ENVIRONMENTAL ANALYSIS AND DECISION ON THE NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT (EIS)
Form 1600-1 Rev. 7-2006

Department of Natural Resources (DNR)

Region or Bureau	SCR
Type List Designation	Type II

NOTE TO REVIEWERS: This document is a DNR environmental analysis that evaluates probable environmental effects and decides on the need for an EIS. The attached analysis includes a description of the proposal and the affected environment. The DNR has reviewed the attachments and, upon certification, accepts responsibility for their scope and content to fulfill requirements in s. NR 150.22, Wis. Adm. Code. Your comments should address completeness, accuracy or the EIS decision. For your comments to be considered, they must be received by the contact person before 4:30 p.m., April 29, 2013.

Contact Person:
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Applicant **(a)**: GL Biogas, LLC.

Address: 1900 South Avenue, La Crosse, WI 54601

Title of Proposal: Dane County Manure Handling Facility (Middleton) WPDES Permit

Location: Town of Springfield, Dane County

Township, Range, Section(s): T. 8 N., R. 8 E., Section 33

Applicant **(b)**: Ziegler Dairy, Greg & Cheryl Ziegler

Address: 4985 Church Road, Middleton, WI 53562

Title of Proposal: Ziegler Dairy Expansion WPDES Permit

Location: Town of Springfield, Dane County

Township, Range, Section(s): T. 8 N., R. 8 E., Section 33

PROJECT SUMMARY

1. Brief overview of the proposal including the DNR action (include cost and funding source if public funds involved)

This environmental analysis is associated with the Department of Natural Resources' (Department) proposed issuance of Wisconsin Pollutant Discharge Elimination System (WPDES) permits for two independent but linked projects: **(a)** the proposed Dane County Manure Handling Facility (Facility), also known as the Middleton Digester, to be operated by GL Dairy Biogas, LLC and **(b)** the expansion of the Ziegler Dairy Farm Inc. (Ziegler Dairy). Ziegler Dairy is one of the three farms planned to participate in the Dane County Manure Handling Facility to be located in the Town of Springfield, just north of the City of Middleton. The Department has proposed to issue separate individual WPDES permits to the Dane County Manure Handling Facility and Ziegler Dairy. Ziegler Dairy has applied for a WPDES permit because the expansion they have planned will make them a Concentrated Animal Feeding Operation (CAFO), requiring permit coverage. A CAFO is a farm with at least 1000 animal units (one milking cow is considered to be 1.4 animal units). This operation has not held a WPDES permit in the past. Permits are normally issued for up to five years. GL Dairy Biogas, LLC has applied for a WPDES permit for the Middleton Digester because it is a new industrial processing facility. Although this project will result in the sharing of a manure handling system, many aspects of the facilities will be separate.

(a) Dane County performed a comprehensive search to select the proposed location for the manure handling facility. Initially a survey was conducted to find producers that had an interest in participating in a manure management project. From the interested farmers, sites were assessed to find a location that could serve multiple farms with large animal numbers. The Soil and Water Assessment Tool (SWAT) was run by a private company for the County to determine areas that have a high potential for delivering phosphorus to nearby surface waters. The model identified that choosing an appropriate location for the Facility would be very important for the success of the project. The model took into account parameters including farming practices, animal units and landscape factors such as soils and slopes.

The proposed site is an approximately 22 acre open field located in Section 33 of Springfield Township, Dane County off of

Schneider Road. The Dane County Manure Handling Facility will accept manure from three farms: Hensen Brothers Dairy, Ziegler Dairy, and Blue Star Dairy (Attachment A). Manure from all three farms will be either pumped to the digester site or hauled by trucks to the processing facility.

The digester facility will be owned, designed, constructed, and operated by GL Dairy Biogas, LLC. The equipment that relates to phosphorus removal will be owned by both the County and will be leased to GL Dairy Biogas, LLC. The facility will be located on property owned by Dane County that will be leased to GL Dairy Biogas, LLC.

The manure from Ziegler Dairy will be pumped via a 6 inch SDR26 PVC forcemain directly from the local reception pit at Ziegler's facility to the 150,000 gallon underground concrete raw manure storage tank at the Facility. A second 6 inch forcemain will also be installed at Ziegler's for redundancy purposes. The manure from both Hensen and Blue Star will be hauled daily to the site via semi tanker and delivered at the truck unloading depot upon entry to the site. This manure will be gravity fed into the 150,000 gallon underground concrete storage tank where it will be homogenized with Ziegler's manure.

The manure from the raw manure storage tank will then be metered into each of the three 1,063,000 gallon cast in place concrete digester tanks. Each of the three tanks will be internally mixed with three fixed paddle style mixers. Each digester will have a double membrane PVC coated polyester cover. The outer membrane is held in place by an air blower that creates a low pressure between the two bladders. The inner bladder captures the biogas created during the digestion process and can raise and lower depending on the rate of biogas production. The biogas bladder typically operates at a biogas pressure of 0.5" to 1.2" of water column. There are over pressure and vacuum pressure emergency safety devices mounted to the top of the tank to protect the integrity of the tank and bladder. The digester is operated at 95-105°F. To heat the digester contents, there are rows of stainless steel piping mounted inside from the tank wall going the circumference of the tank. Hot water from the generators flows through these pipes and transfers the heat to the liquids inside the digester. The digester tank is covered with insulation and then an aluminum cladding is attached to the outside of the tank. The digester system is designed for a 25-30 day hydraulic retention time.

The site will also include a 40' x 20' solid manure receiving bunker that will be housed within the 71,000 square foot composting building to control odors. Bedding pack manure, frozen manure, and other organic by-products will be stored here and transported using an end loader to the solids feeding hopper. The solids will then be metered and mixed with liquid manure before being injected into the digesters. A 2,500 square foot main building will also be constructed to house the electrical and control rooms, rest room facilities, meeting room, mechanical room, and maintenance area. A truck scale will also be located on site to accurately quantify all material entering and leaving the facility.

There will also be one 100,000 gallon concrete organic waste tank located on site. This tank will be used to store organic substrates (stillage from ethanol processing; glycerin bottoms from bio-diesel processing; wastewater from cheese, yogurt, and milk plants; wastewater from food packaging plants, grocery store waste, bakery waste, etc…) delivered to the site prior to processing in the digester. In addition, one 25,000 gallon concrete tank will be used to store fats, oils, and greases (FOG) separately for supplementing biogas production within the facility. The FOG was selected to provide a feed stock with a high energy density but relatively low nutrient content. This substrate is necessary to make the system economically viable. FOG produces about 8-10 times more biogas than manure of the same volume. Other organic substrates, such as the ones listed above, produce only 2-5 times more biogas than manure for the same volume. A system running on only manure would not produce enough biogas to convert into electricity to generate sufficient revenue to overcome the operating expenses of the plant. If this system only used manure, it would create enough biogas to generate 650-700 kW of electricity. That would only generate about $550,000/yr. in revenue for a plant with operating expenses of almost $1 million/yr. By adding substrates, this plant has the ability to generate over 2,000 kW of electricity. That equates to almost three times the revenue with a minimal increase in capital cost and creates a facility that generates more revenue than it costs to operate. It is anticipated that about 30% of the substrate by volume will be FOG added to the manure. The substrate quantity will also be metered prior to feeding into the digesters.

There will be a loading and unloading depot/containment area where trucks will be unloaded of liquid manure, organic waste products, and FOG, as well as loaded with centrate and digestate to bring back to the farms. Digestate is a combination of substrates and manure that have undergone anaerobic digestion. Centrate is the liquid product of substrates and manure that have undergone anaerobic digestion before having a portion of the suspended solids removed through a screw press and centrifuge system. This depot will have an internal floor drainage system to collect any potential spills. Any spills containing substrates, FOG, and/or manure will be pumped into the digester tanks. The centrate and digestate will either be loaded on trucks and returned to Blue Star and Hensen Dairies or will overflow into the 15 million gallon on-site storage structure.

Centrate will be returned to Blue Star and Hensen Dairy using a semi tanker truck. There will be a 25,000 gallon underground concrete centrate storage tank in the loading area with a gravity overflow to the storage lagoon on-site. Storage at the Blue Star farm will be in an existing earthen storage lagoon. Storage at Hensen's farm will be in an existing concrete manure storage structure. Ziegler's centrate will be stored in the 11 million gallon portion of the concrete storage lagoon to be constructed at the facility with the digestate stored in the remaining 4 million gallon portion of the lagoon. The total lagoon size is 15 million gallons with a concrete dividing wall separating the centrate and digestate.

In addition to the main storage tanks there will be: a 2,000 gallon polyethylene screw press balance tank that will provide a constant flow rate to the centrifuge and absorb any variances in output from the screw presses, a 2,000 gallon polyethylene pressate liquid buffer tank that will collect liquids generated from the screw presses, and a 6,000 gallon precast concrete condensate storage tank for collecting condensate from the biogas pipeline and gas conditioning equipment.

The digestion will be a continuous process with fresh manure always entering the digesters and the digested effluent constantly being removed from the digesters. Following the digestion process, the manure will be pumped to two screw press separators. This will separate the coarse solid material from liquids. The solids or fiber will then be placed into windrows inside the 71,000 square foot composting building where it will be composted for 35-45 days and aerated with a self-propelled compost row turner. This composting process will insure that the resulting fiber product is pathogen free. The site will include a truck scale so the material leaving the facility can be measured and verified. Once the composting is complete, the compost will be loaded onto trucks with a front-end loader and sold to a horticultural wholesaler. They typically use this material to blend into various growing mixes that are sold primarily to large commercial growers and greenhouses.

The liquids from the screw press will then be processed by a centrifugal separator to remove the fine solids. The solids or cake from the centrifuge will be stacked for truck loadout. The liquids from the centrifuge will go to a 25,000 gallon underground concrete centrate storage tank where it will be pumped back onto semi-trucks for transport back to the two remote farms for long-term storage and land application. Additional centrate will overflow into the 11 million gallon portion of the 15 million gallon lagoon on site to be land applied by Ziegler Dairy.

The land application of both centrate and digestate is critical for all three farms. These materials contain nutrients (nitrogen, phosphorus, and potassium) that are essential for crop growth. These materials are needed by the farms in order to ensure that an adequate and appropriate amount of nutrients are available for growing crops. If these nutrients are not returned, the participating farmers will need to import nutrients from outside the watershed to meet crop needs. This contradicts the primary goal of the project, which is the removal of nutrients, in particular phosphorus, from the watershed. The purpose of having both centrate and digestate available to the farmers is due to their difference in nutrient concentrations. The centrate contains a relatively lower amount of phosphorus and higher amount of nitrogen when compared to the digestate. In order to maximize nutrient uptake efficiency and minimize nutrient loss, 25% of the total volume of liquid returned to the farms will be digestate with the remaining 75% being centrate. Farmers will then be able to use their manure spreading equipment to deliver a more appropriate amount of nutrients to growing crops based on onsite conditions and soil fertility levels. The overall reduction in phosphorus concentration from the manure going to the digester and the material (centrate and digestate) returning to the farms is estimated to be 43%.

Upon start up, 60% of the phosphorus contained within the centrate will be removed and captured in the solids along with 60% of the phosphorus from the substrates. The amount of phosphorus capture from the substrates will incrementally increase over the course of the next 5 years until 2018 where 100% of the phosphorus in the substrates will be removed. The primary reason for this incremental increase is due to fluctuations in the volume of nutrients that will be sent to the digester (Ziegler Dairy expansion) and time needed to stabilize the digestion process.

The biogas collected from each of the digesters will be piped to a central biogas conditioning and compression skid. This skid will remove the water vapor from the biogas and compress it to 3 psi for the engines. The biogas will be the fuel source for one (1) 633 kW GE Jenbacher engine generator and one (1) 1426 kW GE Jenbacher engine generator. These will be pre-packaged units. Gas conditioning equipment and cooling radiators setting on concrete pads will be placed adjacent to the generators. The electricity generated will be sold to Madison Gas & Electric. The heat from the engines will be captured and piped back to the process building where it will be distributed to heat the digesters, tanks, and buildings on the site. In the event the engines are down and there is no longer any biogas storage available in the digesters, a flare will be used to burn off the excess biogas.

The driveway will be asphalted from the road to the south side of the compost building. There will be an earthen secondary containment area around the digester tanks, as well as a variety of bio filter infiltration basins located around the site to treat storm water. Also, as part of the construction, the hill immediately to the south of Schneider Road will be graded back 50' level with the road elevation. This will allow for improved visibility for vehicles traveling around the bend on Schneider Road as well as for truck traffic leaving the facility.

Since this is proposed as a community digester, design features are incorporated into the initial phase of construction to facilitate the possibility of adding additional farms to the system. These include room for a fourth digester and the solids processing facility is sized to accommodate future expansion.

The project is estimated to cost $12 million to construct. The project will be privately funded through construction. Once the project is operating, the phosphorus removal equipment and land will be sold to Dane County for $3.3 million and leased back to GL Dairy Biogas LLC.

Dane County is also exploring the feasibility of adding further water treatment technology to the plant at a future date. The additional technology would concentrate the centrate volume down to 25% of its original volume and create clean water. The technology would reduce the manure volume by 75%, requiring fewer applications per acre to achieve the desired nutrient levels. This should assist in protecting surface and groundwater by reducing the amount of manure on the field that could potentially run off or leach into the soil before the nutrients are utilized by the crops. This process is under evaluation by the county and is not reviewed further in this environmental analysis.

(b) Ziegler Dairy is a dairy operation located in the Springfield Township of Dane County. They have been continuously growing in anticipation of future expansion and currently have approximately 1,000 animal units. Their expansion plans include the addition of 300 calves, 500 heifers, and 400 cows bringing their total animal units up to about 2,045. As a condition of the expansion, Ziegler Dairy will be required to obtain a WPDES CAFO permit from the WDNR. The expansion project also includes the abandonment of their current liquid manure storage pit, the construction of a centralized liquid manure reception area, an addition onto their current South Barn, the construction of a new dairy barn, and the installation of a leachate and runoff collection and treatment system (Attachment B). Construction is planned to begin in the spring of 2013 and is planned to be completed December 1st, 2013. Animal unit goals are planned to be reached sometime in 2014. A new calf facility may or may not be constructed sometime in the future. It is not included in this proposed expansion. However, the amount of manure produced from the increase in calf numbers is considered in the nutrient management plan.

Abandonment of the current liquid manure storage pit will consist of constructing a concrete wall that will create a 21 ft. by 18ft. concrete manure reception area at the far western portion of the pit. The remaining portion of the pit will then be abandoned according to Natural Resources Conservation Service specifications and filled with earthen material generated from the construction of the Dane County Manure Handling Facility. Manure from the reception area will then be pumped to a 12 ft. diameter circular reception tank containing an agitator and pumping equipment that will be used to pump the manure to the Dane County Manure Handling Facility.

Once the pit is abandoned, construction will begin on expanding the South Barn to the west over the previously existing pit and newly created manure reception area. This new addition will be 113 ft. by 18 ft. and will provide an additional 1,650 sq. ft. of space for the dairy cows.

The proposed dairy barn will be located just south of the parlor and hospital barn. Construction of this facility will likely take place in the summer and fall of 2013. The north dairy barn will be converted to a heifer barn in 2013. The new dairy barn will include an under floor reception tank. All manure collected in the centralized liquid manure reception area adjacent to the south barn will be transferred to the new dairy barn reception tank and then transferred to the Dane County Manure Handling Facility via underground transfer lines.

The leachate and runoff collection and treatment system consists of two major components. The first is designed to divert existing storm water generated from the gravel drive and buildings to the east of the feed pad around the bunkers to be discharged to the north into a field. This system is comprised of a 40 ft. long grated diversion trench constructed at the east end of the feed bunker pad. A 20 ft. long 6 in. high concrete wall and a series of various sized manhole drains and culvert pipes. The second major component is designed to collect and treat storm water runoff that originates from the bunkers and feed loading pad. A 6 in. tall curb will be constructed to divert runoff into a 10 ft. by 10 ft. by 2 ft. settling basin. This basin will then outlet to a 5,000 gallon Wieser precast collection tank. Leachate that is collected in this tank is pumped with a 100 gallon per minute pump through a 4 in. pipe to the manure reception area. The settling basin also contains a 12 in. tall and 6 ft. long concrete weir containing a baffle board. Storm water in the settling basin that overtops the weir flows west in a 6 ft. wide concrete channel before hitting a gravel spreader where it will flow north across a 285 ft. by 110 ft. vegetated treatment area (VTA). Both the storm water diverted around the bunkers and from the VTA is discharged to the original flow paths.

A WPDES permit requires the dairy have a minimum of 180 days of storage for liquid manure. To meet this requirement, all of the manure produced on the farm will be pumped to the Dane County Manure Handling Facility (Middleton) for treatment prior to storage. Storage of the treated manure will be in a 15 million gallon lagoon storage structure located at the Dane County Manure Handling Facility. This large storage structure is more than enough to accommodate Ziegler's planned future growth.

Existing manure storage structures located on the farm will be abandoned in order to allow for the construction of the planned production facilities.

Following is the current animal types and numbers that are currently part of the Ziegler Dairy operation from the 2013 Nutrient Management Plan (NMP):

Animal Type	Current Number of Animals/Type	Average Weight per Animal/Type	Animal Unit Equivalency Conversion Factor	Total Animal Units per Animal Type
Currently-2012				
Milking cows	490	1,400	1.4	686
Dry cows & Springing Heifers	210	1,400	1.4	294
Calves	100	100	0.2	20
				1000 Total A.U.

Following is the proposed animal types and numbers after Ziegler Dairy's expansion is complete in 2014:

Animal Type	Number of Animals/Type	Average Weight per Animal/Type	Animal Unit Equivalency Conversion Factor	Total Animal Units per Animal Type
2013				
Milking cows	830	1,400	1.4	1,162
Dry cows & Springing Heifers	270	1,400	1.4	378
Heifers (500-850 lbs)	250	675	0.6	150
Heifers (850 – 1300 lbs)	250	1075	1.1	275
Calves	400	200	0.2	80
				2,045 Total A.U.

Ziegler Dairy plans to continue marketing milk during and after the expansion.

The approximate cost for the construction of the proposed expansion is $500,000. This includes the abandonment of the current manure storage pit, construction of the manure receiving area, the addition onto the existing South Barn, and construction of the leachate and runoff collection and treatment system. Construction of the heifer barn and manure storage pit is not included in the estimated price and will not likely be constructed within the next year. All construction will occur at their existing facility.

2. Purpose and Need (include history and background as appropriate)

(a) Studies show that Phosphorus entering the Yahara chain of lakes (Mendota, Monona, Waubesa and Kegonsa) has led to eutrophication and negative impacts on recreation and wildlife (Lathrop 2007) (Lathrop and Carpenter 2011) (Yahara CLEAN Final Report). It is believed that a portion of the phosphorus in the watershed is attributed to agricultural runoff from land applied manure. The primary goal of this project is to preserve the water quality of the Yahara River Watershed through innovative nutrient management solutions of agricultural waste. The proposed construction of a community anaerobic digestion facility should achieve this through the capture of phosphate in the manure stream which will be composted on site and exported as a soil amendment product. The facility will remove as much as 60 percent of phosphorus from incoming manure streams. Any farms participating in the project will be required to have a Nutrient Management Plan (NMP) and will need to abide by the land spreading agreements set forth in the Facility's WPDES permit. With the three current farms, this will result in an additional 3,800 acres of cropland being regulated by the WDNR. The added level of management needed to comply with the increased regulation should provide a reduced likelihood of an over-application of nutrients and loss of nutrients during a winter/spring runoff event. The land spreading agreement also prohibits participating farms from applying any liquid manure, digester nutrients, or solid manure on frozen or snow-covered ground. The application of manure or digester nutrients during this time period is highly susceptible to runoff given the inability for rainfall to effectively infiltrate and the lack of cover/vegetation to retain nutrients on the landscape. As a result of this prohibition, the likelihood of nutrients being lost during a winter/spring runoff event will be reduced. Other beneficial impacts of the project include production of renewable energy and improved air quality through the reduction of greenhouse gasses.

This project began when Dane County decided to evaluate options for reducing phosphorous runoff in the agricultural industry. As part of the development of this project, Dane County performed two feasibility studies, *Community Manure Management Feasibility Study (2008)* and *Community Manure Management Facilities Plan (2009)*. These studies evaluated several alternatives for manure and phosphorous management. Even though the total number of farms and cows in the currently proposed project are slightly different than what was assessed in the feasibility studies, many of the findings in the studies are still valid for this project.

The 2008 study looked at several technologies, including: anaerobic digestion, aerobic digestion, composting, combustion, pyrolysis, gasification, sand and grit separation, at least nine methods of manure solids separation, manure drying, phosphorus minimization in feeds, advanced phosphorus removal through chemical precipitation, and others. The review looked at the feasibility of each technology, based on economics, technological reliability, and 18 non-monetary criteria, such as phosphorus reduction, water quality impacts, and air quality impacts. The review of all of the non-monetary criteria can be found in Section 5 of the 2008 study. (Attachment C)

Ultimately, the 2008 feasibility study found that a community system was more economical than a system at each individual farm. Additionally, this study concluded that the currently proposed project, anaerobic digestion, followed by advanced phosphorus removal, was the best option. This option is the most economical, and it also scored the highest in the assessment of environmental and other non-monetary criteria

(b) Ziegler Dairy's herd size has been growing. The dairy is now approaching the 1,000 animal unit threshold and has applied for a WPDES permit. A WPDES permit requires the dairy have a minimum of 180 days of storage for liquid manure. To meet this requirement the dairy proposes to construct a centralized manure collection pit that will pump manure to the Dane County Manure Handling Facility. This Facility will treat the manure and store it on site in its 15 million gallon storage lagoon. This lagoon is more than adequate to provide storage for the farms anticipated yearly 21 million gallon manure production (once herd numbers are achieved). By pumping and storing the manure at the Facility, Ziegler Dairy will have increased flexibility in applying manure during times of the year when runoff is less likely. In addition, they will be applying manure that has been treated enabling them to deliver a more appropriate amount of nutrients based on crop needs.

3. Authorities and Approvals (list local, state and federal permits or approvals required)

Applicant **(a)**

a. Town of Springfield:
    a. Rezoning with certified survey approval
    b. Conditional use permit
    c. Building permit
    d. Road Crossing Permit
b. Dane County:
    a. Chapter 14 manure storage permit
    b. Stormwater and shoreland erosion control permit (Main Project Site)
    c. Stormwater and shoreland erosion control permit (Hensen Dairy)
    d. Stormwater and shoreland erosion control permit (Blue Star Dairy)
    e. Rezoning with certified survey approval
    f. Conditional Use permit
    g. Septic System Permit
c. State of Wisconsin:
    a. Wisconsin Department of Natural Resources (WDNR)
        i. WPDES Permit
        ii. Wisconsin Pollutant Discharge Elimination System (WPDES) Permits for Land Disturbing Construction Activities affecting one or more acres (WI-0067831), under Ch. NR 151 – Runoff Management, Wis. Adm. Code.
        iii. Construction Air Pollution Control Permit and Operating Air Pollution Control
        iv. Chapter 30 Permit (Hensen Dairy)
        v. Well Construction Permit
    b. Wisconsin Department of Safety and Professional Services
        i. Building Permit
        ii. Electrical Permit
d. Federal Government
    a. None

Applicant (b)

a. Dane County:

   i. Manure Storage Permit (Ch. 14)
   ii. Erosion Control Permit

b. State of Wisconsin:

   a. Wisconsin Department of Natural Resources (WDNR)

      i. Wisconsin Pollutant Discharge Elimination System (WPDES) Permits for Concentrated Animal Feeding Operations (CAFO), those operations with 1,000 animal units or more under Ch. NR 243 – Animal Feeding Operations, Wis. Adm. Code.
      ii. Odor control requirements may be imposed by order of the Department if the Department determines that an objectionable odor is determined to exist per s. NR 429.03 – Malodorous Emissions, Wis. Adm. Code
      iii. Air emission limitations from s. NR 415.04, Wis. Adm. Code, covering fugitive dust sources
      iv. Applicable permitting thresholds contained in s. NR 406.04(2)(c), Wis. Adm. Code (construction permits); s. NR 407.02(4), Wis. Adm. Code (operation permits), and s. NR 405.02(22)(a)2, S. NR 405.02(27) and s. NR 405.07(9), Wis. Adm. Code prevention of significant deterioration (PSD)
      v. Chs. NR 406, 407, Wis. Adm. Code, contain provisions that allow a source to exclude emissions of hazardous air contaminants (including ammonia and hydrogen sulfide) associated with agricultural waste. On May 24, 2011, the Joint Committee for the Review of Administrative Rules adopted a motion under s. 227.26(2)(d), Stats., suspending s. NR 406.04(3)(c) in part and suspending s. NR 407.03(2)(d) in part. These provisions apply to hazardous air contaminants only and do not apply to criteria pollutants such as PM or VOCs, or to federal hazardous pollutants or to PSD major source permitting thresholds contained in Ch. NR 405, Wis. Adm. Code.
      vi. Emissions reporting requirements contained in Ch. NR 438, Wis. Adm. Code.
      vii. Wisconsin Pollutant Discharge Elimination System (WPDES) Permits for Land Disturbing Construction Activities affecting one or more acres (WI-0067831), under Ch. NR 151 – Runoff Management, Wis. Adm. Code.
      viii. Review and approval authority of manure storage facilities and runoff control systems, under Ch. NR 243 – Animal Feeding Operations, Wis. Adm. Code
      ix. Nutrient Management Plan review and approval under Ch. NR 243, Wis. Adm. Code – Animal Feeding Operations, Wis. Adm. Code.

PROPOSED PHYSICAL CHANGES (more fully describe the proposal)

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4. Manipulation of Terrestrial Resources (include relevant quantities - sq. ft., cu. yard, etc.)

(a) The site of the Dane County Manure Handling Facility (Middleton) will include 712,950 sq. ft. of disturbed area during construction. There will be 221,100 sq. ft. of new impervious surface including the access road to the facility, and 136,000 sq. ft. for the new lagoon. The site location is currently agricultural cropland (Attachment A).

(b) Ziegler's expansion project will disturb approximately 35,000 sq. ft. of material. This is largely due to the construction of the leachate and runoff collection and treatment system. Construction at the farm is expected to last approximately 6 months. Fill for the abandonment of the manure storage pit will come from the excavation of the Dane County Manure Handling Facility. The site will utilize the existing farm entrance. The increase in impervious area will be minimal since the addition onto the South Barn will be going over the already existing manure storage pit.

5. Manipulation of Aquatic Resources (include relevant quantities - cfs, acre feet, MGD, etc.)

(a) There will be no manipulation of aquatic resources as a result of either of these proposals. The Facility will be located more than 500 ft. away from the nearest stream and will be more than 900 ft. away from the closest wetland identified on the WDNR Wisconsin Wetland Inventory (WWI) map (Attachment D). There currently is a grassed waterway to the east of the proposed facility. This grassed waterway should not be impacted by the project. The site will be graded in a way that will direct storm water to bio filter infiltration basins located on the property.

(b) There will be no manipulation of aquatic resources as a result of either of these proposals. Ziegler Dairy is more than 400 ft. away from the nearest surface water which is classified as an intermittent stream. It also is located more than 1000 ft. away from the closest wetland identified on the WDNR Wisconsin Wetland Inventory (WWI) map. Both the stream and wetland are located to the south and west of the operation. Neither the wetlands nor stream will be impacted from the proposed construction. The major storm water path is to the north and west of the operation and will dissipate across the flat topography of the field to the north.

6. Buildings, Treatment Units, Roads and Other Structures (include size of facilities, road miles, etc.)

(a) The proposed site will include a variety of tanks, buildings, and equipment. The site will consist of (3) three 1,063,000 gallon cast in place concrete digester tanks with dual PVC coated polyester covers. The tanks will be internally mixed with three fixed paddle style mixers. The tanks will also be heated hydronically using waste thermal energy captured from the facilities generators.

