

4 Circle Four Farms

**Operating and Maintenance Manual
for
Primary Anaerobic Treatment Lagoon
and
Containment Basin
Waste Systems**

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Jim Webb, MBA
Circle Four Environmental Resources Manager

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**Lagoon Operating
and
Maintenance Manual**

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Lagoon Operating and Maintenance Manual

1.0 INTRODUCTION

- 1.1 This manual satisfies the Utah Department of Environmental Quality, Division of Water Quality (DWQ) requirement for lagoon operation and maintenance as required in Groundwater Discharge Permit No. UGW010002, UGW21005 and UGW010008. This document will be referenced in future issued permits as well as renewed permits as a compliance document for all farm sites. It is a guideline and reference document for the proper operation and maintenance of Circle Four Farms (CFF) anaerobic treatment lagoon systems. This manual outlines the best management practices to be followed by all employees of Circle Four. Employees will be trained to follow and implement the guidelines contained in this manual.
- 1.2 This manual generally applies to all Circle Four Farms sites. Farms that have a Bion waste-handling system or other alternative waste handling will have their own O&M manual specific to their individual systems. However portions of this manual will apply to all waste handling systems, due to the similarity in construction.
- 1.3 The procedures for start-up, normal operating, inspecting, monitoring for proper operation, and repairs to the lagoons are included in this manual.
- 1.4 Requirements for annual analytical testing of Circle Four Farms lagoons are contained in the DEQ Ground Water Discharge Permits.

2.0 LAGOON INSPECTIONS

- 2.1 **General.** The following routine inspections are to be performed at each lagoon site:
 - a. Daily inspections by farm personnel.
 - b. Non-farm personnel monthly inspection by environmental resources.
- 2.1.a. **Daily farm personnel inspections.**

This inspection is designed to be a cursory overview of the farm in order to catch anything that could pose an immediate threat to the environment. Farm personnel should drive or walk the alignment of the waste system piping and inspect the lagoon system. While performing the inspection farm personnel are to observe that:

 - Lagoon Levels have not changed more than a foot since last inspection
 - Crossover Pipe is Flowing or above water line



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- No Broken Clean outs
- No Missing or Unsecured Cleanout Caps
- No Wet Soil Around Pits, Pipes or Lagoon
- No Exposed Drain pipes
- No Whaling of Lagoon Liner
- Recycle Pump Operating Correctly
- Minimal Debris in Lagoon (less than a 16 gallon trash bag full)
- Minimal trash and weeds around barns (less than a 16 gallon trash bag full)
- No spilled feed
- Feed bins and lines are in good working order
- Rodent bait stations are properly secured (daily) and baited (at least monthly)
- Mortalities placed in dumpster at the end of the day

Any item found that could potentially cause a loss of waste containment, or a release of waste to the ground surface or ground water, shall be immediately reported to Circle Four by use of the emergency contact list. Priority shall be given to such items to make repairs to restore the item to proper working order, or measures shall be taken to prevent waste spillage or release from the waste piping and treatment system until such measures can be taken.

2.1.b. Monthly Inspection by non-farm personnel. Circle Four environmental resources personnel shall perform the non-farm personnel monthly inspection. This inspection is to be comprehensive in nature and provides a detailed second person inspection of each waste system. The same items in 2.1.a. are to be inspected. All new or outstanding repairs that need to be made will be documented. All Circle Four sites will be inspected every month. At completion of the inspection, environmental resources shall then compile a report, describing lagoon levels, and any repairs that need to be addressed and prioritized. A work order will be generated for any repairs needed. The work order will allow us to track the needed repairs and ensure their completion.

3.0 LAGOON WATER CHEMISTRY TESTING

3.1 Procedure.

3.1.1 Calibrate pH/ORP and salinity (EC) meter prior to obtaining sample. Calibration of these meters will be done according to the instruction manual for each meter and shall be done using standardized buffer



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solutions. Calibrations will be done at the beginning of each day of sampling.

3.1.2 Measurements. ORP, conductivity, and pH readings should be taken one to two feet below the surface of the lagoon.

Measurements will be taken in one corner of the lagoon. All lagoons should be measured yearly. All measurements will be recorded on the Lagoon Chemistry Field Data Sheet (Appendix A).

