CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

FACT SHEET
ORDER NO. R9-2004-0065
NPDES PERMIT NO. CA0109207

WASTE DISCHARGE REQUIREMENTS
FOR
VAN OMMERING DAIRY
SAN DIEGO COUNTY

1. CONTACT INFORMATION

Regional Water Quality Control Board Contact Person:

Ms. Whitney J. Ghoram
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San Diego, California 92123
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Van Ommering Dairy Contact Person:

Mr. Robert Van Ommering
14950 El Monte Road
Lakeside, California 92040
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2. BACKGROUND

On November 12, 2002, Mr. Robert Van Ommering submitted a Report of Waste Discharge (RWD) for a *National Pollutant Discharge Elimination System* (NPDES) permit for the Van Ommering Dairy, located at 14950 El Monte Road, Lakeside, California. The facility is regulated under Waste Discharge Requirements, Order No. 94-134, for the disposal of dairy waste from a mature milking cow herd size of 480. In the RWD, Mr. Van Ommering indicated that the Van Ommering Dairy has begun an environmental stewardship project that will include an anaerobic digester, freestall barns for the milking cows, and a composting operation. Mr. Van Ommering also requested an increase in herd size to 700 milking cows. The proposed number of animals will classify Van Ommering Dairy as a Concentrated Animal Feeding Operation (CAFO) and requires an NPDES permit.

By letters dated December 6, 2002 and June 13, 2003, this Regional Board deemed Mr. Van Ommering's NPDES application incomplete and requested additional documentation and clarifications. Mr. Van Ommering submitted part of the requested information on February 21, 2003 and the remaining information on February 25, 2004. On February 26, 2004, the Regional Board deemed Mr. Van Ommering's application complete.

3. FACILITY DESCRIPTION

The Van Ommering Dairy has been in operation since 1957 and is situated on approximately 200 acres of land located south of the San Diego River and north of 14950 El Monte Road in Lakeside, California. The dairy is located in the San Diego River Hydrologic Subarea 907.15 of the lower San Diego Hydrologic Area 907.10 of the San Diego Hydrologic Unit 907.00. The dairy is zoned for a maximum of 1,300 cows by San Diego County.

A. CURRENT OPERATION

The current herd size is 485 milking cows, 52 heifers, 151 dry cows, and 96 calves. The cows are kept in six corrals that are located on the northern and northeastern portion of the dairy. The corral area is approximately 10 acres. Adjacent to the corrals is a 5,600 square foot (ft^2) milking barn where most of the wastewater is generated. A 4.5 acre-foot settling basin and a 15.1 acre-foot storage lagoon are located south of the milking barn. Barn wastewater and runoff from corrals, irrigation pastures, and composting areas are diverted to the settling basin where a significant portion of the solids is removed. The majority of the solid manure is hauled offsite. The liquid waste is diverted to the storage lagoon where the water is used for irrigation of approximately eleven acres of double-cropped pasture of Bermuda and Rye grass.

B. PROPOSED IMPROVEMENTS

Mr. Van Ommering proposes changes to the current waste handling system to reduce the overall volume of dairy waste and to reduce pathogens and odors in liquid waste as well as to decrease composting time of solid waste. A registered professional engineer from JB Young & Associates, LTD certified the technical report that describes the new system. The report was submitted on February 25, 2004. RCM Digesters of Berkeley, California designed the anaerobic digester and manure handling system described below.

Mr. Van Ommering plans on building three freestall barns (roofed areas instead of open air corrals), totaling approximately 70,000-ft^2, for housing all milking cows. Manure from the freestall barns will be scraped twice daily to a slurry tank and pumped to a 350,000-gallon plug flow anaerobic digester. The slurry will consist of 12 % total solids for optimal performance. Hot water will heat the slurry inside the digester to 100 degree Fahrenheit, which will speed up the natural production of methane gas from volatile solids contained in the slurry. The methane gas will be used to fuel an engine-generator that will supply the dairy's electrical and hot water needs. It is expected that 28 % of the solids entering the digester will be converted to gas, 22 % will be recovered as solid waste, and 50 % will remain in the liquid.

Manure will spend approximately 24-28 days in the plug flow digester until a screw press separates the liquid from the solids portion. The liquid portion will flow to the storage lagoon and will be used for irrigation. The solids portion will be moved to a compost pad west of the dairy where it will be prepared for sale as soil amendment or reused as bedding material in the freestall barns.

