6 X		9,82 5.6			

Crop in field	No. indicates total loads "X" indicates other manure apps
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Table 6-6. Planned Nutrient Applications (Manure-spreadable Area)

Field	App. Month	Target Crop	Nutrient Source	Application Method	Rate Basis	Rate/Acre	Loads, Speed or Time	Total Amount Applied	Acres Cov.	Avail N (Lbs/A)	Avail P ₂ O ₅ (Lbs/A)	Avail K ₂ O (Lbs/A)
Baker (1)	May 2013	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,195,776 Gal	129.1	202	98	361
Baker (1)	May 2014	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	2,949,960 Gal	129.1	142	69	254
Baker (1)	Jun 2015	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	2,949,960 Gal	129.1	142	69	254
Baker (1)	Apr 2016	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	2,949,960 Gal	129.1	142	69	254
Baker (2)	May 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	3,286,764 Gal	143.8	142	69	254
Baker (2)	May 2014	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	5,245,500 Gal	161.4	202	98	361
Baker (2)	May 2015	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	3,687,996 Gal	161.4	142	69	254
Baker (2)	Apr 2016	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	Lds	3,687,996 Gal	161.4	142	69	254
Baker (3)	Sep 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	20,364 Gal	806.8 Lds	209,768 Gal	10.3	126	61	226
Baker (3)	Sep 2014	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	905.3 Lds	235,378 Gal	10.3	142	69	254
Baker (3)	Sep 2015	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	905.3 Lds	235,378 Gal	10.3	142	69	254
Baker (3)	Sep 2016	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	905.3 Lds	235,378 Gal	10.3	142	69	254
Boyer (1)	Sep 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	20,364 Gal	5709.8 Lds	1,484,548 Gal	72.9	126	61	226
Boyer (1)	Sep 2014	Annual ryegrass seed	Solids Storage Area	Truck Spreader, Not incorporated	Custom	15 Ton	149.8 Lds	1,094 Ton	72.9	111	69	98
Boyer (1)	Sep 2015	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	6406.8 Lds	1,665,768 Gal	72.9	142	69	254
Boyer (2)	Sep 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	20,364 Gal	8756.6 Lds	2,276,716 Gal	111.8	126	61	226
Boyer (2)	Sep 2014	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	9825.6 Lds	2,554,656 Gal	111.8	142	69	254
Boyer (2)	Jun 2016	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	9825.6 Lds	2,554,656 Gal	111.8	142	69	254
Boyer (2)	Sep 2016	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	9825.6 Lds	2,554,656 Gal	111.8	142	69	254
Goracke	Feb 2013	Peren ryegrass, maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361

Field	App. Month	Target Crop	Nutrient Source	Application Method	Rate Basis	Rate/Acre	Loads, Speed or Time	Total Amount Applied	Acres Cov.	Avail N (Lbs/A)	Avail P ₂ O ₅ (Lbs/A)	Avail K ₂ O (Lbs/A)
Goracke	Feb 2014	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361
Goracke	Feb 2015	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361
Goracke	Feb 2016	Peren ryegr forage,maint	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	4,923,750 Gal	151.5	202	98	361
Home	Apr 2013	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Home	Apr 2014	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Home	Apr 2015	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Home	Mar 2016	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	3,890,250 Gal	119.7	202	98	361
Sievers	May 2013	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	7830.6 Lds	2,035,956 Gal	89.1	142	69	254
Sievers	Jun 2014	Annual ryegrass seed	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	7830.6 Lds	2,035,956 Gal	89.1	142	69	254
Sievers	Mar 2015	Corn, silage	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	32,500 Gal	Lds	2,895,750 Gal	89.1	202	98	361
Sievers	Apr 2016	Wheat,winter, grain+straw	Waste Storage Ponds	Traveling Big Guns, Not incorporated	Custom	22,850 Gal	7830.6 Lds	2,035,956 Gal	89.1	142	69	254

Table 6-7. Field Nutrient Balance (Manure-spreadable Area)

Year	Field	Size Acres	Crop	Yield Goal /Acre	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
					N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
2013	Baker (1)	129.1	Corn, silage	30	203 [□]	74 [□]	195 [□]	202	98	361	-1	24	166	-22	85
2014	Baker (1)	129.1	Wheat,winter, grain+straw		174 [□]	81 [□]	101 [□]	142	69	254	-32	12	319		
2015	Baker (1)	129.1	Annual ryegrass seed		146 [□]	43 [□]	43 [□]	142	69	254	-4	38	530		
2016	Baker (1)	129.1	Annual ryegrass seed		146 [□]	43 [□]	43 [□]	142	69	254	-4	64	741		
Total	Baker (1)				669	241	382	628	305	1123					
2013	Baker (2)	161.4	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	127	61	226	-19	18	183	52	216
2014	Baker (2)	161.4	Corn, silage	30	203 [□]	74 [□]	195 [□]	202	98	361	-1	42	349	30	301
2015	Baker (2)	161.4	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	142	69	254	-32	30	502	41	476

Year	Field	Size	Crop	Yield Goal	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
					N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
2016	Baker (2)	161.4	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	142	69	254	-4	56	713	101	720
Total	Baker (2)				669	241	382	613	297	1095					
2013	Baker (3)	10.3	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2014	Baker (3)	10.3	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	126	61	226	-20	18	183	52	216
2015	Baker (3)	10.3	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	142	69	254	-4	44	394	112	460
2016	Baker (3)	10.3	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	142	69	254	-32	32	547	123	635
Total	Baker (3)				612	210	230	410	199	734					
2013	Boyer (1)	72.9	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2014	Boyer (1)	72.9	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	126	61	226	-20	18	183	52	216
2015	Boyer (1)	72.9	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	111	69	98	-35	44	238	112	304
2016	Boyer (1)	72.9	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	142	69	254	-4	70	449	172	548
Total	Boyer (1)				584	172	172	379	199	578					
2013	Boyer (2)	111.8	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	0	0	0	-174	-81	-101	-58	-79
2014	Boyer (2)	111.8	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	126	61	226	-20	18	183	52	216
2015	Boyer (2)	111.8	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	142	69	254	-4	44	394	112	460
2016	Boyer (2)	111.8	Corn, silage	30	203 [□]	74 [□]	195 [□]	142	69	254	-61	39	453	61	438
Total	Boyer (2)				669	241	382	410	199	734					
2013	Goracke	151.5	Peren ryegr forage,maint	5	204 [□]	68 [□]	195 [□]	202	98	361	-2	30	166	36	190
2014	Goracke	151.5	Peren ryegr forage,maint	5	204 [□]	68 [□]	195 [□]	202	98	361	-2	60	332	72	380
2015	Goracke	151.5	Peren ryegr forage,maint	5	204 [□]	68 [□]	195 [□]	202	98	361	-2	90	498	108	570
2016	Goracke	151.5	Peren ryegr forage,maint	5	204 [□]	68 [□]	195 [□]	202	98	361	-2	120	664	144	760
Total	Goracke				816	272	780	808	392	1444					
2013	Home	119.7	Corn, silage	30	203 [□]	74 [□]	195 [□]	202	98	361	-1	24	166	-22	85
2014	Home	119.7	Corn, silage	30	203 [□]	74 [□]	195 [□]	202	98	361	-1	48	332	-22	170
2015	Home	119.7	Corn, silage	30	203 [□]	74 [□]	195 [□]	202	98	361	-1	72	498	-22	255
2016	Home	119.7	Corn, silage	2000	203 [□]	74 [□]	195 [□]	202	98	361	-1	96	664		
Total	Home				812	296	780	808	392	1444					
2013	Sievers	89.1	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	142	69	254	-4	26	211	60	244

