Nutrient Management Plan (NMP)
DRAFT 1/3/18

Farm/Facility: Wadeland South Dairy
c/o Clint Wade
6061 W 900 South
Ogden, UT 84404

Owner/Operator:

On-site Office Latitude/Longitude: 41 14' 56" N; 112 7' 36" W

Plan Period: Jan 2015 – Dec 2019

Certified Conservation Planner

I certify that I am a Natural Resources Conservation Service (NRCS) approved certified planner qualified to review and approve nutrient management plans (NMPs) for compliance with NRCS NMP planning practices and NRCS standard practices. I certify that the NMP developed for the facility submitting this NOI for permit coverage complies with Parts VII, VIII, IX, XI, and XII of the CAFO permit and all applicable NRCS practice standards, including Practice 590 and UMARI. The NMP, if fully implemented, will be in accordance with all NMP permit requirements and all applicable NRCS practice standards for the facility.

I approve the nutrient management plan for the facility seeking permit coverage under this NOI.

Signature: _____ Date: January 8, 2018
Name: Dr. Howard R. Thomas
Title: Conservation Planner TSP Certification Credentials: NRCS TSP

Owner/Operator

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations.

Signature: _____ Date: January 8, 2018
Name: Clint Wade

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Section 1. Background and Site Information

1.1. General Description of Operation

The dairy has 2000 lactating dairy cows with 500 dry cows and 600 replacement heifers located on the main operation.

Storage currently consists of one liquid manure pit holding about 4.5 million gallons of liquid manure. Manure is normally stacked in a bunker and then moved to the composting area for processing. Compost is then used as it matures for bedding of all the animals. Approximately 16,000 tons of composted materials are used for bedding each year.

Excess compost is sold on the local market. This provides an outlet for excess manure to the farmers in the local area.

This plan includes a new dry storage bunker and a 10,400,000 gallon liquid storage lagoon. The new lagoon will be engineered with liner to satisfy NRCS lagoon construction and liner standards. This will allow the operator to store about 6 months manure production during the wet winter months and during spring wet periods.

A manure separator will be installed to remove up to 90% of the solids from the liquid manure before moving into liquid storage. This will reduce the amount of phosphorus applied across the farm and transfer the phosphorus to the dry storage and eventually to the compost for treatment and use as bedding or transfer to sales.

Using these and existing storage the owner will be able to maintain proper levels in each facility and go into each winter with sufficient storage capacity to satisfy the nutrient management requirements of the 590 standards. The dairy is set up to transfer liquid and solid waste with pipelines and concrete lanes to move the accumulated manure into existing storage. The new manure management system will be designed to move the accumulated manure through the separator to the liquid and solid storage facilities nearly automatically.

Section 2. Resource Concerns and Management

2.1 Soil Quality Concerns

Soil Quality Concern	Activities to Address Concern
Ephemeral Gully Erosion	Land leveling and maintenance of slope
Gully Erosion	Irrigation water management
Sheet and Rill Erosion	Irrigation water management, slope maintenance
Nutrients applied from any source must be recorded	All nutrients applied will be tracked and accounted for in the reporting system for the dairy. These include commercial fertilizer, manure, waste water and the nutrients in irrigation water.
Wind Erosion	Cover crops and rough tillage. Cover crops should be planted as soon as practicable after the corn is harvested. The cover crops perform two services for the dairy. protecting the land from wind erosion and removing nutrients from the soil which allows more manure application
Fields with excess nutrients	Crops will continue be planted on these fields (Fields 6 and 7 tract 7407) and no manure or waste water will be applied until the annual soil tests indicate the need for additional nutrients. The NRCS Phosphorus application

Soil Quality Concern	Activities to Address Concern
	guidelines will be followed based on nutrient uptake and crop use.

2.2 Water Quality Concerns

Water Quality Concern	*Activities to Address Concern*
Facility Wastewater Runoff	The driveway has been reconstructed and cleaned so that manure will not be available to enter the drains to the irrigation pond. Track out manure from the dairy will be removed from the concrete when tractors and equipment is required to use the driveway. The drains to the irrigation pond will be plugged and manure management practices adopted to move water and manure from the driveways to the manure storage facilities. The dairy plans to manage the equipment in such a way as to eliminate track out onto the new driveway as much as possible. Dairy barn waste has been rerouted to drain directly into the liquid storage lagoon.
Manure Runoff (From Field Applications)	Dikes will be maintained around fields to prevent accidental manure runoff. In the case where fields require a runoff allowance during the irrigation season, the field drains will not be opened until manure is incorporated and the fields are ready to be watered. These irrigation drains through field dikes will be restored to their winter time integrity before manure is applied in the fall.
Manure Runoff (From Facilities)	Manure storage and transfer systems will be maintained to minimize the opportunity for accidental runoff from the dairy. Dikes have been constructed on the south side of the dairy to prevent accidental discharge to the borrow pit along the railroad. These dikes will need to be reconstructed according to NRCS standards. The berms will be constructed to the height to meet the most prohibitive requirement between 25-year, 24-hour storm event runoff and the inundation from a 100-year flood event. A foot of freeboard will be provided above the required storage level.
Nutrients in Groundwater	Liquid storage lagoons will be constructed according to NRCS standards to prevent leaching to the ground water. Specific design will be accomplished during design and implementation of the overall plan.
Nutrients in Surface Water	Both manure storage and application systems are designed to prevent nutrients from entering surface water. Manure will only be applied in winter months where adequate dikes are in place to prevent surface drainage to water of the state.
Silage Leachate	Berms will be placed around feed storage and waste storage areas, as needed, to prevent runoff. All silage storage units will have properly constructed dikes to prevent the leachate from leaving the storage area.
Excessive Soil Test Phosphorus	Soil tests will be taken each year to monitor the amount of phosphorus in the soil and application of manure will be adjusted to keep the soil phosphorus within limits prescribed in the NRCS Standard for the area. Fields with

Water Quality Concern	*Activities to Address Concern*
	high phosphorus soil tests will be cropped without additional manure or phosphorus application until the phosphorus levels meet NRCS Criteria as stated in NRCS Standard 590.
Run on prevention	The dairy is situated with the road to the north which prevents water from getting to the dairy facilities.
Feed Runoff	Berms will be placed around feed storage as needed to prevent runoff.

2.3 Other Concerns

Soil Quality Concern	Activities to Address Concern
Acres Available for Manure Application	There are sufficient acres for manure application with the new systems required for the nutrient management plan. It is essential that manure be separated and the solids used in bedding or sold from the Dairy as planned.
Improve Dikes	The west side of the dairy and the south end below the compost area has been bordered with dikes temporarily and final construction according to NRCS standards will be included in the implementation process.
Dikes for effective runoff containment	The certified planner has determined with the following calculations that the installed dikes will be adequate until the permanent dikes can be engineered and constructed. The area inside the dike is approximately 7.5 acres which would hold over 4,885,000 gallons of runoff in case of an emergency at a safe depth of under 2 feet. This value is about 4 months' worth of manure storage from the dairy including a 25-year 24 hour storm event.

Section 3. Production Area Effluent Limitation Guidelines

3.1 Production Area Maps

Planned.... The area included in Field # 4 Tract 581 has been designated and is being used as a composting facility for the dry material coming from the dairy liquid separator. Fields 5 and 6 along with the area to the west of Field 5 will be the location of the new waste water Lagoon. The likely engineering option is to build a large 20.4 million gallon lagoon with 15.025 gallons of active storage space and 5.3 million gallons of free board. Since there are more than one option the exact location of the lagoon will not be drawn out on the map. This new lagoon will be in addition to the 2.1 million gallons currently available.

The following maps show the aerial view of the facilities and the field locations for the planned lagoons based on the narrative above.

3.2. Generation, Storage, and Transfer of Manure, Wastewater, and Compost

a. The producer shall remove at least 90 percent of the capacity of the lagoon before the first of December of each year so that the pond will not need to be disturbed during the winter when it is more difficult to control odors when the lagoon surface is disturbed for manure removal. Proper storage capacity for the permittee's required storm event shall be maintained.

i. Manure and process wastewater stored in impoundments shall be removed as necessary to maintain a minimum freeboard of one foot or more, in addition to maintenance of the freeboard needed for the required storm event.