4. DISCHARGE DESCRIPTION

The following section contains general information on animal waste followed by a detailed description of the sources and types of waste generated at the Van Ommering Dairy.

A. GENERAL INFORMATION ON ANIMAL WASTE

Any major concentration of animal waste or waste products is potential site for point source pollution. Problems associated with dairy operations in the San Diego Region include ground water mineralization, the addition of nutrients to groundwater, surface runoff of biodegradable and suspended material, nuisance odors, the addition of nutrients to adjacent surface water streams, and other miscellaneous problems. Dairy wastes contain pollutants that include nutrients, salts, organic matter, metals, and infectious agents. These pollutants are described below:

i. Nutrients

The nutrients of greatest concern are nitrogen and phosphorus. Animal wastes can contribute to nitrogen concentrations in excess of the drinking water standard of 10 mg/L and to phosphorous concentrations in excess of what has been determined to stimulate rapid aquatic algae growth. Excessive levels of nutrients in surface waters can cause algae blooms, fish kills, odors, and increase the turbidity. Nutrients can also leach through the soil. Potential groundwater contamination by nitrates from animal waste can lead to public health concerns if the groundwater is used for drinking water.

ii. Salt

Animal waste contains a high salt concentration. Excess salts, such as potassium and sodium, pass through the animal and remain in the manure. The application of manure or discharges of process wastewater to land at high rates result in discharges of salts that can impact the quality of groundwater and surface waters in the region. Excess potassium and sodium contribute to soil structure deterioration and can also reduce the crop yields.

iii. Organic Matter

Due to the high organic matter in livestock wastewater runoff, oxygen supply typically found in streams or lakes can be rapidly depleted. This can lead to fish kills and severe disruptions of other aquatic life. In addition, nutrients released as organic matter are biodegraded. The

decomposing organic matter may cause color, taste, and odor problems in public or private water systems that depend on surface water sources.

iv. Heavy Metals

Some heavy metals, such as zinc and copper, are present in many animal feeds, which could lead to an increase in metals concentration on agricultural lands were animal waste is being applied. Most of these metals are immobile in soils with a pH of 6.0 to 6.8 and rarely accumulate in crops at levels that present a danger to people or animals consuming the crops.

v. Infectious Agents

Animal waste can carry pathogens to surface waters that might be designated for drinking or swimming. The animal waste can contain bacteria, viruses, and other microorganisms that can infect people and animals and can cause outbreaks of diseases in the aquatic environment.

B. VAN OMMERING DAIRY WASTE

The two major sources of wastewater generated at the Van Ommering Dairy are milk barn wash water and corral runoff. Additional liquid wastes generated at the Van Ommering dairy include runoff from irrigation pasture and composting areas. The proposed freestall barns are expected to generate additional indoor liquid waste. Solid waste at the dairy consists of manure that is collected, composted, and dried.

i. Milk Barn Wash Water

Milk barn wash water is produced from the wash down of cows prior to milking and from the cleaning of the milk barn and the equipment. Cows are milked twice per day at the Van Ommering Dairy, which produces approximately 48,500 gallons per day of wash water waste for the 485 milking cows currently at the Van Ommering Dairy (approximately 100 gallons of wash water per day per cow). Table 1 shows sample results of pollutant concentrations that have been found in milk barn wash water as well as sample results from milk barn wash water at the Van Ommering Dairy, taken August 13, 2003.

Table 1: Milk barn wash water.

CONSTITUENTS	LOW (mg/L) [1]	HIGH (mg/L) [1]	Van Ommering Dairy Sample (mg/L)
Total Dissolved Solids	1,070	2,644	1,900
Suspended Solids	969	2,485	Not tested
Total Nitrogen (as N)	138	648	102
Total Phosphate	17	109	16.2

[1]Staff Report: *Dairy Farm Waste,* CRWQCB San Diego Region, June 1975

After the cows are relocated to the freestall barns, it is expected that the wash water will decrease to 30 gallons per cow per day, since the cows will stay cleaner indoors. Additional indoor wastewater is expected when milking cows are housed inside the freestall barns. An estimated 15 gallons per day per cow of liquid waste is expected. The total wastewater volume for 700 cows, housed in freestall barns, is expected to be around 31,500 gallons per day.

ii. Corral Runoff/ Irrigation Pasture Runoff/ Composting Area Runoff

Corral runoff and composting area runoff is normally produced when rainwater mixes with cow manure inside corrals or on the composting pads. Irrigation pasture runoff can be produced during rainfall and when irrigation land has been over-irrigated. Over-irrigation runoff occurs when the soil is supersaturated and cannot take up any additional moisture. Table 2 gives an overview of the pollutant concentration found in these types of waste.