Year	Field	Size	Crop	Yield Goal	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
		Acres			N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
2014	Sievers	89.1	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	142	69	254	-4	52	422	120	488
2015	Sievers	89.1	Corn, silage	30	203 [□]	74 [□]	195 [□]	202	98	361	-1	76	588	98	573
2016	Sievers	89.1	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	142	69	254	-32	64	741	109	748
Total	Sievers				669	241	382	628	305	1123					

Field Nutrient Balance (Non-manure-spreadable Area)

Year	Field	Size	Crop	Yield Goal	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
		Acres			N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
2013	Baker (1)	1.9	Corn, silage	30	203 [□]	74 [□]	195 [□]	0	0	0	-203	-74	-195	-120	-276
2014	Baker (1)	1.9	Wheat,winter, grain+straw		174 [□]	81 [□]	101 [□]	0	0	0	-174	-81	-101		
2015	Baker (1)	1.9	Annual ryegrass seed		146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43		
2016	Baker (1)	1.9	Annual ryegrass seed		146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43		
Total	Baker (1)				669	241	382	0	0	0					
2013	Baker (2)	10.0	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2014	Baker (2)	10.0	Corn, silage	30	203 [□]	74 [□]	195 [□]	0	0	0	-203	-74	-195	-120	-276
2015	Baker (2)	10.0	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	0	0	0	-174	-81	-101	-58	-79
2016	Baker (2)	10.0	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
Total	Baker (2)				669	241	382	0	0	0					
2013	Baker (3)	0.4	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2014	Baker (3)	0.4	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2015	Baker (3)	0.4	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2016	Baker (3)	0.4	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	0	0	0	-174	-81	-101	-58	-79
Total	Baker (3)				612	210	230	0	0	0					
2013	Boyer (2)	7.9	Wheat,winter, grain+straw	90	174 [□]	81 [□]	101 [□]	0	0	0	-174	-81	-101	-58	-79
2014	Boyer (2)	7.9	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2015	Boyer (2)	7.9	Annual ryegrass seed	2000	146 [□]	43 [□]	43 [□]	0	0	0	-146	-43	-43	-9	-10
2016	Boyer (2)	7.9	Corn, silage	30	203 [□]	74 [□]	195 [□]	0	0	0	-203	-74	-195	-120	-276

Year	Field	Size Acres	Crop	Yield Goal /Acre	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
					N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
Total	Boyer (2)				669	241	382	0	0	0					
2013	Wildlife1	10.8						0	0	0					
2014	Wildlife1	10.8						0	0	0					
2015	Wildlife1	10.8						0	0	0					
2016	Wildlife1	10.8						0	0	0					
Total	Wildlife1				0	0	0	0	0	0					
2013	Wildlife2	8.0						0	0	0					
2014	Wildlife2	8.0						0	0	0					
2015	Wildlife2	8.0						0	0	0					
2016	Wildlife2	8.0						0	0	0					
Total	Wildlife2				0	0	0	0	0	0					
2013	Wildlife3	50.1						0	0	0					
2014	Wildlife3	50.1						0	0	0					
2015	Wildlife3	50.1						0	0	0					
2016	Wildlife3	50.1						0	0	0					
Total	Wildlife3				0	0	0	0	0	0					
2013	Baker Wildlife (1)	4.7						0	0	0					
2014	Baker Wildlife (1)	4.7						0	0	0					
2015	Baker Wildlife (1)	4.7						0	0	0					
2016	Baker Wildlife (1)	4.7						0	0	0					
Total	Baker Wildlife (1)				0	0	0	0	0	0					
2013	Baker Wildlife (2)	37.3						0	0	0					
2014	Baker Wildlife (2)	37.3						0	0	0					
2015	Baker Wildlife (2)	37.3						0	0	0					
2016	Baker Wildlife (2)	37.3						0	0	0					
Total	Baker Wildlife (2)				0	0	0	0	0	0					
2013	Baker Wildlife (3)	6.2						0	0	0					
2014	Baker Wildlife (3)	6.2						0	0	0					
2015	Baker Wildlife (3)	6.2						0	0	0					

Year	Field	Size Acres	Crop	Yield Goal /Acre	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
					N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
2016	Baker Wildlife (3)	6.2						0	0	0					
Total	Baker Wildlife (3)				0	0	0	0	0	0					
2013	Baker Wildlife (4)	5.2						0	0	0					
2014	Baker Wildlife (4)	5.2						0	0	0					
2015	Baker Wildlife (4)	5.2						0	0	0					
2016	Baker Wildlife (4)	5.2						0	0	0					
Total	Baker Wildlife (4)				0	0	0	0	0	0					
2013	Baker Wildlife (5)	13.3						0	0	0					
2014	Baker Wildlife (5)	13.3						0	0	0					
2015	Baker Wildlife (5)	13.3						0	0	0					
2016	Baker Wildlife (5)	13.3						0	0	0					
Total	Baker Wildlife (5)				0	0	0	0	0	0					
2013	Baker (HQ)	10.4						0	0	0					
2014	Baker (HQ)	10.4						0	0	0					
2015	Baker (HQ)	10.4						0	0	0					
2016	Baker (HQ)	10.4						0	0	0					
Total	Baker (HQ)				0	0	0	0	0	0					
2013	VanBeek (HQ)	1.6						0	0	0					
2014	VanBeek (HQ)	1.6						0	0	0					
2015	VanBeek (HQ)	1.6						0	0	0					
2016	VanBeek (HQ)	1.6						0	0	0					
Total	VanBeek (HQ)				0	0	0	0	0	0					
2013	Sievers (HQ)	5.1						0	0	0					
2014	Sievers (HQ)	5.1						0	0	0					
2015	Sievers (HQ)	5.1						0	0	0					
2016	Sievers (HQ)	5.1						0	0	0					
Total	Sievers (HQ)				0	0	0	0	0	0					
2013	CAFO	29.4						0	0	0					
2014	CAFO	29.4						0	0	0					

Year	Field	Size	Crop	Yield Goal	Fertilizer Recs ¹			Nutrients Applied ²			Balance After Recs ³			Balance After Removal ⁴	
					N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	N Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A	P ₂ O ₅ Lb/A	K ₂ O Lb/A
2015	CAFO	29.4						0	0	0					
2016	CAFO	29.4						0	0	0					
Total	CAFO				0	0	0	0	0	0					

¹ Fertilizer Recs are the crop fertilizer recommendations. The N rec accounts for any N credit from previous legume crop.