B. Whenever the storage capacity of impoundments is less than the volume required to store runoff from the required storm event specified under Effluent Limitations and Standards in VII, the structures shall be properly dewatered to a level that restores the required capacity and freeboard. During dewatering, land application sites must have water holding capacity and containment to Production Area Effluent Limitations and Standards for All Operations (new and existing), Except New (as of December 4, 2008) Poultry, Swine, or Veal

1. From any point source, there shall be no discharge of manure, litter, compost, process wastewater, or other pollutants into surface waters of the State except when:

a. The production area is properly designed, constructed, operated, and maintained to contain all manure, litter, compost, process wastewater, and other pollutants plus runoff and direct precipitation from the 25-year, 24-hour storm event for the CAFO. Retention, treatment, containment, and storage facilities and structures for manure, litter, compost, process wastewater, and other pollutants must be designed, constructed, operated, and maintained according to applicable practices and standards of Utah Natural Resources Conservation Service, requirements of this permit, and the facility's NMP.

b. The design storage volume is adequate to contain all manure, litter, compost, process wastewater, and other pollutants accumulated considering, at a minimum, the following:

i. the volume of manure, litter, compost, process wastewater, and other

pollutants accumulated during the proper storage period;

ll. normal precipitation less evaporation during the storage period;

111. normal runoff during the storage period;

Iv. the direct precipitation from the 25-year, 24-hour storm for the area;

v. the runoff from the 25-year, 24-hour storm event from the production area;

vl. residual solids in structure;

VIL necessary freeboard to maintain structural integrity (minimum freeboard of one foot); and

v111. a minimum treatment volume, in the case of treatment lagoons.

u. receive process wastewater.

The producer will maintain proper procedures for composting manure for the bedding material to reduce odors and maintain the runoff from the composting area on the property or divert the runoff onto producer owned liquid storage (See Appendix 3, The Composting Process.)

A dike has been constructed around the compost area to prevent overflow into the Railroad right of way. This dike will be included in plans to install new storage and manure handling equipment to implement the NMP. The current dike is adequate until the permanent dike is constructed as part of the NMP implementation. The current dike will be maintained at a height of 3 feet to ensure adequate storage and free board for storm events.

Improve dikes	The west side of the dairy and the south end below the compost area has been bordered with dikes temporarily. Final construction will be according to NRCS standards will be designed and scheduled during implementation. Current dikes need to be upgraded to NRCS standards.
rain water containment	Roof runoff will be diverted to the existing and new ponds as needed to contain waste water in the lagoon facility. The operator chooses to add enough capacity to contain roof water in the lagoon rather than divert it. the addition of this water will be minimal as the separation equipment will remove most of the water from storms and allow it to be reused for flushing the aisles and walkways.
Are dikes adequate for effective runoff containment.	The certified planner has determined with the following calculations that the installed dikes will be adequate until the permanent dikes can be engineered and constructed. The area inside the dike is approximately 7.5 acres which would hold over 4,885,000 gallons of runoff in case of an emergency at a safe depth of under 2 feet. This value is about 4 months' worth of manure from the dairy including a 25 year 24 hour storm event. The dikes at the end of the property provide protection from large storm events

	including the 100-year storm.
Water utilization to reduce water use	It is recommended that the operator reuse flush water to reduce the amount of water in the storage facilities. This water will be reused as it accumulates from the separation centrifuge.

Storage ID	Type of Storage	Pumpable or Spreadable Capacity	Annual Manure Collected	Maximum Days of Storage
Compost Storage Area	Manure composter	50,400 Tons	0 Tons	
Liquid Manure lagoon, Existing	Uncovered watertight structure	4,736,093 Gal	5,944,000 Gal	291
Liquid manure # 2 planned	Uncovered watertight structure	15.4 Million Gal	5,242,000 Gal	727
Dry Stack	Unroofed storage	3,649 Tons	50,592 Tons	26

New storage tank calculations. This tank will be required for storage capacity to be adequate for the number of animals on this dairy. The original storage tank provides approximately 4.8 million gallons of storage. The planned storage lagoon will have a capacity of 20.4 million gallons with sufficient storage for 8 months waste water and the normal rainfall. The lagoon will have the capacity to store the runoff of a 25 year 24 hour storm event. The exact location and design of this lagoon will be incorporated into the CNMP by addition when it is complete and the construction has begun.

The lagoon is being designed with the capacity to hold all water discharged from the dairy facilities. The two ponds will receive all of the process and runoff water from barns and walkways. Most of the water will be run through the centrifuge and reused for flushing.

Planned Manure Exports off the Farm

The Farm will export compost from the dairy to local buyer in Weber County. The buyer markets compost to other farmers and the public. Records of transfer will be kept and maintained on site for five years for periodic inspection. A manure transfer form will used to document any transfers to other parties. The form will contain the following information: 1) the date; 2) amount of manure, compost, or wastewater; and 3) the name and address of the recipient. The dairy will provide the recipients with representative information on the phosphorus and nitrogen content based on monitoring results for manure, compost, or wastewater.

The estimated amount of manure transferred annually is about 200 tons. The estimated amount of compost that will be transferred is about 60 tons. There are no plans to transfer wastewater off-site.

Planned Manure Imports onto the Farm

The dairy does not plan to import manure.

Planned Internal Transfers of Manure

Manure will be transferred to the compost area. The plan calls for approximately 3800 tons per month being transferred to compost from the dry stack storage and periodically from the open calf area. Wet manure during the winter will be separated and the dry material transferred to the compost facilities.

3.3. Animal Mortality Management

Plan for Proper Animal Mortality Management

To decrease non-point source pollution of surface and ground water resources, reduce the impact of odors that result from improperly handled animal mortality, and decrease the likelihood of the spread of disease or other pathogens, approved handling and utilization methods shall be implemented in the handling of normal mortality losses. If on-farm storage or handling of animal mortality is done, NRCS Standard 316, Animal Mortality Facility, will be followed for proper management of dead animals. The following narrative describes how normal animal mortality will be managed in a manner that protects surface and ground water quality

The county land fill will be used to dispose of dead animals within 24 hours of the demise of the animal. I contained vehicle will be used to haul dead animals to the land fill and cleaned as soon as it returns to the dairy with wash water being stored in the waste water lagoon. Employees will be trained to handle animal mortality and procedures to follow in the event of a catastrophic mortality.

3.4 Catastrophic Animal Mortality Management

Refer to NRCS standards, or state guidance, regarding appropriate catastrophic animal mortality handling methods.

The following narrative describes how catastrophic animal mortality will be managed in a manner that protects surface and ground water quality. All national, state and local laws, regulations and guidelines that protect soil, water, air, plants, animals and human health must be followed.

In the case of a catastrophic animal mortality the producer will immediately call the state veterinarian (801-538-7162) and the local health Department (801-399-7114). If there is a potential for a spill the State Emergency spill hotline should also be called (801-536-4123).

Immediate efforts should be made to protect the waters of the state from possible dead animal contamination.

Efforts should be made to remove the dead animals from the premises under the direction of the local health department and the state Veterinarian.

Important! In the event of catastrophic animal mortality, contact the county authority prior to carcass disposal.

3.5. Clean Water Diversion

Run on Issues: The road to the north prevents run on from the upper watershed and the dike around the south end is high enough to prevent back flow into the production area in case of high water. The production area, including the composting area, will be protected from inundation from a 100-year flood event through berms constructed and maintained in compliance with NRCS practice standards. Berms are located at the end of the property below the current lagoon to prevent flood waters from flowing back into the lagoon. The new lagoons

will require adequate berms to prevent flood waters from flowing into the south end of the lagoon. These will be engineered and constructed according to NRCS Standards,

3.6. Direct Animal Contact with Surface Water

Animals do not have contact with surface water. Animals are not grazed and waters of the state do not go through animal confinement areas.

3.7. Chemical Handling

The following measures will be taken to prevent chemicals and other contaminants from contaminating process waste water or storm water storage and treatment systems.

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

Section 4. Nutrient Application and Land Management

4.1. Land Application Methods

Manure will be applied through the sprinkler system by pumping from the appropriate lagoon as conditions dictate. The solid manure will be composted and either sold or used for bedding. Appropriate records of manure transfers off the farm will be kept by the producer using the manure transfer form from the Division of Water Quality

4.2 Calibration of Application Equipment

Equipment calibration method and frequency: NRCS guidelines will be followed to calibrate manure spreading equipment at least annually.