Table 2: Runoff quality from corrals and manure collection and storage areas.[1]

CONSTITUENTS	LOW (mg/L)	HIGH (mg/L)
Total Dissolved Solids	3,500	22,000
Suspended Solids	13,600	32,100
Total Nitrogen (as N)	64	555
Total Phosphate	13.9	120

[1]Staff Report: *Dairy Farm Waste,* CRWQCB San Diego Region, June 1975

Rainwater from areas that come in contact with, or have the potential to come in contact with, manure will be diverted to the storage lagoon. After construction of the freestall barns, rainwater runoff from areas that have no potential to be contaminated with manure, such as freestall barn roofs and several access roads, will be diverted to an existing clean water diversion channel on the east side of the dairy. Storm water runoff from 24.5 acres of land that is expected, or has the potential, to come into contact with manure will be diverted to the storage lagoon.

iii. Solid Waste

Solid waste from dairy operations is stored at the composting area on the west side of the facility. A small amount of the composted waste (less than 2%; as reported in the 2003 Annual Monitoring Report) is used at the dairy for fertilizing pastureland while the remaining solid waste is taken off-site.

iv. Dairy Waste Calculations

To estimate how much waste is produced at the Van Ommering Dairy, calculations were made with the current herd size of 485 milking cows and with the proposed maximum number of 700 milking cows (see *Attachment I* of this Fact Sheet). The calculations included the reported amount of runoff from a 25-year, 24-hour storm event that would be captured in the storage pond, which would be approximately 1.8 million gallons. The current daily wash water volume

of 50 gallons per day per cow, milked twice daily, was used in calculating the liquid waste generated at the dairy.

With the total waste produced by the current number of milking cows, the 15.1 acre-foot storage pond is adequately sized for the 60-day storage requirement (approximately 86 % of the pond is used). The storage pond capacity cannot support an increase in herd size if the wash water remains at 100 gallons per cow per day. A storage pond of approximately 17 acre-foot is needed for 700 milking cows that produce 100 gallons per day of wastewater.

With the current 485 milking cows, the irrigation land area of approximately 11 acres is adequate. When expanding to 700 milking cows, an irrigation land area of approximately 23 acres would be required. These calculations were based on the hydraulic loading and do not take nitrogen limitations into consideration.

With the proposed new animal facilities and waste treatment system, the 15.1 acre-foot storage lagoon is large enough to accommodate 700 milking cows that produce 30 gallons per day of wastewater plus 15 gallons per day of additional indoor liquid waste generated by keeping the cows in freestall barns (approximately 10 acre-foot is needed).

Based on the calculation above, Mr. Van Ommering must either complete building the new animal facilities and waste treatment system to reduce the waste generate at the dairy or increase the storage pond capacity and irrigation land area to accommodate an increase in herd size before increasing the milking cow herd size above the current 485 milking cows.

5. REQUIREMENTS TO INCREASE HERD SIZE

The Order includes requirements that must be completed before the milking cow herd size can be increased to a maximum of 700 milking cows. The requirements are summarized below:

a. The new animal facility has to be completely constructed and operable prior to increasing the milking cow herd size.

b. A report from a registered engineer certifying the adequacy of the animal facility to comply with this Order has to be submitted and received by this Regional Board prior to increasing the herd size.

c. An inspection of the new facilities has been made by staff of this Regional Board.

d. Mr. Van Ommering has been notified by this Regional Board that an increase in herd size can be initiated.

6. BASIS FOR WASTE DISCHARGE REQUIREMENTS

A. FEDERAL NPDES REGULATIONS

40 Code of Federal Regulations (CFR) Parts 9, 122, 123 and 412 establish regulations and effluent limit guidelines for Concentrated Animal Feeding Operations. 40 CFR Part 122.23 defines a Large Concentrated Animal Feeding Operation (Large CAFO) as any animal feeding operation that has more than 700 mature dairy cows, whether milked or dry. A Medium Concentrated Animal Feeding Operation (Medium CAFO) is defined as having 200 to 699 mature diary cows. The current number of milking cows at the dairy classifies the dairy as a Medium CAFO, while the proposed number of milking cows at the Van Ommering Dairy will classify the dairy as a Large CAFO. Pursuant to the Clean Water Act (CWA), all CAFOs are point sources and are subject to NPDES permitting requirements.