² Nutrients Applied are the nutrients expected to be available to the crop from that year's manure applications plus nutrients from that year's commercial fertilizer applications and nitrates from irrigation water. With a double-crop year, the total nutrients applied for both crops and the year's balances are listed on the second crop's line.

³ For N, Nutrients Applied minus Fertilizer Recs for indicated crop year. Also includes amount of residual N expected to become available that year from prior years' manure applications. For P₂O₅ and K₂O, Nutrients Applied minus Fertilizer Recs *through* the indicated crop year, with positive balances carried forward to subsequent years. Negative values indicate a potential need to apply additional nutrients.

⁴ Nutrients Applied minus amount removed by harvested portion of crop through the indicated year. Positive balances are carried forward to subsequent years.

[‡] Indicates a custom fertilizer recommendation in the Fertilizer Recs column.

^a Indicates in the Balance After Recs N column that the legume crop is assumed to utilize some or all of the supplied N.

[†] Indicates in the Balance After Recs N column that the value includes residual N expected to become available that year from prior years' manure applications.

Table 6-8. Projected P and K Levels*

Field ID	P Level at Start of Plan (ppm)	Excess P ₂ O ₅ Applied (lbs)	P Level at End of Plan (ppm)	K Level at Start of Plan (ppm)	Excess K ₂ O Applied (lbs)	K Level at End of Plan (ppm)
Baker (1)	12	64	15	160	741	253
Baker (2)	5	56	8	95	713	184
Baker (3)	23	32	25	43	547	111
Boyer (1)	55	70	59	261	449	317
Boyer (2)	22	39	24	86	453	143
Goracke	45	120	51	621	664	704
Home	115	96	120	817	664	900
Sievers	106	64	109	806	741	899
Wildlife1	NA	NA	NA	NA	NA	NA
Wildlife2	NA	NA	NA	NA	NA	NA
Wildlife3	NA	NA	NA	NA	NA	NA
Baker Wildlife (1)	NA	NA	NA	NA	NA	NA
Baker Wildlife (2)	NA	NA	NA	NA	NA	NA
Baker Wildlife (3)	NA	NA	NA	NA	NA	NA
Baker Wildlife (4)	NA	NA	NA	NA	NA	NA
Baker Wildlife (5)	NA	NA	NA	NA	NA	NA
Baker (HQ)	NA	NA	NA	NA	NA	NA
VanBeek (HQ)	NA	NA	NA	NA	NA	NA
Sievers (HQ)	NA	NA	NA	NA	NA	NA
CAFO	NA	NA	NA	NA	NA	NA

*Projected levels include only planned manure applications.

Table 6-9. Plan Nutrient Balance (Manure-spreadable Area)

	N (lbs)	P ₂ O ₅ (lbs)	K ₂ O (lbs)
Total Manure Nutrients on Hand at Start of Plan ¹	30,889	10,603	37,337
Total Manure Nutrients Collected ²	1,260,442	474,427	1,263,844
Total Manure Nutrients Imported ³	0	0	0
Total Manure Nutrients Exported ⁴	472,500	207,000	292,500
Total Manure Nutrients on Hand at End of Plan ⁵	31,088	11,339	33,427
Total Manure Nutrients Applied ⁶	786,786	268,104	976,204
Available Manure Nutrients Applied ⁷	550,048	268,104	976,204
Commercial Fertilizer Nutrients Applied ⁸	0	0	0
Available Nutrients Applied ⁹	550,048	268,104	976,204
Nutrient Utilization Potential ¹⁰	598,444	248,891	483,049
Nutrient Balance of Spreadable Acres ^{11*}	-48,396	19,213	493,155
Average Nutrient Balance per Spreadable Acre per Year ^{12*}	-14	6	146

1. Values indicate total manure nutrients present in storage(s) at the beginning of the plan.

2. Values indicate total manure nutrients collected on the farm.

3. Values indicate total manure nutrients imported onto the farm.

4. Values indicate total manure nutrients exported from the farm to an external operation.

5. Values indicate total manure nutrients present in storage(s) at the end of plan.

6. Values indicate total nutrients present in land-applied manure. Losses due to rate, timing and method of application are not included in these values.

7. Values indicate available manure nutrients applied on the farm based on rate, time and method of application. These values are based on the total manure nutrients applied (row 6) after accounting for state-specific nutrient losses due to rate, time and method of application.

8. Values indicate nutrients applied as commercial fertilizers and nitrates contained in irrigation water.

9. Values are the sum of available manure nutrients applied (row 7) and commercial fertilizer nutrients applied (row 8).

10. Values indicate nutrient utilization potential of crops grown. For N the value generally is based on crop N recommendation for non-legume crops and crop N uptake or other state-imposed limit for N application rates for legumes. P₂O₅ and K₂O values generally are based on fertilizer recommendations or crop removal (whichever is greatest).

11. Values indicate available nutrients applied (row 9) minus crop nutrient utilization potential (row 10). Negative values indicate additional nutrient utilization potential and positive values indicate over-application.

12. Values indicate average per acre nutrient balance. Values are calculated by dividing nutrient balance of spreadable acres (row 11) by the number of spreadable acres in plan and by the length of the plan in years. Negative values indicate additional average per acre nutrient utilization potential and positive values indicate average per acre over-application.

* Non-trivial, positive values for N indicate that the plan was not properly developed. Negative values for N indicate additional nutrient utilization potential which may or may not be intentional. For example, plans that include legume crops often will not utilize the full N utilization potential for legume crops if manure can be applied to non-legume crops that require N for optimum yield. Positive values for P₂O₅ and/or K₂O do not necessarily indicate that the plan was not developed properly. For example, producers may be allowed to apply N-based application rates of manure to fields with low soil test P values or fields with a low potential P-loss risk based on the risk assessment tool used by the state. Negative values for P₂O₅ and K₂O indicate that planned applications to some fields are less than crop removal rates.