There will be a 180 ft. x 455 ft. building that is 38 ft. high at the peak. This building will house the manure and substrate unloading equipment, the separation equipment, and the compost processing for the dewatered dairy fiber. There will be a process building that is 50 ft. x 50 ft. with a peak height of 24 feet. This building will house the electrical room, the mechanical room, a meeting room, a restroom, and the shop. The facility will have (2) Combined Heat and Power (CHP) units, one (1) 633kW GE Jenbacher, and one (1) 1426kW GE Jenbacher, both installed in shipping containers that are each approximately 10 ft. wide by 40ft. long. Adjacent to the CHP containers will be gas conditioning equipment and cooling radiators setting on concrete pads and a flare mounted to a concrete pad. There will be a 15 million gallon concrete storage lagoon approximately 416 ft. in diameter with a depth of 16 feet. There will be a fuel storage depot located to the west of the compost building. The facility will also include a truck scale. The approximately 55,940 sq. ft. drive way on the north and west sides of the site will be asphalted. The balance of the drive way and access areas around the equipment, approximately 60,700 sq. ft., will be gravel. The site will include bio filters and an infiltration pond as required to treat site storm water. In addition, (2) 6 inch forcemain SDR26 PVC pipes spanning 2,200 feet will be used to transfer manure from Ziegler's to the facility.

See the attached site plan for further details (Attachment E).

(b) Ziegler's expansion will consist of the following: abandonment of the current manure storage pit, construction of a 21 ft. by 18 ft. manure receiving area within the foot print of the abandoned manure storage pit, expansion of the South Barn (113 ft. by 18 ft.) over the top of the abandoned manure storage pit and newly built manure receiving area, and construction of a leachate and runoff control/treatment system that has a 10 ft. by 10 ft. settling basin and a 285 ft. by 110 ft. vegetated treatment area.

See the attached site plan for details on structures layout (Attachment B).

7. Emissions and Discharges (include relevant characteristics and quantities)

(a) The manure and substrate receiving tanks at the facility will be located inside an enclosed building to minimize odors from the site. The composts building will also be enclosed to help reduce odors. Hazardous pollutants, including ammonia, hydrogen sulfide, and methane will be addressed in this project. Typically the greatest ammonia odor is present in the solids shortly after coming out of the separator. To address this concern, the solids will be enclosed in a building to control any possible odor. The hydrogen sulfide will be scrubbed out of the biogas at the top of each digester prior to the biogas being utilized by the engines for fuel. Scrubbing should reduce hydrogen sulfide levels from about 3,000 to 5,000 ppm to less than 275 ppm. The installation of the digester will reduce the amount of methane that would have been released into the atmosphere, as a result of land spreading the manure, equivalent to a reduction in carbon dioxide emissions of approximately 9,400 tons carbon dioxide per year.

This facility will receive manure from three farm operations consisting of approximately 3,290 (2012) animal units and 3,800 acres for land spreading. Based upon nutrient management plans submitted by each operation, sufficient crop acres are available for the land application of manure. These numbers will increase with the expansion of Ziegler Dairy's operation to 4,845 animal units sometime in 2014. Though the facility will be rather large in capacity, controlled anaerobic digestion of animal manure has been a proven method of reducing foul odors. Odors become an issue under uncontrolled anaerobic digestion, which will not be occurring at this facility (see Penn State publication for more information).

The primary driveway will be asphalted to minimize dust from truck traffic on facility property.

(b) It is estimated that Ziegler Dairy will produce approximately 16 million gallons of liquid manure, including parlor water, leachate collected and "first flush" feed storage pad runoff collected during the course of one calendar year once animal numbers are fully reached in 2014. Approximately 1,200 tons of solid manure will be produced annually. Total nutrients for the manure generated for maximum animal numbers is estimated at 379,760 lbs. of Nitrogen, 161,720 lbs. of P_2O_5, and 352,104 lbs. of K_2O, based on liquid and solid manure tests, during the course of one calendar year. The Ziegler Dairy expansion project is not proposing to discharge manure or parlor water to surface water or wetlands and would be prohibited from any discharge from the facility under the required WPDES permit.

Ziegler Dairy has 2,240 acres of cropland available for land spreading its manure. The dairy owns 1,228 acres, and rents an additional 1,012 acres of cropland. If necessary an additional 150 – 170 acres is available within 1 to 1.5 miles away for land application under a manure spreading agreement with the land owner who is currently a cash grain farmer.

Based upon the submitted nutrient management plan, Ziegler Dairy has sufficient crop acres for the land application of manure. The proposed community digester plans to separate out manure solids and sell most of the solids outside of the watershed as a soil amendment product. Ziegler Dairy would only receive digested liquid (centrate and digestate) back from the digester. These liquids will contain lower amounts of nutrients then the manure sent to the digester. The objective of the digester is to remove up to 60% of the phosphorus from the manure. The digester will also remove up to 60% of the phosphorus from the added substrates initially and up to 100% of the phosphorus from the added substrates after five years. Depending on the quality of the digested solids, Ziegler Dairy may consider using them for bedding. Currently, digested solids will not be used by Ziegler Dairy and any future use would be subject to agreements between the Facility and Ziegler Dairy.

The farm currently incorporates some manure to minimize odors during land spreading. However, some manure is also surface applied. The farm has not received complaints of odors in the past. The proposed upgrades to Ziegler Dairy are not expected to increase odors. With the manure being processed by a digester, odors overall should be reduced.

Fugitive dust is not expected to be an issue at the farm; however, water will be used on site to reduce dust during the construction of the expansion**.** If an erosion control plan is needed for this expansion one will be submitted to the Department of Natural Resources.

The project presents the potential for particulate matter, dust, ammonia, hydrogen sulfide emissions, and odors being generated. Ziegler Dairy does not expect to have a problem with these air issues. Caution signs are to be placed on the covers of the leachate collection tank warning of potential hazardous pollutants inside. However, the contents of the leachate tank will be pumped to the manure receiving area where it will be diluted with collected manure. The manure receiving area is also well ventilated, minimizing any potential risks of hazardous pollutants.

8. Identify the maps, plans and other descriptive material attached

Attachment A: Middleton Digester Farms

Attachment B: Ziegler Expansion Project

Attachment C: Community Manure Management Feasibility Study (2008)

Attachment D: Middleton Digester Wetland Map

Attachment E: Site Plan

Attachment F: Ziegler Dairy & Middleton Digester Floodplain Map

Attachment G: Manure and wastewater calculations US Biogas Springfield 2014

Attachment H: Soil Test Summary

Attachment I: Middleton Digester Land Spreading Plan

Attachment I: Land Spreading Plan Middleton Attachment 1

Attachment J: Spill and Emergency Response

Attachment K: Operation and Maintenance

AFFECTED ENVIRONMENT (describe existing features that may be affected by proposal)

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9. Information Based On (check all that apply):

☐ Literature/correspondence (specify major sources)

Community Manure Management Feasibility Study (2008). See Attachment C.

Lathrop, R. C. (2007). Perspectives on the eutrophication of the Yahara lakes. *Lake and Reservoir Management* 23:345-365.

Lathrop, R. C. and S. R., Carpenter. (2011). Phosphorus Loading and Lake Response Analysis for the Yahara Lakes. (Manuscript is being prepared for scientific journal publication)

Lake Mendota Watershed Priority Report. Dane County, WI. June 2000.

McGinley, Paul. "Field-Scale Influences on Runoff Phosphorus Loss from Alfalfa". University of Wisconsin-Stevens Point. September 2004.

Penn State, College of Agriculture Sciences-Cooperative Extension. "Anaerobic Digestion: Biogas Production and Odor Reduction from Manure". Retrieved from http://pubs.cas.psu.edu/freepubs/pdfs/g77.pdf on January 15, 2013.

Struss, Ron. "The 500 lbs Algae Adage. Where did it come from—and is it true?". University of Minnesota Extension Service. July 2003. Retrieved from http://www.cleanwatermn.org/app_themes/cleanwater/pdfs/forTeachers/Algae.pdf on May 12, 2010.

Yahara Clean Final Report. A CLEAN Future for the Yahara Lakes: Solutions for Tomorrow, Starting Today. Retrieved from http://www.yaharawatershed.org/documents/doc/CLEAN_Report_090910.pdf on February 6, 2013

☐ Personal Contacts (list in item 26)

Field Analysis By: ☐ Author ☐ Other (list in item 26)

Past Experience With Site By: ☐ Other (list in item 26)

10. Physical Environment (topography, soils, water, air)

(a) Construction of the facility will require coverage under a WDNR WPDES storm water construction permit because grading on the site will be greater than 1 acre. The permit requires that an erosion control plan be developed and implemented during construction. Soil will be stockpiled on-site for use during construction. The site is designed to balance the required amounts of cut and fill, although there will be roughly 3,000 cubic yards of soil material left over from construction. This soil will be transported to Ziegler's farm to use in the abandonment of an existing manure storage facility in preparation for the expansion of the existing free stall barn. There is expected to be excess topsoil which will be re-distributed on nearby crop fields.

The facility site is located approximately 500 feet west of the Pheasant Branch stream. The WDNR Surface Water Viewer identifies the stream at this location as an intermittent waterway. This intermittent stream flows approximately 4,500 feet to form the perennial stream, Pheasant Branch. Pheasant Branch is currently listed as an "Area of Special Natural Resource Interest." This stream is also currently listed as a 303d impaired water body. Impairments include low dissolved oxygen, degraded biological community, and degraded habitat. Pollutants include total phosphorus, sediment/total suspended solids. No subsurface drainage tiles or ditches are being proposed. There will be bio filters and infiltration basins located around the site to treat storm water.

Land spreading is proposed to take place in the Sixmile Creek, Pheasant Branch, Upper Black Earth Creek, Waunakee Marsh-Sixmile Creek, and Badger Mill Creek watersheds. Land spreading fields are located approximately 1,300 feet from Pheasant Branch, 350 feet from Dorn Creek, 2,000 feet from Black Earth Creek, and 5,000 feet from Six Mile Creek, all perennial streams. The combined byproducts (centrate and digestate) returned to the participating producers for land spreading will be reduced in phosphorus by 43%. The reduction in the total amount of phosphorus reaching nearby surface waters is estimated to be 25%. Total carbon dioxide emission reductions by offsetting coal power with renewable power are expected to be approximately 12,500 tons of carbon dioxide per year as a result of the methane generated energy.

(b) There are no apparent mapped floodplains in the project area based on the 2009 Digital Flood Insurance Rate Map produced by the Federal Emergency Management Agency (Attachment F). However, the vegetated treatment area that is to be constructed as part of the leachate and runoff control and treatment system will be located within a small portion of the 0.2% Annual Flood

Chance Area. Pheasant Branch, which is designated by the DNR Surface Water Data Viewer as an intermittent waterway at this location, is situated approximately 400 ft. to the west and south of the proposed project site. This intermittent stream becomes a perennial stream approximately 5,800 feet to the south and east. Pheasant Branch is currently listed as an "Area of Special Natural Resource Interest." This stream is also currently listed as a 303d impaired water body. Impairments include low dissolved oxygen, degraded biological community, and degraded habitat. Pollutants include total phosphorus, sediment/total suspended solids. Outstanding or Exceptional Resource Waters in proximity to the farms or lands that spreading will occur on include Six Mile Creek. There are no plans to disturb these waterways. Manure will be land spread on fields within the Six Mile and Pheasant Branch Creek Watershed, the Yahara River and Lake Mendota Watershed, and the Lake Wisconsin Watershed.

11. Biological Environment (dominant aquatic and terrestrial plant and animal species and habitats including threatened/endangered resources; wetland amounts, types and hydraulic value)

(a) The specific aquatic species currently present in the intermittent waterway near the project site or land spreading areas is not known. Based on a review of the Wisconsin Natural Heritage Inventory, there are no known endangered resources within the proposed digester site. Two special concern species have been observed within a one mile radius, *Reithrodontomys megalotis* (Western Harvest Mouse) and *Microtus ochrogaster* (Prairie Vole). Impacts to these species are not expected as the project will be constructed on agricultural land unsuitable for them.

(b) The specific aquatic species currently present in the intermittent waterway near Ziegler Dairy is not known. Based on a review of the Wisconsin Natural Heritage Inventory, there are no known endangered resources within the farm expansion area. Two special concern species have been observed within a one mile radius, *Reithrodontomys megalotis* (Western Harvest Mouse) and *Microtus ochrogaster* (Prairie Vole). Impacts to these species are not expected as the project will be constructed on agricultural land unsuitable for them.

12. Cultural Environment

a. Land use (dominant features and uses including zoning if applicable)

(a) The project area consists of agriculture cropland, zoned for agricultural uses. The project site will need to be re-zoned A-1EX to A-B.

(b) According to Ziegler Dairy, the site is currently zoned agricultural and we understand changes in zoning are not needed. Farmland is the dominate land use adjacent to the area of the project. Changes in land use are not anticipated.

b. Social/Economic (including ethnic and cultural groups)

(**a**) The closest homes to the proposed site are owned by a participating producer and a large WPDES permitted farm. Some residential homes are located to the west within ¼ mile of the facility. However, the vast majority of the land surrounding the facility is currently being used for agriculture. The City of Middleton is located less than ½ mile to the south. Nearby homeowners will benefit from the reduction in odor of land spread manure. Studies show that digested manure has a substantial reduction in odor when compared to liquid manure produced on a farm (Penn State).

The economy of the local community should be directly impacted by the project. This project should increase the property tax base for local schools and the community. The majority of the work performed during construction will be from local contractors. In addition, the land will be purchased from one of the participating farms. During construction, those contractors not local to the site will stay in the local hotels, eat at the local restaurants, and shop at the local convenience stores, hardware stores, and grocery stores. The completed facility will employ three to four operators.

(b) There are approximately 12 homes and 3 farms within a half mile radius of the farm site. One of the farms is a permitted farm under the WI DNR WPDES permitting system.

This project will increase the tax base for local schools and the community. Organic nutrients should help improve soil quality while helping to limit commercial fertilizer purchases.

According to the Wisconsin Milk Marketing Board, approximately $2,300 per cow is made available to the local economy and for every new agricultural job created, 1.3 jobs are added to the state of Wisconsin employee base. This would be $2,300 dollars for each of the milk cows (590 additional milking cows; which totals to approximately $1,357,000 that will be contributing to the local economy). The project will increase investment in the farm, and may increase markets and economic activity in the area, but it is difficult to assess the extent or existence of such impacts on property values and these impacts are beyond the regulatory authority of the Department.

The farm employs 15 employees, which includes 6 family members. The farm is considering hiring 7 additional employees after the expansion.

We believe the local farm people and rural residents are supportive of agriculture in the community. We do not anticipate controversy over the proposed expansion. The farm has been milking 610 cows with no opposition or complaints.

c. Archaeological/Historical

(a) There are no known archaeological or historical landmarks present on the project site (communication with Dr. Mark Dudzik, WDNR Archeologist)

(b) There are no known archaeological or historical landmarks present on the project site (communication with Dr. Mark Dudzik, WDNR Archeologist)

13. Other Special Resources (e.g., State Natural Areas, prime agricultural lands)

(a) There are no State Natural Areas in or adjacent to lands operated in cooperation with the Dane County Manure Handling Facility (Middleton). The digester facility site is proposed to be constructed on land classified as Prime Farmland by the USDA/NRCS Web Soil Survey.

(b) There are no State Natural Areas in or adjacent to lands operated by Ziegler Dairy. The farm expansion is proposed on land classified as Prime Farmland by the USDA/NRCS Web Soil Survey, however this land will remain in agricultural land use.

ENVIRONMENTAL CONSEQUENCES (probable adverse and beneficial impacts including indirect and secondary impacts)

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14. Physical (include visual if applicable)

(a) There will be an increase in impervious surface as a result of the project totaling 357,100 square feet (site + storage lagoon). As a means of reducing site storm water runoff, one infiltration basin and three bio-filters will be installed. The infiltration basin is approximately 11,850 square feet and the bio-retention ponds are over 6,000 square feet collectively.

No sensitive terrestrial or aquatic resources will be disturbed during construction, nor should they be negatively impacted as a result of the proposal. Minor visual impacts will occur from the digester building, but this should not be significant considering the presence of other existing buildings within close proximity (large permitted CAFO ~900 feet to the West).

The most significant beneficial impact of the proposed project is the reduction in phosphorus (P) loading in to the Yahara chain of lakes as follows:

1) 43,800 lbs or 22 tons (43% of total P load from the 3 farms in 2014) of P exported out of the Lake Mendota watershed annually as a result of the proposed Dane County Manure Handling Facility. The facility will market and sell in bulk the bi-products (digested solid manure) that contain 43% of the P to the horticultural industry as a soil amendment product (Attachment G).

2) Reduction of P from the soil profile on these 3 farms. Research shows that excessively high P soils discharge 4 times the rate compared to soil P loss from "optimum" P level soils (McGinley 2004). According to University of Wisconsin recommendations, optimum P levels are 30 ppm and excessively high P soils are soils with 100 ppm and over. All 3 farms have between 40% and 68% of fields with high (50-100 ppm) to excessively high (100-200+ ppm) P soils. The use of digested materials is estimated to reduce this number to between 31% and 46% of fields by the end of the cropping rotations (Attachment H).

3) Nutrient Management Planning (NMP) prioritizes the reduction of soil P on those fields with high to excessively high P levels and allows the nutrient build up of P on soils that are at a less then optimum level. The NMP also addresses application issues in a Land Spreading Plan (Attachment I). The plan prohibits manure application on frozen or snow-covered ground and requires that all fields be planed to a Phosphorus Index (PI) of 6 or less throughout the rotation while no field may have an annual PI of 12 or more. The PI is based on a model (SNAP Plus) that provides an index of the amount of phosphorus that is reaching nearby surface water on an annual basis. The units for the PI are in pounds of phosphorus delivered per acre per year. It is a goal of this project to prevent an increase in the rotational PI of any field. The plan also addresses solid manure applications and has emergency

provisions established. These provisions provide non-participating farmers a place to take manure during emergency situations such as the failure of a manure storage structure (Attachment J).

4) The Soils Nutrient Application Planner (SNAP-Plus) model was used to determine the P runoff "before" and "after" the Dane County Manure Handling Facility is implemented. Manure production, land acreage for spreading, and land use information prior to 2012 were used to determine the 'Phosphorus Load with Raw Manure'. A 'Phosphorus Load with Digester' was determined by updating the nutrient management plans to reflect the phosphorus reductions as a result of the Dane County Manure Handling Facility. The resulting 'Phosphorus Load Reduction' is the difference between the two. Breakdown by participating farm is as follows:

	Phosphorus Load with Raw Manure	Phosphorus Load with Digester	Phosphorus Load Reduction
Farm A (2170 - 2240 acres)	8,868 lbs annually	6,170 lbs annually	2,698 lbs annually
Farm B (640 acres)	2,513 lbs annually	2,252 lbs annually	261 lbs annually
Farm C (926 acres)	3,410lbs annually	2,622 lbs annually	788 lbs annually
Total Estimated Phosphorus	14,791 lbs annually	11,044 lbs annually	**3,747 lbs annually**

	Farm Average PI with Raw Manure	Farm Average PI with Digester	Farm Average PI Reduction
Farm A	4.1 lbs/acre/year	2.8 lbs/acre/year	1.3 lbs/acre/year
Farm B	3.9 lbs/acre/year	3.5 lbs/acre/year	0.4 lbs/acre/year
Farm C	3.7 lbs/acre/year	2.8 lbs/acre/year	0.9 lbs/acre/year

This analysis for phosphorus load reduction was completed based upon 2012 and 2013 Nutrient Management Plans using the Snap-Plus Model. SNAP-Plus is a field scale model and estimates P delivery to surface waters. It does not estimate P delivery to Lake Mendota. This model indicates a P load reduction of 3,747 lbs. (25.3%) annually from these 3 farms.

5) The project has also taken into account and built into its design the flexibility to accept manure from additional farms. The procedures in which additional farms can be incorporated into the digester are outlined in Attachment K.

(b) There will be an increase in animal units within the watershed due to the expansion of Ziegler Dairy. Though there will be a significant increase in manure production on the Ziegler Dairy farm, the manure will be treated at the Dane County Manure Handling Facility, reducing the impact of the expansion on the environment. The expansion will result in little if any increase in impervious surface area given the addition onto the South Barn will occur over the abandoned manure pit.

Ziegler Dairy is currently operating approximately 2,200 acres of agricultural land. The average acreage for each crop gown is approximately; 675 acres of Alfalfa, 800 acres of Corn Grain, 475 acres of Corn Silage, 230 acres of Soybeans, and 50 acres of Winter Wheat. Based on University of Wisconsin crop nutrient uptakes the average amount of P_2O_5 (phosphorus) taken up each year by the planed crops is 155,394 lbs. Currently only 78,500 lbs. of P_2O_5 is being applied from manure. With Ziegler Dairy's planned expansion this number will increase to 161,835 lbs. assuming the manure is not sent to the Dane County Manure Handling Facility. After digestion of the manure the amount of P_2O_5 being applied will be roughly 90,000 lbs. Based on the amount of land and crops being grown Ziegler Dairy has enough land to apply the amount of manure it would produce from its expansion. Below is a table showing; the amount of nutrients removed by crops (Total crop nutrient uptake), the amount of nutrients applied using centrate and digestate (Estimated yearly application), and the difference between the two (Difference in application and crop uptake).

	--Total crop nutrient uptake--			Estimated yearly application			Difference in application and crop uptake		
	(Total lbs)			(Total lbs)			(Total lbs)		
Year	**N**	**P2O5**	**K2O**	**N**	**P2O5**	**K2O**	**N**	**P2O5**	**K2O**
2013	479,832	145,308	335,458	*184,746	*78,500	*170,831	-295,086	-66,808	-164,627
**2014	498,617	157,500	369,979	412,598	80,581	343,562	-86,018	-76,919	-26,417
2015	512,094	160,177	410,357	441,540	90,635	364,387	-70,554	-69,542	-45,970
2016	504,907	155,914	403,156	439,915	89,929	363,539	-64,993	-65,985	-39,616
2017	497,219	156,399	374,156	439,915	89,929	363,539	-57,305	-66,470	-10,617
2018	483,073	157,065	367,717	439,915	89,929	363,539	-43,159	-67,136	-4,177

* is the amount of nutrients applied using manure
**2014 is when manure will be sent to the digester.

15. Biological (including impacts to threatened/endangered resources)

(a) The specific aquatic species currently present in the intermittent waterway near the project site is not known. Based on a review of the Wisconsin Natural Heritage Inventory, there are no known endangered resources within the construction site. Two special concern species have been observed within a one mile radius, *Reithrodontomys megalotis* (Western Harvest Mouse) and *Microtus ochrogaster* (Prairie Vole). Impacts to these species are not expected as the project will be constructed on agricultural land unsuitable for them.

(b) The specific aquatic species currently present in the intermittent waterway near Ziegler Dairy is not known. Based on a review of the Wisconsin Natural Heritage Inventory, there are no known endangered resources within the construction site. Two special concern species have been observed within a one mile radius, *Reithrodontomys megalotis* (Western Harvest Mouse) and *Microtus ochrogaster* (Prairie Vole). Impacts to these species are not expected as the project will be constructed on agricultural land unsuitable for them.

16. Air Quality Impacts

(a) Ambient Air Emissions
The digester waste to energy facility operations will result in ambient air emissions. Sources of air emissions include the three (3) manure digesters, two biogas fired engine generator sets, a biogas flare as well as emissions from vehicles and vehicle traffic. The common forms of air pollution associated with this type of waste to energy facility are odors, particulate matter, combustion emissions, hazardous air pollutants and fugitive dust.

Odor
Wisconsin Administrative Code requires all sources of air emissions to regulate objectionable odors (s. NR 429.03, Wis. Adm. Code). This rule establishes general limitations on objectionable odor, defines the test for what constitutes objectionable odor and sets abatement or control requirements.

To minimize odors, the incoming manure receiving tanks, the raw manure above ground tank, and the solid storage at the facility will all be covered. Effluent odor from the anaerobic digesters is significantly less than odors from conventional manure management systems because these tanks are covered at all times. Odors are not anticipated from the combustion of biogas in the engines or flare.

GL Dairy will be required to prepare a malodorous emissions control plan to document the steps to be taken to control odors resulting from the operation of the anaerobic digester and address any complaints received.

Particulate Matter and Fugitive Dust
Wisconsin's fugitive dust rule, s. NR 415.04, Wis. Adm. Code establishes general limitations on fugitive dust and sets specific precaution for limiting fugitive dust emissions. Fugitive Dust during construction from gravel driveway and routine traffic can be controlled with the implementation of a watering program. After construction, the access road will be paved and any remaining gravel areas on the site will be watered as needed to minimize dust.

Ambient air quality standards for particulate matter are established in s. NR 404.04 and NR 404.05, Wis. Adm. Code. It is anticipated the ambient air quality standards for particulate matter and fine particulate matter (PM2.5) established at the federal level will be met at this site. A dispersion modeling analysis dated March 20, 2013 demonstrated that the emission from the sources at this site will be able to attain and maintain air quality standards. This analysis can be found as part of the preliminary determination documents.

Combustion Emissions

Combustion of biogas in the engine generator sets to produce electricity results in emissions of nitrogen oxides, carbon monoxide, sulfur dioxides and hazardous air pollutants (formaldehyde). Emissions from the engines are regulated the Federal New Source Performance Standards (NSPS), 40 CFR Part 60, subpart JJJJ for spark ignition internal combustion engines and under the National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR Part 63, subpart ZZZZ, for reciprocating internal combustion engines (RICE) promulgated under section 112 of the Clean Air Act. Information available from the engine manufacturer indicates that the emissions from the engines are anticipated to meet these standards. GL Dairy will be required to perform stack emission tests to demonstrate compliance with the standards.

Emissions of sulfur dioxide will be controlled by limiting the amount of hydrogen sulfide in the biogas. GL Dairy will utilize a gas conditioning system to decrease the amount of hydrogen sulfide in the biogas and provide the engines with a sufficient quality of gas to maintain engine performance.

Greenhouse Gases (GHG)

Conventional liquid and slurry manure management practices emit large amounts of methane, a greenhouse gas that contributes to global warming by trapping energy from the sun and from human activity. The methane created by anaerobic digestion is captured and burned in the engines or flare reducing the greenhouse gas emissions. In addition, combustion of the methane to produce electricity in the engine generator sets off energy that would otherwise be derived from virgin fossil fuels.

(b) Air Pollutants

All animal agricultural operations generate odors and air pollutants. How animals and wastes are managed will determine the air quality impacts on human health and the environment. Larger operations have the potential for larger air quality impacts. Airborne contaminant emissions from CAFO and other types of animal agricultural operations include gases and particles. Air quality concerns are focused primarily on ammonia (NH3), hydrogen sulfide (H2S), odors, particulate matter (PM), volatile organic compounds (VOC), and greenhouse gases (GHG).

Odors are produced by a number of different air pollutants associated with animal agriculture. Some of the most objectionable compounds produced are: organic acids including acetic acid, butyric acids, valeric acids, caproic acids, and propanoic acid; sulfur containing compounds such as hydrogen sulfide and dimethyl sulfide; and nitrogen-containing compounds including ammonia, methyl amines, methyl pyrazines, skatole and indoles.

Diesel exhaust particulate matter emissions from semi-trucks, manure spreaders, and other miscellaneous farm equipment could also be generated by animal agricultural operations. Emergency generators, other stationary diesel or biogas engines and other combustion sources will emit pollutants, too. The combustion of diesel, biogas or other fuels emits and forms pollutants such as oxides of nitrogen (NOx); carbon monoxide (CO); sulfur dioxide (SO2) and products of incomplete combustion.

In addition to primary emissions, certain air pollutants are formed through chemical processes in the atmosphere known as secondary formation processes. The secondary pollutants have significant effects. Ammonia reacts with SO2 and NOx to form PM2.5. VOC and NOx react to form ozone. Nitrogen containing compounds such as ammonia and NOx result in increased nutrient loading and acidification of soils and waters.