40 CFR Part 122.42 requires all CAFOs to develop a Nutrient Management Plan (NMP). At a minimum, the NMP has to include Best Management Practices (BMPs) and procedures necessary to achieve effluent limitations and standards. The NMP must address the following elements:

i. Ensure adequate storage of manure, litter, all process wastewater, including procedures to ensure proper operation and maintenance of the storage facilities;
ii. Ensure proper management of animal mortalities to ensure that they are not disposed of in a liquid manure, storm water, or process wastewater storage or treatment system that is not specifically designed to treat animal mortalities;
iii. Ensure that clean water is diverted, as appropriate, from the production area;
iv. Prevent direct contact of confined animals with waters of the United States;
v. Ensure that chemicals and other contaminants handled on-site are not disposed of in any manure, litter, process wastewater, or storm water storage or treatment system unless specifically designed to treat such chemicals and other contaminants;
vi. Identify appropriate site specific conservation practices to be implemented, including as appropriate buffers or equivalent practices, to control runoff of pollutants to waters of the United States;
vii. Identify protocols for appropriate testing of manure, litter, process wastewater, and soil;
viii. Establish protocols to land apply manure, litter or process wastewater in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrient in the manure, litter, or process wastewater; and
ix. Identify specific records that will be maintained to document the implementation and management of the minimum elements described in elements (i) through (viii) above.

Order No. R9-2004-0065 contains requirements for the Van Ommering Dairy to develop and implement a NMP within one year after adoption. The NMP must include all of the above requirements.

B. CALIFORNIA CODE OF REGULATIONS

Regulations governing discharges from CAFOs are contained in the Combined State Water Resources Control Board/California Integrated Waste Management Board AB 1220 Regulations (California Code of Regulations), which became effective on July 18, 1997. Chapter 7, Subchapter 2, Article 1, contains requirements for CAFOs.

Waste discharge requirements implement the regulations for confined animal facilities contained in California Code of Regulations, Title 23, Division 3, Chapter 15, Article 6, Sections 2560-2565.

In compliance with the CWA and the California Code of Regulations, this Order prohibits discharges to any surface water bodies, or tributary thereof, unless rainfall events, either chronic or catastrophic, causes an overflow of process wastewater from a facility designed, constructed and operated to contain all process generated wastewaters plus runoff from a 25-year, 24-hour rainfall event.

The major requirements contained in waste discharge requirements for dairies are as follows:

i. Dairies must be designed and constructed to retain all facility wastewater generated, together with all precipitation on, and drainage through manured areas during a 25-year, 24-hour storm.

ii. All precipitation and surface drainage outside of manured areas, including that collected from roofed areas, and runoff from tributary areas during a 25-year, 24-hour storm, shall be diverted away from manured areas, unless such drainage is fully retained.

iii. Retention ponds and manured areas at dairies must be protected from inundation or washout by overflow from any stream channel during 20-year peak stream flows. Existing facilities that are protected against 100-year peak stream flows must continue to provide such protection.

iv. New facilities shall be protected against 100-year peak stream flows.

v. Retention ponds shall be lined with or underlain by soils which contain at least 10 percent clay and not more than 10 percent gravel or artificial materials of equivalent impermeability.

vi. Facility wastewater, collected precipitation and drainage may be discharged to properly operated use or disposal fields or to wastewater treatment facilities approved by this Regional Board.

Order No. R9-2004-0065 contains all the above requirements.

C. WATER QUALITY CONTROL PLAN, SAN DIEGO BASIN (9)

The *Water Quality Control Plan, San Diego Basin (9)* (Basin Plan) was adopted by the Regional Board on September 8, 1994 and approved by the State Board. Subsequent revisions to the Basin Plan have also been adopted by this Regional Board and approved by the State Board. The Basin Plan identifies the following beneficial uses for surface waters of the El Monte Hydrologic Subarea (907.15), where Van Ommering Dairy is located:

i. Municipal and Domestic Supply (potential)
ii. Industrial Service Supply
iii. Water Contact Recreation
iv. Non-Contact Water Recreation
v. Warm Freshwater Habitat
vi. Cold Freshwater Habitat
vii. Wildlife habitat
viii. Preservation of Rare and Endangered Species

The Basin Plan identifies the following beneficial uses for groundwaters of the El Monte Hydrologic Subarea:

i. Municipal and Domestic Supply
ii. Aricultural Supply
iii. Industrial Service Supply
iv. Industrial Process Supply (potential)

In order to protect these beneficial uses, the Basin Plan establishes water quality objectives (for bacterial, physical, chemical, and biological characteristics, and for radioactivity), general requirements for management and quality of waste discharges, discharge prohibitions, and general provisions. The applicable prohibitions of the Basin Plan have been incorporated herein in *Prohibitions A* and as *Attachment A* of Order No. R9-2004-0065.