4.3. Narrative Nutrient Management Planning

The cropping system on this dairy is continuous corn silage, plus cover crops. Manure will be applied to fields owned or operated by the dairy based on the following guidelines;

When soil test phosphorus is less than 50 ppm Lagoon wastewater will be applied in the Spring or in the Fall to meet the nitrogen needs of the crop. It may be necessary to make several applications over the field to achieve the proper rate for nitrogen of the crop.

When soil test phosphorus is more than 50 ppm but less than 100 ppm Lagoon wastewater will be applied in the Spring or in the Fall to meet the phosphorus needs of the crop. Nitrogen needs will be met using commercial fertilizer. It may be necessary to make several applications over the field to achieve the proper rate for phosphorus of the crop.

When soil test phosphorus is more than 100 ppm but less than 120 ppm Lagoon wastewater will be applied in the Spring or in the Fall to meet the half the phosphorus needs of the crop.

When soil test phosphorus is more than 120 ppm no manure will be applied to that field.

Compost is used daily for bedding and uses some 16,000 tons of compost per year. Remaining compost is sold to a local processor who sells to other farmers in the area and to the general public.

Cover crops will help reduce the amount of nutrients in the soil and should be considered for all fields. Minimum tillage may be required to take advantage of the timing for planting a cover crop after the corn crop is removed.

In the event of a change in cropping system the annual soil tests will be used to determine manure application amounts for the specific crops grown. Perennial crops will require reference to NRCS Standard 590 for specific manure application and testing guidance. The dairy uses two main rotations, corn for silage with a fall cover crop and a periodic planting of Barley and a cover crop. The choice of the cropping system for any given year depends on spring conditions and the planning dates dictated by spring storms.

Liquid Storage must be no more than 10 percent full as of December 1 in any year. When the design is completed the freeboard indication of depth and for the required water levels for the winter will be marked on the measuring standard in the lagoon.

Compost is used daily for bedding.

4.4. Field Maps

Figure 1 farm fields north of Dairy

United States Department of Agriculture
Farm Service Agency

USDA

N

Digital Orthophotography
Not to Scale

Farm 2562 Tract 685
Wadeland South LLC
Weber

Disclaimer: Wetland identifiers do not represent the size, shape or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact wetland boundaries and determinations, or contact NRCS.

Figure 2 Farm fields 685 1 – 2

United States Department of Agriculture
Farm Service Agency

USDA

N

Digital Orthophotography
Not to Scale

Disclaimer: Wetland identifiers do not represent the size, shape or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact wetland boundaries and determinations, or contact NRCS.

Farm 2562 Tract 581
Wadeland South LLC
Weber

4.5. Soil and Field Information

Field	Soil Survey	Map Unit	Soil Component Name	Surface Texture	Slope Range (%)	OM Range (%)	Drainage	HWT (cm)	Hydro-logic Group	AWC (in.)
Field 1 581-1	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 2 581-2	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 3 581-4	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 4 581-5	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 5 581-6	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 6 685-2	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 7 7407-1	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 8 7407-2	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 9 7407-3	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 10 7407-4	607	MrA	Martini	FSL	0-1%	2-4%	MWell	130	B	6.39
Field 11 7407-5	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 12 7407-6	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 13 7407-7	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 14 7407-8	602	Sy	Sunset	SIL	0-2%	1-3%	MWell	92	C	8.00
Field 15 7407-9	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Fld 16 7407-10	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Fld 17 7407-11	607	So	Syracuse	LFS	0-2%	1-2%	SPoor	106	B	5.87
Fld 18 685-1	607	SkA	Sunset	L	0-1%	2-5%	MWell	130	B	9.57
Field 19 581-3	607	So	Syracuse	LFS	0-2%	1-2%	SPoor	106	B	5.87

Field ID	Total Acres	Spread-able Acres	County	Predominant Soil Type	Slope (%)	Watershed Code	FSA Farm	FSA Tract
Field 1 581-1	9.9	9.9	Weber	SkA (Sunset L)	0.0	160101020000	2226	**581**
Field 2 581-2	2.5	2.5	Weber	SkA (Sunset L)	0.0	160101020000	2226	581
Field 3 581-4	6.7	6.7	Weber	SkA (Sunset L)	0.0	160101020000	2226	581
Field 4 581-5	6.2	6.2	Weber	SkA (Sunset L)	0.0	160101020000	2226	685
Field 5 581-6	5.4	5.4	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 6 685-2	16.9	16.9	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 7 7407-1	15.6	15.6	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 8 7407-2	15.9	15.9	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 9 7407-3	23.0	23.0	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 10 7407-4	22.6	22.6	Weber	MrA (Martini FSL)	0.0	160101020000	2226	7407
Field 11 7407-5	17.1	17.1	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 12 7407-6	25.5	25.5	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 13 7407-7	24.4	24.4	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Field 14 7407-8	14.9	14.9	Weber	Sy (Sunset SIL)	0.0	160101020000	2226	7407
Field 15 7407-9	20.6	20.6	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Fld 16 7407-10	12.7	12.7	Weber	SkA (Sunset L)	0.0	160101020000	2226	7407
Fld 17 7407-11	2.4	2.4	Weber	So (Syracuse LFS)	0.0	160101020000	2226	7407
Fld 18 685-1	4.9	4.9	Weber	SkA (Sunset L)	2.0	160101020000	2226	685
Field 19 581-3	6.4	6.4	Weber	So (Syracuse LFS)	0.0	160101020000	2226	581

4.6. Nitrogen and Phosphorus Risk Analyses

Utah Phosphorus Index

Field	Crop Year	Winter Application Total	Non-Winter Application Total	P Index w/o P Apps	P Index w/ P Apps	P Loss Risk
Field 1 581-1	2015	25.0	31.0	23.0	31.0	Low
Field 1 581-1	2016	25.0	23.5	23.0	23.5	Low
Field 1 581-1	2017	25.0	31.0	25.0	25.0	Low
Field 1 581-1	2018	25.0	25.0	25.0	25.0	Low
Field 1 581-1	2019	19.0	19.0	17.0	19.0	Low
Field 2 581-2	2015	28.0	28.0	26.0	28.0	Low
Field 2 581-2	2016	28.0	26.5	26.0	26.5	Low
Field 2 581-2	2017	28.0	28.0	28.0	28.0	Low
Field 2 581-2	2018	28.0	28.0	28.0	28.0	Low
Field 2 581-2	2019	28.0	28.0	26.0	28.0	Low
Field 3 581-4	2015	28.0	26.5	26.0	26.5	Low
Field 3 581-4	2016	28.0	26.5	26.0	26.5	Low
Field 3 581-4	2017	28.0	28.0	28.0	28.0	Low
Field 3 581-4	2018	28.0	28.0	28.0	28.0	Low
Field 3 581-4	2019	28.0	28.0	26.0	28.0	Low
Field 4 581-5	2015	22.0	22.0	20.0	22.0	Low
Field 4 581-5	2016	28.0	26.5	26.0	26.5	Low
Field 4 581-5	2017	28.0	28.0	28.0	28.0	Low
Field 4 581-5	2018	28.0	28.0	28.0	28.0	Low
Field 4 581-5	2019	28.0	28.0	26.0	28.0	Low
Field 5 581-6	2015	28.0	28.0	26.0	28.0	Low
Field 5 581-6	2016	28.0	26.5	26.0	26.5	Low
Field 5 581-6	2017	28.0	28.0	28.0	28.0	Low
Field 5 581-6	2018	28.0	28.0	28.0	28.0	Low
Field 5 581-6	2019	28.0	28.0	26.0	28.0	Low
Field 6 685-2	2015	28.0	28.0	26.0	28.0	Low
Field 6 685-2	2016	28.0	26.5	26.0	26.5	Low
Field 6 685-2	2017	28.0	28.0	28.0	28.0	Low
Field 6 685-2	2018	28.0	34.0	26.0	34.0	Medium
Field 6 685-2	2019	28.0	28.0	26.0	28.0	Low
Field 7 7407-1	2015	28.0	26.5	26.0	26.5	Low
Field 7 7407-1	2016	28.0	34.0	28.0	28.0	Low
Field 7 7407-1	2017	28.0	28.0	28.0	28.0	Low
Field 7 7407-1	2018	28.0	28.0	26.0	28.0	Low
Field 7 7407-1	2019	28.0	28.0	26.0	28.0	Low
Field 8 7407-2	2015	28.0	26.5	26.0	26.5	Low
Field 8 7407-2	2016	28.0	28.0	28.0	28.0	Low
Field 8 7407-2	2017	28.0	28.0	28.0	28.0	Low