Odor

Odor is a very real and often highly charged issue for farmers, neighbors and local government in terms of health risks, both perceived and real, and nuisance law suits. In fact, the issue of air emissions and odors are often talked about as being one-and-in-the-same. However, it is important to note that not all air emissions have odors, just as not all odor-causing agents are regulated air pollutants. Differentiating between air pollutant emissions and odors is important, both in terms of mitigation practices and the effectiveness of those practices.

Wisconsin Administrative Code requires all sources of air emissions to regulate objectionable odors (s. NR 429.03, Wis. Adm. Code). This rule establishes general limitations on objectionable odor, defines the tests for what constitutes objectionable odor, and sets abatement or control requirements. Ch NR 429, Wis. Adm. Code includes a procedure for determining objectionable odors based on conditions at the facility once it has been constructed and is operating.

The Livestock Facility Siting rule consists of s. 93.90, Wis. Stats. and Ch. ATCP 51, Wis. Adm. Code and establishes state standards (including provisions for addressing odors) and procedures local governments must follow if they choose to require conditional use or other permits for siting new and expanded livestock operations. Facilities covered by the Livestock Facility Siting Law must comply with an odor standard that uses a predictive model to determine acceptable odor levels from the farm areas, including manure storage, animal housing and open lots.

The predictive model used with ATCP 51 has several features. For example, the model:

- requires practices if a proposed facility does not have adequate separation distance from neighbors
- provides a range of practices to choose from (including low cost options to manage odor)
- protects future expansions by fixing the closest neighbor at the time of the original application, yet does not allow for continuous odor monitoring for enforcement purposes

The Siting Law does not provide authority to monitor and regulate air emissions.

Air Quality Regulations Overview

Ziegler Dairy, as with any source of air pollution, is required to evaluate existing information, determine its air emissions, and comply with any air regulatory requirements that apply.

Existing Federal Regulations

Under the federal Clean Air Act, new and existing major stationary sources of federally regulated criteria air pollutant emissions are subject to federal air permit requirements. Included are permit requirements under the federal "Prevention of Significant Deterioration (PSD)" and "Non-Attainment Area" New Source Review programs, along with the applicable requirements for "Best Available Control Technology", and "Lowest Achievable Emission Rate" technology and offsets, respectively. Emissions associated with animal feeding operations (AFOs) are not, categorically, exempt from these requirements.

Under Section 112(b) of the federal Clean Air Act, hazardous air pollutants are regulated through National Emission Standards for Hazardous Air Pollutants established by industry sector. No such standards have been established specifically for AFOs. Ammonia and hydrogen sulfide, two air pollutants associated with AFOs, are not regulated as federal hazardous air pollutants under section 112(b).

The Clean Air Act lists ammonia in section 112(r)(3) and the EPCRA have reporting requirements that are triggered when 100 pounds per day of ammonia (18.3 tons per year), are "released."

The Clean Air Act lists hydrogen sulfide (H2S) in section 112(r)(3), and both the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the EPCRA have reporting requirements that are triggered when 100 pounds per day of H2S (18.3 tons per year), are "released."

Methanol and acetaldehyde are federal hazardous air pollutants with emission limitations covered under section 112(b) of the Clean Air Act. Any stationary source which emits, or has the potential to emit, 10 tons per year of methanol or acetaldehyde, or 25 tons/year combined, would be a "major source" under the Clean Air Act.

Existing State Regulations

The federal air permit requirements described above are incorporated into state air permit rules in chs. NR 405, 406, and 407. In addition, chs. NR 406 and 407 include air permit requirements for minor sources. Emissions associated with animal feeding operations are not categorically exempt from these requirements.

Ch. NR 445, Wis. Adm. Code, addresses the control of state hazardous air contaminants. This rule establishes ambient air standards for specific contaminants in the ambient air. The acceptable 24-hour average ambient concentrations for ammonia and hydrogen sulfide, the two primary contaminants associated with agricultural waste, are 418 and 335 micrograms per cubic meter, respectively.

2011, Wisconsin Act 122 (creating s. 285.28, Stats.), signed into law March 7, 2012, exempts hazardous air contaminants associated with "agricultural waste" from requirements of ch. NR 445, Wis. Adm. Code. Specifically, the law states that the

Department "…may not regulate the emission of hazardous air contaminants associated with agricultural waste except to the extent required by federal law." This permanent exemption also pertains to portions of chs. NR 407 and 407 which directly relate to NR 445.

Odors are addressed in ch. NR 429 (Malodorous Emissions), yet odor control practices contained in ch. ATCP 51 (Livestock Facility Siting) are included with the proposed project. The Livestock Facility Siting Law consists of a state statute (s. 93.90) and rule (ATCP 51) that establish state standards and procedures local governments must follow if they choose to require conditional use or other permits for siting new and expanded livestock operations.

Similar to federal reporting requirements, state reporting requirements include the air spill reporting requirements in ch. NR 445 and the annual air emission reporting requirements of ch. NR 438. Air emissions from animal feeding operations are not categorically exempt from these reporting requirements, including ammonia and hydrogen sulfide which are required under federal law by EPCRA reporting requirements.

17. Cultural

a. Land Use (including indirect and secondary impacts)

(a) The area of the proposed project is agriculture in nature and is zoned for agriculture use.

All participating farms will be required to have a 590 Nutrient Management Plan (NMP) approved annually by the Dane County Land Conservation Department. This requirement will help farmers with the management of all nutrient sources (manure, digested material, fertilizer, etc…) and aid in preventing the over application of nutrients as well as help minimize the loss of nutrients to nearby surface waters. Participating farmers will also not be allowed to land apply any nutrients during frozen ground periods, further minimizing the risk of nutrient loss from the landscape. As a result of the increased management of nutrients and decreased risk of nutrient loss the amount of phosphorus entering nearby surface waters will be reduced.

(b) The land will continue to be used for agriculture purposes. Ziegler Dairy will be required to have a 590 Nutrient Management Plan (NMP) approved annually by the Dane County Land Conservation Department. This requirement will help the farm with the management of all nutrient sources (manure, digested material, fertilizer, etc…) and aid in preventing the over application of nutrients as well as help minimize the loss of nutrients to nearby surface waters. The farm will also not be allowed to land apply any nutrients during frozen ground periods, further minimizing the risk of nutrient loss from the landscape. As a result of the increased management of nutrients and decreased risk of nutrient loss the amount of phosphorus entering nearby surface waters will be reduced.

b. Social/Economic (including ethnic and cultural groups, and zoning if applicable)

(a) Area residents will see an increase in traffic on Schneider Road as it is anticipated that the project will require 17-20 semi-trucks entering and leaving the site daily for the duration of a 5 day work week. Hours of operation for the facility in which truck traffic can be expected is 5:00 a.m. to 9:00 p.m. Additional truck traffic will also be occurring during the two times per year that Ziegler Dairy is applying centrate and digestate that is stored in 15,000,000 gallon lagoon. There will also be an increase in noise and traffic during construction.

The economy of the local community should be directly impacted by the project. This project will increase the property tax base for local schools and the community. The majority of the work performed during construction will be from local contractors. It is estimated that approximately $2 million will be paid to local contractors to perform the work. In addition, the land will be purchased from one of the participating farms. During construction, those contractors not local to the site will stay in the local hotels, eat at the local restaurants, and shop at the local convenience stores, hardware stores, and grocery stores. The completed facility will employ three to four operators.

The estimated $12 million digester project will be financed with both private and public funding. The 2009 State of Wisconsin biennial budget (2009 Wisconsin Act 28) included a $6.6 million grant to Dane County of state general obligation borrowing to be used to support two manure digester projects in the Yahara Lakes Watershed. On November 17, 2010, the State Building Commission approved a $3.3 million grant to Dane County for this project. Dane County will provide a $3.3 million grant to GL Dairy Biogas, LLC for the construction costs related to phosphorus removal. In addition, Dane County paid $100,000 to Strand Associates, Inc. for the development of the Community Manure Management Feasibility Study and paid Strand Associates, Inc. for services and development of the Community Manure Management Facilities Plan. These plans originated prior to construction of the first Dane County Manure Handling Facility located in Waunakee.

(b) This project should increase the tax base for local schools and the community. Organic nutrients should help improve soil quality while helping to limit commercial fertilizer purchases.

According to the Wisconsin Milk Marketing Board, approximately $2,300 per cow is made available to the local economy and for every new agricultural job created, 1.3 jobs are added to the state of Wisconsin employee base. This would be $2,300 dollars for each of the milk cows (590 additional milking cows); which totals to approximately $1,357,000 that will be contributing to the local economy. With increased markets and economic activity in the area, and increased investment in the farm, overall farm and community property values are expected to stay the same or increase.

The farm employs 15 employees, which includes 6 family members. The farm is considering hiring seven additional employees after the expansion.

c. Archaeological/Historical

(a) No archaeological or historical landmarks present on site (communication with Dr. Mark Dudzik, WDNR Archealogist)

(b) No archaeological or historical landmarks present on site (communication with Dr. Mark Dudzik, WDNR Archealogist)

18. Other Special Resources (e.g., State Natural Areas, prime agricultural lands)

(a) No State Natural Areas are in or adjacent to lands operated in cooperation with the Dane County Manure Handling Facility. The digester facility site is proposed to be constructed on land classified as Prime Farmland by the USDA/NRCS Web Soil Survey.

(b) No State Natural Areas are in or adjacent to the Ziegler Dairy construction site. The farm expansion site is proposed to be constructed on land classified by the USDA/NRCS Web Soil Survey as Prime Farmland.

19. Summary of Adverse Impacts That Cannot Be Avoided (more fully discussed in 15 through 18)

(a) There will be an increase in construction traffic as well as additional traffic daily for maintenance of the facility. Semi trailers will be entering and exiting the area to transport the solid byproduct from the digester to areas outside of the watershed. Increased traffic for manure hauling equipment will also occur before the planting and after the harvesting of crops. The amount of impervious area will also be increased as a result of construction of the Facility. This will be mitigated through the installation of a retention basin and bio-filters. Visual aesthetics will be minimally impacted since the facility is being constructed in an area of high agricultural use (large CAFO farm located just to the west). Impact to the terrestrial environment is also minimal as a result of the Facility being located on agricultural lands that have been cropped and tilled. Aquatic resources will not be adversely impacted but instead should be positively impacted as a result of less phosphorus reaching surface waters.

(b) There will be an increase in construction traffic during expansion and additional traffic after expansion to transport products produced on the farm. The amount of manure produced on the farm will increase as will the amount of land that receives manure. Visual aesthetics and cultural impacts will be minimally impacted since the expansion is occurring in an existing agricultural area. The increase in impervious area will also be minimized since the expansion is occurring over an existing manure storage pit.

DNR EVALUATION OF PROJECT SIGNIFICANCE (complete each item)

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20. Environmental Effects and Their Significance

a. Discuss which of the primary and secondary environmental effects listed in the environmental consequences section are long-term or short-term.

(a) The two main consequences resulting from the project are increased impervious surface and increased traffic. Though the increase in impervious surface will be long-term, steps will be taken to reduce runoff, including the installation of an infiltration basin and three bio-filters. The increase in traffic will be significant during construction but will be reduced as the project nears completion. There will be daily semi-truck traffic as manure, centrate, and solids are hauled to and from the digester.

Benefits of the Facility include; an increase in green energy production, reductions in the amount of phosphorus reaching surface waters, decreased odor associated with manure applications, a facility in which agricultural producers can bring manure during emergency situations, and improved nutrient management.

(b) The main consequence of the Ziegler Dairy expansion is the increase in manure production in an already dairy intensive area. Due to the Dane County Manure Handling Facility proposal, the impact of the additional manure will be reduced as 43 percent of the phosphorus produced from the animals will be removed. The increase in impervious surface will be minimal since the expansion will occur over the current manure storage pit. Odors associated with the increased manure quantities will also be reduced as a result of the Dane County Manure Handling Facility.

Benefits of the expansion include: the facility being managed to a higher level as a result of needing a WDNR WPDES permit, the treatment of runoff collected from the feed storage and loading pad, an improved management of manure, and a positive impact on the local economy as dairy products are increased and additional workers are hired.

b. Discuss which of the primary and secondary environmental effects listed in the environmental consequences section are effects on geographically scarce resources (e.g. historic or cultural resources, scenic and recreational resources, prime agricultural lands, threatened or endangered resources or ecologically sensitive areas).

(a) The proposed digester is not expected to result in adverse impacts to geographically scarce resources.
(b) The farm expansion is not expected to result in adverse impacts to geographically scarce resources.

c. Discuss the extent to which the primary and secondary environmental effects listed in the environmental consequences section are reversible.

(a) The land disturbance is a permanent consequence and increased impervious surface would be difficult to reverse, but is being mitigated through the construction of an infiltration basin and three bio-filters.

(b) The land disturbance is a permanent consequence and increased impervious surface would be difficult to reverse, however the amount of impervious area is minimal. The animal numbers may be reduced in the future, but is unlikely due to the input costs to construct facilities to house the additional animal units.

21. Significance of Cumulative Effects

Discuss the significance of reasonably anticipated cumulative effects on the environment (and energy usage, if applicable). Consider cumulative effects from repeated projects of the same type. Would the cumulative effects be more severe or substantially change the quality of the environment? Include other activities planned or proposed in the area that would compound effects on the environment.

(a) Multiples of the proposed project would be expected to have positive effects on the environment by reducing the amount of released methane and other harmful gasses along with reducing soil phosphorus in the watershed. Each facility would be reviewed independently as they are proposed.

Phosphorus in the watershed should be reduced over time as over 43,800 lbs. of P will be removed each year through the solid separation process. The reduction of P making its way to Lake Mendota may reduce the amount of algae present each year. It is estimated that for each pound of P that enters surface water, 500 lbs of algae will be produced (Struss 2003). Estimates show that approximately 3,747 lbs. of P run-off will be reduced from impacting nearby surface waters from the participating farms. This equates to an approximately 1,873,500 lb. reduction of algae in the surface water system. If multiples of the project were to be installed over time, it is believed that improvements in Lake Mendota's water quality would be significant. The facility will also reduce nutrient levels by 43% thus assisting in the reduction of soil test P levels.

Not only will the digestion process decrease the amount of methane released into the atmosphere from animal waste, but it will create enough energy to power approximately 2,500 homes with renewable energy sources. With the digestion process, odors should be reduced if the system is properly maintained.

(b) If numerous projects of this type are proposed in the same geographic area, there is a concern that the land base available for land spreading manure could be overwhelmed. This would make a number of such projects nonviable, primarily with the cost associated with hauling manure long distances for land spreading.

Any future projects will be examined at the appropriate time. With each new operation or proposed expansion, cumulative effects such as impacts from manure land spreading are considered. Unless these facilities are poorly sited or concentrated in a small area, the cumulative impacts to the environment should not be significant.

22. Significance of Risk

a. Explain the significance of any unknowns that create substantial uncertainty in predicting effects on the quality of the environment. What additional studies or analysis would eliminate or reduce these unknowns?

(a) Much of the project analysis was based on models, each of which holds its own assumptions and uncertainties. Dane County will use this project as an opportunity to explore alternative monitoring options to track the models predictions over time. The Digester is one way to reduce risks associated with current ongoing nonpoint source efforts such as changes in tillage practices and rotations. The farms participating in this project are agreeing to increased regulation of their farming practices as a condition of their participation. Increased regulation and implementation of a nutrient management plan for participating farms may reduce uncertainty as nutrients applied to agricultural fields should be more carefully managed. This should reduce the risk of some environmental impacts, such as increased P loading to participating fields and elimination of spreading during winter months. It is anticipated that an estimated 21,900 tons of carbon dioxide emissions will be off set by the burning of methane gas. There are also the unknown risks associated with potential spills or failures in equipment. Secondary containment and redundancies have been put in place to mitigate any spills should they occur.

(b) The main unknown from the expansion is how the addition of animals and subsequent applications of manure will impact surface waters. The environmental analysis is heavily weighted on models. The models are continuously being updated and improved; however the models can not predict changes in day to day operational management. What is actually implemented and how it compares to model parameters is unknown.

b. Explain the environmental significance of reasonably anticipated operating problems such as malfunctions, spills, fires or other hazards (particularly those relating to health or safety). Consider reasonable detection and emergency response, and discuss the potential for these hazards.

(a) The environmental significance of any anticipated operation problems is minimal given the design of the Facility containing berms, retention basins, and bio-filters that would aid in the containment of materials should any structures fail. The Facility also has in place a spill and emergency response plan (Attachment L) outlining the procedures in response to any spills.

(b) The geographical location of the proposed expansion is located more then 400 ft. away from surface water and the major flow path from the facility is to the north away from this surface water. Should any operational problems occur from the failure of the leachate collection and runoff control/treatment system, or other buildings and structures, a large majority of materials will flow north onto the adjacent agricultural fields. On farm machinery including tractors, skid steers, trailers, hay, and other materials are available to respond to any malfunctions or spills. Operation and Maintenance Plans for the manure transfer and leachate collection and runoff control/treatment system will be implemented to further reduce the risk of any potential problems or malfunctions (Attachment M).

23. Significance of Precedent

Would a decision on this proposal influence future decisions or foreclose options that may additionally affect the quality of the environment? Describe any conflicts the proposal has with plans or policy of local, state or federal agencies. Explain the significance of each.

(a) Implementing this proposal will hopefully bring about the establishment of other digester systems servicing farms in the watershed of Lake Mendota. By placing additional digesters in the Mendota watershed, it is anticipated that P reduction will benefit all of the lakes downstream. As the digester project is estimated to remove over 43,000 lbs. of P from the watershed within its first year in operation, soil P levels will begin to decrease over time. An article focusing on P runoff from alfalfa fields (McGinley 2004) discussed study findings that found that when soil P levels are around 110 ppm, the P runoff is four times higher as compared to fields with soil P levels of around 39 ppm, regardless of crop grown. With this being said, controlling P going into Lake Mendota can not be solved entirely though current soil conservation practices, removal of P from the watershed must be accomplished to meet water quality goals.

(b) All future projects will be evaluated by their own specific adverse and beneficial impacts. There are 233 permitted CAFOs in Wisconsin, including 11 in Dane County. Each individual project is considered separately based on its own merits.

24. Significance of Controversy over Environmental Effects

Discuss the effects on the quality of the environment, including socio-economic effects, that are (or are likely to be) highly controversial, and summarize the controversy.

(a) It is not anticipated that there will be widespread significant opposition to the Middleton Digester project. The goal of this project of improving water quality of the Yahara Lakes is believed to be shared by many citizens of Dane County. However, there will be significant resources expended for benefits that may only be realized in the long-term in the watershed.

Other potential controversies include concerns at the local level of increased traffic on Town roads. This issue is being discussed with the Town Planning Commission, Town Board, and local residents in order to come to a resolution that will protect the interests and safety of the local residents while allowing the project to move forward.

(**b**) The proposed expansion of the Ziegler farm is not expected to be controversial.

ALTERNATIVES

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25. Briefly describe the impacts of no action and of alternatives that would decrease or eliminate adverse environmental effects. (Refer to any appropriate alternatives from the applicant or anyone else.)

(a) This project began when Dane County decided to evaluate options for reducing phosphorous runoff in the agricultural industries. As part of the development of this project, Dane County performed a feasibility study, *Community Manure Management Feasibility Study (2008)*. This study evaluated several alternatives for manure and phosphorous management. Even though the total number of farms and cows in the currently proposed project is slightly different than what was assessed in the feasibility study, many of the findings in the study are still valid for this project. Brief descriptions of the evaluated alternatives are given here.

<u>Alternative 1: Do Nothing</u>
There are many areas within the Yahara Watershed that have high phosphorus levels in the soil. This has led to a high level of phosphorus runoff in the Yahara chain of lakes, contributing to algae blooms and other adverse effects. The proposed project should remove significant amounts of phosphorus from manure being land applied in the Yahara Watershed with a goal of reducing phosphorus runoff into the lakes. The proposed project should also reduce greenhouse gas (GHG) emissions from these farms. If this project does not happen, an effort to reduce GHG emissions would not be achieved, and 100% of the phosphorus from the three farms identified will continue to be land applied, which will continue to contribute to phosphorus loading to the Yahara chain of lakes.

<u>Alternative 2: Other Technologies</u>
As part of the 2008 study, Dane County evaluated several technologies for manure solids destruction and stabilization, manure solids separation, and phosphorus removal and recovery from manure. This included a literature review of available technologies and several site visits. A summary of the technologies reviewed and their feasibility on Dane County Farms can be found in Section 3-5 of the 2008 study.

The 2008 study looked at several technologies, including: anaerobic digestion, aerobic digestion, composting, combustion, pyrolysis, gasification, sand and grit separation, at least nine methods of manure solids separation, manure drying, phosphorus minimization in feeds, advanced phosphorus removal through chemical precipitation, and others.

The review looked at the feasibility of each technology, based on economics, technological reliability, and 18 non-monetary criteria, such as phosphorus reduction, water quality impacts, and air quality impacts. The review of all of the non-monetary criteria can be found in Section 5 of the 2008 study. Ultimately, the study found that a community system was more economical than a system at each individual farm. Additionally, this study concluded that the currently proposed project, anaerobic digestion, followed by advanced phosphorus removal, was the best option.

<u>Alternative 3: Other Locations</u>
The initial step in the 2008 Study was a survey of Dane County farms to determine farmer interest in participating in this project. Based on the farm responses, two clusters of farms were identified as potential sites. These clusters were chosen primarily due to their willingness to participate, but also due to their number and concentration of animals. The two farm clusters are in Middleton and Waunakee. The Waunakee digester is currently in operation and thus this project aims at completing the second of the two recommended sites.

<u>Alternative 4: Smaller Facility</u>
Another option would be to construct a smaller facility. This would have the advantage of less land disturbance. However, it would not reduce emissions or phosphorous to the same degree. Also, this option is not economically feasible due to economies of scale. This was evaluated in the 2008 Study.

<u>Alternative 5: Larger Facility</u>
A larger facility would have the negative impact of increased land disturbance, but it would increase the reduction of phosphorous and GHG emissions. However, a larger facility would require additional manure, which is not currently available. It would also require manure from farther farms to be trucked to the site, thereby increasing trucking emissions. The Facility is designed to

allow for expansion in the future.

(b) Expanding the facilities as proposed will give Ziegler Dairy the ability to meet both the needs and the goals of the dairy. The expansion will aid them in utilizing their manure more efficiently while at the same time minimize both costs and impacts on the environment.

Alternative 1: Do Nothing

Ziegler Dairy has been expanding and is now approaching 1,000 animal units in which it is required to obtain a WDNR WPDES permit. Without the proposed expansion of the facility Ziegler Dairy would continue to operate as a non permitted facility and as such would not be subject to additional regulations under the WPDES permit. Without the proposed expansion Ziegler Dairy would also not be able to collect the runoff from their feed storage and loading area resulting in the continued runoff of these materials and nutrients.

Alternative 2: Other Locations

Locating the expansion in a different location is not economically feasible for Ziegler Dairy. The dairy already has a significant investment in the existing site including freestall barns, milking parlor, feed storage, and manure transfer and storage. Simply moving the location of the expansion to a different peace of land they already own would not change the potential impacts to the environment.

SUMMARY OF ISSUE IDENTIFICATION ACTIVITIES

26. List agencies, citizen groups and individuals contacted regarding the project (include DNR personnel and title) and summarize public contacts, completed or proposed).

Date	Contact	Comment Summary
10/26/12 11/5/12 12/3/12 12/29/12 1/7/13 2/4/13 2/20/13 3/4/13	Town of Springfield	Provided general information regarding the digester project at the Town of Springfield Board Meeting. A packet of information regarding the project and the request for re-zoning was submitted. A public hearing on the project was held by the Town of Springfield on Dec. 3, 2012. Questions were raised by the citizens regarding noise, truck traffic, and odors which were addressed during the meeting. Members of the Town Board and Planning Commission toured the proposed site and toured the Waunakee Digester Project on Dec. 29, 2013. The re-zoning request and conditional use permit were addressed by the Planning Commission at the Jan. 7, 2013 meeting. Recommendations were made by the Planning Commission and the drawings were revised per their recommendations. The Planning Commission made a motion to recommend approval of the re-zoning and conditional use permit (CUP) at the Feb 4th meeting. At the Feb. 20 Town Board, meeting the re-zoning and CUP were recommended for approval by Dane County and forwarded to Dane County for approval. On March 4th, the Planning Commission approved the version of the re-zoning and CUP as approved by the County and it now goes to the Town Board for approval at the March 19th meeting.
Numerous	Dane County	Numerous meetings which included Dave Merritt, Charles Hicklin, Kevin Connors, John Welch and others to discuss the project and how to move it forward. Meetings were held with Kevin Connors, Pat Sutter, and Kyle Minks to discuss the nutrient management plans and land spreading restrictions.
2/26/13	Dane County	The Dane County Planning Commission reviewed the re-zoning request and CUP as submitted by the Town of Springfield. It was approved by the Planning Commission and sent to the County Board for approval. At the March 7th County Board meeting the re-zoning and CUP were approved by the County.
11/28/12	DNR	Lloyd Eagan, Mark Cain, Brenda Howland, and others to discuss completion of the Environmental Assessment, WPDES permit application, storm water permit application, and air permit application

5/14/12	MMSD	Discussed the options for sending the RO water into the MMSD system for the potential second phase of this project.
5/16/12	Town of Middleton	Presenting an overview of the digester project to the Town of Middleton for informational purposes only.
5/31/12 6/25/12 1/22/13 3/12/13	City of Middleton	Provided drawing set and CSM to the City of Middleton for review. The project is on the agenda for the Planning Commission meeting on Jan. 22, 2013. The drawings were also submitted to the Fire Dept. for review since the City of Middleton provides fire coverage for this portion of the Town of Springfield. Discussed the location of the project and its proximity to the airport with Mark Opitz. He provided the height restriction maps for the proposed project area. Following approval of the re-zoning and CUP Dane County, the updated certified survey map (CSM) and CUP were recommended for approval by the to the City of Middleton Board for approval by the Planning Commission.
4/13/12 5/3/12 11/29/12	Clean Lakes Alliance	Meetings with Don Heilman and James Tye to update on progress of Springfield Digester Project and discuss impacts on the Lakes.
1/15/13	DWD	Requested a prevailing wage determination from the Dept. of Workforce Development regarding the construction of this project.
Approximately monthly over past 3 years	Farms	Discussed this project with many of the farms in the Town of Springfield as a possible host site and/or as a possible participant. At this point, three farms have agreed to join the project and others are waiting to understand the requirements versus the benefits before committing to participation.

Project Name: County:

PRELIMINARY DECISION

In accordance with s. 1.11, Wis. Stats., and Ch. NR 150, Wis. Adm. Code, the Department is authorized and required to determine whether it has complied with s. 1.11, Wis. Stats., and ch. NR 150, Wis. Adm. Code.

The Department has made a preliminary determination that the Environmental Impact Statement process will not be required for this action/project. This recommendation does not represent approval from other DNR sections which may also require a review of the action/project.

Signature of Evaluator	Date Signed 5/2/13

FINAL DECISION

The public review process has been completed. The Department received and fully considered responses to the news release or other notice.

Pursuant to s. NR 150.22(2)a., Wis. Adm. Code , the attached analysis of the expected impacts of this proposal is of sufficient scope and detail to conclude that this is not a major action, and therefore the environmental impact statement process is not required prior to final action by the Department.

The Department has determined that it has complied with s. 1.11, Wis. Stats., and ch. NR 150, Wis. Adm. Code. This decision does not represent approval from other DNR sections which may also require a review of the action/project.

Signature of Environmental Analysis Program Staff	Date Signed 5/2/13

NOTICE OF APPEAL RIGHTS

If you believe that you have a right to challenge this decision, you should know that the Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed. For judicial review of a decision pursuant to sections 227.52 and 227.53, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to file your petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review must name the Department of Natural Resources as the respondent.

To request a contested case hearing pursuant to section 227.42, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. All requests for contested case hearings must be made in accordance with section NR 2.05(5), Wis. Adm. Code, and served on the Secretary in accordance with section NR 2.03, Wis. Adm. Code. The filing of a request for a contested case hearing does not extend the 30 day period for filing a petition for judicial review.

