Preliminary Design Report

Bent Dairy

PARTS OF SECTION 8, T 22S, R 51W, OF THE 6TH P.M., BENT COUNTY, COLORADO

Prepared By

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1.0 Approval and Certification, and Applicability

1.1 Professional Engineers Certification

I attest that this Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of the Colorado Department of Public Health and Environment, and Bent County Planning and Zoning; that I or one of my properly trained and supervised representatives have visited and examined the facility, that procedures for required inspections and testing have been established; and that this plan is adequate for the facility.

Travis Hertneky, PE
2.0 Purpose and Scope

2.1 Project Summary
Bent Dairy is a proposed dairy facility located north of Las Animas, Colorado in Bent County. This preliminary design has been prepared to obtain a Special Use Permit (SUP) from Bent County. This design addresses many of the issues encountered in the planning stages of a project of this nature including generalized layout, physical and social constraints, operation plans such as the nutrient management planning and Federal, State, and County compliance.

2.2 Project Description and Access
The facility will be a complete self-contained milking dairy and on-site heifer replacement feedyard. The project site is located in the South 1/2 of Section 8, Township 22 South, Range 51 West, of the sixth prime meridian. The project site’s planned primary access is located off of lane 14 and consists of a main access used for feed and livestock. A second access will be utilized as a harvest and emergency access, and a third southern access will be utilized for farming and emergency access. One additional access off of lane 15 will be for farming and emergency access. All but the main access will normally be gated and locked except during its use. The accesses will be made available to emergency personnel as necessary.

2.3 Design Objectives
The facility was designed to accommodate the most efficient number of animals possible with the existing physical and social constraints. The constraints taken into account include but are not limited to: physical animal space, existing site topography, site location and proximity to feed sources, livestock harvesting facilities, proximity to neighboring residences, financial constraints, and neighboring land availability for purchase.

2.4 Basis for Design
This facility was designed in accordance with various universities’ research and extension publications, the Natural Resources Conservation Service (NRCS) recommendations and generally accepted best management practices. Publications directly referenced are from Colorado State University, Kansas State University, Texas A&M University, American Society of Agricultural Engineers (ASAE). The facility was also designed in accordance with the current Colorado Department of Public Health and Environment (CDPHE) regulations for Confined Animal Feeding Operation 5-CCR-1002-61.17 and 5-CCR-1002-81.

3.0 Hydrology and Hydraulics
Current regulations require animal feeding operations over 1,000 head, such as this facility, to intercept any stormwater runoff that comes in contact with feed or manure. In Colorado this is typically done with a waste storage pond. The accumulated water is normally evaporated or land applied at agronomic rates to provide only the amount of nutrients that the crop can utilize. In Colorado, it is also required that animal feeding operations of the size of this facility, have a liner installed in the waste storage pond.
These liners can be made of either earthen or man-made materials and must meet a seepage requirement of $1.0 \times 10^{-6}$ cm/sec. Suitable liner material for the proposed waste storage ponds will be determined once an analysis of the existing site conditions is complete.

This waste management system is designed to contain the 25-year-24-hour storm event as determined from the TAPS weather data. The required capacity was determined using the spreadsheet 313Pond.XLS "RECTANGULAR WASTE STORAGE POND DESIGN COMPUTATIONS" developed by NRCS State Conservation Engineer for Colorado, John Andrews. The spreadsheet uses a monthly balance approach accounting for precipitation inputs as well as evaporation and pumped draw-downs during the summer irrigation season for the outputs.

All storm water from the production area will be contained in the proposed storage ponds. All precipitation that does not fall directly on this area will be diverted away from the containment area and will flow into the natural drainages.

3.1 Proposed Facility

The proposed facility consists of one major drainage basin and one sub basin. The northern portions of the site will drain to a stormwater pond located in the middle of the site near the manure separation system. This pond will capture the normal predicted runoff from winter as well as normal rainfall events. In the event of a large storm event this pond will overflow to the larger southern pond which has been designed to have the entire design storm volume contained within the pond. This large southern pond will contain the direct runoff from the entire heifer facility, including runoff from daily precipitation events as well as the design storm runoff from this portion of the facility.

Process water will be generated from the facility during barn cleaning, milking equipment cleaning, freeze protection, and other daily operations. This process water, which is typically higher in nutrient concentration, will be collected and contained in a separate collection and storage system consisting of four earthen settling basins and two process ponds that is independent of the stormwater runoff collection system. Separating out the process water from the stormwater runoff and containing it in a process water pond reduces the risk of higher nutrient concentration in any runoff storage pond discharge.