Field	Crop Year	Winter Application Total	Non-Winter Application Total	P Index w/o P Apps	P Index w/ P Apps	P Loss Risk
Field 8 7407-2	2018	28.0	34.0	26.0	34.0	Medium
Field 8 7407-2	2019	28.0	26.5	26.0	26.5	Low
Field 9 7407-3	2015	28.0	26.5	26.0	26.5	Low
Field 9 7407-3	2016	28.0	26.5	26.0	26.5	Low
Field 9 7407-3	2017	28.0	28.0	28.0	28.0	Low
Field 9 7407-3	2018	28.0	26.5	26.0	26.5	Low
Field 9 7407-3	2019	28.0	26.5	26.0	26.5	Low
Field 10 7407-4	2015	28.0	26.5	26.0	26.5	Low
Field 10 7407-4	2016	28.0	28.0	28.0	28.0	Low
Field 10 7407-4	2017	28.0	34.0	26.0	34.0	Medium
Field 10 7407-4	2018	28.0	28.0	26.0	28.0	Low
Field 10 7407-4	2019	28.0	34.0	28.0	28.0	Low
Field 11 7407-5	2015	28.0	26.5	26.0	26.5	Low
Field 11 7407-5	2016	28.0	28.0	28.0	28.0	Low
Field 11 7407-5	2017	28.0	34.0	26.0	34.0	Medium
Field 11 7407-5	2018	28.0	26.5	26.0	26.5	Low
Field 11 7407-5	2019	28.0	28.0	28.0	28.0	Low
Field 12 7407-6	2015	28.0	26.5	26.0	26.5	Low
Field 12 7407-6	2016	28.0	28.0	28.0	28.0	Low
Field 12 7407-6	2017	28.0	28.0	26.0	28.0	Low
Field 12 7407-6	2018	28.0	26.5	26.0	26.5	Low
Field 12 7407-6	2019	28.0	28.0	28.0	28.0	Low
Field 13 7407-7	2015	28.0	26.5	26.0	26.5	Low
Field 13 7407-7	2016	28.0	28.0	26.0	28.0	Low
Field 13 7407-7	2017	28.0	28.0	26.0	28.0	Low
Field 13 7407-7	2018	28.0	26.5	26.0	26.5	Low
Field 13 7407-7	2019	28.0	28.0	28.0	28.0	Low
Field 14 7407-8	2015	34.0	32.5	32.0	32.5	Medium
Field 14 7407-8	2016	34.0	40.0	32.0	40.0	Medium
Field 14 7407-8	2017	34.0	34.0	32.0	34.0	Medium
Field 14 7407-8	2018	34.0	32.5	32.0	32.5	Medium
Field 14 7407-8	2019	34.0	40.0	34.0	34.0	Medium
Field 15 7407-9	2015	28.0	26.5	26.0	26.5	Low
Field 15 7407-9	2016	28.0	28.0	26.0	28.0	Low
Field 15 7407-9	2017	28.0	28.0	26.0	28.0	Low
Field 15 7407-9	2018	28.0	34.0	28.0	28.0	Low
Field 15 7407-9	2019	28.0	28.0	28.0	28.0	Low
Fld 16 7407-10	2015	28.0	26.5	26.0	26.5	Low
Fld 16 7407-10	2016	28.0	28.0	26.0	28.0	Low
Fld 16 7407-10	2017	28.0	26.5	26.0	26.5	Low
Fld 16 7407-10	2018	28.0	34.0	28.0	28.0	Low

Field	Crop Year	Winter Application Total	Non-Winter Application Total	P Index w/o P Apps	P Index w/ P Apps	P Loss Risk
Fld 16 7407-10	2019	28.0	28.0	28.0	28.0	Low
Fld 17 7407-11	2015	31.5	29.5	29.0	29.5	Low
Fld 17 7407-11	2016	31.5	31.0	29.0	31.0	Low
Fld 17 7407-11	2017	31.5	29.5	29.0	29.5	Low
Fld 17 7407-11	2018	31.5	37.0	31.5	31.5	Low
Fld 17 7407-11	2019	31.5	31.0	31.5	31.5	Low
Fld 18 685-1	2015	29.5	28.0	27.5	28.0	Low
Fld 18 685-1	2016	29.5	29.5	27.5	29.5	Low
Fld 18 685-1	2017	29.5	28.0	27.5	28.0	Low
Fld 18 685-1	2018	29.5	29.5	29.5	29.5	Low
Fld 18 685-1	2019	29.5	29.5	29.5	29.5	Low
Field 19 581-3	2015	24.0	22.0	21.5	22.0	Low
Field 19 581-3	2016	24.0	22.0	21.5	22.0	Low
Field 19 581-3	2017	24.0	22.0	21.5	22.0	Low
Field 19 581-3	2018	24.0	22.0	21.5	22.0	Low
Field 19 581-3	2019	24.0	22.0	21.5	22.0	Low

Section 5. Best Management Practices (BMPs)

5.1. Required BMPs

The dairy will implement the following BMPs:

1. Perform weekly visual inspection of all storm water run-on diversion devices, runoff diversion structures, animal waste storage structures and devices channeling process wastewater to impoundments or tanks.

2. Daily visual inspection of water lines, including drinking water or cooling water lines looking for leaks that could create process wastewater that would require containment or treatment of the contaminated leaked water.

3. Place depth markers in all open liquid impoundments and terminal storage tanks to indicate the maximum elevation to maintain capacity necessary to contain the facility's required storm event amount, and in addition provide a one-foot freeboard elevation above the containment freeboard of the facility's required storm event. The depth markers shall be marked at a maximum of one-foot increments.

4. Perform weekly inspections of impoundments and tanks and record the process wastewater elevation levels in the structures as indicated by the depth marker(s).

5. Correct any deficiencies found as a result of daily and weekly inspections as soon as possible, but no later than 30 days after identifying the deficiency, unless:

    a. Factors preventing correction within 30 days have been documented.

    b. Any deficiency where storage structure freeboard or structure integrity is insufficient to contain the required storm event, must be corrected immediately and is not given the 30-day timeframe to correct a problem.

6. Remove accumulations of liquids, solids, and manure from impoundments and tanks as necessary to maintain the capacity of the structures to retain the storage volume for the required storm event.

7. Maintain on-site records documenting the implementation of the required BMPs. All records shall be maintained and retained on-site for five-years from the date they were created and must be made available during inspections by DWQ or authorized agent.

8. The production area will not be located within a 100-year flood plain, unless the production area is protected from inundation damage and discharges that may as a result of 100-year flood waters or flow.

9. There shall be no discharge of manure, litter, or process wastewater from the production area to groundwater with direct hydrologic connection to surface waters of the State.

Section 6. Emergency Response Plan

6.1. Emergency Response Plan

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

Implement the following first containment steps:

a. Stop all other activities to address the spill.
b. Stop the flow. For example, use skid loader or tractor with blade to contain or divert spill or leak.
c. Call for help and excavator if needed.
d. Complete the clean-up and repair the necessary components.
e. Assess the extent of the emergency and request additional help if needed.
f. Employees will be trained on emergency procedures for spills and other emergencies. The training must include actions to be taken in case of a breach in the walls, potential for over topping and any other contingency that may lead to a spill of waste water from the dairy.

Bypass and Upset Response:

a. In case of accidental By Pass the first fields for water spreading and storage will be Fields 4 and 6 in Tract 581.
b. The secondary response will be to push water through the sprinkler system to the fields in tract T-7407. These fields drain away from the water on the east and will provide excellent short term storage for emergencies.
C The pond across the road from the dairy is used in the summer for irrigation and would provide a third level of protection for any BY Pass waters.

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 address the spill and stop the flow.
b. Call for help if needed.
c. If the spill posed a hazard to local traffic, call for local traffic control assistance and clear the road and roadside of spilled material.
d. Contain the spill or runoff from entering surface waters using straw bales, saw dust, soil or other appropriate materials.
e. If flow is coming from a tile, plug the tile with a tile plug immediately.
f. Assess the extent of the emergency and request additional help if needed.