Heggelund, Eric P - DNR

From: Cain, Mark R - DNR
Sent: Thursday, May 02, 2013 4:03 PM
To: hsgarn@wisc.edu; Heggelund, Eric P - DNR; Minks, Kyle (Minks.Kyle@countyofdane.com)
Cc: Wible,Lyman; Stefanie Brouwer; Emil Haney; Bruce Froehlke; Dawn Meyer
Subject: RE: Manure Digester EA comments

Herb,

Thanks for your comments on the EA for the Dane County Manure Handling Facility, Middleton Digester. I would like to respond to your comments in this e mail and I will attach a copy of this e-mail to the EA.

Acker Farm

The Acker Farm (Randy Acker) along with many other farms, were contacted by Dane County regarding their interest in participating and had many chances to request inclusion into the project. Participation in the project is completely voluntary and the Acker's apparently were not interested at this time.

The facility has been designed to allow for expansion and the addition of farms in the future. Procedures have been put in place for incorporating new farms (Attachment K) however these expansions do come at a cost. Upon completion of construction and stabilization of the digester facility it is highly likely that the project owner will consider adding additional farms. However, currently adding additional farms is not economically feasible given the already high costs associated with construction of the proposed facility.

Digester Tanks

The digesters are 30-foot high concrete tanks. The top of the base slap is at a site elevation of 953 feet, which is approximately 3.5 feet below grade. NR 213, the design code for industrial storage facilities, requires a minimum separation distance from the bottom of the sub-base to groundwater and bedrock of 5 feet. The maximum groundwater elevation determined in the site borings was 935.5 feet. No bedrock was encountered in any of the borings. The separation distance requirement is satisfied.

The bottom slab is 8-inch thick reinforced concrete, placed on 12-inch compacted granular fill. The wall is 16-inch thick reinforced concrete. PVC water stops will be installed at all concrete joints. Considering the robust construction, it is not felt necessary to require monitoring wells. The Department has not required monitoring wells downgradient of storage facilities that are designed in accordance with design codes.

Digestate/Centrate Storage Tank

The 15-million gallon tank used to store the treated wastes has a bottom of base slab site elevation of 942.6 feet. The separation distance requirement to groundwater and bedrock is satisfied. The base slab is 5-inch thick reinforced concrete poured on compacted ground sub-base. The wall is 15-inch thick reinforced concrete poured on 6-inch granular sub-base. Water stops will be installed at all concrete joints. Considering the nature of the construction material, the wastes have received some treatment, and the fact that design code requirements are meet, it is not felt necessary to require monitoring wells around this tank.

The storage tanks will be used year round, but will be emptied out when land application is appropriate. Routine maintenance will be part of the operations management plans.

Participating Farms Map

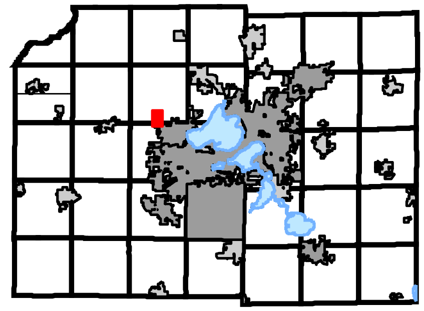
Middleton Manure Digester Project

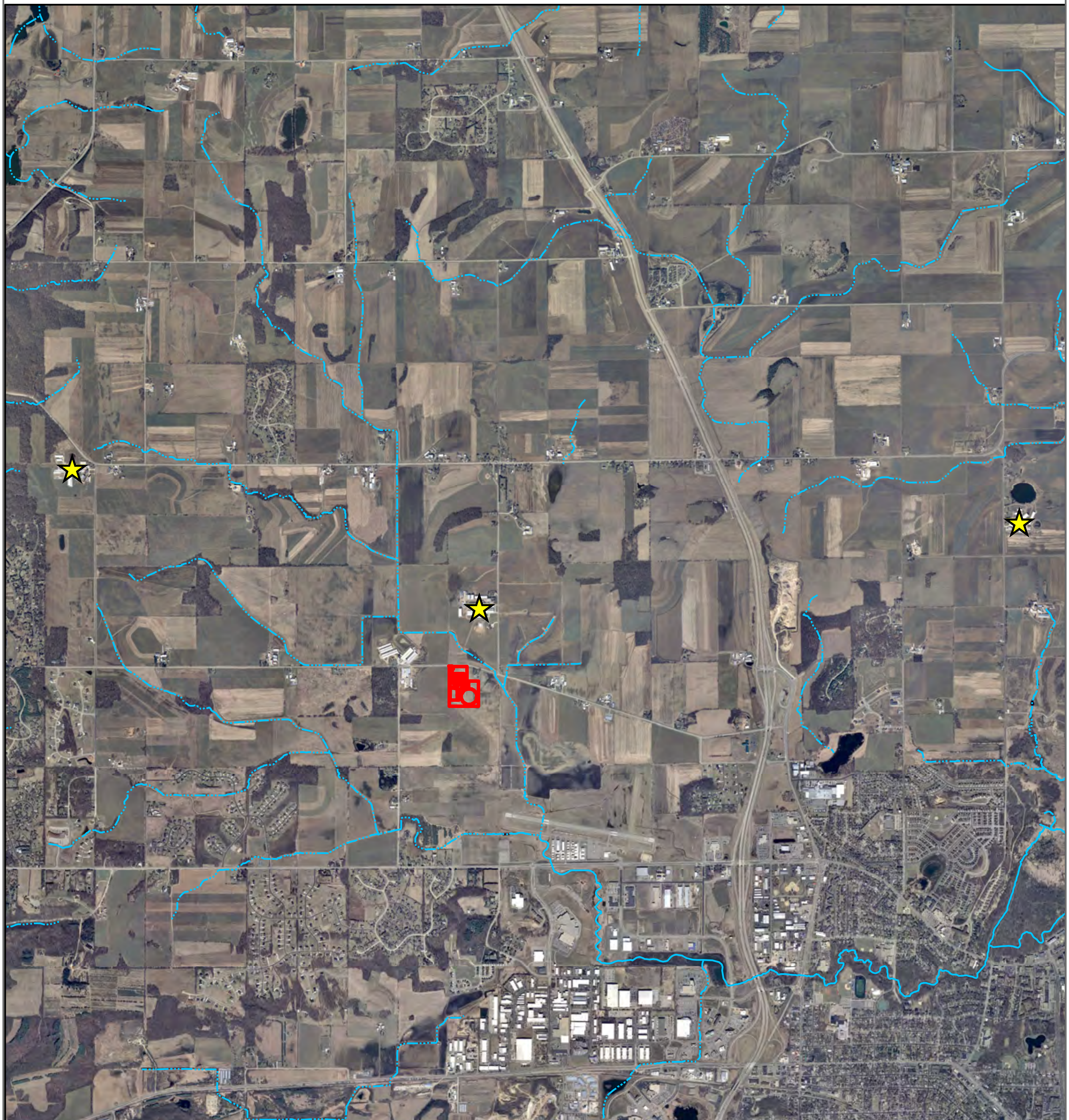
- ★ Participating Farms
- Perennial Stream
- Intermittent Stream
- Manure Handling Facility

Data Source:
Facility data from US Biogas, 8/15/2012
Digital orthophoto 2010

Map updated February 6, 2013 by Dane Co. LWRD
Middleton Digester Farms.mxd

Map Location in Dane County





REVISIONS:
DATE
DATE
DATE
DATE

RESOURCE ENGINEERING ASSOCIATES, INC.

Resource Engineering Associates, Inc.
3510 Parmenter St., Suite 100
Middleton, Wisconsin 53562-2507
Phone: 608-831-5522
Fax: 608-831-6564
Web: www.reaeng.com

PROPOSED SITE LAYOUT
WPDES PERMIT APPLICATION
ZIEGLER DAIRY FARMS
5031 CHURCH ROAD
MIDDLETON, WI 53562

DATE: JAN, 2013
DRAWN: RAN
CHECKED: CTC
APPROVED: RJP
DRAWING NAME: 1250topo.dwg
PROJECT NUMBER: 120050.1

C801

Report

Community Manure Management Feasibility Study

Dane County, WI

February 2008

Report for

Dane County, Wisconsin

Community Manure Management Feasibility Study

Prepared by:

STRAND ASSOCIATES, INC.®
910 West Wingra Drive
Madison, WI 53715
www.strand.com

February 2008

SECTION 4
DESIGN BASIS AND FINANCIAL EVALUATIONS

This section presents our opinion of cost evaluations of the eight manure management alternatives described in Section 3. A description of the facilities included in each alternative is presented, and opinions of capital, operational and maintenance (O&M), and overall life cycle costs are developed in this section. Cost sensitivity analyses are presented with respect to major O&M cost variables.

4.01 DESIGN BASIS

Chapters 2 and 3 discussed the current characteristics of each cluster and the assumed characteristics of the prototype farm in general. Based on that information, the preliminary design basis for each of the management alternatives was developed (Table 4.01-1). This design basis was used to develop preliminary facility and equipment requirements, which were then used to obtain proposals from manure management equipment and system providers and vendors.

The design basis was developed using the information collected with the farm surveys, and additional references were used to complete the design basis when the survey farm data was either incomplete or varied too much to rely on. These references included *Publication A2809 Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops* in Wisconsin issued by the UW Extension and the *Nutrient Management Fast Facts* brochure from the Nutrient and Pest Management Program at the UW Extension. Most significantly, the solids content of the manure was assumed to be as presented in *Publication A2809,* Table 9.2.

It is noted that these design conditions are preliminary, and additional data collection, manure characterization, and quantity estimation should be conducted before proceeding to an implementation phase. For example, the manure production rate for the Waunakee Cluster was approximately 50 percent higher than for the Middleton Cluster (9.9 dry lbs/day/A.U. vs. 6.4 dry lbs/day/A.U.). While both of these values are within the normal range of manure production for dairy cattle of 6 to 10 lbs/day/A.U., this variation was not expected and is not readily explained. The Middleton Cluster does have higher numbers of young cattle and handles more of the manure in a dry form versus liquid form. Inaccurate manure estimation quantities might explain most of the discrepancy.

To develop facility requirements (sizes and capacities) for each of the three design conditions (individual farms, Waunakee Cluster, Middleton Cluster), a 25 percent allowance in the total manure quantities was included to provide capacity for additional manure loadings and/or alternate feed stocks such as industrial wastes. However, in the following sections, the mass balances and figures presented for each manure management alternative do not include this 25 percent allowance to better reflect the anticipated manure quantities. The quantities do, however, reflect the anticipated growth of the farms represented in the alternative analyses.

The alternatives included below for both the individual farms and the farm clusters assume that sand separation has already taken place prior to the equipment and processes described in the following sections for each of the management alternatives. All of the alternatives include some

TABLE 4.01-1

PRELIMINARY DESIGN BASIS

	Prototype Farm	Waunakee Cluster	Middleton Cluster
General Characteristics			
Total Number of A.U. (2007)	500	3,145	3,813
Anticipated Percent Growth through 2012 (Percent)	7	9	4
Total Number of A.U. (2012)	535	3,434	3,966
Additional Growth Allowance (Percent)	25	25	25
Design A.U.	669	4,293	4,957
Manure Production Rate (dry lbs/day/A.U.)[a]	6.3	9.9	6.4
Liquid Manure Generation[b]			
Percentage of Total Manure Solids	46	80	50
Mass of Manure Solids (dry lbs/day)	1,938	34,000	15,862
Solids Concentration of Manure (Percent)	6.0	6.0	6.0
Volume of Liquid Manure (gallons/day)	3,873	67,946	31,699
Nutrient Loadings:			
N (lbs/day)	93	1,631	761
P_2O_5 (lbs/day)	35	612	285
K_2O (lbs/day)	77	1,359	634
S (lbs/day)	16	285	133
Solid Manure Generation[b]			
Percentage of Total Manure Solids	54	20	50
Mass of Manure Solids (dry lbs/day)	2,275	8,500	15,862
Solids Concentration of Manure (Percent)	24	24	24
Volume of Solid Manure (gallons/day)	1,137	4,247	7,925
Nutrient Loadings:			
N (lbs/day)	47	177	330
P_2O_5 (lbs/day)	24	89	165
K_2O (lbs/day)	43	159	297
S (lbs/day)	7	27	50
Total Manure Generation Summary			
Total Mass (dry lbs/day)	4,213	42,500	31,724
Total Solids Content (Percent)	10.1	7.1	9.6
Total Manure Production (wet tons/day)	21	301	165
Total Manure Volume (gal/day)	5,010	72,192	39,624
Total Nutrient Loadings			
N (lbs/day)	137	1,808	1,091
P_2O_5 (lbs/day)	59	700	450
K_2O (lbs/day)	120	1,518	931
S (lbs/day)	23	312	183

[a] Based on survey data.
[b] Liquid manure is generally flushed as a liquid or semi-liquid and stored in a tank of lagoon; solid manure is generally scraped and stored in a stack or pile on-site.

level of storage prior to the alternative technologies employed, and at a minimum, sand would tend to settle within such storage structures.

One alternative that was not included, but that has been employed on an individual farm basis, is simple solids separation (no polymer or other chemical addition) using screw presses or similar equipment. This type of equipment may be used to recover some of the fiber in the manure, and the fiber can often be reused as animal bedding even without digesting or otherwise treating the solids. However, the amount of P removed in such a system (typically 20 to 30 percent) is lower than required to meet the County's goals for phosphorus reduction. Therefore, simple solids separation without any chemical addition was not evaluated in this report. In addition, new technologies and methods for managing manure are under development, and significant research is being conducted world wide on manure management. The technologies considered herein represent viable technologies at the current time, and we understand that new technologies may be developed in the near future that could change these evaluations.

4.02 INDIVIDUAL FARM ALTERNATIVES–DETAILED DESCRIPTIONS

This chapter provides a discussion of the equipment, tanks, building, and related construction elements required for each of the individual farm alternatives. In the following analyses, quantities, performance, and similar information provided should be considered as preliminary.

A. Alternative F-1: Fine Solids Separation with Polymer Addition

Raw manure would be collected at a central manure receiving pit sized to hold two days of manure generation. Manure would be pumped to the solids separation equipment, and polymer would be injected into the pipe prior to the separation equipment to improve solids capture. The polymer system includes a polymer makeup and delivery system that uses emulsion polymers (liquid dry polymers could also be used) delivered and stored in portable 2,200-pound (about 300 gallons) tote containers. Polymer would be diluted with fresh water prior to being mixed into the manure.

Separated solids would be transferred to a covered storage space protected from the elements, where the solids could be stored for up to three months as needed. The liquid portion of the separated manure would be pumped to storage. The storage lagoon would be sized for six months of storage. Cost opinions assume there is an existing raw manure storage lagoon, which would be converted to storage for effluent liquids. The estimated volume of this existing storage lagoon is 1 million gallons based on manure production rates. In this alternative, the addition of polymer water and dewatering equipment wash water would require additional storage capacity, resulting in a total storage volume requirement of approximately 3-million gallons. Therefore, a new 2-million-gallon storage lagoon is required. The liquid is assumed to be land-applied by trucking on nearby land (reduced trucking compared to the existing operations) since the P content is significantly less than the phosphorus content of the raw sludge.

This system will be equipped with a nonpotable water (NPW) system incorporating a storage tank and booster pumps to feed wash water to the fine solids separation unit and to feed dilution water to the polymer system. The storage tank would be filled from the farm's well.

Figure 4.02-1 shows the mass balance through the solids separation process. The mass balance was generated using manufacturer's data for system performance. Based on this data, about 77 percent of the raw manure volume is conveyed to liquid storage along with the water added for polymer dilution and screen wash water, and the liquid portion contains about 55 percent of the solids, N, P, and K. Polymer dilution water and wash water are assumed to add negligible solids and nutrients.

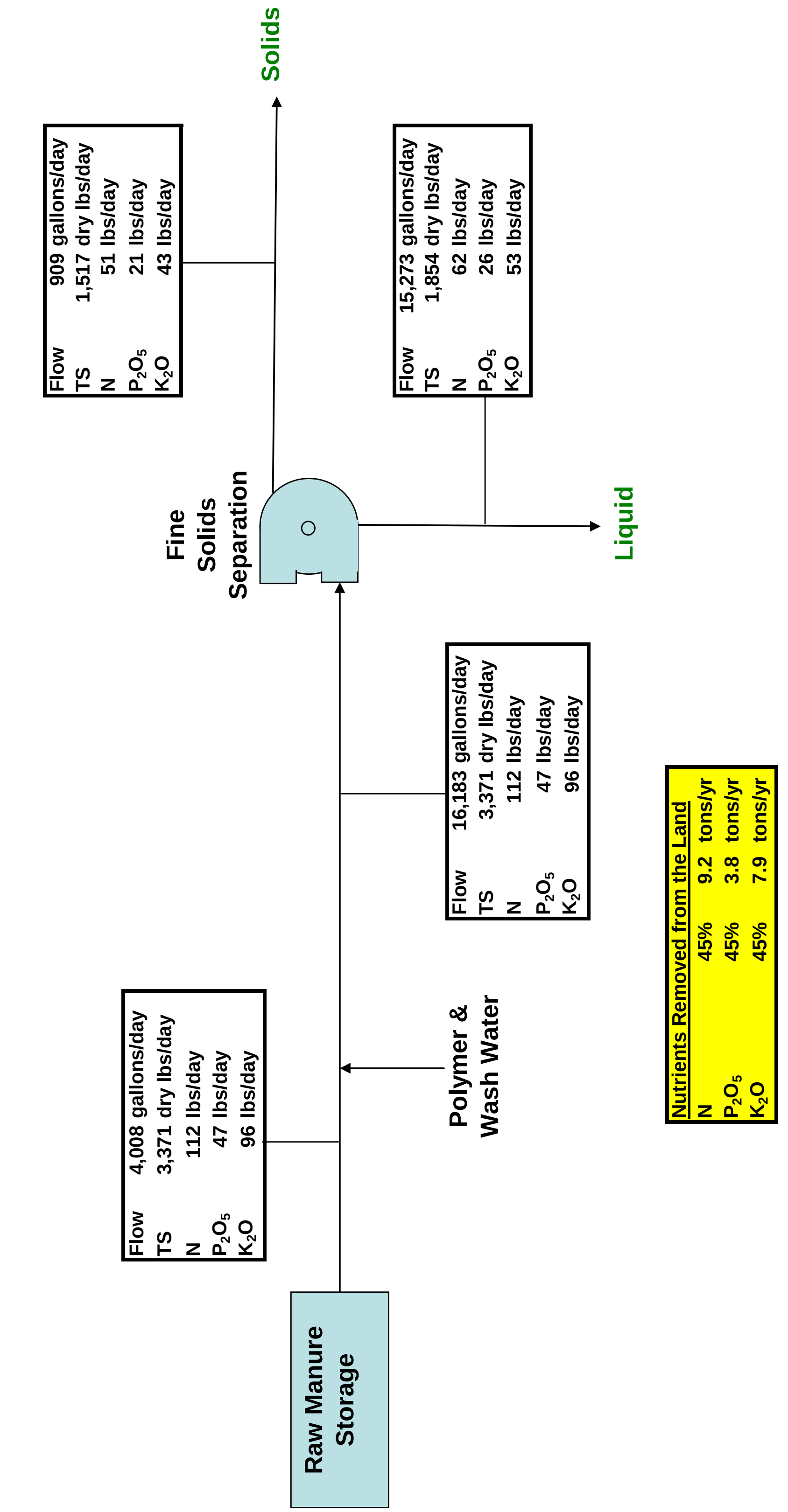
The polymer demand for this system is about 60 lbs/day. The system would also require approximately 3,800 gallons of polymer makeup water and 8,400 gallons of screen wash water per day. The system is designed to operate approximately 40 to 50 hours/week and is anticipated to require 0.5 full-time staff for operations and maintenance.

B. <u>Alternative F-2: Fine Solids Separation with Ferric Chloride and Polymer Addition</u>

This alternative is very similar to Alternative F-1. The basic difference is the addition of ferric chloride to the solids separation equipment feed line, which improves P and solids capture, resulting in higher P in the solids and lower solids and nutrients in the liquid portion. The ferric chloride feed system would be similar to the polymer feed system with the exception that dilution water is not required for the ferric system.

A new solids storage structure will be constructed to hold about one month of solids. This storage time is less than in Alternative F-1 and was assumed because of the higher nutrient value of the solids and the subsequent increased likelihood of transporting the solids off-site more readily than in Alternative F-1. The solids can be land-applied, sold to another end user, or composted. We have assumed the liquids would be applied to nearby fields using irrigation equipment. We have included traveling spray guns, approximately one-half mile of underground piping to nearby fields, and a 100 hp irrigation pump in our cost opinions. The storage lagoon would be sized for about three months of storage, which will be approximately 1-million gallons. Cost evaluations assume that the existing 1-million-gallons storage lagoon will be converted to storage for treated liquids. The duration for liquids storage has been reduced because liquids will have low enough nutrient content to allow spray application to growing crops.

The wash water needs of the separation equipment would probably be partially met by recycling water from the separation equipment. The effluent water has fairly low solids and nutrients, and in similar applications, the equipment vendor has indicated a significant savings by recycling water to clean the equipment screens.



ALTERNATIVE F-1
FINE SOLIDS SEPARATION WITH POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

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FIGURE 4.02-1
1-124.005

Figure 4.02-2 shows the mass balance through the solids separation process. These numbers were generated using manufacturer's data. Based on the manufacturer's estimates, the liquid portion would contain approximately 5 percent of the solids, 55 percent of the N, 15 percent of the P, and 55 percent of the K. The solids portion is 23 percent of the volume and contains approximately 95 percent of the solids and 85 percent of the P. Polymer dilution water and wash water are assumed to add negligible solids and nutrients.

The ferric chloride and polymer usage for this alternative is anticipated to be about 250 lbs/day and 30 lbs/day, respectively. The system would require approximately 1,900 gallons of polymer makeup water and 5,200 gallons of screen wash water per day. The system is designed to operate approximately 40 to 50 hours/week and is anticipated to require 0.5 full-time staff for operations and maintenance.

C. Alternative F-3: Anaerobic Digestion Followed by Fine Solids Separation with Ferric Chloride and Polymer Addition

Raw manure would be collected at a central location on-site and pumped to an anaerobic digester on a continuous basis. The digester would be sized for a 28-day detention time to provide adequate destruction of disease organisms and is assumed to operate at mesophilic temperatures in the range of 90° to 100°F. The digester would be an aboveground covered tank equipped with mixing and heating equipment. The anaerobic digester cover will be designed to collect biogas and would be equipped with the proper gas safety equipment and devices necessary for systems generating methane gas. Biogas would be delivered to engine-generation equipment designed to burn biogas and generate electricity. The electricity would be used on the farm to supplement demand. Heat would be recovered from the engine and used to maintain the digester temperature and provide building heat.

Anaerobically digested manure would then be pumped to a solids separation system identical to that described for Alternative F-2. Figure 4.02-3 shows the mass balance through the anaerobic digestion and solids separation processes. These numbers were generated using anticipated removal rates for anaerobic digestion and manufacturer's data for the solids separation process. It was assumed that the raw manure is about 90 percent volatile and that the anaerobic digester will destroy 35 percent of the volatile solids in the raw manure. The anticipated effluent total solids concentration from the digester is approximately 2,300 dry lbs/day. The nutrient content of the manure is expected to be conserved through the digester, although there will be some changes in the form of the nutrients, especially N and P. After solids separation, about 84 percent of the raw manure volume is conveyed to liquid storage along with the water added for polymer dilution and screen wash water. The liquid portion contains 5 percent of the solids, 55 percent of the N, 15 percent of the P, and 55 percent of the K. The solids portion contains 16 percent of the initial volume, 95 percent of the solids, and 85 percent of the P. Polymer dilution water and wash water are assumed to add negligible solids and nutrients.

ALTERNATIVE F-2
FINE SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

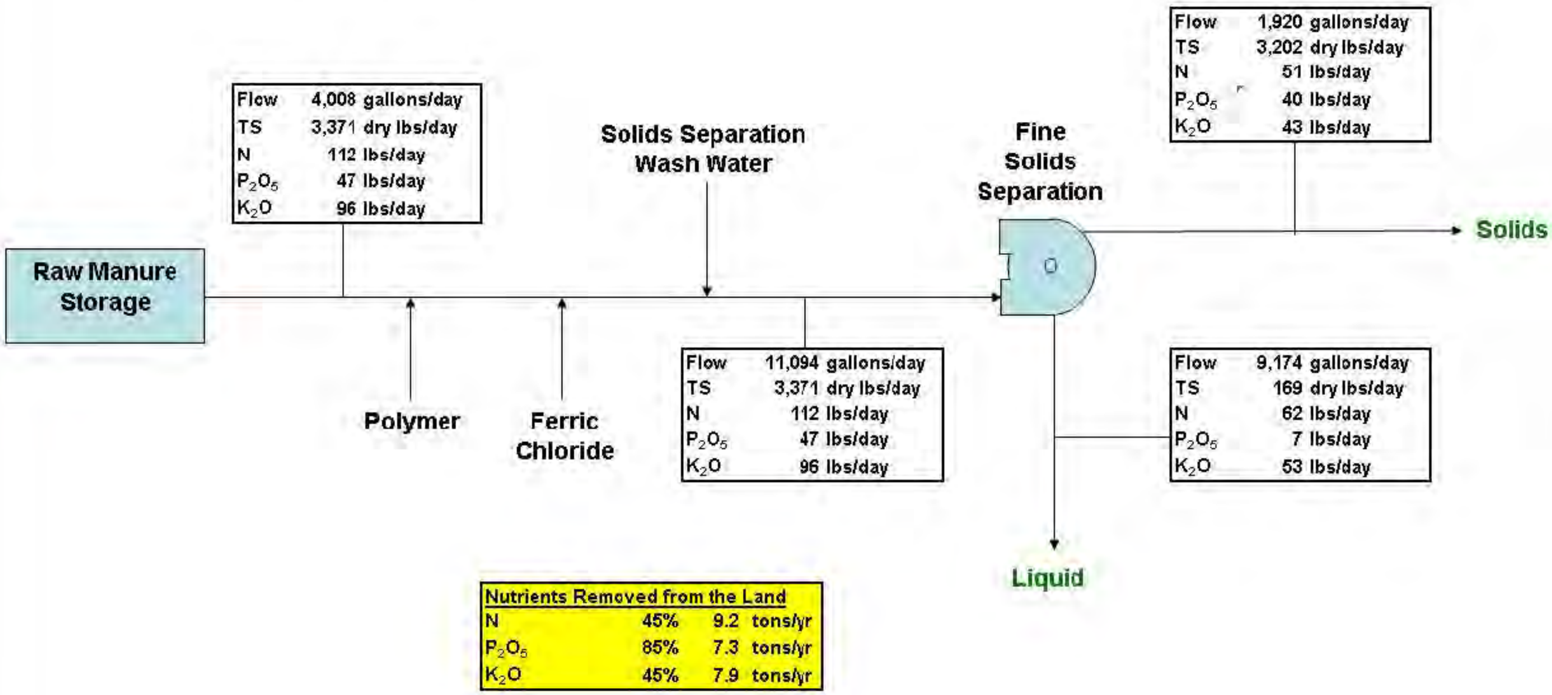

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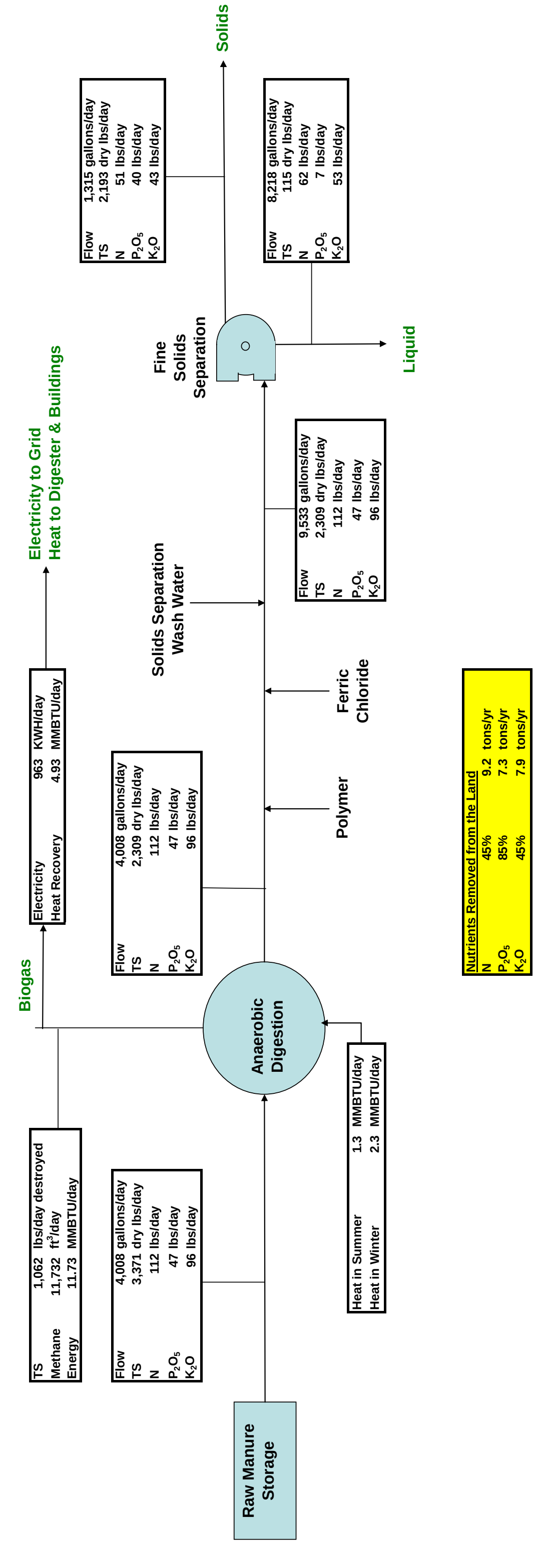
FIGURE 4.02-2
1-124.005



ALTERNATIVE F-3
ANAEROBIC DIGESTION FOLLOWED BY FINE SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

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FIGURE 4.02-3
1-124.005

The ferric chloride and polymer demands for the system are about 170 lbs/day and 22 lbs/day, respectively. The system would require approximately 1,300 gallons of polymer makeup water and 4,200 gallons of screen wash water per day. The system is designed to operate approximately 40 to 50 hours/week and is anticipated to require 1.0 full-time staff for operations and maintenance.