Plan Nutrient Balance (Non-manure-spreadable Area)

	N (Lbs)	P ₂ O ₅ (Lbs)	K ₂ O (Lbs)
Commercial Fertilizer Nutrients Applied ¹	0	0	0
Nutrient Utilization Potential ²	13,491	4,856	7,656
Nutrient Balance of Non-spreadable Acres ^{3*}	-13,491	-4,856	-7,656
Average Nutrient Balance per Non-spreadable Acre per Year ^{4*}	-17	-6	-9

1. Values indicate nutrients applied as commercial fertilizers and nitrates contained in irrigation water.

2. Values indicate nutrient utilization potential of crops grown based on crop fertilizer recommendations.

3. Values indicate commercial fertilizer nutrients applied (row 1) minus crop nutrient utilization potential (row 2). Negative values indicate additional nutrient utilization potential and positive values indicate over-application.

4. Values indicate average per acre nutrient balance. Values are calculated by dividing nutrient balance of non-spreadable acres (row 3) by number of non-spreadable acres in plan. Negative values indicate additional average per acre nutrient utilization potential and positive values indicate average per acre over-application.

* Non-trivial, positive values for N indicate that the plan was not properly developed. Negative values for N indicate additional nutrient utilization potential which may or may not be intentional. Positive values for P₂O₅ and/or K₂O do not necessarily indicate that the plan was not developed properly. For example, multiple year applications may have been planned during the final plan year(s) and these nutrients will not be utilized by crops in the current plan. Negative values for P₂O₅ and K₂O indicate that applications to some fields may have been delayed to allow the producer to apply the nutrients in accordance with their fertilization schedule.

Table 6-10. Manure Inventory Annual Summary

Manure Source	Plan Period	On Hand at Start of Period	Total Generated	Total Imported	Total Transferred In	Total Applied	Total Exported	Total Transferred Out	On Hand at End of Period	Units
Waste Storage Ponds	Oct '12 - Sep '13	3,258,288	21,624,732	0	0	22,303,528	0	0	2,579,492	Gal
Solids Storage Area	Oct '12 - Sep '13	180	11,681	0	0	0	11,000	0	861	Ton
Waste Storage Ponds	Oct '13 - Sep '14	2,579,492	21,624,732	0	0	21,835,450	0	0	2,368,774	Gal
Solids Storage Area	Oct '13 - Sep '14	861	11,681	0	0	1,094	11,000	0	449	Ton
Waste Storage Ponds	Oct '14 - Sep '15	2,368,774	21,624,732	0	0	20,248,852	0	0	3,744,654	Gal
Solids Storage Area	Oct '14 - Sep '15	449	11,681	0	0	0	12,000	0	130	Ton
Waste Storage Ponds	Oct '15 - Sep '16	3,744,654	21,624,732	0	0	22,832,602	0	0	2,536,784	Gal
Solids Storage Area	Oct '15 - Sep '16	130	11,681	0	0	0	11,000	0	811	Ton

Section 7. Feed Management

An imbalance of a whole-farm nutrient balance can lead to a lack of nutrients to meet production goals or an excess of nutrients that can contribute to a degradation of water and air resources. Developing a good feed management program can help to minimize the effects from a lack or excess of nutrients being available to meet production goals.

Usually animal diets are formulated to feed enough nutrients to meet the animal's needs with a little extra thrown in just to make sure their needs are met. Adjusting the diets of animals to more closely meet their needs can reduce nitrogen and phosphorus excreted from the animal by 5 to 30%. One way to adjust animal diets is to group animals by age class and weight so diets can be formulated for each animal group rather than using one formulation for all age and weight classes which can lead to excess nutrients being excreted from most of the animals. Other ways to reduce excess nutrients from being excreted from animals is to adjust dietary formulations for climatic conditions, minimize feed waste and process feeds so the animal can absorb and retain more of the nutrients being fed.

A competent feed management specialist should be consulted before any changes to dietary formulations are made. A feed management specialist can help analyze the nutrient content of dietary formulations and suggest ways to minimize over feeding nutrients and assess the effects of any changes made to dietary formulations.

Contact your local Oregon State University (OSU) Extension office for help in locating a feed management specialist to consult with in determining what changes can be made to dietary formulations for your farm.

Section 8. Other Utilization Options

This nutrient management plan was developed based on the maximum number of animals VanBeek Dairy plans to have on farm and currently there are no plans for any future expansion of the operation at this site. Any future expansion would require additional facilities for the animals and an increase in feed and forage production or import more feed and export more manure to maintain a nutrient balance in the existing fields. Any future expansion would also require additional manure storage facilities to be constructed.

Section 9. Operation, Maintenance, and Recordkeeping

This plan should be reviewed annually to insure it accurately describes the VanBeek Dairy operation and will need revision if any of the following conditions occur:

1. Additions or changes to land application areas not described in this plan,
2. Any changes to maximum annual manure application rates,
3. Any changes to the maximum amount of nitrogen and phosphorus applied to the crop land fields,
4. Any changes in the crops grown on the fields where manure applied,
5. Any changes to the manure handling system not described in this plan,
6. Any changes that are likely to increase the risk of nitrogen and phosphorus transport to surface or ground waters.

Soil sampling of all fields shall be conducted a minimum of once every four years according to this state's guidance. Any laboratory certified by the state shall be used to analyze the soil samples. Nutrient values of manure shall be determined annually by laboratory testing prior to land application.

Whenever the manure storage capacity is less than the required amount, manure removal and land application shall be initiated and conducted on all days suitable for land application. Manure shall not be applied to saturated, frozen, or snow-covered ground unless the potential risk for runoff is minimized as described above. Liquid manure shall not be applied at rates that exceed the infiltration rate of the soil, and the amount being applied shall not exceed the moisture-holding capacity of the soil profile at the time of application.

Records will be maintained by documenting the actual rate at which nutrients were applied compared to the recommended and planned rates. The records will indicate the reasons for difference in application rates. Records will include:

- Soil test results and recommendations for nutrient applications.
- Quantities, analysis and sources of all nutrients applied.
- Dates and methods of nutrient applications.
- Crops planted, planting and harvest dates, yields, and crop residues removed.
- Results of water, plant, and organic by-product analysis.
- Dates of review and person performing review, and recommendations that resulted from review.

Prior to transferring manure, litter or process wastewater to other persons, the livestock or poultry operation shall provide the recipient of the manure, litter or process wastewater with the most current nutrient analysis. The operators shall analyze their manure at least annually. Records of transfers shall include the date, recipient name and address, and approximate amount of manure, litter or process wastewater that is transferred to another person. Records shall be maintained for five years. Example record-keeping forms for land application can be found at the end of this section.

Equipment for application of nutrients will be calibrated on an annual basis. Manure and fertilizer will be uniformly applied to soils. Manure and fertilizer application equipment will be calibrated to deliver within 10 percent of the planned rate. Calibration of the solid manure box spreader should follow the procedures outlined in applicable state or federal guidance. To determine the application rate, the producer must divide the weight of the manure collected on a tarp by the area covered.