Emergency Contacts

Department / Agency	Phone Number
Fire	801 782-3580
Rescue services	801 629-3580
State veterinarian	801 538-7162
Sheriff or local police	801 629-8221

Nearest available excavation equipment/supplies for responding to emergency

Equipment Type	Contact Person	Phone Number
Backhoe	Clint Wade	

Contacts to be made by the owner or operator within 24 hours

Organization	Phone Number
DWQ (Don Hall)	801 536-4492
County Health Department	801 399-7114
Utah Dept. of Environmental Quality hotline	801-536-4123

Be prepared to provide the following information:

a. Your name and contact information.
b. Farm location (driving directions) and other pertinent information.
c. Description of emergency.
d. Estimate of the amounts, area covered, and distance traveled.
e. Whether manure has reached surface waters or major field drains.
f. Whether there is any obvious damage: employee injury, fish kill, or property damage.
g. Current status of containment efforts.

Section 7. Other Requirements and Practices

7.1. Closure of Facilities or Dairy Operation

Potential closure of facilities	In case the dairy decides to close a storage structure or cease operations entirely at this facility, the permit requires the facility to be de commissioned according to NRCS Standard 360 (Closure of Waste impoundments). The dairy will follow NRCS Standard 360 in the closure of any facilities.

Section 8. Record Keeping

8.1. List of Required Records

Records will be maintained and retained through the duration of this permit. Records will be retained on-site and made available to DWQ or its' agents for inspection.

1) Copy of current NMP
2) Copy of the NOI
3) Copies of annual reports

4) Manure transfer records
5) Records of mortality management
6) Records of overflows or discharges to surface waters of the state with the date, time, and estimated volume of any overflow
7) Land application records on a field-specific basis
   a) Dates of applications
   b) Weather conditions at time of application and 24 hours prior to application
   c) Amount of manure, compost, or wastewater applied to each field
8) Methods and protocols used to sample and analyze soil, manure, compost, and wastewater
9) Results of soil, manure, compost, and wastewater (Potassium, Nitrogen, Phosphorus reported in parts-per-million) samples. Manure must be sampled annually. Compost and wastewater must be sampled annually if land applied or transferred
10) Crops grown and expected and actual crop yield records for each crop, on a field-specific basis
11) Records of daily water line inspections
12) Description for the basis for determining application rates
13) Calculations showing the total nitrogen and phosphorus applied to each field, including sources other than manure, litter, compost, and wastewater
14) Methods used to apply manure, compost, and wastewater
15) Dates of manure application equipment inspections and calibrations
16) Weekly inspections of storage structures and manure, compost, and wastewater impoundments
17) Weekly freeboard readings
18) Records documenting corrective actions. Deficiencies not covered within 30 days must have an explanation of the factors preventing corrective
19) Records, drawings, etc., documenting the current design of any manure. compost, and wastewater storage structures, including volume for solids accumulation, design treatment volume, total design volume, and approximate number of days storage capacity.
20) Records of weekly inspections of storm water run-on diversion devices, Animal waste storage structures, and devices channeling process waste water to impoundment tanks.

Section 9. Monitoring and Analytical Methods

9.1 Manure and Soil Sampling Frequency

1) Manure sampling frequency: Manure samples will be taken annually to determine the amount of nutrients available to crops. In addition, wastewater and compost will also be sampled annually if land applied or transferred to other persons.
2) Soil testing frequency: Soils will be tested annually for annual crops to determine the amount of manure that can be applied for the next growing cycle. Soils will be sampled at least once every three years for cropland with perennial crops.

9.2 Monitoring Protocols

See Appendix B for sampling protocols.

Section 10. Monitoring Results

10.1 Soil Sampling Results

Year:_____

Field ID	Date Sampled	Nitrogen (N) (ppm)	Total Phosphorus (P2O5) (ppm)	Potassium (K2O) ppm)
Field 1 581-1				
sample #1				
sample #2				
sample #3				
Field 2 581-2				
sample #1				
sample #2				
sample #3				
Field 3 581-4				
sample #1				
sample #2				
sample #3				
Field 4 581-5				
sample #1				
sample #2				
sample #3				
Field 5 581-6				
sample #1				
sample #2				
sample #3				
Field 6 685-2				
sample #1				
sample #2				
sample #3				
Field 7 7407-1				
sample #1				
sample #2				
sample #3				
Field 8 7407-2				
sample #1				
sample #2				
sample #3				
Field 9 7407-3				
sample #1				
sample #2				
sample #3				
Field 10 7407-4				
sample #1				
sample #2				
sample #3				
Field 11 7407-5				
sample #1				
sample #2				
sample #3				

Field ID	Date Sampled	Nitrogen (N) (ppm)	Total Phosphorus (P2O5) (ppm)	Potassium (K2O) ppm)
Field 12 7407-6				
sample #1				
sample #2				
sample #3				
Field 13 7407-7				
sample #1				
sample #2				
sample #3				
Field 14 7407-8				
sample #1				
sample #2				
sample #3				
Field 15 7407-9				
sample #1				
sample #2				
sample #3				
Fld 16 7407-10				
sample #1				
sample #2				
sample #3				
Fld 17 7407-11				
sample #1				
sample #2				
sample #3				
Fld 18 685-1				
sample #1				
sample #2				
sample #3				
Field 19 581-3				
sample #1				
sample #2				
sample #3				

10.2 Compost Sampling Results

Year:_____

Sample Location	Date Sampled	Nitrogen N (ppm)	Total Phosphorus P2O5 (ppm)	Potassium K2O (ppm)

10.3 Wastewater Sampling Results

Year:_____

Sample Location	Date Sampled	Nitrogen N (ppm)	Total Phosphorus P2O5 (ppm)	Potassium K2O(ppm)

Section 11. References

Animal Waste

Manure Estimated Nutrient Content 3.02e2.xls

Crop Fertilizer Recommendations

"Fertilizer Management for Grass and Grass-Legume Mixtures," Utah State Ext., AG-FG-03, Aug. 2002
http://extension.usu.edu/files/publications/publication/AG-FG-_03.pdf

"Utah Fertilizer Guide," Utah State Extension, AG 431, 1993
http://extension.usu.edu/files/publications/publication/AG_431.pdf

Manure Application Setback Features/Distances

Waste Utilization Standard 633
http://efotg.nrcs.usda.gov/references/public/UT/633UtOct03.pdf

Manure Nutrient Availability

Manure Estimated Nutrient Content spreadsheet, version 3.0e2

Phosphorus Assessment

Utah Manure Application Risk Index (UMARI)
http://efotg.nrcs.usda.gov/references/public/UT/Umari.pdf

Appendix A Utah Nutrient Management Standard 590 June 2013

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE

- To budget, supply, and conserve nutrients for plant production.
- To minimize agricultural nonpoint source pollution of surface and groundwater resources.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical, and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied. This standard does not apply to one-time nutrient applications to establish perennial crops.

CRITERIA

General Criteria Applicable to All Purposes

A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

Enhanced efficiency fertilizers, used in Utah must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by

Robert L. Hougaard Utah Department of Agriculture and Food 350 N. Redwood Rd. PO Box 146500 Salt Lake City, UT 84114-6500 Phone: (801) 538-7187 who is the State fertilizer control official, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

For nutrient risk assessment policy and procedures see Title 190, General Manual (GM), Part 402, Nutrient Management, and Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation.

To avoid salt damage, the rate of applied nitrogen and potassium in starter fertilizer must be consistent with Utah State University guidelines; The Utah Fertilizer Guidehttp://extension.usu.edu/files/publications/publication/AG_431.pdf Page 23. The NRCS-approved nutrient risk assessment for nitrogen must be completed on all source protection zones identified by the State of Utah Department of Environmental Quality Division of Drinking Water. NRCS Field offices have access to this GIS database layer . Contact Ryan Pierce at NRCS for specific maps and updates.

The NRCS-approved nutrient risk assessment for phosphorus must be completed when:

- phosphorus application rate exceeds Utah State University fertility rate guidelines for the planned crop(s), or
- the planned area is within a phosphorus- impaired watershed (contributes to 303d-listed water bodies), or
- where NRCS and the State of Utah Division of Water Quality have not determined specific conditions where the risk of phosphorus loss is low.

A phosphorus risk assessment will not be required when the State NRCS, with concurrence of the State of Utah Division of Water Quality, has determined specific conditions where the risk of phosphorus loss is low. These fields must have a documented agronomic need for phosphorus; based on soil test phosphorus (STP) and Utah State University nutrient recommendations. When Nutrient Management 590 is planned, all fields will be rated using Utah's Manure Application Risk Index UMARI.