4.03 CLUSTER ALTERNATIVES–DETAILED DESCRIPTIONS

This section provides a detailed discussion of the equipment, tanks, building, and related construction elements required for each of the cluster alternatives.

A. Common Facilities–All Alternatives

For each of the cluster alternatives, raw manure must be collected at each of the cluster farms and transported to a central facility for processing by one of the five alternatives (C-1 through C-5). The facilities required at each farm are independent of the technology employed at the central facility and are required for all alternatives. These facilities are described below for the Waunakee and Middleton clusters.

1. Waunakee Cluster

The Waunakee Cluster would use pumping stations to convey raw manure at each farm to the central processing facility, as the three farms (Farms 4, 32, and 150) included in this cluster are relatively close to each other. The central facility was assumed to be located at Farm 32 because this farm has more of the desired infrastructure already in place. Farms 4 and 150 would pump their manure on a regular basis to a raw manure storage tank at Farm 32. Conveyance systems would be designed to drain as much as possible after pumping ceases to reduce the potential of lines plugging with manure that has settled in the lines.

Manure would be processed through the community facility, and the remaining liquids would be distributed among the three farms for land application. Conveyance of water to the farms would be through the same pipeline that is used for raw manure delivery. Valves at the community facility and the farms would be used to control the flow path of the manure.

The following additional infrastructure would be necessary at each farm:

a. Farm 32: Additional force main (on-site) and a pumping station.

b. Farm 150: Force main between Farm 150 and Farm 32 of approximately 1,750 feet, short-term storage for raw manure, and a raw manure pumping station. The existing 12 months of storage will be converted to finished liquid storage.

c. Farm 4: Force main between Farm 4 and Farm 32 of approximately 3,500 feet, six months of storage for finished liquid storage, and a manure pumping station. Six months of storage for this farm is estimated to be a 7.5-million-gallon lagoon.

This infrastructure will be necessary for each of the alternatives except for Alternative C-5 (Combustion). Since there will be no liquid effluent stream from Alternative C-5 (Combustion), six months storage will not be necessary for Farm 4 and short-term storage will not be necessary for Farm 150; however, the other infrastructure will still be necessary.

For Alternatives C-2 (Fine Solids Separation/Ferric), C-3 (Anaerobic Digestion), and C-4 (Drying), irrigation equipment will be necessary at each farm if the farm does not already have a means of applying liquids to fields. This document assumes that irrigation equipment is necessary at each farm.

2. Middleton Cluster

The Middleton Cluster (Farms 89, 112, 142, 145, 156, 176, and 195) would use trucks to haul the manure to the community facility. Ideally, the community facility would be located along the Highway 12 corridor near County Highway K. Manure would be trucked to the community facility from each of the farms, and liquid residuals would be trucked back to each of the farms for storage and land application. The existing raw manure storage at each of the farms would be converted to liquid residual storage, and one of the other existing storage structures or a new storage structure would be used for raw manure storage prior to hauling to the community facility. The raw manure storage on each farm should provide approximately one week of storage or more.

The following additional infrastructure would be necessary at the farms as noted:

a. Farm 89: One week of storage for raw manure prior to hauling to community facility.

b. Farm 112: None.

c. Farm 142: One week of storage for raw manure prior to hauling to community facility.

d. Farm 145: None.

e. Farm 156: Six months of storage for liquid residuals. Storage will be sized to hold 10 percent of the liquid residual from the treatment system. This percentage was selected because this farm has 10 percent of the A.U. in this cluster. This lagoon is roughly 2-million gallons, but it varies depending on the alternative.

f. Farm 176: One week of storage for raw manure prior to hauling to community facility.

g. Farm 195: One week of storage for raw manure prior to hauling to community facility.

This infrastructure would be necessary for each of the alternatives except for Alternative C-5. Since there will be no liquid effluent stream from Alternative C-5, raw manure storage would not be necessary for Farm 89, Farm 142, Farm 176, and Farm 195, and six months of storage for liquid residuals would not be necessary for Farm 156.

For Alternatives C-2, C-3, and C-4, irrigation equipment will be necessary at each farm to spray irrigate returned water on nearby fields.

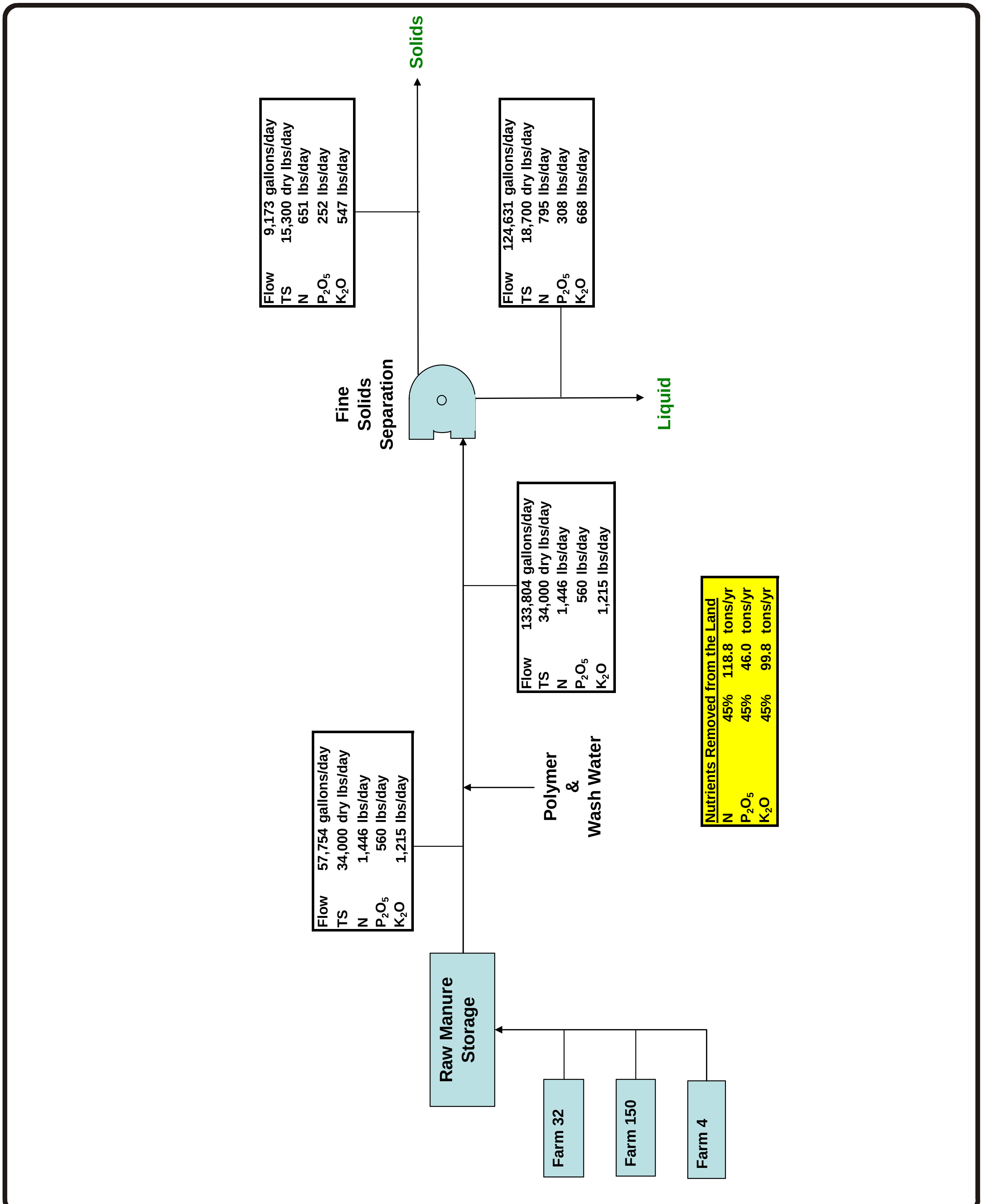
B. Alternative C-1: Fine Solids Separation with Polymer Addition

Raw manure will be delivered to a central manure receiving pit at the community facility sized to provide approximately one week of raw manure storage. The polymer dosing and solids separation equipment is similar to that described for Alternative F-1, with the exception that the equipment would be sized to handle the higher loadings, and a dry polymer system would likely be included in lieu of the emulsion polymer system for Alternative F-1. For economy reasons, dry polymer systems are normally used for larger applications with significant polymer usage.

Approximately one month of liquids residual storage will be constructed at the cluster site, which amounts to 4.5-million gallons of liquid storage in the Waunakee Cluster and 3.1-million gallons of storage in the Middleton Cluster. A new structure will be constructed to hold three months of solids at the processing facility site. The solids can be land-applied or composted. Liquids will be land-applied by the cluster farms.

Figures 4.03-1 and 4.03-2 show the mass balance through the solids separation process for the Waunakee and Middleton Clusters, respectively. Based on this information, approximately 77 percent of the initial volume and 55 percent of the solids, N, P, and K will end up in the liquid portion of the separated manure.

The estimated polymer demand for the Waunakee cluster is 600 to 650 lbs/day. The system would also require approximately 38,000 gpd of polymer makeup water and 38,000 gpd of screen wash water. The polymer demand for the Middleton cluster is estimated at 450 to 500 lbs/day. The system would require approximately 29,000 gpd of polymer makeup water and 42,000 gpd of screen wash water. Both systems were sized to operate 40 to 50 hours/week, and both systems are anticipated to require two full-time staff for operation and maintenance.



ALTERNATIVE C-1W (WAUNAKEE)
FINE SOLIDS SEPARATION WITH POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

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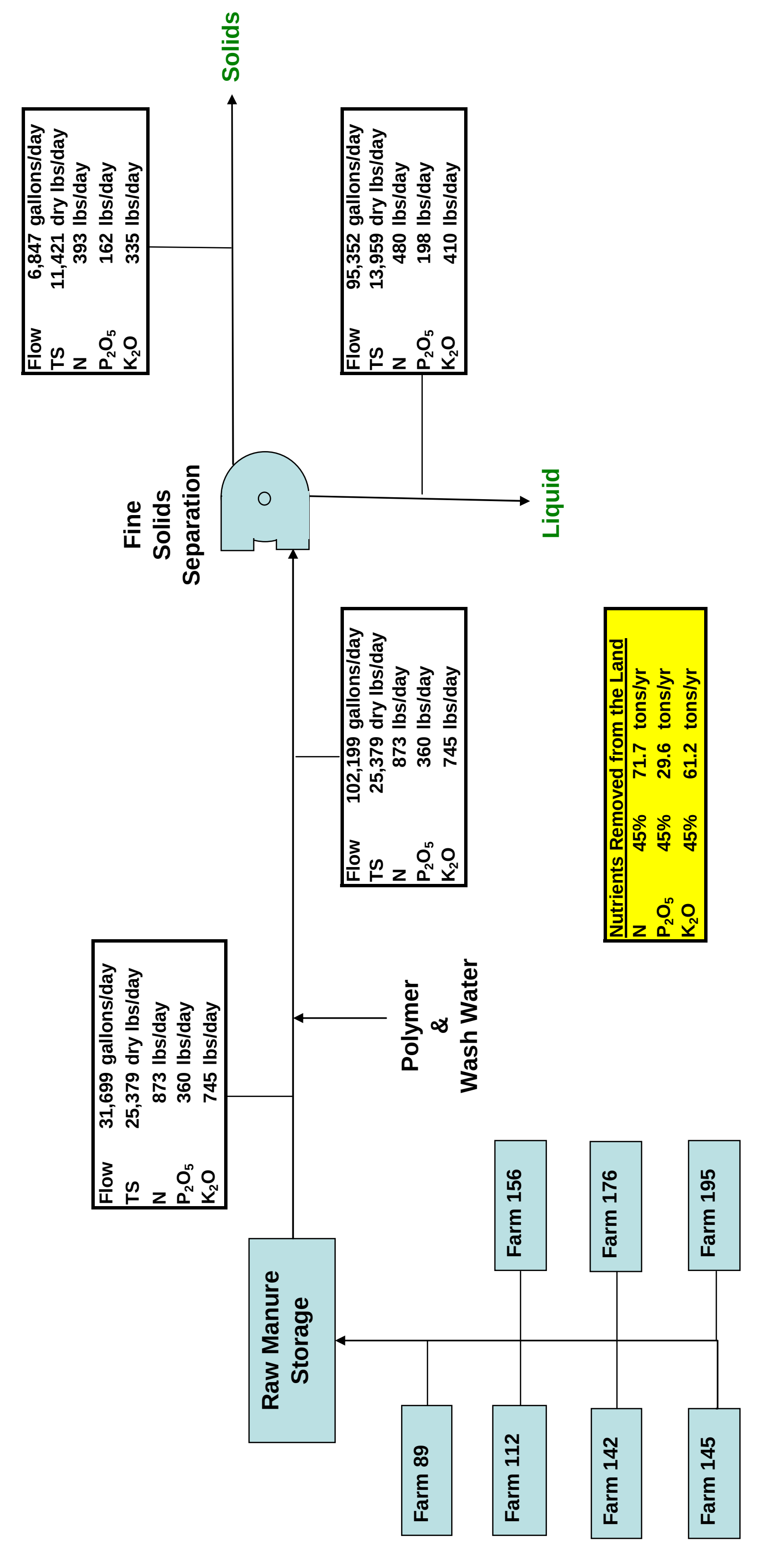
FIGURE 4.03-1
1-124.005



ALTERNATIVE C-1M (MIDDLETON)
FINE SOLIDS SEPARATION WITH POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

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FIGURE 4.03-2
1-124.005

C. Alternative C-2: Fine Solids Separation with Ferric Chloride and Polymer Addition

Raw manure will be delivered to a central manure receiving pit at the community facility sized to provide approximately one week of raw manure storage. The polymer dosing and solids separation equipment is similar to that described for Alternative F-2, with the exception that the equipment would be sized to handle the higher loadings, a dry polymer system would likely be included in lieu of the emulsion polymer system for Alternative F-2, and a bulk ferric chloride storage facility would be included in lieu of chemical storage in totes or drums.

Approximately 3.1-million gallons of storage will be necessary for liquids storage in the Waunakee Cluster, and 2.3-million gallons of storage will be necessary for liquids storage in the Middleton Cluster. A new structure will be constructed to hold one month of solids. The solids can be land applied, sold to another end user, or composted. The amount of solids storage has been reduced for this alternative and others that produce similar solids because of the increased flexibility in solids disposal. Liquids will be spray irrigated by the cluster farms.

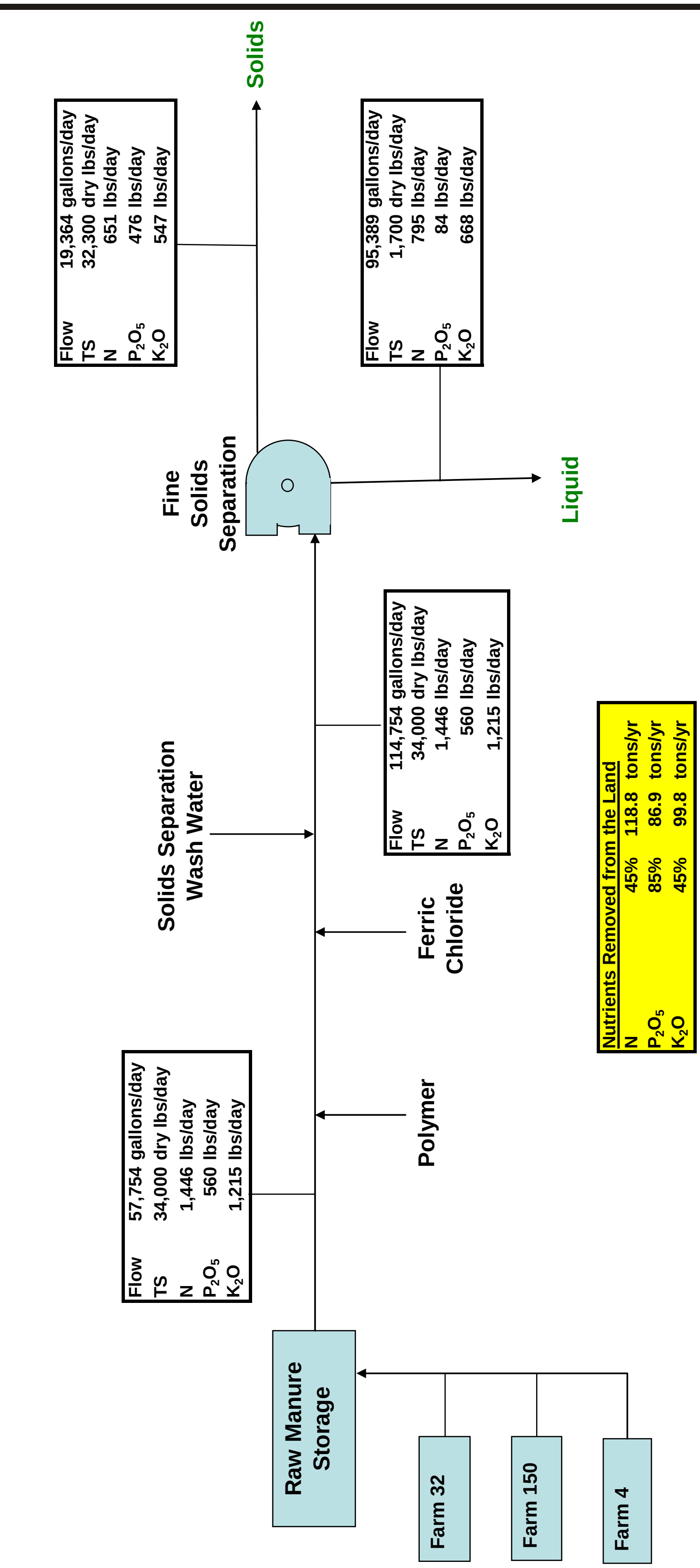
Figures 4.03-3 and 4.03-4 show the mass balance through the solids separation process for the two clusters. These balances were generated using manufacturer's data for system performance. Based on this information, 75 to 85 percent of the raw manure volume is conveyed to liquid storage along with the water added for polymer dilution and screen wash water. The liquid portion contains less than 5 percent of the solids, approximately 15 percent of the P, and 55 percent of the N and K for both clusters.

The anticipated average polymer and ferric chloride demands for the Waunakee cluster are 320 lbs/day and 2,600 lbs/day, respectively. The system would also require approximately 19,000 gallons of polymer makeup water and 38,000 gallons of screen wash water per day. A portion of the wash water flows are assumed to be recycled water from the separator.

The anticipated average polymer and ferric chloride demands for the Middleton cluster are 240 lbs/day and 1,900 lbs/day, respectively. The system would also require approximately 15,000 gpd of polymer makeup water and 42,000 gpd of screen wash water. Both systems are designed to operate 40 to 50 hours/week, and both systems are anticipated to require two full-time staff for operations and maintenance.

D. Alternative C-3: Anaerobic Digestion Followed by Solids Separation with Ferric Chloride and Polymer Addition

Raw manure will be delivered to a central manure receiving pit at the community facility sized to provide approximately one week of raw manure storage. The digestion, biogas utilization, chemical addition, and solids separation and equipment would be similar to that described for Alternative F-3. In addition to providing electricity for use on the farm, however, excess electricity is assumed to be sold to the local utility.



ALTERNATIVE C-2W (WAUNAKEE)
FINE SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
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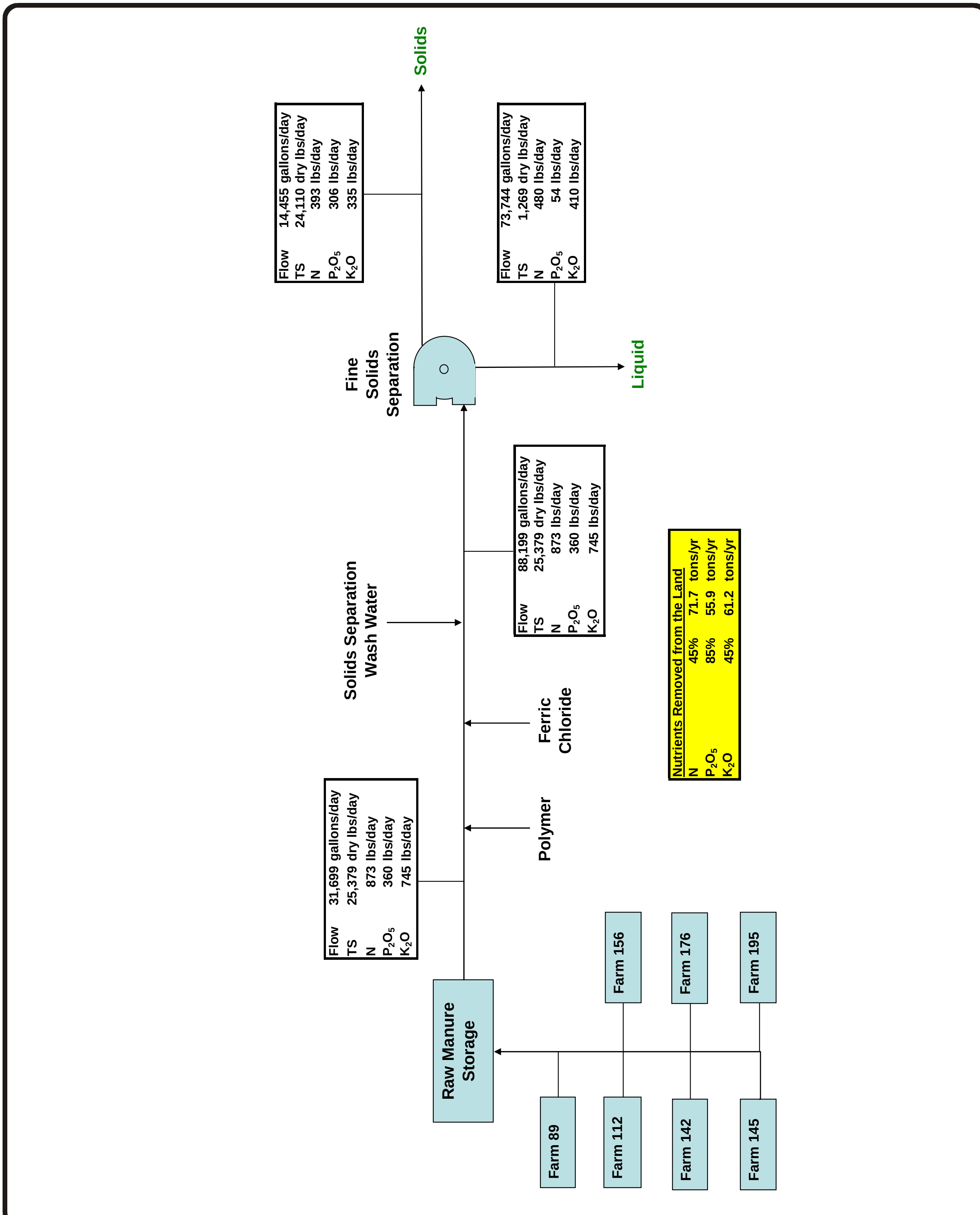
FIGURE 4.03-3
1-124.005



ALTERNATIVE C-2M (MIDDLETON)
FINE SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
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FIGURE 4.03-4
1-124.005

The on-site liquid storage lagoon should be sized for one month of storage. Approximately 2.8-million gallons of storage would be necessary for on-site liquid storage at the Waunakee cluster, and about 1.9-million gallons of storage would be necessary for liquids storage in the Middleton cluster. A new structure will be constructed to provide approximately one month of solids storage. The solids can be land-applied, sold to another end user, or composted. Liquids would be spray irrigated by the cluster farms.

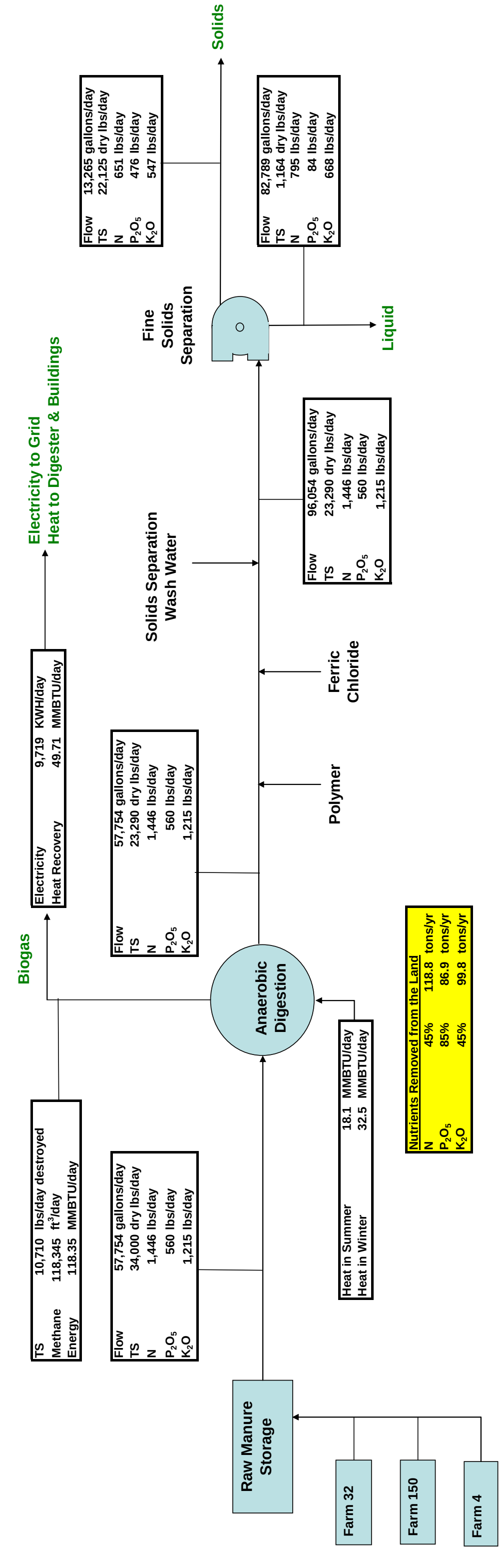
Figures 4.03-5 and 4.03-6 present the mass balance through the anaerobic digestion and solids separation process for each cluster. The digestion performance was assumed to be similar to that described for Alternative F-3. The effluent total solids from the digester are projected to be approximately 29,000 dry lbs/day for the Waunakee cluster and 22,000 lbs/day for the Middleton cluster. The total mass of nutrients is expected to be conserved through the digester. Digestion and solids separation performances were developed based on manufacturers' data for system performance. Manufacturers used existing installations to estimate performance for each cluster. Based on these analyses, 85 to 90 percent of the raw manure volume would be conveyed to liquid storage along with the water added for polymer dilution and screen wash water. The liquid portion contains less than 5 percent of the solids, 15 percent of the P, and 55 percent of the N and K for both clusters.