3.1.3 Rinse probe after use and store in appropriate solution.

3.2 Records. Keep records of lagoon testing in a safe permanent place where they can be stored, archived, and retrieved for future reference. Transfer data to the overall CFF Sampling and Monitoring Database. The database will be made available to the DWQ when requested.

3.3 Recommended Operational Ranges for Field Test Values. Circle Four is studying the chemical and physical aspects of its lagoons to track trends and determine recommended operational ranges for ORP, pH, and conductivity. Below are the recommended ranges for ORP, pH and conductivity; these ranges are based upon our testing and limited published data. These recommended values are not intended to be a compliance limit but rather to be used as a leading indicator of lagoon functionality.

- ORP results should fall at or below -50 mV.
- The pH value for field lagoon testing should fall above 6.5.
- Conductivity will be tracked to identify trends in ionic concentrations.
- Sludge profiling is also an indicator of proper lagoon operation. Sludge profiling is done according to the approved plan. We will monitor sludge profiling in conjunction with the other recommended values mentioned above.

4.0 OPERATION AND MAINTENANCE PROCEDURES

4.1 General. This section describes start-up, normal operating procedures, inspection response procedures, loss of waste containment procedures, and field sampling and testing response procedures.

4.2 Start-up Procedures. Fresh water should be added to the lagoon before population up to 60 percent of the total treatment volume of the lagoon according to ANSI/ASAE Engineering Practice EP403.3. Otherwise, once the lagoon liner is certified, fresh water will be immediately added through the pits in the barns so that the manure is diluted at least 60 percent. Fresh water will continue to be added until the lagoon reaches the proper seasonal level. This procedure will ensure proper conditions for bacterial growth within the lagoon.

4.3 Normal Operating Procedures. Keys to the proper operation of the system are assurance of proper water levels, development and adherence to a regular pit pull plug schedule to assure uniform loading, assurance of operational pipe and pumping equipment, good housekeeping measures, and good record keeping. The farm leader is responsible to assure compliance with normal operating procedures.

4.3.1 Correct Water Levels. The assurance of maintaining proper water levels in the lagoon will maximize treatment efficiency of hog manure, benefit hog health by providing higher quality recycle water back to the barns, and assures operation within design parameters. Each farm has a specific water balance sheet. The farm leader is to be cognizant of the appropriate water level in their lagoon at all times. Farm Leaders will refer to the water balance sheet, or contact Environmental Resources if they are unsure of appropriate water levels. Water conservation measures are to be implemented if lagoon levels are too high. Supplemental water may be added at the pits inside the barn if lagoon water levels are too low. Supplemental water should be added inside the barn, using the approved hose and backflow prevention device, preferably at a location near the end of the pit, opposite the pull plug.

4.3.2 Pit Pull Plug Schedule. Several pits and pit plugs exist at each farm site. A daily pit pull plug schedule has been developed that will provide a consistent loading rate of nutrients to the lagoon system. The pit pull schedule should allow the maximum number of pits to be pulled and filled each day. When pulling a pit plug, pit wastewater is drained by gravity to the lagoon system. Once a pit is emptied, plugs should be replaced and valves from the recycle system should be opened to refill the pit. Pit plugs will not be left out over night. All pits have an overflow feature that will overflow water to the pipelines to the lagoons when the pit is full. There shall always be at least two valves on the recycle system open at all times. Interruptions in the schedule, such as a broken recycle pump, may occur. Therefore, the pit pull schedule should be floating with no specific day of the week assigned to any pit, so that after interruptions, the rotation of pit changing can resume where it was interrupted.

4.3.3 Pipeline O & M. Gravity pipelines from the barn pits to the lagoons, as well as the recycle system, should be kept open and operational at all times. Take all precautions necessary to keep unwanted debris out of the waste system. Do not allow trash, feed spills, pigs, pig mortalities, or other unwanted debris into the waste system through floor grating or slats. If a noticeable increase in pit drain time is noticed maintenance should be contacted to evaluate and possibly clean out the line to remove any possible debris. Recycle pump motors and shafts should be greased by Circle Four maintenance according to the Circle Four preventative maintenance plan. Assure that caps are securely installed at all cleanout pipes. Obtain assistance from maintenance personnel if an unpreventable or noticed blockage in the pipeline system is detected.