On organic operations, the nutrient sources and management must be consistent with the USDA's National Organic Program.

Areas contained within minimum application setbacks (e.g., sinkholes, wellheads, gullies, ditches, or surface inlets) must receive nutrients consistent with the setback restrictions listed in the Utah Manure Application Risk Index.

Applications of irrigation water must minimize the risk of nutrient loss to surface and groundwater.

Soil pH must be maintained in a range that enhances an adequate level for crop nutrient availability and utilization. Refer to Utah Fertilizer Guide: http://extension.usu.edu/files/publications/publication/AG_431.pdf**Soil, Manure, and Tissue Sampling and Laboratory Analyses (Testing).**

Nutrient planning must be based on current soil, manure, and (where used as supplemental information) tissue test results developed in accordance with Utah State University guidance, or industry practice.(reference material – list here

Current soil tests are those that are no older than one year for annual crops or 3 years for perennial crops, The area represented by a soil test must be that acreage recommended by Utah State University.

Where a conservation management unit (CMU) is used as the basis for a sampling unit, all acreage in the CMU must have similar soil type, cropping history, and management The soil and tissue tests must include analyses pertinent to monitoring or amending the annual nutrient budget, e.g., pH, electrical conductivity (EC) and sodicity where salts are a concern, soil

organic matter, phosphorus, potassium, or other nutrients and test for nitrogen where applicable.

Guidelines from the Utah Fertilizer Guide will be used for sampling http://extension.usu.edu/files/publications/publication/AG_431.pdf.

Soil test analyses must be performed by laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP) under the auspices of the Soil Science Society of America (SSSA) and NRCS, or other NRCS-approved program that considers laboratory performance and proficiency to assure accuracy of soil test results NAPT can be found here:

http://www.naptprogram.org/about/participants

Nutrient values of manure, organic by-products and biosolids must be determined prior to land application.

Manure analyses must include, at minimum, total nitrogen (N), ammonium N, total phosphorus (P) or P_2O_5, total potassium (K) or K_2O, and percent solids, or Utah State University guidance regarding required analyses.

Manure, organic by-products, and biosolids samples must be collected and analyzed at least annually, or more frequently if needed to account for operational changes (feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. If no operational changes occur, less frequent manure testing is allowable where operations can document a stable level of nutrient concentrations for the preceding three consecutive years, unless federal, State, or local regulations require more frequent testing.

Samples must be collected, prepared, stored, and shipped, following Utah State University guidance or industry practice.

When planning for new or modified livestock operations, acceptable "book values" recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and Utah State University, or analyses from similar

operations in the geographical area, may be used if they accurately estimate nutrient output from the proposed operation.
Manure testing analyses must be performed by laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program (MTLCP) under the auspices of the Minnesota Department of Agriculture, http://www2.mda.state.mn.us/webapp/lis/manurelabs.jsp
or other NRCS- approved program that considers laboratory performance and proficiency to assure accurate manure test results.
Nutrient Application Rates.
Planned nutrient application rates for nitrogen, phosphorus, and potassium must not exceed Utah State University guidelines or industry practice when recognized by the university.
At a minimum, determination of rate must be based on crop/cropping sequence, current soil test results, realistic yield goals, and NRCS- approved nutrient risk assessments.
If the land-grant university does not provide specific guidance that meets these criteria, application rates must be based on plans that consider realistic yield goals and associated plant nutrient uptake rates.
Realistic yield goals must be established based on historical yield data, soil productivity information, climatic conditions, nutrient test results, level of management, and local research results considering comparable production conditions.
Estimates of yield response must consider factors such as poor soil quality, drainage, pH, salinity, etc., prior to assuming that nitrogen and/or phosphorus are deficient.
For new crops or varieties, industry- demonstrated yield, and nutrient utilization information may be used until Utah State University information is available.
Lower-than-recommended nutrient application rates are permissible if the grower's objectives are met.
Applications of biosolids, starter fertilizers, or pop-up fertilizers must be accounted for in the nutrient budget.
Nutrient Sources.
Nutrient sources utilized must be compatible with the application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.
Nutrient Application Timing and Placement.
Timing and placement of all nutrients must correspond as closely as practical with plant nutrient uptake (utilization by crops), and consider nutrient source, cropping system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment results.
Nutrients must not be surface-applied if nutrient losses offsite are likely. This precludes spreading on:

- frozen and/or snow-covered soils, and
- when the top 2 inches of soil are saturated from rainfall or snow melt.

Exceptions for the above criteria can be made for surface-applied manure when the Utah Manure Application Risk Index is used and the risk is "Low". Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

Planners must use the current Utah Manure Application Risk Index.
When there is a high risk of transport of nutrients, conservation practices must be coordinated to avoid, control, or trap manure and nutrients before they can leave the field by surface or subsurface drainage (e.g., tile). The number of applications and the application rates must also be considered to limit the transport of nutrients to tile drains.
Nutrients must be applied with the right placement, in the right amount, at the right time, and from the right source to minimize nutrient losses to surface and groundwater. The following nutrient use efficiency strategies or technologies must be considered:

- slow and controlled release fertilizers
- nitrification and urease inhibitors
- enhanced efficiency fertilizers
- incorporation or injection
- timing and number of applications
- soil nitrate and organic N testing
- coordinate nutrient applications with optimum crop nutrient uptake

- Corn Stalk Nitrate Test (CSNT), Pre-Sidedress Nitrate Test (PSNT), and Pre-Plant Soil Nitrate Test (PPSN)
- tissue testing, chlorophyll meters, and spectral analysis technologies
- other land-grant university recommended technologies that improve nutrient use efficiency and minimize surface or groundwater resource concerns.

Additional Criteria Applicable to Properly Utilize Manure or Organic By-Products as a Plant Nutrient Source

When manures are applied, and soil salinity is a concern, salt concentrations must be monitored to prevent potential crop damage and/or reduced soil quality.
The total single application of liquid manure:

- must not exceed the soil's infiltration or water holding capacity
- be based on crop rooting depth
- must be adjusted to avoid runoff or loss to subsurface tile drains.

Crop production activities and nutrient use efficiency technologies must be coordinated to take advantage of mineralized plant-available nitrogen to minimize the potential for nitrogen losses due to denitrification or ammonia volatilization.
Nitrogen and phosphorus application rates must be planned based on risk assessment results as determined by the Utah Manure Application Risk Index.

- Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass, not to exceed Utah State University recommendations.

Manure may be applied at a rate equal to the recommended phosphorus application, or estimated phosphorus removal in harvested plant biomass for the crop rotation, or multiple years in the crop sequence at one time. When such applications are made, the application rate must not exceed the acceptable phosphorus risk assessment criteria, must not exceed the recommended nitrogen application rate during the year of application or harvest cycle, and no additional phosphorus must be applied in the current year and any additional years for which the single application of phosphorus is supplying nutrients.

Additional Criteria to Protect Air Quality by Reducing Odors, Nitrogen Emissions and the Formation of Atmospheric Particulates

To address air quality concerns caused by odor, nitrogen, sulfur, and/or particulate emissions; the source, timing, amount, and placement of nutrients must be adjusted to minimize the negative impact of these emissions on the environment and human health. One or more of the following may be used:

- slow or controlled release fertilizers
- nitrification inhibitors
- urease inhibitors
- nutrient enhancement technologies
- incorporation
- injection
- stabilized nitrogen fertilizers
- residue and tillage management
- no-till or strip-till
- other technologies that minimize the impact of these emissions

Do not apply poultry litter, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material offsite.

Additional Criteria to Improve or Maintain the Physical, Chemical, and Biological Condition of the Soil to Enhance Soil Quality for Crop Production and Environmental Protection

Time the application of nutrients to avoid periods when field activities will result in soil compaction.
In areas where salinity is a concern, select nutrient sources that minimize the buildup of soil salts.