The chemical demands for the Waunakee cluster are about 220 lbs/day of polymer and 1,800 lbs/day of ferric chloride. The system would require approximately 13,000 gallons of polymer makeup water and 25,000 gallons of screen wash water per day. The chemical demands for the Middleton cluster are about 160 lbs/day of polymer and 1,300 lbs/day of ferric chloride. Polymer dilution water and screen wash water are estimated to require approximately 10,000 gpd and 25,000 gpd, respectively. Both systems are designed to operate approximately 40 to 50 hours/week and are estimated to require two full-time staff for operation and maintenance.

E. Alternative C-4: Fine Solids Separation with Ferric Chloride and Polymer Addition Followed by a Dryer/Pelletizer

This alternative includes the entire Alternative C-2 followed by a dryer system to produce a final solids product with a moisture content of about 10 to 15 percent or less. The solids from the solids separation equipment will be transferred to a storage bin that will act as the feed hopper for the dryer. From there, an auger will be used to feed solids into the dryer. The drying process uses three different stages to dehydrate the solids. The different stages are controlled by individual burners and are designed to maximize drying while limiting burning or overheating of the material. The dryer also has a thermal oil heating system and a condenser and off-gassing system. Once the manure has been dried, it will be transferred to final product storage through a discharge/cooling conveyor. Final storage is sized to hold one month of dried material.

The dryer will be operated in a batch mode where separated solids will be collected and stored until the feed hopper is nearly full. Then the dryer will be started and operated until the feed solids supply is depleted. Because of manufacturer's sizing limitations, the dryer at each cluster has



ALTERNATIVE C-3W (WAUNAKEE)
ANAEROBIC DIGESTION FOLLOWED BY SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

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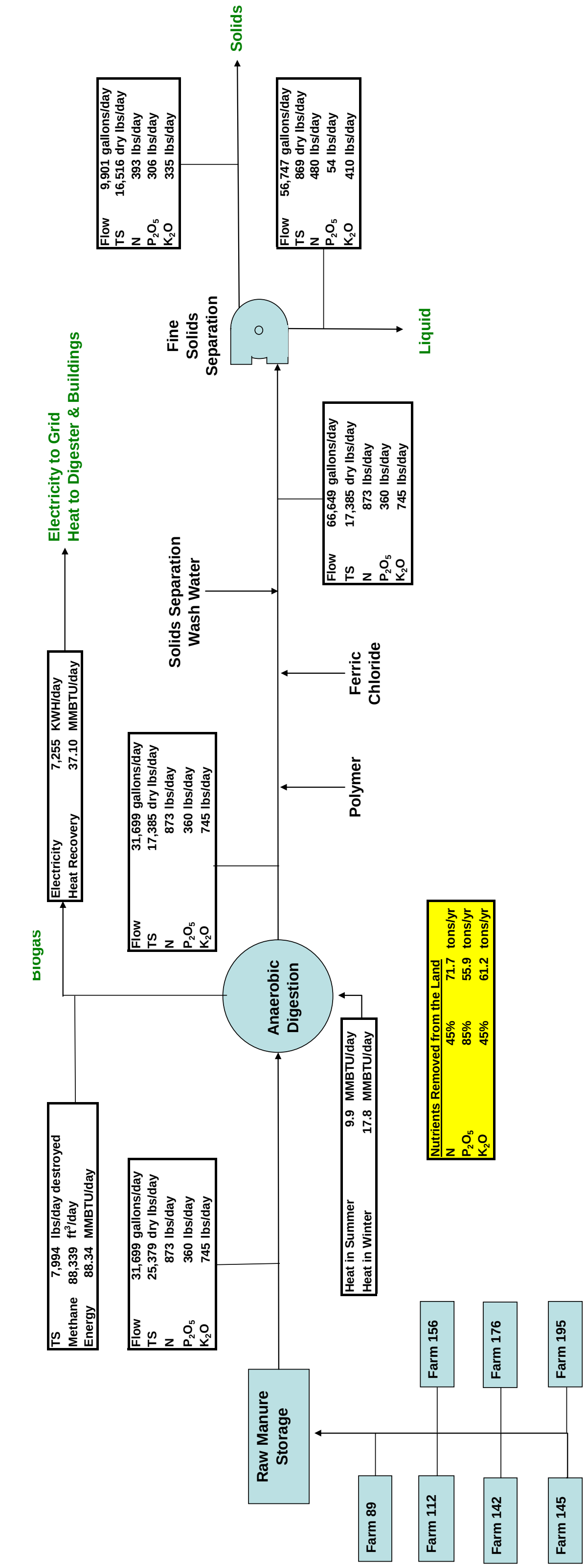
FIGURE 4.03-5
1-124.005



ALTERNATIVE C-3M (MIDDLETON)
ANAEROBIC DIGESTION FOLLOWED BY SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

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FIGURE 4.03-6
1-124.005

excess capacity. The dryer would be sized to operate at 80 percent of its capacity for the Waunakee cluster and about 60 percent of its capacity in the Middleton cluster. The efficiency of the system will be maximized when operated at the design solids throughput capacity. Therefore, if this alternative is further evaluated, additional manufacturers should be contacted to determine if the capacity of the dryer can more closely match the design solids throughput.

Figures 4.03-7 and 4.03-8 show the mass balance through the solids separation and drying processes for the two clusters. These balances were generated using manufacturers' estimates for system performance. Approximately 75 to 85 percent of the raw manure volume would be conveyed to liquid storage following the dewatering step along with the water added for polymer dilution and screen wash water. This liquid portion contains less than 5 percent of the solids, 10 percent of the P, and 55 percent of the N and K for both clusters. The solids are dried to approximately 85 to 90 percent dryness. Polymer dilution water and wash water are assumed to add negligible amounts of solids and nutrients.

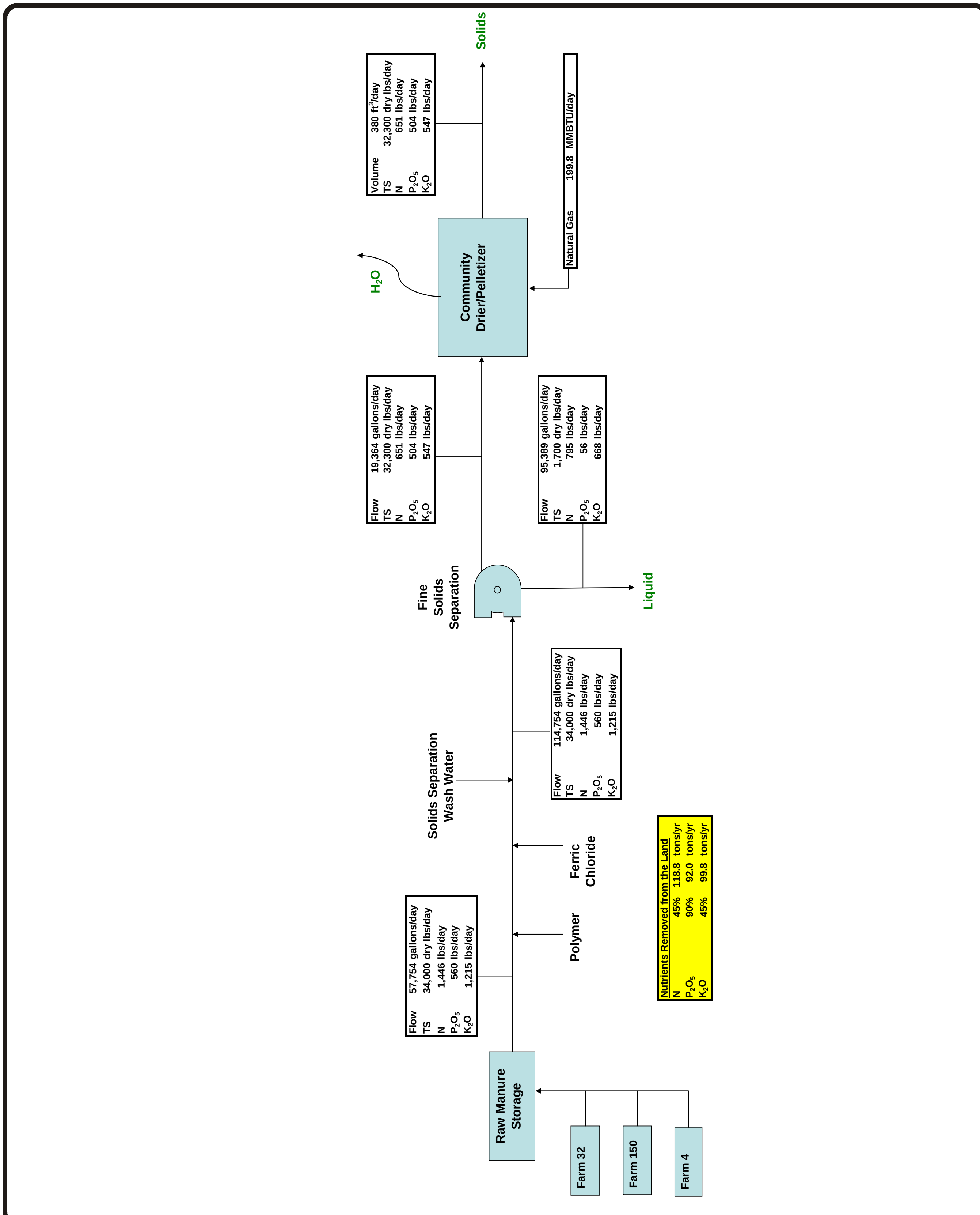
The chemical demands for the Waunakee cluster are 320 lbs/day of polymer and 2,600 lbs/day of ferric chloride. The system also requires approximately 19,000 gpd of polymer makeup water and 38,000 gpd of screen wash water. The chemical demands for the Middleton cluster are 240 lbs/day of polymer and 1,900 lbs/day of ferric chloride. Estimated water requirements are 15,000 gpd of polymer makeup water and 42,000 gpd of screen wash water. The solids separation systems are designed to operate 40 to 50 hours per week. The dryer will operate approximately 5.6 days per week for the Waunakee cluster and 4.2 days per week for the Middleton cluster. Both systems are anticipated to require two full-time staff for operation and maintenance.

F. <u>Alternative C-5: Manure Combustion</u>

In this alternative, raw manure would be delivered to a raw manure storage tank sized to provide about one week of storage. From there the raw manure would be pumped into a drying vessel that uses recovered heat and mixing to evaporate moisture and achieve relatively dry solids (moisture content is approximately 40 percent). After drying, the manure can be used for bedding or it can continue to the combustion system (boiler). In the boiler, the dried manure is combusted to create steam. The steam is piped to a turbine/generator set and used to generate electricity. Waste steam heat is recovered and used in the upstream drying process.

Figures 4.03-9 and 4.03-10 show the mass balance through the drying and incineration processes for each cluster. These numbers were generated using manufacturers' data for system performance. Manufacturers' used existing installations to estimate future performance.

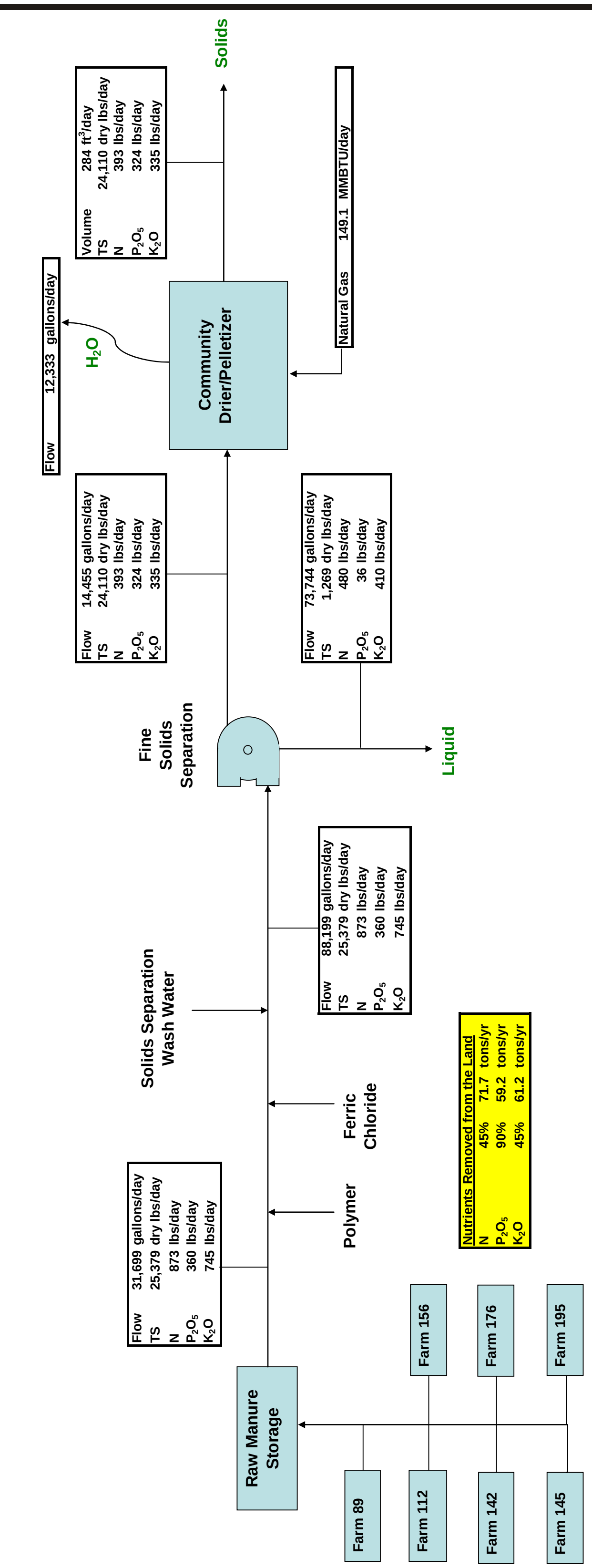
This system will operate 168 hours per week and will require two full-time staff for operations and maintenance.



ALTERNATIVE C-4W (WAUNAKEE)
FINE SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITIONS FOLLOWED BY A DRYER/PELLETIZER
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

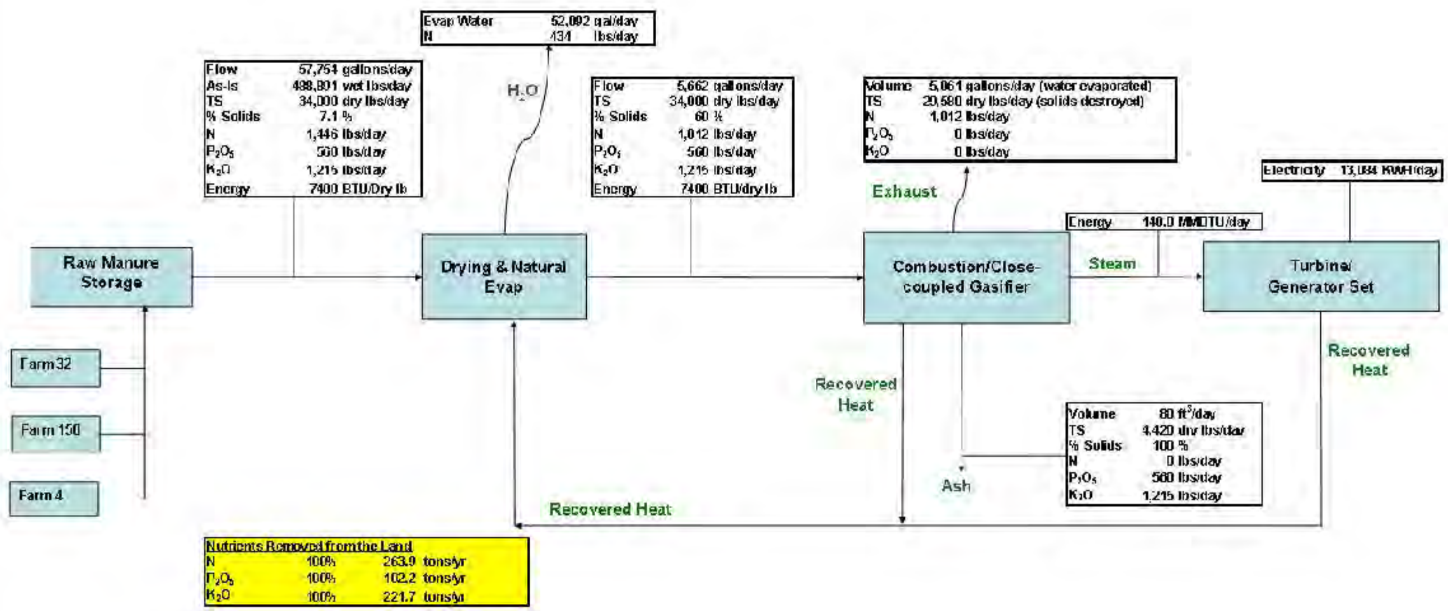
FIGURE 4.03-7
1-124.005



ALTERNATIVE C-4M (MIDDLETON)
FINE SOLIDS SEPARATION WITH FERRIC CHLORIDE AND POLYMER ADDITION FOLLOWED BY A DRYER/PELLETIZER
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

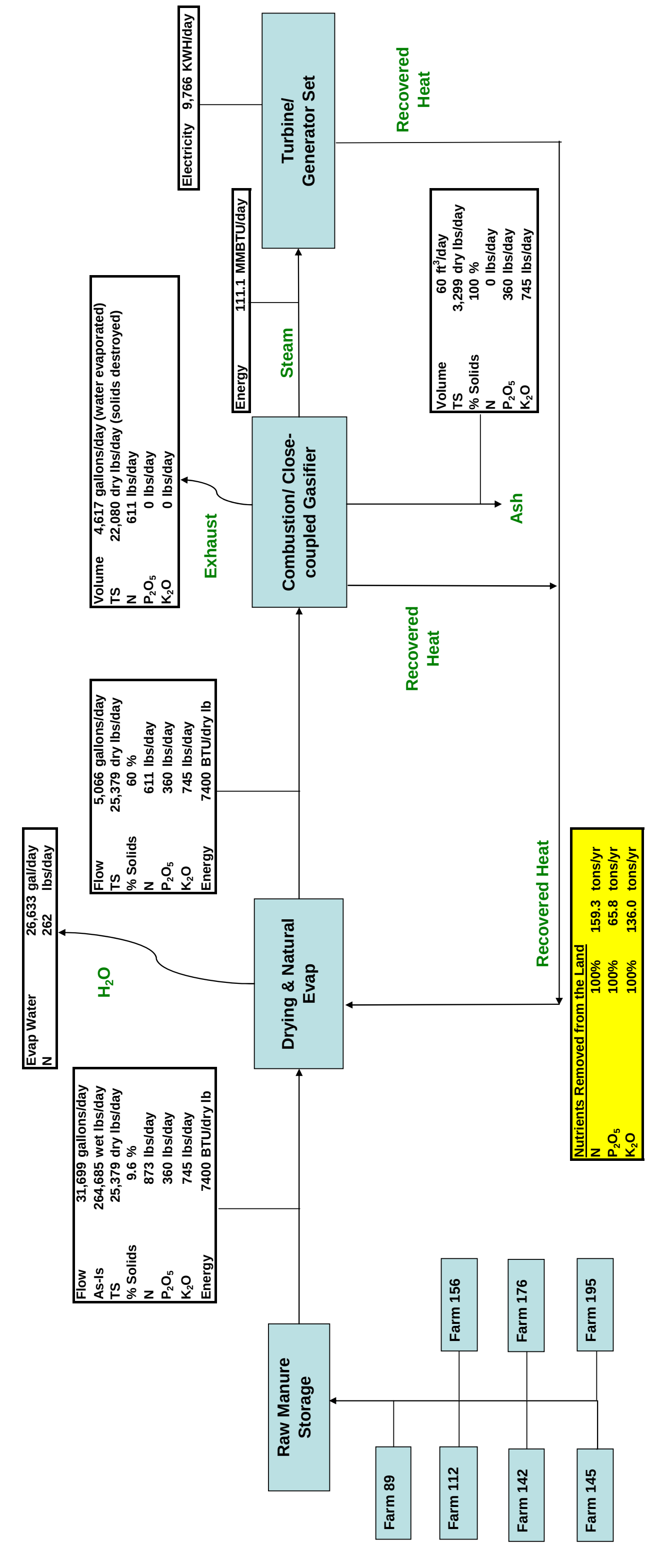
FIGURE 4.03-8
1-124.005



ALTERNATIVE C-5W (WAUNAKEE)
MANURE COMBUSTION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.03-9
1-124.005



ALTERNATIVE C-5M (MIDDLETON)
MANURE COMBUSTION
COMMUNITY MANURE MANAGEMENT FEASIBILITY STUDY
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.03-10
1-124.005

4.04 OPINION OF CAPITAL COSTS

At this early stage of planning, detailed opinions of capital cost cannot be developed precisely, since the project elements and details have not been considered thoroughly. Based on our experience with similar projects, we used the following procedure to develop opinions of capital cost for the eight management alternatives:

1. Proposals for major equipment were solicited from manure processing equipment manufacturers and vendors. We typically add a 35 percent factor to account for labor, miscellaneous materials, and other unforeseen items required to install the equipment.

2. For some equipment and structures, our past experience with similar projects was relied on to develop costs.

3. Equipment and control building sizes were estimated and assigned a unit cost of $\$100/ft^2$.

4. Solids storage facilities were assigned a unit cost of $\$25/ft^2$ plus an additional $350/cy for the concrete slab. Slabs were estimated to be 1 foot thick.

5. Underground piping (force mains) was assigned a unit cost of $60/LF.

6. Percentages of equipment costs and buildings cost subtotals were used to estimate subcontractor installation costs for piping and mechanical (10 percent), electrical (10 percent), heating and ventilation (5 percent), and site work (5 percent).

7. These percentages are based on past projects and the current construction market.

8. General conditions for the contractor have been estimated at 8 percent of the cost of the equipment, buildings, mechanical, electrical, heating and ventilating, and site work costs. Contingencies at 25 percent and engineering/legal services at 15 percent of the total construction cost were included in the overall capital cost opinion for the eight alternatives.

These assumptions are summarized in Table 4.04-1.

A summary of the opinions of capital cost are included in Table 4.04-2 for all the alternatives. The detailed cost evaluations are included in Appendix C. In general, the capital costs for the Waunakee cluster are greater than those for the Middleton cluster because of the infrastructure required to pump manure to the cluster site. In addition, the volumes of manure are greater in the Waunakee cluster based on the data contained in the farm surveys responses.

On a per animal unit basis, the costs for the larger cluster facilities are considerably lower than the costs at an individual farm. In particular, the capital cost per animal unit for the Middleton Cluster is approximately one-half the capital cost per A.U. for the individual farm for similar technologies (i.e., comparing Alternative F3 with Alternative C-3M). This is the result of significant economies of scale that would be realized by constructing a cluster facility to serve more than one farm.

Alternative	P Removed (%)	Capital Costs		
		Total	Per Current A.U.	Per Design A.U.
Individual Farm[a]				
F-1	45%	$1,426,000	$2,850	$2,130
F-2	85%	$1,685,000	$3,370	$2,510
F-3	85%	$2,840,000	$5,680	$4,240
Waunakee Cluster[b]				
C-1W	45%	$6,423,000	$2,040	$1,500
C-2W	85%	$8,415,000	$2,680	$1,960
C-3W	85%	$11,495,000	$3,660	$2,680
C-4W	90%	$13,507,000	$4,300	$3,150
C-5W	100%	$11,333,000	$3,600	$2,640
Middleton Cluster[c]				
C-1M	45%	$5,127,000	$1,340	$1,030
C-2M	85%	$8,215,000	$2,150	$1,660
C-3M	85%	$10,934,000	$2,870	$2,210
C-4M	90%	$13,247,000	$3,470	$2,670
C-5M	100%	$10,319,000	$2,710	$2,080

[a] Current A.U. = 500; design A.U. = 669.
[b] Current A.U. = 3,145; design A.U. = 4,293.
[c] Current A.U. = 3,813; design A.U. = 4,957.
[d] the opinion of costs are considered +/- 25 percent at this time.

Table 4.04-2 Opinion of Capital Cost Summary[d]

4.05 OPINION OF OPERATION AND MAINTENANCE (O&M) COSTS

O&M costs include the costs or revenues anticipated to occur on a regular, on-going basis. Opinions of annual O&M costs were developed for three scenarios: (1) Year 2007 condition with the existing herd sizes, (2) Year 2012 conditions including the anticipated growth of the herds, and (3) Year 2012 conditions including the anticipated growth and the 25 percent allowance for additional manure or industrial waste loadings to the facility. The design basis for the individual farm, Waunakee Cluster, and Middleton Cluster included 535 A.U., 3,434 A.U., and 3,966 A.U., respectively.

Category	Unit O&M Cost	
	(2007)	**(2012)**[1]
Labor (per hour)	$ 40	$45
Electricity (per KWH)	$0.10	$0.11
Electricity Buy-Back Rate (per KWH)[2]	$0.065	$0.070
Natural Gas (per therm)	$1.00	$1.13
Solids Value (per wet ton)		
Alt. F-1, C-1	$5	$6
Alt. F-2, C-2	$10	$11
Alt. F-3, C-3	$20	$23
Alt. C-4, C-5	$50	$57
Renewable Energy Certificates (per KWH)[2]	Included above[2]	
GHG Emission Reductions Credit (per $MtCO_2e$)[3]	$6	$12
Polymer (per pound)	$1.50	$1.70
Ferric Chloride (per gallon)	$1.00	$1.13
Maintenance and Supplies[4] (% of equipment costs)	2.0	2.3
Land Rental (per acre/year)	$140	$158

1 Year 2012 costs assumed to increase at the rate of inflation (2.5 percent/year) except for GHG emission reductions and RECs.
2 The electrical buy-back rate includes RECs associated with the electrical generation from biogas.
3 $MtCO_2e$ = metric ton of CO_2 equivalent; 1 metric ton ~ 2,200 lbs.
4 Maintenance costs estimated by manufacturers were used in lieu of percentages when provided.

Table 4.05-1 O&M Unit Costs (2007)

Table 4.05-1 presents a summary of the unit costs we have included in these evaluations. Most of the O&M cost categories were inflated by 2.5 percent annually to derive the year 2012 O&M costs. The exception to this is the GHG reduction credit and associated revenue stream, which are expected to increase at a rate faster than inflation. Projections from the Carbon Solution Group™ were applied to the potential GHG emission reduction credits in 2007 and 2012. Detailed O&M costs for all alternatives are presented in Appendix C.

The following discussion presents some of the assumptions and background information for each of the O&M cost categories.

Labor was estimated on a full-time equivalent (FTE) basis at a rate of $40/hour, which includes fringe benefits. Operators are expected to be knowledgeable about mechanical systems and treatment process environments. It is expected that they will be familiar with chemical feed systems and working in hazardous environments.