Fertilizer and organic by-product storage facilities shall be protected from weather and accidental leakage or spillage. Workers shall be protected from and avoid unnecessary contact with chemical fertilizer and organic by-products. Protection should include the use of personal protective equipment

when working with nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The proper disposal of material generated by cleaning nutrient application equipment shall be accomplished. Excess material should be collected and stored or field-applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff or leaching.

See Section 2.3, Operation Area Practices starting on page 15 and Section 4.4, Land Treatment Area Practices starting on page 49 for Operation and Maintenance guidance for individual practices.

Section 10. References

10.1 Publications

Crop Fertilizer Recommendations

"Annual Ryegrass," OSU FG5-E, Dec 2003 (w. of Cascades only)
<http://extension.oregonstate.edu/catalog/details.php?sortnum=0134&name=Fertilizer+Guides>

"Manure app. rates for forage," OSU EM8585, Aug 97; "Perennial ryegrass," OSU FG46, Jan 2000 (w. only)
<http://extension.oregonstate.edu/catalog/details.php?sortnum=0134&name=Fertilizer+Guides>

OSU EM8585, Aug 1997 and FG10, Apr 1983 (w. of Cascades); OSU FG71, Jan 2000 (e. of Cascades)
<http://extension.oregonstate.edu/catalog/details.php?sortnum=0134&name=Fertilizer+Guides>

OSU FG9, Jan 2000 (w. of Cascades); OSU FG40, Jan 2000 (e. of Cascades)
<http://extension.oregonstate.edu/catalog/details.php?sortnum=0134&name=Fertilizer+Guides>

Manure Application Setback Features/Distances

CAFO General Permit #1
http://oregon.gov/ODA/NRD/docs/pdf/cafo_gnlpmt.pdf

Waste Utilization 633 Operation and Maintenance Worksheet
<http://efotg.nrcs.usda.gov/references/public/OR/633om.doc>

Manure Nutrient Availability

Waste Utilization Jobsheet 633 OR-JS, Oregon USDA-NRCS, May 2003
<http://efotg.sc.egov.usda.gov/references/public/OR/633js042707.pdf>

Phosphorus Assessment

"Agronomy Technical Note No. 26: The Phosphorus Index," Oregon NRCS, June 2008
ftp://ftp-fc.sc.egov.usda.gov/OR/Technical_Notes/Agronomy/Agronomy26.pdf

Agricultural Phosphorus Management Using the Oregon/Washington Phosphorus Indexes
<http://eesc.orst.edu/agcomwebfile/edmat/em8848-e.pdf>

Practice Standards

Oregon NRCS Nutrient Management Standard (590), May 2008
<http://efotg.nrcs.usda.gov/references/public/OR/590std.doc>

Water Quality/Quantity

Oregon NRCS Water Quality Technical Note No. 1: Water Quality Indicator Tools, October 2000
ftp://ftp-fc.sc.egov.usda.gov/OR/Technical_Notes/Water%20Quality/WaterQual01.pdf

10.2 Software and Data Sources

MMP Version	MMP 0.3.1.0
MMP Plan File	VanBeekDairy.mmp 7/4/2012 12:05:53 PM
MMP Initialization File for Oregon	10/4/2011
MMP Soils File for Oregon	8/29/2011
Phosphorus Assessment Tool	2010.09.30
NRCS Conservation Plan(s)	n/a
RUSLE2 Library	n/a
RUSLE2 Database	n/a

Appendix D

RUSLE Calculations

RUSLE2 Erosion Calculation Record

Info: VanBeek Dairy for Home field in continuous corn silage with conventional tillage in the spring and tillage and planting conducted cross-slope.

profiles\VanBeek_Home_2012

Inputs:

Location: Oregon\Benton County\OR_Benton_R44-48

Soil: 140 Santiam silt loam, 2 to 8 percent slopes\Santiam silt loam 80%

Slope length (horiz): 200 ft

Avg. slope steepness: 3.0 %

Contouring: b. absolute row grade 2 percent

Strips/barriers: (none)

Diversion/terrace, sediment basin: (none)

Base management: c.Other Local Mgt Records\VanBeek_Corn, silage; spring CT, CMZ53

<i>Date</i>	<i>Operation</i>	<i>Vegetation</i>	<i>Surf. res. cov. after op, %</i>
5/1/0	Manure, liquid irrigation		27
5/5/0	Disk, tandem heavy primary op.		6.8
5/10/0	Plow, moldboard		1.5
5/15/0	Cultivator, field w/ spike points		1.7
5/20/0	Cultivator, field w/ spike points		1.5
5/20/0	Harrow, spike tooth		1.5
5/25/0	Cultipacker, roller		1.6
6/1/0	Planter, double disk opnr	Corn, silage	1.6
7/1/0	Manure, liquid irrigation		1.4
9/15/0	Harvest, silage		32

Outputs:

T value: 5.0 t/ac/yr

Soil loss for cons. plan: 4.5 t/ac/yr

RUSLE2 Erosion Calculation Record

Info: VanBeek Dairy for Goracke field in continuous grass hay with conventional tillage in the fall to re-establish; 4 year rotation with 4 hay cuttings and 4 liquid manure applications per year.

profiles\VanBeek_Goracke_2012

Inputs:

Location: Oregon\Benton County\OR_Benton_R44-48

Soil: 140 Santiam silt loam, 2 to 8 percent slopes\Santiam silt loam 80%

Slope length (horiz): 200 ft

Avg. slope steepness: 3.0 %

Contouring: a. rows up-and-down hill

Strips/barriers: (none)

Diversion/terrace, sediment basin: (none)

Base management: c.Other Local Mgt Records\VanBeek; Grass hay; fall planted 4 yr rotation, manure application

Date	Operation	Vegetation	Surf. res. cov. after op, %
9/5/0	Disk, offset, heavy		11
9/10/0	Disk, offset, heavy		14
9/10/0	Cultivator, field w/ spike points		14
9/15/0	Harrow, spike tooth		11
9/15/0	Cultipacker, roller	Grass, cool season, fall seeded	11
9/15/0	Drill or airseeder, double disk		11
4/15/1	Manure, liquid irrigation		48
6/15/1	Harvest, hay, grass	Grass, dense, regrowth after cut	49
6/20/1	Manure, liquid irrigation		49
7/15/1	Harvest, hay, grass	Grass, dense, regrowth after cut	58
7/20/1	Manure, liquid irrigation		59
8/15/1	Harvest, hay, grass	Grass, dense, regrowth after cut	65
8/20/1	Manure, liquid irrigation		66
9/15/1	Harvest, hay, grass	Grass, dense, regrowth after cut	69
4/15/2	Manure, liquid irrigation		36
6/15/2	Harvest, hay, grass	Grass, dense, regrowth after cut	40
6/20/2	Manure, liquid irrigation		42
7/15/2	Harvest, hay, grass	Grass, dense, regrowth after cut	51
7/20/2	Manure, liquid irrigation		53