4.3.4 Good Housekeeping Measures. Debris on the lagoon water surface must be removed on a monthly schedule. This keeps the lagoon aesthetically more attractive, keeps debris from clogging the lagoon crossover pipe, and prevents unwanted recycle pump failure due to a plugged intake or debris inside the pump. Upstream prevention to keep debris out of the system is the key; by assuring farm employees do not dispose of garbage, gloves, or other floating debris through slats or grating into the pits. Floating debris on the lagoon surface is to be removed using the aluminum rakes provided at each farm site. Care will be taken to assure that the metal rakes are used so that they will not damage the lagoon liner in any way. Dispose of debris in the on-site farm trash dumpster after removal from the lagoon. An anaerobic lagoon will naturally form a floating scum layer on the surface; this scum layer is beneficial to the lagoon and should not be removed with the debris.

4.3.5 Record Keeping. The monthly Water Usage Report and the Daily Lagoon Inspection report are to be completely filled out. The Water Usage Report is to be submitted by the farm leader to Environmental Resources at the end of each month, and no later than the first Monday of the following month. Environmental Resources will review this report as received. Farm water use, water levels, and current water use strategies will be checked for appropriateness and if not appropriate, farm leaders will be notified of the corrective actions to be taken. Production Team Leaders will also be provided a copy of a summary report showing all farms, and corrective actions that needs to be taken, if any. The Daily Lagoon Inspection Report will be kept in the farm's files.

4.3.6 Average Number of Animals. All farms are designed for a target number of animals, however as with any living system, some variation is to be expected in population numbers based on a seasonal and a



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production-needs basis. The annual average number of animals at all sow farms, the controlling factor in our production system, should be maintained at design limits to assure correct annual lagoon loading rates. All records of site animal populations will be kept on file for review.

4.4 Inspection Response Maintenance. This section describes the inspection response maintenance procedures for items requiring attention, found in the daily inspections, or monthly inspections.

4.4.1 Maintenance items that are non-urgent, but requiring attention can be corrected either by on-farm personnel, or by the maintenance department. If work is to be done by maintenance personnel a work order request form must be filled out and given to data entry. If work is urgent, i.e. waste spillage apparent, contact maintenance immediately according to the emergency action plan. For work that is not urgent and is found during the monthly inspections, Environmental Resources will determine the items that can be repaired by maintenance personnel, or which items need to be addressed by an outside contractor. Environmental Resources shall issue a work order to the internal maintenance personnel for the appropriate items to be repaired. The technician compiling the monthly lagoon inspection report will keep a copy of the inspection in their file box.

All work to be done on the systems shall be performed in such a manner as to bring the waste handling system within specifications of the original construction.

4.4.2 Loss of Waste Containment Procedure. In the event that there is a significant loss of waste containment the procedures described in the Spill Response Manual will be implemented. The DWQ shall be notified verbally within 24 hours of such instances. Following this notification a follow-up letter describing the leakage and the plan for making the correction shall be sent to the DWQ within 5 business days.

4.4.3 Rodent Intrusion. Rodent intrusion is defined as excessive burrowing in a lagoon dike embankment. The procedure to exterminate rodent intrusion shall be to spread rodent poison along the banks of the lagoon. Care will be taken to assure that no poison is accidentally spread into the lagoon. Rodent burrows will be backfilled as appropriate.

4.4.4 Vegetation Control. Vegetation with deep penetrating roots should be killed on sites with clay-lined lagoons. The banks of all clayed lined lagoons will be sprayed with herbicide annually to kill the weeds. Care will be taken to assure that no herbicide is accidentally sprayed into the lagoon.

4.4.5 Erosion to Clay Lined Embankments. Erosion to clay-lined lagoon embankments usually occurs in areas where heavy wave action is present, or where riprap protection is inadequate. In areas where erosion of the embankment is evident, repairs must be made. Repairs include, but are not limited to, installation of bentonite clay chips at the erosion area, and new rip-rap installed over the eroded area at a minimum of 8-inches in thickness, using 2 to 6-inch gradation rock.