Electricity and natural gas usage was estimated based on manufacturers' information and horsepower operating hours. Unit costs for electricity and natural gas are an approximate average rate in Dane County at this time. An energy credit was applied where alternatives would generate excess energy. The credit assumes the excess energy would be used to generate electricity (Alternatives F-3, C-3, and C-5), and any electricity generated beyond that needed on-site would be purchased by the local power utility at an average buy-back price of $0.065/kWh based on current rates. This buy-back rate is based on one utility company's existing program in Wisconsin, in which the utility purchases electricity and associated renewable energy credits generated by anaerobic digesters owned by its Wisconsin customers. Under a 10-year contract, customers receive $0.08/ kWh for electricity generated on-peak (9 A.M. to 9 A.M.) and $0.049/ kWh for electricity generated off-peak (9 P.M. to 9 A.M.). Assuming relatively uniform biogas generation throughout a typical day, the average buy-back rate is approximately $0.065/ kWh.

In lieu of electrical generation, the excess energy could be in the form of excess biogas produced at a manure digestion facility (Alternatives F-3 and C-3). The excess biogas could be cleaned to near natural gas quality and injected directly into a natural gas pipeline, or the biogas could be used by a nearby industry to supplement natural gas usage (e.g., used in a boiler). This latter potential may especially be feasible for the Middleton Cluster because of its location. However, this use was not considered in these analyses.

There are at least a few examples of cleaning manure-based biogas to natural-gas grade quality. The Scenic View Dairy in Fennville, Michigan, was started up in 2007 and digests manure from approximately 2,000 dairy cattle (2,800 A.U.). The excess methane generated may be used on-site or injected into a natural gas pipeline. A similar, but larger facility in Texas was installed to produce pipeline-grade natural gas from biogas generated from anaerobic digestion of manure from up to 10,000 cows.

Solids management is one of the most significant O&M cost variables in these analyses since the value of the final solids products will likely vary considerably as a function of the management alternative, the location, and the market for the solids at any given time. Potential disposal markets include composting operations, supplement for wood processing/fiberboard, use as a soil amendment and/or fertilizer, and potting soil replacement among others. None of these markets are well developed at this time. However, based on our discussions with researchers (Forest Products Laboratory, UW-Platteville) and entities engaged in these markets, we understand that the high-end value of the solids produced from anaerobic digestion (Alternatives F-3 and C-3) is about $30/ton at this time. Alternatives F-1 and C-1, as well as F-2 and C-2, would have lower market value on average because of the potential for disease organisms, the poorer consistency in fiber characteristics, and the potential odors from such material. In addition, based on a manure management operation in southeast Wisconsin, we believe the market for dried manure may be as high as $80 or $90 per ton. The values used in these analyses are lower than the values cited herein to provide a measure of conservatism. However, we have also included a sensitivity analysis as a function of the value of the solids generated in manure management alternatives later in this chapter.

GHG emission reduction credits are based on the estimated mass of GHG emissions eliminated with each alternative compared to the existing method of lagoon storage and land application. The inherent assumption in this determination is that, within the storage lagoons, anaerobic conditions generate methane gas, which is released to the atmosphere. The amount of methane production expected from lagoon storage is based on the site location–in northern climates, the average temperature is lower and the amount of biological activity in the lagoon decreases, resulting in lower methane production. Therefore, the GHG credits are typically lower in northern climates as compared to a similar facility located in the south. By implementing alternate manure management systems, some or all of the organic material will not be stored for long periods of time, and, therefore, methane emissions will be reduced.

For Alternatives F-3, C-3, and C-5, in which either biogas or manure is combusted to produce energy, CO_2 and other GHGs may be given off in excess of the levels that would have been emitted from storage lagoons. However, the GHG emissions from a lagoon are considered biogenic (produced by natural life processes, including the natural processes inherent to plants and animals) as opposed to anthropogenic (derived from human activities). Therefore, the emissions associated with the combustion of the biogas captured (or from the manure itself) do not count as increased GHG emissions. This is because the feedstocks in the manure are natural carbon sequesters, and in a natural aerobic environment where the material is allowed to decay, these emissions would have occurred naturally (biogenically). Therefore, combusting the biogas does not result in anthropogenic emissions such as would occur with the combustion of fossil fuels.

GHG emission reduction credits included in these analyses are based on preliminary estimates from the Carbon Solution Group™. The estimated GHG emission reduction from a 5,000-A.U. anaerobic digestion system was estimated at approximately 18,500 $MtCO_2e$/year. For the purposes of this evaluation, we have developed approximate GHG emission reductions for the alternatives based on solids eliminated from long-term lagoon storage (Table 4.05-2).

Renewable energy certificates (RECs) are included in the electrical buy-back cost noted above and in Table 4.05-1. The value of RECs is expected to vary significantly and generally increase over time. Based on recent information, the current value of RECs is in the range of $0.004 to $0.005/ kWh, or approximately 5 to 10 percent of the buy-back value of electricity.

Chemical cost opinions were developed based on manufacturers' estimates and our experience with polymer and ferric chloride in wastewater treatment applications. Maintenance and supply costs were estimated at 2 percent of the equipment costs or as specified by the manufacturer.

Raw manure hauling and liquid disposal costs were estimated for the Middleton Cluster using the *Professional Nutrient Applicators of Wisconsin Truck Haul Job Estimator* spreadsheet. Trips were assumed to be two-way hauling trips with raw manure being hauled to the cluster and finished liquids being hauled back to the farm for as many trips as possible. In all cases the volume of finished liquids exceeds raw manure, which required additional one-way trips to haul finished liquids to the farms. Raw manure and finished liquids will be pumped in the Waunakee Cluster. The costs for pumping are accounted for in the equipment costs and the power costs. It was assumed that farmers will own enough land for spray irrigation of liquid residuals.

The current O&M costs for the individual farms and the cluster farms were developed for comparison by using data reported in the survey for each of the cluster farms extrapolated to the design A.U. size. The cluster data was used to estimate the individual farm costs using average costs per A.U. The current operating costs generally consist of three elements, labor, hauling, and land rental, as discussed here:

Alternative	Solids Removed (% of Existing)	GHG Emission Reduction[a] ($MtCO_2e$/year)
Individual Farms (535 A.U., 1.7 dry tons/day)		
F-1	45	890
F-2	95	1,880
F-3[b]	100	1,980
Waunakee Cluster (3,434 A.U., 17 dry tons/day)		
C-1W	45	8,900
C-2W	95	18,800
C-3W[b]	100	19,800
C-4W[c]	100	15,000
C-5W	100	19,800
Middleton Cluster (4,000 A.U., 12.7 dry tons/day)		
C-1M	45	6,650
C-2M	95	14,000
C-3M[b]	100	14,800
C-4M[c]	100	11,900
C-5M	100	14,800

[a] Based on 18,500 $MtCo_2e$/year reduction from a 5,000-A.U. anaerobic digestion facility designed to handle 15.9 dry tons/day of solids (Carbon Solutions Group[TM]). GHG generation from vehicular fuel and operating power are not included as these values are minor compared to the GHG reductions. Results are preliminary and subject to a more detailed investigation.

[b] Assumed solids in liquid are nonbiodegradable.

[c] Natural gas used in the drying process estimated at 199.8 MMBTU/day for the Waunakee Cluster and 149.1 MMBTU/day for the Middleton Cluster. GHG equivalent of natural gas ~ 117 lbs CO_2/MMBTU.

Table 4.05-2 GHG Emission Reductions

1. Labor costs were estimated using the reported time from each farm for hauling manure, applying manure, and maintaining manure-related equipment and labor cost of $40 per hour.

2. Hauling costs were estimated using the *Truck Haul Job Estimator* spreadsheet. Half of the average maximum hauling distance for the cluster was used as the hauling distance.

3. Land rental costs were estimated using reported acres rented that manure is spread on at an annual cost of $140/acre.

Table 4.05-3 presents our opinion of annual O&M costs for the existing individual farms, existing farm clusters, and each of the manure management alternatives. The O&M costs are presented in the current year (2007) as well as in the year 2012. Appendix C presents more detailed opinions of O&M costs for all of the alternatives evaluated.

Alternative	P Removed (%)	Opinion of Net Annual O&M Expense (Revenue)			
		Year 2007	Year 2012	Year 2012 + 25% (design A.U.)	Per A.U. (2007)
Individual Farm[a]					
Existing	0%	$82,000	$93,000	$107,000	$164
F-1	45%	$152,000	$165,000	$193,000	$304
F-2	85%	$53,000	$47,000	$48,000	$106
F-3	85%	$82,000	$78,000	$80,000	$174
Waunakee Cluster[b]					
Existing	0%	$936,000	$1,059,000	$1,218,000	$298
C-1W	45%	$1,007,000	$1,086,000	$1,291,000	$320
C-2W	85%	$98,000	$20,000	($13,000)	$30
C-3W	85%	($220,000)	($350,000)	($480,000)	($68)
C-4W	90%	$884,000	$890,000	$1,072,000	$281
C-5W	100%	($183,000)	($296,000)	($409,000)	($73)
Middleton Cluster[c]					
Existing	0%	$682,000	$772,000	$926,000	$179
C-1M	45%	$946,000	$1,031,000	$1,222,000	$248
C-2M	85%	$600,000	$612,000	$701,000	$156
C-3M	85%	$304,000	$268,000	$271,000	$82
C-4M	90%	$1,144,000	$1,210,000	$1,451,000	$300
C-5M	100%	$235,000	$199,000	$193,000	$51

[a] Year 2007 A.U. = 500; Year 2012 A.U. = 535; design A.U. = 669.
[b] Year 2007 A.U. = 3,145; Year 2012 A.U. = 3,434; design A.U. = 4,293.
[c] Year 2007 A.U. = 3,813; Year 2012 A.U. = 3,966; design A.U. = 4,957.
[d] O&M costs do not include the cost for any commercial fertilizer required to replace manure-based fertilizer not applied to the soil in any of the alternatives.

Table 4.05-3 Opinion of Annual O&M Costs[d]

The annual O&M cost opinions developed in Table 4.05-3 should not be considered to be precise costs, as they are derived from a number of assumptions, simplifications, and data provided by vendors, farmer surveys, and our past experience. However, on a comparative basis several significant observations are noted:

1. For the individual farm alternatives, only Alternative F-2–Fine solids removal with polymer and ferric addition appears to lower annual O&M costs significantly compared to the existing O&M cost opinions.

2. For the cluster alternatives, the Waunakee Cluster appears to have significantly lower annual O&M costs than the Middleton Cluster. This is mainly because in the Waunakee Cluster, manure and returned liquids are pumped to and from the cluster site, whereas in the Middleton Cluster the manure and returned liquids are transported by truck.

3. For the Waunakee Cluster, all of the alternatives except C-1W (solids separation) and C-4W (drying) are anticipated to lower annual O&M costs significantly compared to the existing farms' O&M costs. The reason that Alternative C-1W is not anticipated to lower annual O&M costs for the farms in that cluster is that, because of the relatively lower solids and phosphorus removal achieved by this technology, the nutrient level of the liquids returned to the farms will still require trucking to the land, which has a higher O&M cost than pumping to land application fields. Alternative C-4W has a high annual cost for natural gas.

4. For the Waunakee Cluster, the options that include energy recovery (Alternatives C-3W and C-5W) appear to generate net revenue. That is, the preliminary estimate of revenue streams (sale of solids, electricity buy-back, and GHG emission reduction credits) exceed the annual costs to operate the facilities. In addition, as the amount of manure handled increases, the net revenue appears to increase.

5. For the Middleton Cluster, only the alternatives with energy recovery (Alternatives C-3M and C-5M) appear to lower annual O&M costs to a significant degree compared to the existing farms' collective O&M costs.

6. For the anaerobic digestion (C-3W) and combustion (C-5W) alternatives for the Waunakee Cluster, the amount of electrical generation potential is approximately 9,700 kWh/day and 13,100 kWh/day, respectively. This is equivalent to the amount of power used by approximately 415 and 560 homes, respectively, with an average energy use of 700 kWh/month.

7. Similarly, for the Middleton Cluster Alternatives C-3M and C-5M, the amount of electrical generation potential is approximately 7,300 kWh/day and 9,800 kWh/day,

respectively, which is equivalent to the amount of power used by approximately 313 and 420 homes, respectively.

8. On a preliminary basis, the potential GHG emissions reduction from eliminating long-term lagoon storage of the manure is estimated at approximately 19,800 metric tons/year of equivalent CO_2 for Alternatives C-3W and C-5W (Table 4.05-2). This is approximately equivalent to:

   - The CO_2 emissions from the annual electrical generation to supply 3,800 homes using 700 kWh/month of electricity (1 kWh of electricity ~ 1.37 lbs CO_2).

   - The CO_2 emissions from the annual natural gas use of 3,900 homes using 80 therms of natural gas/month (1 MMBTU of natural gas ~ 117 lbs CO_2).

   - The CO_2 emissions from driving approximately 50-million miles/year at an average fuel economy of 25 miles/gallon (1 gallon of gasoline ~ 21.7 lbs CO_2).

9. For each of the alternatives, the cost of supplying commercial or other fertilizer to replace the manure-based fertilizer was not included as these costs will vary significantly based on the soil needs, crops planted, available land at each farm and amount of land required to be rented, and similar factors. Such an analysis is beyond the scope of this report. However, it is noted that the cost of commercial fertilizer has increased by 40 to 75 percent from a year ago, which is in large part due to significant increases in natural gas prices and transportation costs. Recent commercial fertilizer values are reported as $0.50/lb of N, $0.40/lb of P, and $0.33/lb of K. At these costs, the added cost to purchase commercial fertilizer could increase the overall O&M costs of the manure management alternatives, and in some cases, the cost increase could be significant.

4.06 ANNUAL O&M SENSITIVITY ANALYSES

Several factors have a major impact on the annual cost to operate manure management facilities. However, a few of the O&M categories could have a major impact on the viability of the manure management alternatives evaluated herein because of the uncertainty of such costs over time. For example, while labor costs are a significant component of the annual O&M cost for a facility, labor costs are relatively simple to project over time. However, the value of the residual solids from a manure management facility could and would vary significantly as markets are developed for such materials. The following paragraphs present sensitivity analyses for the following O&M categories, which were selected specifically because the projection of such costs into the future is relatively uncertain: manure/returned liquids hauling costs, solids disposal revenue, and GHG emission reduction credits. The base conditions for the sensitivity analyses were 2007 conditions and unit costs. Tables 4.06-1, 4.06-2, and 4.06-3 present summaries of these analyses for the individual farm alternatives, Waunakee Cluster alternatives, and the Middleton Cluster alternatives.

A. Liquid Disposal/Manure Trucking

Manure hauling and returned liquid hauling costs are the most significant annual cost item for several of the alternatives, especially for the Middleton Cluster alternatives. These costs are dependent on labor and fuel costs, as well as the cost for land rental, truck maintenance, and related expenses. For this sensitivity analysis, we have calculated the total unit cost for trucking manure and returned liquids as a function of raw manure quantities only for each alternative. This results in a cost per volume of raw manure trucked and is in the range of $0.026 to $0.048 per gallon of raw manure for the various alternatives.

Since each alternative has varying unit costs for hauling manure (and return liquids), the sensitivity analyses varied this unit cost from 50 percent to 150 percent of the calculated unit cost (100 percent = value calculated for Table 4.05-3).

As noted previously, the management systems would be designed with a capacity of approximately 25 percent larger than required for the anticipated growth of the farm(s) being served by the system. This provides the potential of hauling additional manure from other farms to the manure management facility. The cost of hauling this additional manure cannot be determined or even estimated within reason since it is dependent on the location of the farm, quantity of manure hauled, regularity of manure hauling, and other factors. For that purpose, unit costs for such additional hauling was not included herein.

B. Solids Disposal Revenue

The value of the final solids products could vary considerably as markets develop for these materials. As noted previously, we have assumed the value of the solids is dependent on the alternative management system. We assigned a base value of $5/wet ton for alternatives F1 and C-1; $10/wet ton for Alternatives F-2 and C-2 (higher nutrient content), $20/wet ton for Alternatives F-3 and C-3 (fewer concerns with disease organisms), and $50/wet ton for Alternatives C-4 and C-5 (concentration nutrients and improved transportability). For the sensitivity analyses, we allowed the value for each alternative to range from a net cost of $5/wet ton to dispose of the material (no net value) to a high end value of triple the base value used in Table 4.05-3.

C. GHG Emission Reduction Credits

The value of GHG emission reduction credits will likely increase over time and has the potential of significantly increasing. However, there will potentially be restrictions on the level of credits available as the result of carbon market policies. For example, in some countries, limits may be placed on entities so that only a certain percentage of GHG reduction goals for a given entity may be allowable through purchase on the carbon market, with the remaining GHG reduction required

TABLE 4.06-1

INDIVIDUAL FARMS–O&M COST SENSITIVITY ANALYSES

	Annual O&M Cost (Revenue)		
	Alt. F-1	Alt. F-2	Alt. F-3
Base Annual O&M Cost (Revenue)	$152,000	$53,000	$ 82,000
Manure and Liquid Hauling Sensitivity Analyses			
Base Condition (unit cost/gallon)	$ 0.046	NA	NA
50% of current cost	$119,000	$53,000	$ 82,000
75% of current cost	$135,000	$53,000	$ 82,000
100% of current cost (base condition)	$152,000	$53,000	$ 82,000
125% of current cost	$169,000	$53,000	$ 82,000
150% of current cost	$186,000	$53,000	$ 82,000
Solids Disposal Revenue Sensitivity Analyses			
Base Condition (unit value /wet ton)	$ 5.00	$ 10.00	$ 20.00
$5/ton cost of disposal	$166,000	$95,000	$130,000
$0/ton	$159,000	$81,000	$120,000
base value condition (see above)	$152,000	$53,000	$ 82,000
twice base value	$145,000	$25,000	$ 44,000
triple base value	$138,000	($3,000)	$ 6,000
GHG Emission Reduction Credit Sensitivity Analyses			
Base Condition (unit value/MtCO2e)	$ 6.00	$ 6.00	$ 6.00
$3/MtCO2e	$155,000	$59,000	$ 88,000
$6/MtCO2e (base condition)	$152,000	$53,000	$ 82,000
$10/MtCO2e	$149,000	$46,000	$ 74,000
$15/MtCO2e	$145,000	$37,000	$ 64,000
$20/MtCO2e	$140,000	$27,000	$ 54,000

TABLE 4.06-2

WAUNAKEE CLUSTER–O&M COST SENSITIVITY ANALYSES

	Annual O&M Cost (Revenue)				
	Alt. C-1W	Alt. C-2W	Alt. C-3W	Alt. C-4W	Alt. C-5W
Base Annual O&M Cost (Revenue)	$1,007,000	$ 98,000	($220,000)	$438,000	($183,000)
Manure and Liquid Hauling Sensitivity Analyses					
Base Condition (unit cost/gallon)	$ 0.026	NA	NA	NA	NA
50% of current cost	$ 729,000	$ 98,000	($220,000)	$438,000	($183,000)
75% of current cost	$ 868,000	$ 98,000	($220,000)	$438,000	($183,000)
100% of current cost (base condition)	$1,007,000	$ 98,000	($220,000)	$438,000	($183,000)
125% of current cost	$1,146,000	$ 98,000	($220,000)	$438,000	($183,000)
150% of current cost	$1,286,000	$ 98,000	($220,000)	$438,000	($183,000)
Solids Disposal Revenue Sensitivity Analyses					
Base Condition (unit value/wet ton)	$ 5.00	$ 10.00	$ 20.00	$ 50.00	$ 50.00
$5/ton cost of disposal	$1,141,000	$ 523,000	($ 71,000)	$569,000	($152,000)
$0/ton	$1,074,000	$ 381,000	($101,000)	$557,000	($155,000)
base value condition (see above)	$1,007,000	$ 98,000	($220,000)	$438,000	($183,000)
twice base value	$ 940,000	($185,000)	($339,000)	$319,000	($211,000)
triple base value	$ 873,000	($468,000)	($458,000)	$200,000	($239,000)
GHG Emission Reduction Credit Sensitivity Analyses					
Base Condition (unit value/MtCO2e)	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00
$3/MtCO2e	$1,034,000	$ 155,000	($161,000)	$498,000	($124,000)
$6/MtCO2e (base condition)	$1,007,000	$ 98,000	($220,000)	$438,000	($183,000)
$10/MtCO2e	$ 972,000	$ 23,000	($299,000)	$359,000	($262,000)
$15/MtCO2e	$ 928,000	($ 72,000)	($399,000)	$260,000	($362,000)
$20/MtCO2e	$ 883,000	($166,000)	($498,000)	$160,000	($461,000)

TABLE 4.06-3

MIDDLETON CLUSTER–O&M COST SENSITIVITY ANALYSES

	Annual O&M Cost (Revenue)				
	Alt. C-1M	Alt. C-2M	Alt. C-3M	Alt. C-4M	Alt. C-5M
Base Annual O&M Cost (Revenue)	$946,000	$600,000	$304,000	$812,000	$235,000
Manure and Liquid Hauling Sensitivity Analyses					
Base Condition (unit cost/gallon)	$ 0.048	$ 0.040	$ 0.034	$ 0.040	$ 0.026
50% of current cost	$ 667,000	$371,000	$106,000	$ 583,000	$ 82,000
75% of current cost	$ 807,000	$485,000	$205,000	$ 697,000	$159,000
100% of current cost (base condition)	$ 946,000	$600,000	$304,000	$ 812,000	$235,000
125% of current cost	$1,086,000	$715,000	$403,000	$ 927,000	$312,000
150% of current cost	$1,225,000	$830,000	$502,000	$1,042,000	$388,000
Solids Disposal Revenue Sensitivity Analyses					
Base Condition (unit value/wet ton)	$ 5.00	$ 10.00	$ 20.00	$ 50.00	$ 50.00
$5/ton cost of disposal	$1,046,000	$918,000	$415,000	$910,000	$258,000
$0/ton	$ 996,000	$812,000	$393,000	$901,000	$256,000
base value condition (see above)	$ 946,000	$600,000	$304,000	$812,000	$235,000
twice base value	$ 896,000	$388,000	$215,000	$723,000	$214,000
triple base value	$ 846,000	$176,000	$126,000	$634,000	$193,000
GHG Emission Reduction Credit Sensitivity Analyses					
Base Condition (unit value/MtCO2e)	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00
$3/MtCO2e	$966,000	$642,000	$349,000	$857,000	$280,000
$6/MtCO2e (base condition)	$946,000	$600,000	$304,000	$812,000	$235,000
$10/MtCO2e	$919,000	$544,000	$245,000	$753,000	$176,000
$15/MtCO2e	$886,000	$474,000	$171,000	$679,000	$102,000
$20/MtCO2e	$853,000	$404,000	$ 96,000	$604,000	$ 27,000

to be achieved through the entities direct initiatives to reduce GHGs. This could limit market demand in the future for carbon credits. Our sensitivity analyses for GHG reduction credits place a value per metric ton of carbon equivalents in the range of $3 to $20. In the O&M cost evaluations (Table 4.05-3), we assumed a value of \$6/MtCO_2e.

4.07 SUMMARY OF FINANCIAL EVALUATIONS

Based on these evaluations, including the opinions of capital cost and O&M cost, as well as the sensitivity analyses, the following conclusions apply:

- Per animal unit, the cluster alternatives are generally lower in both capital and O&M costs than the individual farm alternatives.

- The Waunakee Cluster has higher capital costs than the Middleton Cluster, which is the result of the costs to construct pumping stations and force mains to convey manure to the cluster site and return liquid to the farms.

- The Middleton Cluster has higher annual O&M costs, which mainly result from the high cost of trucking manure to the cluster site and trucking liquid back to the farms.

- The cluster anaerobic digestion alternatives (C-3W and C-3M) and combustion alternatives (C-5W and C-5M) have the lowest annual O&M cost and are expected to save significant annual O&M costs compared to the existing operations. The preliminary cost opinions for the Waunakee Cluster indicate that these alternatives may provide a net operating surplus (revenue exceeds costs).

- The alternatives are very dependent on the actual unit O&M costs noted in Section 4.06. In particular, the cost of trucking, the value of separated solids, and the value of GHG emission reduction credits will be important in determining financial viability of various alternatives.