3.1.a Waste Storage Pond

The design storm is determined to be the 25yr-24hr event for the Las Animas weather station and is equal to 4.2 in. The total contributing watershed is approximately 235 acres. The watershed is specifically broken down into roof area of 21 acres, pond surface area of 31.3 acres and earthen lot area of 183 acres. Using the earthen lot area with an NRCS curve number of 90, the runoff yield is 3.11 in. This corresponds to a total design storm volume from the earthen lot area of 47.3 acre-feet. Additional water yield will come from the impervious area denoted as roof area as well as the pond surface area which will yield and an additional 7.4 ac-ft and 4.2 ac-ft respectively. This sums to a total stormwater requirement of 59 ac-ft necessary to contain the design storm. Additional working volume is set aside for normal precipitation events and accounts for an additional 77 ac-ft between the two stormwater ponds.
Flush water will be collected in collection trenches along the east and west sides of the freestall barn and conveyed to a collection/pump pit at the manure separation area. This will be comingled with process water generated from the cleaning of milking equipment and pumped through separators. This separated water will be re-used to flush the freestall barns and the excess water generated will flow to the earthen sediment basins and eventually the process ponds.

It has been estimated from extensive experience with this type of facility that the water generation will be approximately 144,000 gallons/day. This water will be stored in the process water ponds until it can be appropriately land applied to surrounding crop fields. Typical design standards for process water storage varies across the country, but is consistent that it should span the longest season that you cannot land apply. In this part of Colorado typically facilities are designed for 6 months of winter storage. The proposed storage at this facility nearly doubles that at 11 months.

The ponds are proposed to be lined with either a compacted clay liner or a geomembrane. The embankments include 2' of freeboard with no emergency spillway, except for a single emergency spillway will be constructed in the Southeast corner of the southern stormwater pond and will be the point of potential discharge measurement and sampling as required by CDPHE. It is anticipated that a discharge will only exist during extreme conditions due to the facility design far exceeding the regulatory design standards. In the event of an overflow wastewater will flow from the emergency spillway to the south east and comingle with the storm flows in a natural drainage before eventually flowing into the Fort Lyon Canal.

The system was designed to be pumped regularly during the crop growing season with permanent floating pumps in both ponds. The water level in the southern pond must be kept below the working depth marked on the staff gauge to ensure adequate storage capacity for runoff from the design storm.

3.1.6 Sediment Settling
A mechanical manure separator and earthen sediment basins will facilitate the separation of the process water to remove the majority of sediment and nutrients from the water. The stormwater runoff collection system will also have solids settling capabilities within the sediment basin along the north side of the southern pond. The runoff from the northern area of the facility will have minimal sediment and thus solids settling should not be necessary.

4.0 Geotechnical Design
A detailed subsurface exploration of the project area has been conducted and lab testing of soil samples is currently progressing. Field notes have been reviewed to determine the existence and depth to subsurface hazards. Typical hazards expected include groundwater which was encountered on this site. Groundwater was encountered at various depths with the shallowest encountered at 14ft, and the deepest at 27ft. These depths have been mapped on the site and all excavations have been planned to not interfere with these groundwater lenses. CDPHE animal feeding operation regulations allow construction of wastewater ponds into groundwater if necessary; however to provide extra safety and facilitate easier construction on the site a setback has been observed on all the proposed ponds.
All earthen material used on this project will come from the necessary excavations including the storage ponds. Soils containing high organic matter shall not be used to construct any structures and will only be used as general fill in the lot area. A qualified geotechnical engineer will certify that the installed waste storage pond liner meets the density and moisture requirements outlined for this soil in the final design construction specifications.

5.0 Manure Management

5.1 Manure Generation

The facility proposes to have approximately 5,800 mature cows and approximately 6,300 replacement heifers in the production area of the facility. Manure from all the mature cows will be managed by flushing the freestall barns and nutrients split between separated solids and process wastewater collected in the process water ponds. All manure generated by the heifers will be managed as a solid.

5.2 Land Resources

The dairy in conjunction with its partner entities has many acres on which it can land apply both the wastewater and solid manure to. Wastewater will be plumbed into nearby center pivots and solids will be applied to more distant farmland or gifted to area farmers.