8/15/2	Harvest, hay, grass	Grass, dense, regrowth after cut	60
8/20/2	Manure, liquid irrigation		61
9/15/2	Harvest, hay, grass	Grass, dense, regrowth after cut	65
4/15/3	Manure, liquid irrigation		33
6/15/3	Harvest, hay, grass	Grass, dense, regrowth after cut	38
6/20/3	Manure, liquid irrigation		40
7/15/3	Harvest, hay, grass	Grass, dense, regrowth after cut	50
7/20/3	Manure, liquid irrigation		51
8/15/3	Harvest, hay, grass	Grass, dense, regrowth after cut	59
8/20/3	Manure, liquid irrigation		60
9/15/3	Harvest, hay, grass	Grass, dense, regrowth after cut	64
4/15/4	Manure, liquid irrigation		33
6/15/4	Harvest, hay, grass	Grass, dense, regrowth after cut	38
6/20/4	Manure, liquid irrigation		39
7/15/4	Harvest, hay, grass	Grass, dense, regrowth after cut	50
7/20/4	Manure, liquid irrigation		51
8/15/4	Harvest, hay, grass	Grass, dense, regrowth after cut	59
9/1/4	Manure, liquid irrigation		58

Outputs:

T value: 5.0 t/ac/yr

Soil loss for cons. plan: 0.28 t/ac/yr

RUSLE2 Erosion Calculation Record

Info: VanBeek Dairy; 4 year rotation with tillage and planting in cross-slope direction.

profiles\VanBeek_Boyer(1,2),Baker(1,2),Siever_2012

Inputs:

Location: Oregon\Benton County\OR_Benton_R44-48

Soil: 140 Santiam silt loam, 2 to 8 percent slopes\Santiam silt loam 80%

Slope length (horiz): 200 ft

Avg. slope steepness: 3.0 %

Contouring: b. absolute row grade 2 percent

Strips/barriers: (none)

Diversion/terrace, sediment basin: (none)

Base management: c. Other Local Mgt Records\VanBeek Dairy; Alt 2.Rev_2012

Date	Operation	Vegetation	Surf. res. cov. after op, %
5/8/0	Manure, liquid irrigation		63
5/15/0	Plow, moldboard		1.5
5/21/0	Disk, tandem secondary op.		1.7
6/1/0	Planter, double disk opnr	Corn, silage	1.6
7/1/0	Manure, liquid irrigation		12
9/15/0	Harvest, silage		32
5/8/1	Manure, liquid irrigation		35
5/15/1	Plow, moldboard		0.75
5/21/1	Disk, tandem secondary op.		1.2
6/1/1	Planter, double disk opnr	Corn, silage	1.2
7/1/1	Manure, liquid irrigation		12
9/15/1	Harvest, silage		32
9/22/1	Manure, liquid irrigation		47
9/30/1	Disk, tandem light finishing		27
10/5/1	Cultivator, field w/ spike points		23
10/12/1	Drill or airseeder, double disk	Wheat, winter, west coast	21
8/1/2	Harvest, killing crop 20pct standing stubble		98
8/15/2	Bale straw or residue		40
9/1/2	Manure, liquid irrigation		56
9/10/2	Disk, tandem light finishing		37

9/15/2	Cultivator, field w/ spike points		34
9/21/2	Drill or airseeder, double disk	Ryegrass, ann, seed prod	30
8/1/3	Harvest, grass seed, remove forage	Ryegrass, annual, seeding yr	33
5/1/4	Harvest, hay, grass	Ryegrass, annual, seeding yr	60

Outputs:

T value: 5.0 t/ac/yr

Soil loss for cons. plan: 2.4 t/ac/yr

RUSLE2 Erosion Calculation Record

Info: Baker 3 field planned rotation is 3 to 5 years perennial ryegrass for seed; conventional tillage. Field is subject to flood overflow and wetness limiting crop rotation alternatives.

profiles\VanBeek_Baker3_2012

Inputs:

Location: Oregon\Benton County\OR_Benton_R44-48

Soil: Wc WAPATO SILTY CLAY LOAM\WAPATO silty clay loam 90%

Slope length (horiz): 300 ft

Avg. slope steepness: 1.0 %

Contouring: a. rows up-and-down hill

Strips/barriers: (none)

Diversion/terrace, sediment basin: (none)

Base management: a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53

Date	Operation	Vegetation	Surf. res. cov. after op, %
9/15/0	Disk, offset, heavy		3.1
9/20/0	Plow, moldboard		0.61
9/25/0	Cultivator, field w/ spike points		0.71
9/26/0	Harrow, spike tooth		0.50
9/28/0	Harrow, spike tooth		0.35
9/29/0	Cultipacker, roller		0.55
10/1/0	Drill or airseeder, double disk	Grass seed, fall seeding	0.43
7/15/1	Harvest, grass or legume seed, remove forage	Grass seed, yr2 senescence	17
7/15/2	Harvest, grass or legume seed, remove forage	Grass seed, established, senescence	22
7/15/3	Harvest, grass or legume seed, remove forage	Grass seed, established, senescence	23
7/15/4	Harvest, grass or legume seed, remove forage	Grass seed, established, senescence	23

Outputs:

T value: 5.0 t/ac/yr

Soil loss for cons. plan: 0.24 t/ac/yr

Appendix E

Phosphorus Index Calculations

Phosphorus Index

The Phosphorus Index for Oregon was developed by a nutrient management advisory group comprised of members from the Natural Resources Conservation Service in Oregon and Washington, Oregon State University, Washington State University, and agricultural industry.

The Phosphorus Index is a field-level assessment tool designed to evaluate the relative potential for off-site movement of phosphorus from the landscape. The purpose of the Phosphorus Index is to provide field personnel, watershed planners, and land managers with a tool to assess various soils, landforms, and management practices for potential risk of phosphorus movement into surface waters.

Conservation planners can use the Phosphorus Index to develop alternatives that include management and conservation practices that will reduce the potential for phosphorus transport to surface waters.

Phosphorus Movement Factors

The main factors influencing P movement can be separated into two main categories: **transport and source factors**. The following factors are considered in the Phosphorus Index for Oregon.

Transport factors:

- Soil erosion (sheet and rill, wind)
- Irrigation-induced erosion
- Runoff class
- Flooding frequency
- Distance to surface waters / buffer width
- Subsurface drainage

Source Factors:

- Soil test P concentration
- Commercial P fertilizer application rate
- Commercial P fertilizer application method
- Organic P source application rate
- Organic P source application method

Each factor is assigned a ***Phosphorus Loss Rating*** of ***None, Low, Medium, High, or Very High*** based on the relative risk of phosphorus transport to surface waters. In addition, each factor is assigned a ***Factor Weight*** ranging from 0.25 to 1.50, based on the relative contribution of that factor to P transport.