CONSIDERATIONS

Elevated soil test phosphorus levels are detrimental to soil biota. Soil test phosphorus levels should not exceed State-approved soil test thresholds established to protect the environment.
Use no-till/strip-till in combination with cover crops to sequester nutrients, increase soil organic matter, increase aggregate stability, reduce compaction, improve infiltration, and enhance soil biological activity to improve nutrient use efficiency.
Use nutrient management strategies such as cover crops, crop rotations, and crop rotations with perennials to improve nutrient cycling and reduce energy inputs.
Use variable-rate nitrogen application based on expected crop yields, soil variability, soil nitrate or organic N supply levels, or chlorophyll concentration.
Use variable-rate nitrogen, phosphorus, and potassium application rates based on site-specific variability in crop yield, soil characteristics, soil test values, and other soil productivity factors.
Develop site-specific yield maps using a yield monitoring system. Use the data to further diagnose low- and high-yield areas, or zones, and make the necessary management changes. See Title 190, Agronomy Technical Note (TN) 190.AGR.3, Precision Nutrient Management Planning.
Use manure management conservation practices to manage manure nutrients to limit losses prior to nutrient utilization.
Apply manure at a rate that will result in an "improving" Soil Conditioning Index (SCI) without exceeding acceptable risk of nitrogen or phosphorus loss.
Use legume crops and cover crops to provide nitrogen through biological fixation and nutrient recycling.
Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standard (CPS) Code 592, Feed Management.
Soil test information should be no older than 1 year when developing new plans.
Excessive levels of some nutrients can cause induced deficiencies of other nutrients, e.g., high soil test phosphorus levels can result in zinc deficiency in corn.
Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.
Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in the NRCS' National Nutrient Policy in GM 190, Part 402, Nutrient Management.
Potassium should not be applied in situations where an excess (greater than soil test potassium recommendation) causes nutrient imbalances in crops or forages.
Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling anhydrous ammonia or when dealing with organic wastes stored in unventilated enclosures.
Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.
Nutrient containers should be recycled in compliance with State and local guidelines or regulations.
Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater.
Use conservation practices that slow runoff, reduce erosion, and increase infiltration, e.g., filter strip, contour farming, or contour buffer strips. These practices can also reduce the loss of nitrates or soluble phosphorus.
Use application methods and timing strategies that reduce the risk of nutrient transport by ground and surface waters, such as:

- split applications of nitrogen to deliver nutrients during periods of maximum crop utilization,
- banded applications of nitrogen and/or phosphorus to improve nutrient availability,
- drainage water management to reduce nutrient discharge through drainage systems, and
- incorporation of surface-applied manures or organic by-products if precipitation capable of producing runoff or erosion is forecast within the time of planned application.

Use the agricultural chemical storage facility conservation practice to protect air, soil, and water quality.

Use bioreactors and multistage drainage strategies when approved by Utah State University.
Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.
Avoid applying manure and other by-products upwind of inhabited areas.
Use high-efficiency irrigation technologies (e.g., reduced-pressure drop nozzles for center pivots) to reduce the potential for nutrient losses.

PLANS AND SPECIFICATIONS

The following components must be included in the nutrient management plan:

- aerial site photograph(s)/imagery or site map(s), and a soil survey map of the site,
- soil information including: soil type surface texture, pH, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and/or ponding frequency,
- location of designated sensitive areas and the associated nutrient application restrictions and setbacks,
- for manure applications, location of nearby residences, or other locations where humans may be present on a regular basis, and any identified meteorological (e.g., prevailing winds at different times of the year), or topographical influences that may affect the transport of odors to those locations,
- results of approved risk assessment tools for nitrogen, phosphorus, and erosion losses,
- documentation establishing that the application site presents low risk for phosphorus transport to local water when phosphorus is applied in excess of crop requirement.
- current and/or planned plant production sequence or crop rotation,
- soil, water, compost, manure, organic by-product, and plant tissue sample analyses applicable to the plan,
- when soil phosphorus levels are increasing, include a discussion of the risk associated with phosphorus accumulation and a proposed phosphorus draw-down strategy,
- realistic yield goals for the crops,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the plant production sequence or crop rotation,
- listing and quantification of all nutrient sources and form,
- all enhanced efficiency fertilizer products that are planned for use,
- in accordance with the nitrogen and phosphorus risk assessment tool(s), specify the recommended nutrient application source, timing, amount (except for precision/variable rate applications specify method used to determine rate), and placement of plant nutrients for each field or management unit, and
- guidance for implementation, operation and maintenance, and recordkeeping.

In addition, the following components must be included in a precision/variable rate nutrient management plan:

- Document the geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations.
- Document the nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- Document if a variable rate nutrient or soil amendment application was made.
- Provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all

applications that resulted from use of the precision agriculture process for nutrient or soil amendment applications.

- Maintain the electronic records of the GIS data layers and nutrient applications for at least 5 years.

If increases in soil phosphorus levels are expected (i.e., when N-based rates are used), the nutrient management plan must document:

- the soil phosphorus levels at which it is desirable to convert to phosphorus based planning,
- the potential plan for soil test phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus transport and loss,
- for AFOs, a quantification of manure produced in excess of crop nutrient requirements, and
- a long-term strategy and proposed implementation timeline for reducing soil P to levels that protect water quality,

CERTIFICATION REQUIREMENTS

The data listed below is necessary at a minimum to document that the completed practice meets the standard and specification:

1. How the producer has adopted the management and mitigating practices listed on the UMARI
2. Nutrient application records that show nutrients were applied according to the soil test and/or plant tissue test
3. Soil test and other test results (i.e. plant tissue test, manure test), where appropriate
4. Crop(s) grown and yield records
5. Timing and method of application
6. Map indicating acres treated

OPERATION AND MAINTENANCE

Conduct periodic plan reviews to determine if adjustments or modifications to the plan are needed. At a minimum, plans must be reviewed and revised, as needed with each soil test cycle, changes in manure volume or analysis, crops, or crop management.

Fields receiving animal manures and/or biosolids must be monitored for the accumulation of heavy metals and phosphorus in accordance with land- grant university guidance and State law.

Significant changes in animal numbers, management, and feed management will necessitate additional manure analyses to establish a revised average nutrient content.

Calibrate application equipment to ensure accurate distribution of material at planned rates.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation for the change.

Records must be maintained for at least 5 years to document plan implementation and maintenance. As applicable, records include:

- soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application,
- quantities, analyses and sources of nutrients applied,
- dates, and method(s) of nutrient applications, source of nutrients, and rates of application,

- weather conditions and soil moisture at the time of application; lapsed time to manure incorporation; rainfall or irrigation event,
- crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and crop residues removed,
- dates of plan review, name of reviewer, and recommended changes resulting from the review, and
- all enhanced efficiency fertilizer products used.

Additional records for precision/variable rate sites must include:

- maps identifying the variable application source, timing, amount, and placement of all plant nutrients applied, and
- GPS-based yield maps for crops where yields can be digitally collected.

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Appendix B Utah Soil Testing and measurement Guidelines

Soil and Manure Testing

Directions on collecting soil samples

For nitrogen-based applications, collect separate soil samples at depths of 0 to 12 and 12 to 24 inches. For phosphorus-based applications collect soil samples at a depth of 0 to 12 inches only. A soil probe is the most efficient way to collect samples. Probes are available on loan from County Extension Agents. Collect a composite sample by combining a minimum of 8-10 samples taken randomly throughout a field in a plastic bucket. Mix the samples and send at least one pint to the lab for analysis. More than one composite may be needed for large or highly variable fields. **Example**

Directions on collecting manure samples

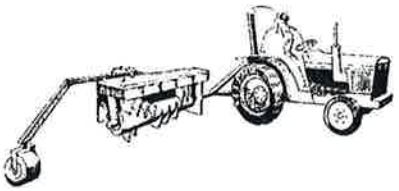
Since manure is a variable material, proper procedures must be followed to ensure a representative sample is collected. For liquids, sample directly from the storage structure, from the outlet pipe where liquid is removed, or from the field using catch cans to collect samples applied through sprinklers. When sampling liquids, collect a minimum of six separate subsamples. Combine the subsamples in a clean bucket, mix well, and transfer approximately one pint of liquid to a clean bottle or other rigid container.

For solids, remove the surface six-inch crust and use an auger or shovel to core into the pile. Take a minimum of six separate sub- samples from around the pile and combine them in a clean bucket. Mix well and transfer approx. one quart to a clean plastic bag. Keep all samples cool until they can be transported to a lab.

Appendix C The Composting Process, USU Extension Bulletin AG-WM-01

UtahStateUniversity
COOPERATIVE EXTENSION

The Composting Process



October

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AG-WM 01

Composting is the aerobic, or oxygen-requiring, decomposition of organic materials by microorganisms under controlled conditions. During composting, the microorganisms consume oxygen (O_2) while feeding on organic matter (Figure 1). Active composting generates considerable heat, and large quantities of carbon dioxide (CO_2) and water vapor are released into the air. The CO_2 and water losses can amount to half the weight of the initial materials, thereby reducing the volume and mass of
the final product.