Initial operations will consist of direct plumbing approximately 500 acres to the wastewater dewatering system with the capability to expand to 2,300 acres.

5.3 Proposed Manure and Wastewater Distribution

Nutrient and soil samples will be collected in the future at the facility for annual site-specific nutrient recommendations. However, for planning purposes an average nutrient value has been used for the land application calculations attached in the Appendices. Based on utilizing these average nutrient values, the facility has enough land available for nutrient application of the solid manure and wastewater that will be applied annually at the facility. Solid manure will be composted at the facility and primarily used as bedding. Compost that is not land applied annually or used as bedding will be stored in the future composting area or provided to neighboring farmers.

<table>
<thead>
<tr>
<th>Manure Type</th>
<th>Approximate Annual Generation</th>
<th>Acres for Application (acres)</th>
<th>Predicted Allowable Application per acre (based on avg samples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separator Solids</td>
<td>24,000 tons</td>
<td>2,300</td>
<td>62 tons/ac</td>
</tr>
<tr>
<td>Heifer solids</td>
<td>11,600 tons</td>
<td>2,300</td>
<td>54 tons/ac</td>
</tr>
<tr>
<td>Wastewater</td>
<td>145 ac-ft</td>
<td>2,300</td>
<td>32,000 gallons/ac</td>
</tr>
</tbody>
</table>
6.0 Nuisance Management

The methods presented below will be implemented by the dairy as applicable and necessary to minimize inherent conditions that exist on an animal feeding operation that may be considered a nuisance to others. The management practices described below are industry accepted and identified as effective at minimizing nuisance conditions. The facility intends to be proactive in its approach to minimizing nuisance conditions.

6.1 Pest Control

Insects and rodents are inherent to agricultural operations where typically a good food supply and ideal habitat for breeding and living are located.

In order to manage insects and rodents, the dairy will implement the following practices:

- Minimize Fly Habitat
  - Ensure good pen slope to promote drainage and reduce standing water to minimize ideal breeding conditions.
  - Keep grass and weeds mowed to reduce fly resting places.
  - Compost manure which minimizes pests by reaching temperatures that kill fly larvae.
  - Frequent manure removal from pens.
  - Keep spillage to a minimum when hauling manure.
  - Avoid feed spills and clean up any spills as soon as possible.

In addition to minimizing the habitat for flies to breed and live, the dairy may use fly traps in areas that flies tend to congregate. Parasitic wasps will also be used if necessary to help reduce fly reproduction. Insecticides and other chemicals will only be used when the other practices have failed to minimize the nuisance. Use of insecticides will be carefully considered as these chemicals typically also kill parasitic wasps.

Minimizing feed spills and overall site maintenance will be used for rodent control. Rodent traps and bait will be used as necessary if the other practices have failed to minimize the nuisance.

6.2 Air Quality

Dust and odor are the two primary air quality issues that arise at animal feeding operations. In order to minimize these potential nuisance conditions, the facility will primarily work to balance pen conditions through pen management. When pens, and therefore manure are wet, increased odor can be expected. However, with dry pens there is typically an increase in dusty conditions especially in evenings when animals tend to be more active.

In order to minimize dust at the facility, the dairy will implement the following practices:

- Pen Management
  - Frequent removal of manure from pens. This will also help compact any remaining manure on the pen surface making it less prone to being stirred up into the air as dust.
  - Maintain that compacted manure layer in the pens.
o Stock animals in pens at densities that allow the pen surface to remain moist.
o Keep empty pens to a minimum to reduce wind erosion that occurs in empty, dry pens.
o Pen sizes are being reduced to decrease open pen surface area potentially affected by wind.

During extremely dry conditions when pen management is not sufficient to minimize the nuisance, the dairy may use water trucks to provide moisture for pens and/or facility roads.

In order to minimize odor at the facility, the dairy will implement the following practices:

- Manure Management
  o Frequent removal of manure from pens.
  o Compost manure which reduces odor.
  o Routine pen maintenance so that there is not standing water present. This includes pen scraping as well as harrowing to aid in drying out the pen surface.

6.3 Noise

Machinery including feed trucks, tractors, skid-steers, pen maintenance equipment and more are used as an integral part of an animal feeding operation.

In order to minimize noise at the facility, the dairy will implement the following practices:

- Equipment Maintenance and Operation
  o Regular lubrication and parts replacement on machinery.
  o Operate machinery at lower speeds.