4.5 Freeboard Maintenance. Freeboard describes the measurement in elevation difference between the maximum design water level in the lagoon and the top of the dike, where water would overflow if allowed to raise above the freeboard allowance. Freeboard provides space for wave action, excessive storm water accumulation, and for emergency use for lagoon dewatering and temporary storage. All lagoon systems feature at least one primary lagoon, and one secondary lagoon (or containment basin). Each lagoon system has a specific freeboard allowance ranging from 1 foot to 3 feet.

Freeboard in the primary lagoon, in most cases, is controlled automatically by the installed crossover pipe elevation. Water cannot rise past this level, unless the secondary lagoon water level is high enough to back water into the primary lagoon or there is a blockage in the crossover pipe. If there is a few feet of elevation difference between the top of the dikes in the primary and secondary lagoons, it will be impossible for the secondary lagoon to back water up into the primary lagoon.

4.5.1 Minimal Freeboard Maintenance. Minimal freeboard maintenance describes the condition where very little freeboard exists, or lagoon water levels are high. The freeboard in the secondary lagoon (or containment basin) is the water level that needs to be monitored to assure that lagoons do not become too full. Both lagoons should be at maximum level in late spring (May), i.e., the containment basin level is full to the maximum allowable freeboard allowance. In late summer (Aug.-Sept.) the secondary lagoons should be nearly empty due to evaporation, ready to receive water from overflow from the primary during the winter months when evaporation is very low. In the event lagoon water levels exceed the freeboard allowance, reduce water consumption by enacting water conservation measures inside the barns.

4.5.2 Excessive Freeboard Maintenance. Excessive freeboard maintenance describes the condition where lagoon water levels are too low. In no instance should the water level in the primary lagoon be allowed to drop more than one (1) foot below the crossover pipe. Supplemental water may



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be added at the pits inside the barn if lagoon water levels are too low or directly to the lagoon in extreme cases. Where possible, supplemental water should be added inside the barn, using the approved hose and backflow prevention device, preferably at a location near the end of the pit, opposite the pull plug.

APPENDICES

A Lagoon Chemistry Field Data Sheet



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APPENDIX A

Lagoon Chemistry Field Data Sheet

CIRCLE FOUR FARMS

Lagoon Chemistry Field Data Sheet



Farm	Date	Conductivity (mS/cm)	ORP	pH	Notes
41101					
41102					
41103					
41104					
41105					
41106					
41107					
41108					
41201North					
41201South					
41202					
41203					
41204					
41205					
41206					
41207					
41208					
41209					
41210					
41301					
41302					
41303					
41304					
41305					
41306					
41307					
41308					
41309					
41310					
41311					
41312					
41313					
41314					
41315					
41316					
41317					
41318					
41319					
41320					
41321					
41322					
41323					

Farm	Date	Conductivity (mS/cm)	ORP	pH	Notes
42100					
42101					
42102					
42103					
42104					
42105					
42106					
42107					
42108					
42200					
42201					
42202					
42203					
42301					
42304					
42305					
42306					
42307					
42308					
42315					
42316					
49170					

CIRCLE FOUR FARMS

Quarterly Lagoon Chemistry Field Data Sheet



Quarter _____

Farm	Date	Conductivity (mS/cm)	ORP	pH	Temp C	Notes
41106						
41107						
41206						
41207						
41306						
41317						
42101						
42201						
42301						

Quarter _____

Farm	Date	Conductivity (mS/cm)	ORP	pH	Temp C	Notes
41106						
41107						
41206						
41207						
41306						
41317						
42101						
42201						
42301						

Quarter _____

Farm	Date	Conductivity (mS/cm)	ORP	pH	Temp C	Notes
41106						
41107						
41206						
41207						
41306						
41317						
42101						
42201						
42301						

Quarter _____

Farm	Date	Conductivity (mS/cm)	ORP	pH	Temp C	Notes
41106						
41107						
41206						
41207						
41306						
41317						
42101						
42201						
42301						