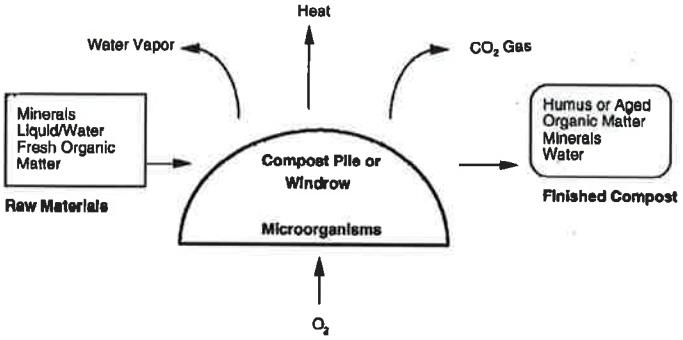

Figure 1. The Composting Process

What Happens During Composting

Composting may begin as soon as the raw materials are mixed together. During the initial stages of the process, oxygen and the easily degradable components of the raw materials are rapidly consumed by the microorganisms.

The temperature of the windrow or pile is directly related to the microorganism activity of the windrow and is a good indicator of what is going on inside. The temperature of the composting materials generally follows a pattern of rapid increase to 120-140°F where it is maintained for several weeks depending on the materials (Figure 2). As active composting slows, temperatures will gradually drop until the compost reaches ambient air temperatures.

A *curing* period usually follows the active composting period. During the curing period, the materials will continue to slowly decompose. Materials continue to break down until the last easily decomposed raw materials are consumed by the

remaining microorganisms. At this point, the compost becomes relatively stable and easy to handle.

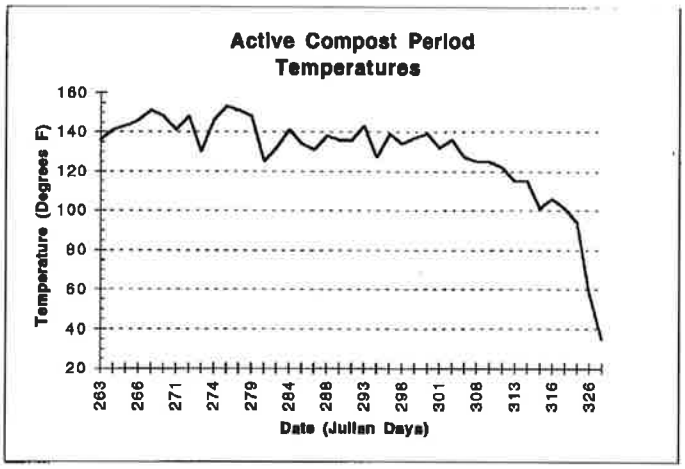

Figure 2. Compost Temperature

Factors Affecting the Composting Process

1. Oxygen and Aeration

Aerobic composting consumes large amounts of oxygen, particularly during the initial stages. If the supply of oxygen is limited, the composting process may turn anaerobic, which is a much slower and odorous process. A minimum oxygen concen- tration of 5% within the pore spaces of the compost is necessary for aerobic composting. Oxygen levels within the windrows or piles may be replenished by turning the materials over with a front-end loader, or by means of mechanical agitation with a special compost turner.

2. C:N Ratio

Carbon (C), nitrogen (N), phosphorous (P), and potassium (K) are the primary nutrients required by the microorganisms involved in composting. Microorganisms use carbon for both energy and growth, while nitrogen is essential for protein production and reproduction. The ratio of carbon to nitrogen is referred to as the C:N ratio. An appropriate C:N ratio usually ensures that the other required nutrients are present in adequate amounts.

Raw materials blended to provide a C:N ratio of 25:1 to 30:1 are ideal for active composting, although initial C:N ratios from 20:1 up to 40:1 consistently give good composting results. For C:N ratios below 20:1, the available carbon is fully utilized without stabilizing all of the nitrogen which can lead to the production of excess ammonia and unpleasant odors. For C:N ratios above 40:1, not enough N is available for the growth of microorganisms and the composting process slows dramatically.

Table 1. Guidelines for composting parameters.

Condition	Reasonable Range*	Preferred Range
Carbon to nitrogen (C:N)ratio	20:1-40:1	25:1-30:1
Moisture content	40-65%**	50-60%
Oxygen concentrations	Greater than 5%	Much greater than 5%
Particle size (diameter in inches)	1/8-1/2	Varies**
pH	5.5-9.0	6.5-8.0
Temperature (°F)	110-150	130-140

Source: On-Farm Composting Handbook, Northeast Regional Agricultural Engineering Service (NRAES-54)
*The recommendations are for rapid composting. Conditions outside of these ranges can also yield successful results.
**Depends on the specific materials, pile size, and/or weather conditions.

3. Moisture

Moisture is necessary to support the metabolic processes of the microbes. Composting materials should be maintained within a range of 40% to 65% moisture. Experience has shown that the composting process becomes inhibited when the moisture content is below 40%. Water displaces much of the air in the pore spaces of the composting materials when the

moisture content is above 65%. This limits air movement and leads to anaerobic conditions. Moisture content generally decreases as composting proceeds; therefore, you may need to add additional water to the compost. As a rule of thumb, the materials are too wet if water can be squeezed out of a handful and too dry if the handful does not feel moist to the touch.

4. Particle Size

The rate of aerobic decomposition increases with smaller particle size. Smaller particles, however, may reduce the effectiveness of oxygen movement within the pile or windrow. Optimum composting conditions are usually obtained with particle sizes ranging from 1/8 to 2 inches average diameter.

5. Temperature

Composting will essentially take place within two tempera- ture ranges known as mesophilic (50-105°F) and thermophilic (over 105°F). Although mesophilic temperatures allow effective composting, experts suggest maintaining temperatures between 110° and 150°. The thermophilic temperatures are desirable because they destroy more pathogens, weed seeds and fly larvae in the composting materials.

If the temperature of your compost pile is in the mesophilic range, try mixing the pile. If the temperature still does not reach the thermophilic range, review the factors described above to determine whether one or more of the factors is limiting the composting process. If you are still unable to increase the compost's temperature, the active stage of composting may be complete.

6. Time

The length of time required to transform raw materials into compost depends upon the factors listed above. In general, the entire decomposition and stabilization of materials may be accomplished within a few weeks under favorable conditions; but, research at Utah State University has shown that 10-14 weeks of active composting for dairy cattle waste is more com- mon. Active composting will change depending upon the amount of natural moisture or water added to the compost, turning frequency, materials being composted, and temperatures reached.

Curing

When windrows or piles no longer reheat after turning, the curing stage begins. The curing stage of compost usually lasts 3 to 4 weeks. Curing is a very important and often neglected part of the composting process. Curing occurs at mesophilic temperatures. The importance of curing increases if the active composting stage is either shortened or poorly managed.

Immature compost can contain high levels of organic acid, a high C:N ratio, and other characteristics which can be damag- ing to crops and plants.

Compost as a soil amendment vs. fertilizer

Most plant nutrients in compost are in an organic form. Although compost is not high in nitrogen, phosphorous, or potassium, (it contains approximately 2% of each) these nutrients are released slowly over a long period of time. Nutrients become available to plant roots at a slower rate with compost compared to inorganic fertilizers, therefore the nutrients are less likely to leach out of the soil. Only a fraction of the nitrogen, phosphorus, and potassium applied as compost is usable by the crop the first year with more becoming avail- able in the years that follow.

The real benefit of adding compost to the soil lies in its ability to increase soil organic matter levels. Research studies at the Connecticut Agricultural Experiment Station[a] have shown that a 1 inch thick layer of leaf compost annually applied and incorporated into the soil over a 12 year period increased the organic matter content from 5.9% to 12.6%. The same studies have shown that the water holding capacity of the soil was increased from 1.3 inches to 1.9 inches of water per foot of soil after seven years of compost applications.

Other Benefits of Compost include:

- Improved manure handling
- Improved land application
- Pathogen destruction
- Excellent soil conditioner
- Possible saleable product
- Weed seed destruction
- Lower risk of pollution problems
- Possible revenue from tipping fees

[a] Maynard, A. A. & Hill, D. E. (1994). Impact of compost on vegetable yields. *Biocycle, 35*(3), 66-67.