Separate Phosphorus Indices were developed for Western and Eastern Oregon. Differences in cropping systems, tillage practices, irrigation systems, climatic factors, and soil phosphorus testing methods across the state made it necessary to have separate indices.

Descriptions of Phosphorus Index Factors

TRANSPORT FACTORS-

Soil Erosion

Soil Erosion – tons/ac/yr (RUSLE)	tons/ac/yr (Score)	< 1 (0)	1 – 3 (1.5)	4 – 6 (3.0)	7 – 15 (6.0)	> 15 (12.0)
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This factor includes both sheet and rill and wind erosion. Irrigation-induced erosion is addressed in other factors. Sheet and rill erosion is the detachment of soil particles by raindrop impact, surface runoff from rainfall, and snowmelt runoff on frozen or thawing soil. Wind erosion is the detachment and transport of soil particles by wind forces. Sheet and rill erosion rates are estimated with the Revised Universal Soil Loss Equation (RUSLE). Wind erosion rates are estimated using the Wind Erosion Equation (WEQ). These soil loss models predict long-term average erosion rates, over the entire crop rotation, in tons of soil loss per acre per year. They do not predict sediment transport and delivery to a water body. The prediction models are used in the Phosphorus Index to quantify the movement of soil, thus potential for sediment and attached phosphorus transport on a slope or unsheltered distance toward a water body.

Soil Erosion from Sprinkler Irrigation

Soil Erosion from Sprinkler Irrigation	Criteria (Score)	No sprinkler irrigation (0)	Application rate < infiltration rate OR No visible runoff at field borders (0.75)	Application rate = infiltration rate OR Little to no visible runoff at field borders (1.5)	Application rate > infiltration rate OR Visible runoff at field borders (3.0)	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present. (6.0)
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This factor is evaluated by comparing the application rate of the sprinkler irrigation system (inches of water per hour) with the infiltration rate of the soil. A visual assessment of runoff and soil erosion caused by irrigation water is also conducted to assign a *Phosphorus Loss Rating* to this factor.

Runoff Class

Runoff Class	Criteria (Score)	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	(8.0)
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The *runoff class* is determined from the *hydrologic group* assigned to the soil map units in a field, and the average slope gradient. *Hydrologic groups* are group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. (National Soil Survey Handbook, Part 618.35).

Flooding Frequency Class

Flooding Frequency Class	Criteria (Score)	None or very rare (0)	Rare (0.75)	Occasional (1.5)	Frequent (3.0)	Very Frequent (6.0)
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Flooding is the temporary covering of the soil surface by flowing water from any source, such as streams overflowing their banks, runoff from adjacent or surrounding slopes, inflow from high tides, or any combination of sources. Floodwaters can carry both sediment-bound and dissolved P into surface waters. Estimates of flooding frequency are based on the interpretation of soil properties and other evidence gathered during soil survey fieldwork. Flooding frequency is defined as the number of times flooding occurs over a period of time and is expressed as a class.

Distance to Perennial Surface waters / Buffer Widths

Distance to Perennial Surface Waters / Buffer Widths	Criteria (Score)	> 500 feet OR buffer > 30 ft. wide (or meets NRCS standards) next to surface waters (0)	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters (0.75)	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters (1.5)	100 – 199 feet AND buffer < 10 ft. wide next to surface waters (3.0)	< 100 feet AND No buffer next to surface waters (6.0)
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This factor considers the flow distance from the edge of the field to the closest perennial surface water, which may include streams, lakes, and those irrigation and drainage ditches that contain water year around. It also considers the presence and width of a vegetated buffer adjacent to that surface water. The closer the edge of the field is to surface water, the higher the potential risk of P transport to that water.

Vegetated buffers are effective in trapping sediment-bound P in runoff water. They are less effective in reducing dissolved P transport. Dissolved P can flow through a buffer and enter surface water. The wider the vegetated buffer, the more effective it will be in reducing total P transport to surface water. Vegetated buffers that are commonly used adjacent to perennial water include filter strips (NRCS Standard 393) and riparian forest buffers (NRCS Standard 391).

Subsurface Drainage

Subsurface Drainage	Criteria (Score)	No Tile Drains (0)	Tile drains present Soil Test P (Bray P1) < 60 ppm (0.5)	Tile drains present Soil Test P (Bray P1) 61 - 140 ppm (1.0)	Tile drains present Soil Test P (Bray P1) 141- 190 ppm (2.0)	Tile drains present Soil Test P (Bray P1) > 190 ppm (4.0)
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Recent research has shown that P can leach through the soil profile, and the risk of leaching is directly related to the soil test P concentration in the soil. The higher the P concentration, the greater the potential for leaching. When subsurface drainage is present, such as perforated pipe tile drains, dissolved and sediment-bound P can enter the drains and be directly transported to surface water at the drain outlet. This factor therefore considers whether tile drains are present in the field, and the soil test P concentration.

SOURCE FACTORS-

Soil Test P

Soil Test P – ppm (Bray P1)	(Score)	Soil Test P – $40 \times 0.10 = (\quad)$ Assign 0 points if Soil Test P < 40 ppm
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A soil sample from the site is necessary to assess the level of "available P" in the surface layer of the soil. Available P is the level customarily reported in a soil test analysis by commercial soil test laboratories. The soil test level for "available P" does not ascertain the total P in the soil. It does however, give an indication of the amount of total P that may be present because of the general relationship between the forms of P (organic, adsorbed, and labile) and the dissolved P available for crop uptake. The higher the soil test P level, the greater the risk of P transport to surface waters.

The depth at which soil samples are collected for available P analysis should be determined from the fertilizer or nutrient management guides for the crops being grown on the site. These guides are available from Oregon State University or Washington State University Cooperative Extension Services. Sampling depth is normally 0 to 6 inches or 0 to 12 inches for cultivated crops, and generally corresponds to typical depth of primary tillage. For established pastures that have not been cultivated for many years, a sample depth of 0 to 3 inches may be appropriate because P tends to be concentrated near the surface when the soil is not cultivated.

In eastern Oregon, soil test P levels should be determined using the Olsen (sodium bicarbonate) extraction method. In western Oregon, the Bray P1 extraction method should be used.

P Fertilizer Application Rate

Commercial P Fertilizer Application Rate	(Score)	lbs/ac $P_2O_5 \times 0.02 = (\quad)$
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The P fertilizer application rate is the amount of commercial phosphate fertilizer (P_2O_5), in pounds per acre per year, which is applied to the soil. This factor does not include phosphorus from organic sources. The higher the application rate, the greater the risk of P transport to surface waters.