Order No. R9-2004-0065 does not contain numeric effluent limitations since the Order prohibits discharges of waste to any surface water bodies, or tributary thereof (*Prohibition A.6*). The Order establishes requirements for design and maintenance of retention ponds, which includes requirements on the pond lining to prevent seepage of wastewater into the groundwater.

The monitoring requirements of Order No. 94-134 required annual monitoring of groundwater for total dissolved solids and nitrate. Data collected at the dairy in the last ten years indicates that the groundwater quality objective of 600 mg/l for total dissolved solids in the El Monte Hydrologic Subarea (907.15) is not met. The total dissolved solids concentration in the samples collected from the Van Ommering Well ranged from approximately 850 to 1,100 mg/l.

To provide a better overview of the overall groundwater quality of the underlying aquifer in the El Monte Hydrologic Subarea and to monitor possible impacts on the groundwater from the dairy discharges, Monitoring and Reporting Program No. R9-2004-0065 requires annual

monitoring of the groundwater at the dairy for groundwater elevation, pH, phosphorus, and sodium in addition to total dissolved solids and nitrate.

7. NPDES RATING AND FEES

Pursuant to the *NPDES Permit Rating Worksheet*, the proposed discharge from Van Ommering Dairy was found to have a point score of 0. Pursuant to U.S. EPA guidance, facilities with a point score less than 80 are designated as NPDES Minor dischargers. The Van Ommering Dairy has been classified as an NPDES Minor discharger.

Pursuant to *Title 23, Section 2200* of the California Code of Regulations, the discharge has been identified as having a *Threat to Water Quality and Complexity* (TTWQ/CPLX) rating of 3/C.

The State Board adopted Resolution No. 2003-0064 in September of 2003. The revised fee schedule for CAFOs includes annual fees that are based on the number of animals at the facility. Facilities with 700 to 1,499 mature dairy cattle are required to pay an annual fee of $1,200 plus $222 for the 18.5% Ambient Water Monitoring surcharge for all NPDES permit holders.

8. EFFECTIVE AND EXPIRATION DATES

Order No. R9-2004-0065 becomes effective ten (10) days after its adoption provided the Regional Administrator, U.S. EPA, has no objection. If the Regional Administrator objects to its issuance, this Order shall not become effective until such objection is withdrawn. This Order expires on June 10, 2009.

9. RECISSION OF ORDER NO. 94-134

Order No. R9-2004-0065, when adopted, will rescind Order No. 94-134, *Waste Discharge Requirements for Van Ommering Dairy, San Diego County*.

10. WRITTEN COMMENTS

Interested persons are invited to submit written comments upon these draft waste discharge requirements. Comments should be submitted either in person, during business hours, or by mail to:

John H. Robertus, Executive Officer
Attn: Industrial Compliance Unit
Regional Water Quality Control Board, San Diego Region
9174 Sky Park Court, Suite 100
San Diego, California 92123

To ensure that this Regional Board has the opportunity to fully study and consider written material, comments regarding Order No. R9-2004-0065 should be received in this Regional Board's office no later than 5:00 P.M. on Wednesday, May 26, 2004. Written material submitted after 5:00 P.M. on Wednesday, June 2, 2004 will not be provided to the Regional Board members and will not be considered by this Regional Board. Oral comments will be received during the hearing on June 10, 2004.