Commercial P Fertilizer Application Method

Commercial P Fertilizer Application Method	Criteria	None Applied	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September	Incorporated within 5 days of application from October through February OR Surface applied March through August	Incorporated more than 5 days after application OR Surface applied September through October	Surface applied November through February
	(Score)	(0)	(1.0)	(2.0)	(4.0)	(8.0)

The manner in which P fertilizer is applied to the soil, and the length of time that fertilizer remains on the soil surface will affect potential P movement. Banding or incorporating P fertilizer into the soil reduces the risk of P transport. P fertilizer that is surface applied, and not incorporated into the soil, has a higher risk of transport to surface water.

The time of year that P fertilizer is applied also affects the risk of P movement. P fertilizer that is applied during the winter and early spring in Western Oregon, when heavy or prolonged precipitation events are likely to occur, creates a higher risk of P transport than applications made from mid-spring to early fall. In Eastern Oregon, there is a greater risk of P transport when fertilizer is surface applied and not incorporated prior to irrigation or winter precipitation.

Organic P Source Application Rate

Organic P Source Application Rate	(Score)	lbs/ac P_2O_5 x 0.02 = ()
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The organic P source application rate is the amount of phosphate (P_2O_5) contained in organic material that is applied to the soil, in pounds per acre per year. An analysis of the organic material is desirable to determine the phosphorus content. When an analysis of the organic material is not available, values from the Animal Waste Management Field Handbook can be used. The higher the application rate, the greater the risk of P transport to surface waters.

Organic P Source Application Method

Organic P Source Application Method	Criteria	None Applied	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September	Incorporated within 5 days of application from October through February OR Surface applied March through August	Incorporated more than 5 days after application OR Surface applied September through October	Surface applied November through February
	(Score)	(0)	(1.0)	(2.0)	(4.0)	(8.0)

The manner in which organic P material is applied to the soil, and the length of time it remains on the soil surface will affect potential P movement. Injecting or incorporating organic P sources into the soil reduces the risk of P transport. Organic P material that is surface applied, and not incorporated into the soil, has a higher risk of transport to surface water.

The time of year that organic P is applied also affects the risk of P movement. Organic P that is applied during the winter and early spring in western Oregon, when heavy or prolonged precipitation events are likely to occur, creates a higher risk of P transport than applications made from mid-spring to early fall. In Eastern Oregon, there is a greater risk of P transport when organic material is surface applied and not incorporated prior to irrigation or winter precipitation.

Appendix F

Soil Test Results

DATE: October 14, 2009
 REPORT: S1408 M
 CLIENT: N W A C
 GROWER: VAN BEEK DAIRY FARM
 SAMPLED: TOM THOMSON

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



SOIL ANALYSIS REPORT

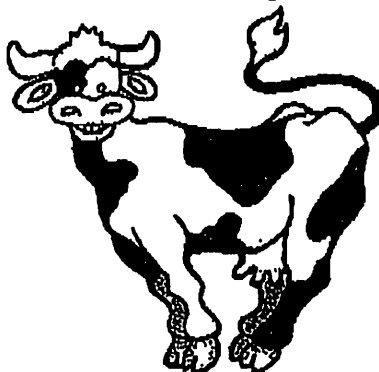
Lab No.	Depth Foot	pH	S.Salt mmhos	O. M. %	P ppm	K ppm	Ca meq	Mg meq	NITROGEN		S ppm	B ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	CEC meq	Na meq	Total Bases	Base Sat. %	SMP Buf.pH	MOISTURE			
									NO3 #/A	NH4 #/A												Total %	Avail. Inches	TKN %	Cl ppm
FIELD: BOYER																									
5768		6.1		3.6	55	261	7.1	1.0											8.8		6.5				
FIELD: GORACKE NE																									
5769		6.3		5.1	45	621	9.3	3.4											14.3		6.7				
FIELD: GORACKE																									
5770		6.7		5.4	70	697	11.1	3.6											16.5		6.8				
FIELD: HOME																									
5771		6.4		5.2	115	817	10.9	4.0											17.0		6.8				
FIELD: HOME NE																									
5772		6.4		5.5	140	931	12.4	4.4											19.2		6.7				
FIELD: SIEVERS																									
5773		6.2		5.5	106	806	7.6	3.6											13.3		6.6				

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

Appendix G

Manure Tests

Van Beek Dairy Farm



26455 McFarland Rd.
Monroe, OR. 97456
Phone: 541-424-5642
Fax: 541-424-5641

Send to: <i>H+R Engineering</i>	From: <i>Martin Van Beek</i>
Attention: <i>Bruce Wilson</i>	Date: <i>10/19/09</i>
Office Location:	Office Location:
Fax Number: <i>503-336-5072</i>	Phone Number:

- ☐ Urgent
- ☐ Reply ASAP
- ☐ Please comment
- ☐ Please Review
- ☒ For your information

Total pages, including cover:

Comments:

Manure liquid analysis are in following ranges:
(numbers are in LBS/1000 gal)

	<u>Nitrogen</u>	<u>Phosphorus</u>	<u>Potassium</u>	
<i>off top -</i>	<i>5.2</i>	<i>1.2</i>	<i>6.8</i>	<i>spring</i>
<i>↓</i>	<i>5.7</i>	<i>1.2</i>	<i>7.1</i>	
<i>↓</i>	<i>7.5</i>	<i>1.3</i>	<i>8.9</i>	
<i>agitation -</i>	<i>8.9</i>	<i>1.3</i>	<i>9.2</i>	<i>fall</i>

DATE: NOVEMBER 18, 2002
REPORT: M7166
CLIENT: N W A C
SOURCE: VAN BEEK DAIRY
SAMPLER: TOM
FAX TO:
TYPE: MANURE (LIQUID)

LAB NO.	SAMPLE I.D.	(As Rec'd) UNIT	Total N	P2O5	K2O	NH4-N	Moisture	Solids
5853	2002	% #/1000 gal.	0.088 7.330	0.034 2.863	0.110 9.131	0.061 5.081	98.18	1.82

DATE: DECEMBER 14, 2001
REPORT: M6099
CLIENT: KAUFFMAN, MARVIN
SOURCE: VAN BEEK DAIRY
SAMPLER: MARTIN VAN BEEK
FAX TO:
TYPE: MANURE (LIQUID)

LAB NO.	SAMPLE I.D.	(As Rec'd) UNIT	Total N	P2O5	K2O	Moisture	Solids
3399	5 / 5	% #/1000 gal.	0.123 10.246	0.044 3.627	0.161 13.446	98.31	1.69
3400	6 / 1	% #/1000 gal.	0.119 9.913	0.041 3.436	0.192 15.955	98.32	1.68
3401	7 / 15	% #/1000 gal.	0.118 9.829	0.034 2.863	0.178 14.851	98.53	1.47
3402	8 / 16	% #/1000 gal.	0.069 5.748	0.023 1.909	0.106 8.830	99.20	0.80