11. PUBLIC HEARING

In accordance with 40 CFR 124.10, the RWQCB must issue a public notice whenever NPDES permits have been prepared, and that the tentative permits will be brought before the RWQCB at a public hearing. The public notice has been published in the San Diego Union Tribune newspaper no less than 30 days prior to the scheduled public hearing. Tentative Order No. R9-2004-0065, will be considered by this Regional Board at a public hearing beginning at 9:00 am on June 10, 2004. The location of this meeting is as follows:

Regional Water Quality Control Board
Regional Board Meeting Room
9174 Sky Park Court, Suite 100
San Diego, California 92123

12. ADDITIONAL INFORMATION

For additional information, interested persons may write the following address or contact Ms. Sabine Knedlik of this Regional Board at (858) 467-2725 or by e-mail at *kneds@rb9.swrcb.ca.gov.*

Regional Water Quality Control Board, San Diego Region
Attn: Whitney J. Ghoram
9174 Sky Park Court, Suite 100
San Diego, California 92123

Copies of the applications, NPDES waste discharge requirements, and other documents (other than those that the Executive Officer maintains as confidential) are available at the RWQCB office for inspection and copying according to the following schedule (excluding holidays):

Monday and Thursday:	1:30 pm to 4:30 pm
Tuesday and Wednesday:	8:30 am to 11:30 am
	1:30 pm to 4:30 pm
Friday:	8:30 am to 11:30 pm

An electronic copy of the Fact Sheet and Order can be accessed on the Regional Board website: *http://www.swrcb.ca.gov/rwqcb9/.*

13. REFERENCES FOR WASTE DISCHARGE REQUIREMENTS

The following documents provide the necessary references for the basis of this NPDES permit:

i. Section 40 Code of Federal Regulations, Parts 9, 122, 123, 131, and 412
ii. The Water Quality Control Plan for the San Diego Basin (9) (Basin Plan), 1994
iii. The Clean Water Act; Sections 301, 302, 303, 304, 306, 307, 402, 403, and 405
iv. The California Code of Regulations, Title 23, Division 9
v. Combined State Water Resources Control Board/California Integrated Waste Management Board AB 1220, Titel 27, Division 2
vi. Dairy Farm Waste Staff Report, San Diego Regional Water Quality Control Board, June 1975
vii. Report of Waste Discharge, NPDES Permit Application, Van Ommering Dairy, November 12, 2002

Attachment I to Fact Sheet for
Order No. R9-2004-0065

June 10, 2004

Assumptions and formulas were taken from the Appendix of the April 29, 1986 Memorandum to Ladin H. Delaney from Brian D. Kelley on compliance status of Van Ommering Dairy (file # 08-196.02)

1. Information

Total runoff area (acre) =	10
Irrigation land area (acre) =	11
Irrigation land and manure storage areas (acre) =	24.5
Maximum number of milking cows =	485
Daily (milking barn waste water x2 (gallons/day/cow) =	100
Additional indoor waste from freestalls (gallons/day/cow) =	0
Pond area (acre) =	1.26
Pond volume w/o 2 foot freeboard (acre-foot) =	15.1
Pond storage period (days) =	60
Inches of rain =	4.6

2. Runoff

Manured Runoff (acre-foot) = Total corral area x (inches of rain - 10% inches of rain)
3.45 acre-foot

3. Milking Barn Washwater Volume

Washwater volume (gallons) = Washwater x pond storage period x cows
2,910,000
Washwater volume (acre-foot) = **8.9 acre-foot**

4. Volume of rainfall onto pond

Rain volume onto pond (gallons) = Pond area x inches of rain x 100% of rain (no percolation)
157,333
Rain volume onto pond (acre-foot) = **0.48 acre-foot**

5. Additional indoor waste after freestalls are constructed

Indoor waste (gallons) = Liquid waste x pond storage period x cows
0
Indoor waste (acre-foot) = **0.00 acre-foot**

6. Total Waste from dairy

Total Waste from Dairy (acre-foot) = Corral Runoff + Milk Barn Washwater + Rainfall on pond
= **12.9 acre-foot** with additional indoor waste
= **12.9 acre-foot** without additional indoor waste

7. Pond storage capacity vs total waste

Pond storage capacity w/o 2ft freeboard=	15.1
Total Waste from Dairy =	12.9
% of storage used by total waste =	85 %
% not used =	15 %

8. Required Irrigation Land Area based on Hydraulic Loading

Required irrigation land area (acres) = [12 (Vm) (E)] / (ET - P)
Vm = Estimated annual volume of wastewater produced at dairy (acre-foot)
E = Application efficiency
ET = Annual potential evaportranspiration value
P = Annual precipitation value

Vm = 100 gallons/day/cow x number of cows x 365 days

Vm =	17,702,500	gallons/year
Vm =	54.3	acre-foot
E =	0.75	
ET =	44.4	inches
P =	14	inches

Required irrigation land area (acres) = **16.1 acres**