Wetland Map

Middleton Manure Digester Project

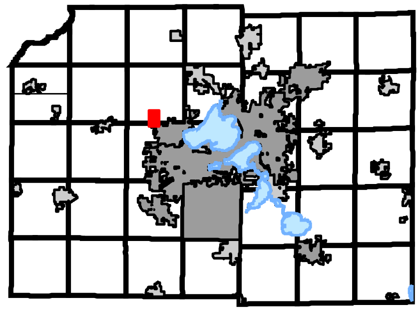
- Manure Handling Facility
- Wetlands < 2 acres
- Wetlands > 2 acres
- Perennial Stream
- Intermittent Stream

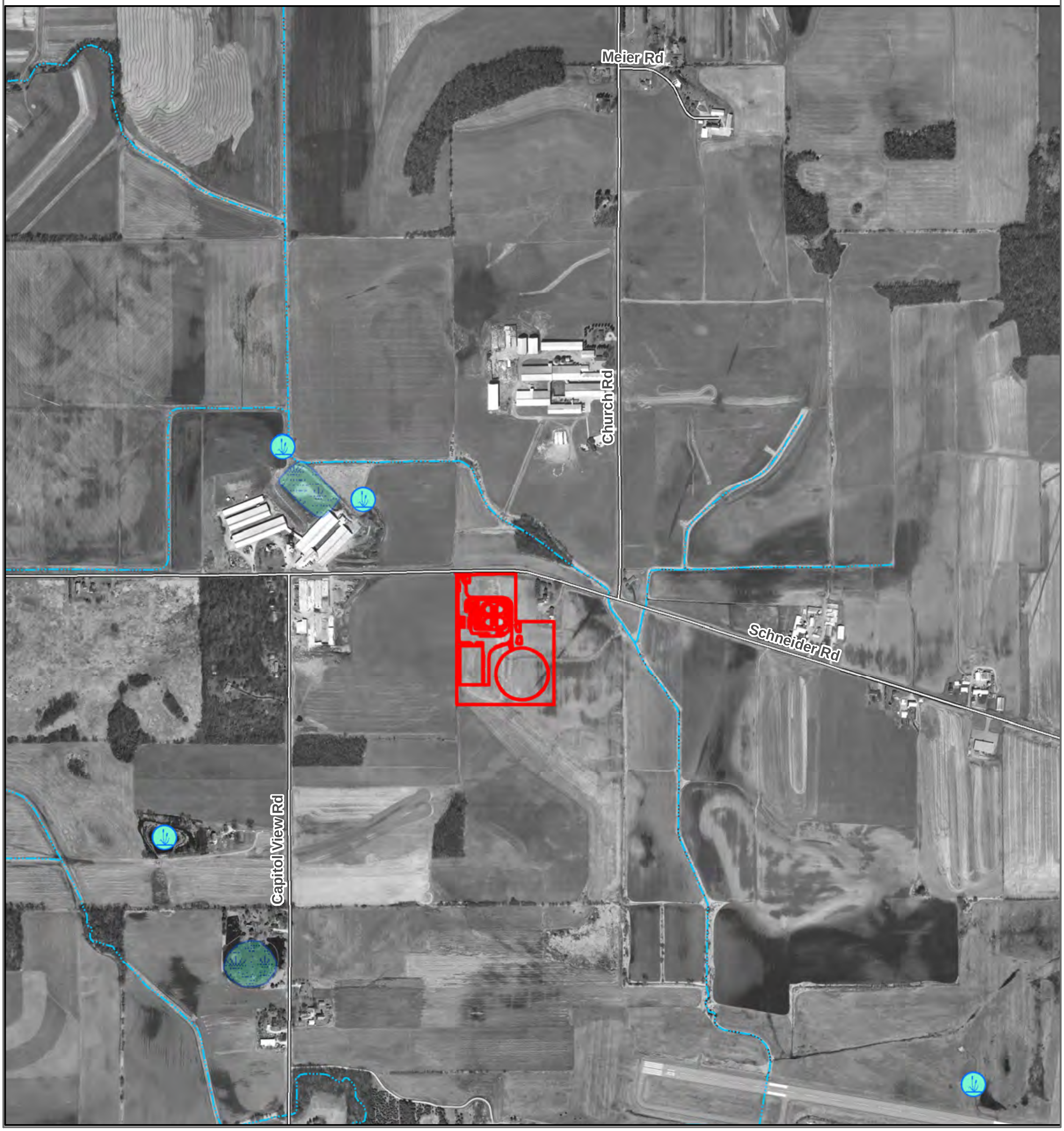
Data Source:
Facility data from US Biogas, 8/15/2012
Digital orthophoto 2010
Wisconsin Department of Natural Resources Wetland Delineation

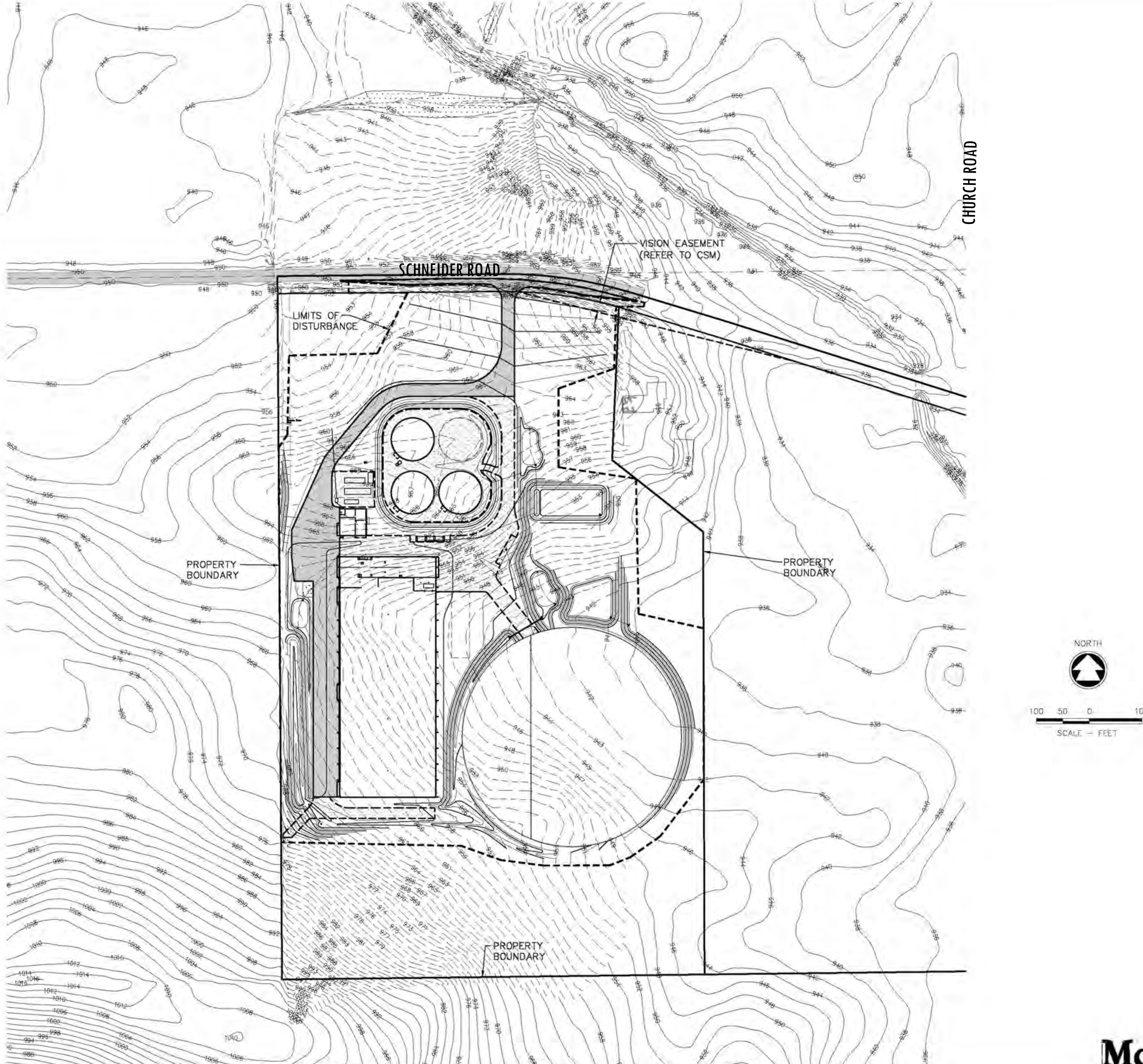
Map updated August 16,2012 by Dane Co. LWRD
Middleton Digester Wetland Map.mxd

0 500 1,000 2,000 Feet

Map Location in Dane County







NO.	DATE	REVISION

GL DAIRY BIOGAS PROJECT
TOWN OF SPRINGFIELD, DANE COUNTY, WISCONSIN
OVERALL SITE PLAN

DESIGNED	DRAWN
–	–

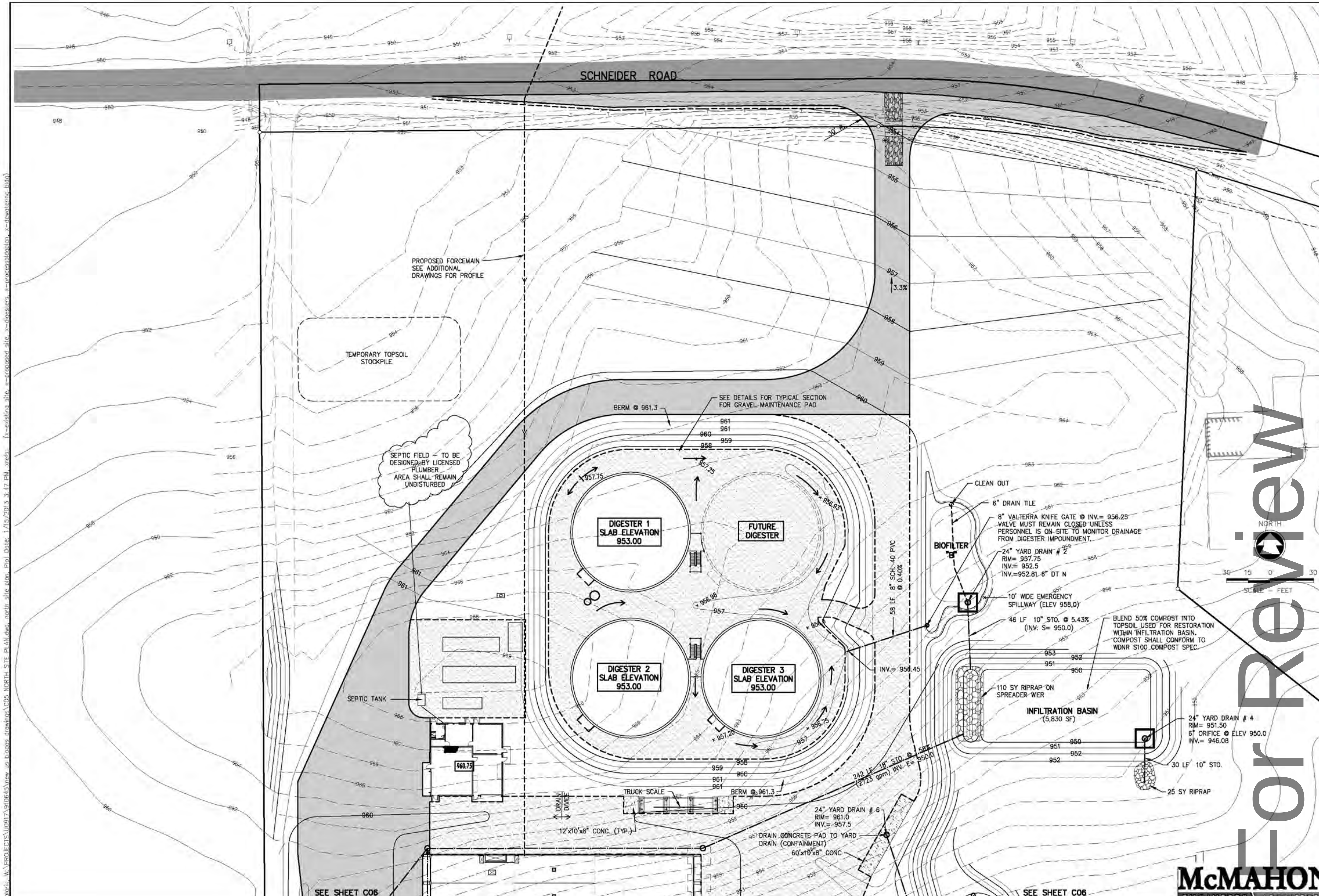
PROJECT NO. U0917-910645

DATE JANUARY, 2013

SHEET NO. C02

McMAHON ENGINEERS \ ARCHITECTS

w:\PROJECTS\U0917\910645\new us biogas drawings\C05 NORTH SITE PLAN.dwg, NORTH SITE PLAN, 1/15/2013 3:47:00 PM, pkolarik, 1:2



US BIOGAS
CGSCHMIDT

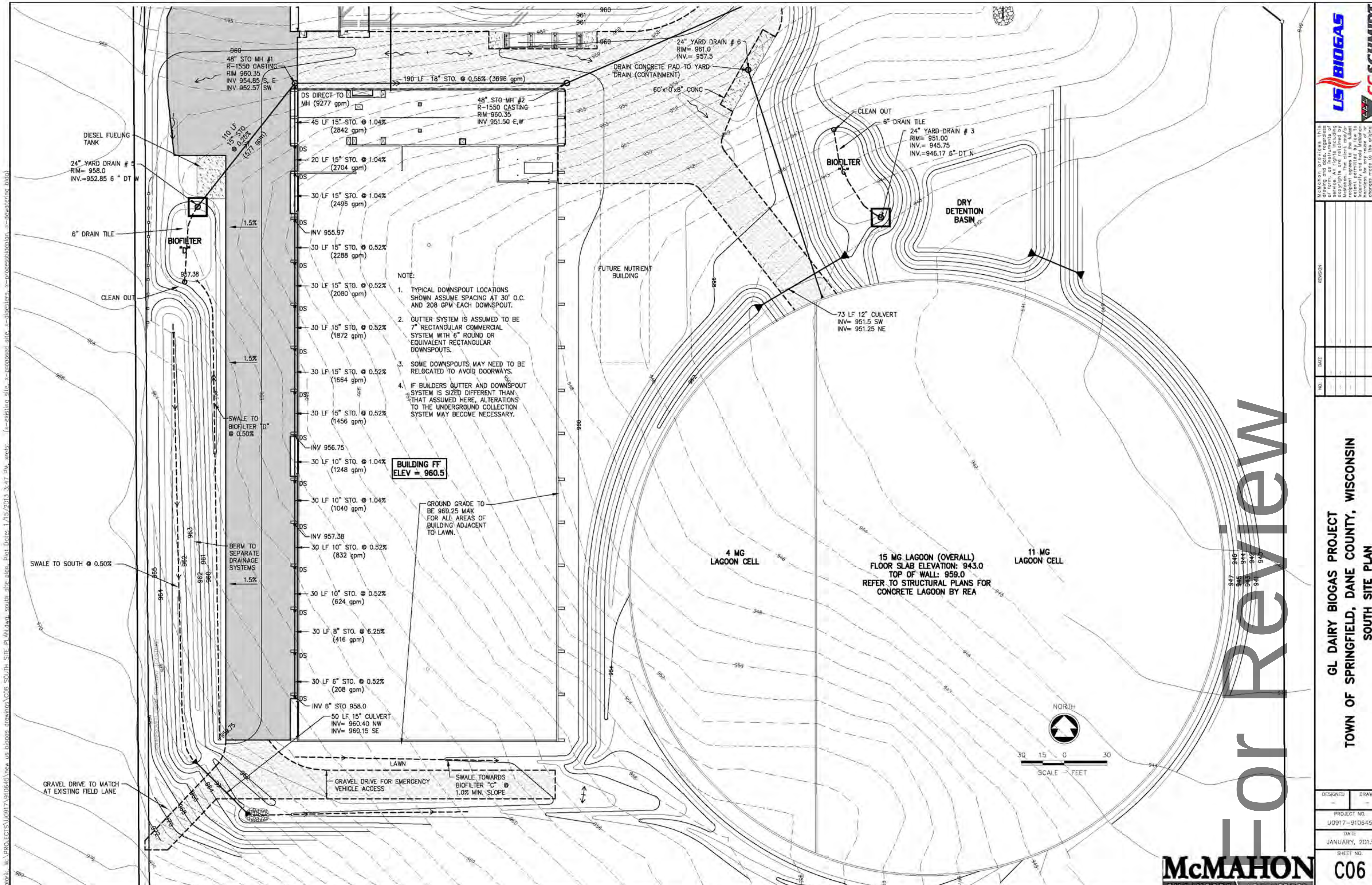
NO.	DATE	REVISION

GL DAIRY BIOGAS PROJECT
TOWN OF SPRINGFIELD, DANE COUNTY, WISCONSIN
NORTH SITE PLAN

DESIGNED	DRAWN
–	–

PROJECT NO. U0917-910645
DATE JANUARY, 2013
SHEET NO. C05

McMAHON ENGINEERS \ ARCHITECTS



48" STO MH #1
R-1550 CASTING
RIM 960.35
INV 954.85 S, E
INV 952.57 SW
190 LF 18" STO. @ 0.56% (3696 gpm)
DS DIRECT TO MH (9277 gpm)
48" STO MH #2
R-1550 CASTING
RIM 960.35
INV 951.50 E,W
24" YARD DRAIN # 6
RIM= 961.0
INV.= 957.5
DRAIN CONCRETE PAD TO YARD DRAIN (CONTAINMENT)
60'x10'x8" CONC
CLEAN OUT
6" DRAIN TILE
24" YARD DRAIN # 3
RIM= 951.00
INV.= 945.75
INV.=946.17 6" DT N
BIOFILTER "C"
DRY DETENTION BASIN
DIESEL FUELING TANK
110 LF 15" STO. @ 0.25% (577 gpm)
24" YARD DRAIN # 5
RIM= 958.0
INV.=952.85 6" DT W
6" DRAIN TILE
BIOFILTER "D"
CLEAN OUT
45 LF 15" STO. @ 1.04% (2842 gpm)
20 LF 15" STO. @ 1.04% (2704 gpm)
30 LF 15" STO. @ 1.04% (2496 gpm)
INV 955.97
30 LF 15" STO. @ 0.52% (2288 gpm)
30 LF 15" STO. @ 0.52% (2080 gpm)
30 LF 15" STO. @ 0.52% (1872 gpm)
30 LF 15" STO. @ 0.52% (1664 gpm)
30 LF 15" STO. @ 0.52% (1456 gpm)
INV 956.75
30 LF 10" STO. @ 1.04% (1248 gpm)
30 LF 10" STO. @ 1.04% (1040 gpm)
INV 957.38
30 LF 10" STO. @ 0.52% (832 gpm)
30 LF 10" STO. @ 0.52% (624 gpm)
30 LF 8" STO. @ 6.25% (416 gpm)
30 LF 6" STO. @ 0.52% (208 gpm)
INV 6" STO 958.0
50 LF 15" CULVERT
INV= 960.40 NW
INV= 960.15 SE
NOTE:
1. TYPICAL DOWNSPOUT LOCATIONS SHOWN ASSUME SPACING AT 30' O.C. AND 208 GPM EACH DOWNSPOUT.
2. GUTTER SYSTEM IS ASSUMED TO BE 7" RECTANGULAR COMMERCIAL SYSTEM WITH 6" ROUND OR EQUIVALENT RECTANGULAR DOWNSPOUTS.
3. SOME DOWNSPOUTS MAY NEED TO BE RELOCATED TO AVOID DOORWAYS.
4. IF BUILDERS GUTTER AND DOWNSPOUT SYSTEM IS SIZED DIFFERENT THAN THAT ASSUMED HERE, ALTERATIONS TO THE UNDERGROUND COLLECTION SYSTEM MAY BECOME NECESSARY.
BUILDING FF ELEV = 960.5
GROUND GRADE TO BE 960.25 MAX FOR ALL AREAS OF BUILDING ADJACENT TO LAWN.
FUTURE NUTRIENT BUILDING
SWALE TO BIOFILTER "D" @ 0.50%
BERM TO SEPARATE DRAINAGE SYSTEMS
SWALE TO SOUTH @ 0.50%
GRAVEL DRIVE TO MATCH AT EXISTING FIELD LANE
LAWN
GRAVEL DRIVE FOR EMERGENCY VEHICLE ACCESS
SWALE TOWARDS BIOFILTER "C" @ 1.0% MIN. SLOPE
73 LF 12" CULVERT
INV= 951.5 SW
INV= 951.25 NE
4 MG LAGOON CELL
15 MG LAGOON (OVERALL)
FLOOR SLAB ELEVATION: 943.0
TOP OF WALL: 959.0
REFER TO STRUCTURAL PLANS FOR CONCRETE LAGOON BY REA
11 MG LAGOON CELL
NORTH
30 15 0 30
SCALE - FEET
US BIOGAS
CGSCHMIDT
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NO. DATE REVISION
GL DAIRY BIOGAS PROJECT
TOWN OF SPRINGFIELD, DANE COUNTY, WISCONSIN
SOUTH SITE PLAN
DESIGNED DRAWN
PROJECT NO. U0917-910645
DATE JANUARY, 2013
SHEET NO. C06
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Flood Plain Map

Ziegler Dairy & Middleton Manure Digester Project

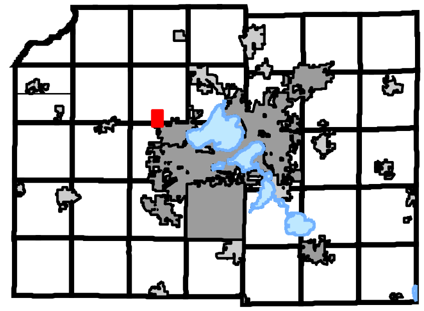
- Floodway Areas in Zone AE
- 1 Percent Annual Flood Chance Area
- 0.2 Percent Annual Flood Chance Area
- Manure Handling Facility
- Intermittent Stream

Data Source:
Facility data from US Biogas, 8/15/2012
Digital orthophoto 2010
2009 FEMA FIRM

Map updated August 16,2012 by Dane Co. LWRD
Middleton Digester Flood Plain Map.mxd

0 225 450 900 Feet

Map Location in Dane County



US Biogas Springfield - Waste calculations (2014)

Assume digester startup date of Aug. 1, 2013 & crop years start on Sept 1 each year

Daily volume of substrate adding to system = 41,000 gals — Yellow highlighted areas are entered values. Other values are calculated

----------- Nutrient sources going to digester ---------------						---- Total nutrients (lbs/1,000 gals) ----				
Nutrient source	Yearly volume (Gals)	% of total from farms	Daily volume (Gals)	Daily volume (ft^3)	% volatile solids	% D.M.*	N	P2O5	K2O	S
Blue Star Dairy	4,877,530	18.6%	13,363	1,787	80%	9.12	29.34	10.61	24.22	1.26
Hensen	5,500,000	21.0%	15,068	2,015	80%	4.70	23.24	6.78	24.68	1.98
Ziegler	15,834,472	60.4%	43,382	5,800	80%	7.41	23.29	9.91	21.57	3.11
Total manure	**26,212,002**	100.0%	71,814	9,601	80%	7.16	24.41	9.38	22.71	2.53
Volume to fill digesters	2,868,000									
Percent of Fill Volume - Manure	50%									
Manure to be digested	**24,778,002**		67,885	9,076						
Total manure nutrients going to digester							604,750	232,497	562,812	62,621
Total substrate	**14,965,000**		41,000	5,481	90%	12.10	16.18	8.26	3.34	0.43
Volume to fill digesters	2,868,000						218,952	111,725	45,241	5,818
Percent of Fill Volume - Substrate	50%									
Substrate to be digested	**13,531,000**									
Totals to digester	**38,309,002**		**112,814**	**15,082**						
Weighted averages of (Nutrient sources prior to digestion)						**8.91**	**21.50**	**8.99**	**15.87**	**1.79**
Total nutrients							**823,702**	**344,222**	**608,053**	**68,439**

Digestion and separation

Number of days to fill digesters =	40	days
Number of days manure going through digester and separator =	365	days
% reduction in Dry matter through digestion process (Based on Clear Horizons - Dane test data)	15.8%	
% Dry matter of 'Nutrient source' after digestion = Weighted % D.M. of 'Manure nutrient sources' going to digester x (1 - % reduction in Dry matter through digestion process)	6.03	
% Dry matter capture rate of solids separator (Based on BIOFerm data)	40%	
Manure N (lbs/day)	1657	lbs/day
Manure P2O5 (lbs/day)	637	lbs/day
Manure K2O (lbs/day)	1542	lbs/day
Manure S (lbs/day)	172	lbs/day
Total manure (lbs/day) = Total manure to be digested (Daily volume in gallons) * 8.34	566,160	lbs/day
Total manure solids (lbs/day) = Total manure % D.M. / 100 * Total manure (lbs/day)	40,539	lbs/day
Volatile solids of manure (lbs/day) = Total manure solids (lbs/day) * Total manure % volatile solids	32,431	lbs/day
Volatile solids destruction rate of manure (Based on US Biogas, LLC data)	40%	
Volatile solids of manure converted to methane (lbs/day) = Volatile solids of manure (lbs/day) * Volatile solids destruction rate of manure	12,972	lbs/day
Remaining volume of manure after methane conversion (gals/day) = [total manure (lbs/day) - volatile solids of manure converted to methane (lbs/day)] / 8.34	66,329	gals/day
% volume reduction of manure through digestion process = [Total manure to be digested (Daily volume in gallons) - Remaining volume of manure after methane conversion (gals/day)] / Total manure to be digested (Daily volume in gallons)	2.3%	
Substrate N (lbs/day)	600	lbs/day
Substrate P2O5 (lbs/day)	306	lbs/day
Substrate K2O (lbs/day)	124	lbs/day
Substrate S (lbs/day)	16	lbs/day
Total substrate (lbs/day) = Total substrate (Daily volume in gallons) * 8.34	341,940	lbs/day
Total substrate solids (lbs/day) = Total substrate % D.M. / 100 * Total substrate (lbs/day)	41,378	lbs/day
Volatile solids of substrate (lbs/day) = Total substrate solids (lbs/day) * Total substrate % volatile solids	37,240	lbs/day
Volatile solids destruction rate of substrate (Based on US Biogas, LLC data)	90%	
Volatile solids of substrate converted to methane (lbs/day) = Volatile solids of substrate (lbs/day) * Volatile solids destruction rate of substrate	33,516	lbs/day
Remaining volume of substrate after methane conversion (gals/day) = [Total substrate (lbs/day) - Volatile solids of substrate converted to methane (lbs/day)] / 8.34	36,981	gals/day
% volume reduction of substrate through digestion process = [Total substrate (Daily volume in gallons) - Remaining volume of substrate after methane conversion] / Total substrate (Daily volume in gallons)	9.8%	
Post digestion manure volume (gals/day) = Total manure to be digested (Daily volume in gallons) x [1 - % volume reduction of manure through digestion process]	66,329	gals/day
Post digestion substrate volume (gals/day) = Total substrate (Daily volume in gallons) x [1 - % volume reduction of substrate through digestion process]	36,981	gals/day
Post digestion total volume (gals/day) = Post digestion manure volume (gals/day)+ Post digestion substrate volume (gals/day)	103,311	gals/day
Post digestion % DM = (((Total manure solids (lbs/day)-Volatile solids of manure converted to methane (lbs/day))+(Total substrate solids (lbs/day)-Volatile solids of substrate converted to methane (lbs/day)))/8.34)/Post digestion total volume (gals/day)	3.68%	
Post digestion N (lbs/day) = (Total Nutrients "N" / 365 days)	2,257	lbs/day
Post digestion P2O5 (lbs/day) = (Total Nutrients "P2O5" / 365 days)	943	lbs/day
Post digestion K2O (lbs/day) = (Total Nutrients "K2O" / 365 days)	1,666	lbs/day
Post digestion S (lbs/day) = (Total Nutrients "S" / 365 days)	188	lbs/day
Post digestion N (lbs/1,000 gal) = (Post digestion N (lbs/day)/(Post digestion total volume (gal/day)/1,000 gal)	21.84	lbs/1,000 gals
Post digestion P2O5 (lbs/1,000 gal) = (Post digestion P2O5 (lbs/day)/(Post digestion total volume (gal/day)/1,000 gal)	9.13	lbs/1,000 gals
Post digestion K2O (lbs/1,000 gal) = (Post digestion K2O (lbs/day)/(Post digestion total volume (gal/day)/1,000 gal)	16.13	lbs/1,000 gals
Post digestion S (lbs/1,000 gal) = (Post digestion S (lbs/day)/(Post digestion total volume (gal/day)/1,000 gal)	1.81	lbs/1,000 gals
Percent 'Post digestion total volume' to separtion system	75.0%	
Post digestion total volume to separtion system (gal/day)	77,483	gals/day

Pressate Volume and Nutrients		
% reduction in N content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion'	10.0%	
% reduction in P_2O_5 content of separated liquid (Pressate) compared to 'Total manure nutrients going to digester'	45.0%	
% reduction in P_2O_5 content of separated liquid (Pressate) compared to Total substrate nutrients going to digester	35.0%	
% reduction in K_2O content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion'	5.0%	
% reduction in S content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion'	2.0%	
Pressate % DM = % Dry matter of 'Nutrient source' after digestion * (1-% Dry matter capture rate of solids separator)	2.21%	
Pressate Volume (gals/day) = Post digestion total volume to separation system - Separated fiber volume	72,485	gals/day
Pressate N (lbs/day) = = Total nutrient N of Nutrient sources prior to digestion * (1 - % reduction in N content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	1,523	lbs/day
Pressate P2O5 (lbs/day) = Total nutrient P2O5 of Nutrient sources prior to digestion * (1 - % reduction in P2O5 content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	412	lbs/day
Pressate K2O (lbs/day) = Total nutrient K2O of Nutrient sources prior to digestion * (1 - % reduction in K2O content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	1,187	lbs/day
Pressate S (lbs/day) = Total nutrient S of Nutrient sources prior to digestion * (1 - % reduction in S content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	138	lbs/day
Pressate N (lbs/1,000 gal) = Total nutrient N of Nutrient sources prior to digestion * (1 - % reduction in N content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	21.02	lbs/1,000 gals
Pressate P2O5 (lbs/1,000 gal) = Total nutrient P2O5 of Nutrient sources prior to digestion * (1 - % reduction in P2O5 content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	5.68	lbs/1,000 gals
Pressate K2O (lbs/1,000 gal) = Total nutrient K2O of Nutrient sources prior to digestion * (1 - % reduction in K2O content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	16.38	lbs/1,000 gals
Pressate S (lbs/1,000 gal) = Total nutrient S of Nutrient sources prior to digestion * (1 - % reduction in S content of separated liquid (Pressate) compared to 'Nutrient sources prior to digestion')	1.90	lbs/1,000 gals
Fiber Volume and Nutrients		
Fiber % DM (Based on testing by US Biogas,LLC)	30.00%	
Fiber recovery through separation factor (Based on testing by US Biogas, LLC)	0.54	lbs/gal
Daily mass of separated fiber = Post digestion manure volume (gals/day) x Fiber recovery through separation factor	41,987	lbs/day
Separated fiber density (Based on NuSolutions Agronomy, LLC measurements)	8.4	lbs/gal
Separated fiber volume (gals/day) = Daily mass of separated fiber / Separated fiber density	4,998	gals/day
Yearly mass of separated fiber = (Daily mass of separated fiber x Number of days manure going through digester and separator) / 2,000	7,663	tons/yr
Fiber N (lbs/day) = Post digestion N (lbs/day) - Pressate N (lbs/day)	169	lbs/day
Fiber P2O5 (lbs/day) = Post digestion P2O5 (lbs/day) - Pressate P2O5 (lbs/day)	295	lbs/day
Fiber K2O (lbs/day) = Post digestion K2O (lbs/day) - Pressate K2O (lbs/day)	62	lbs/day
Fiber S (lbs/day) = Post digestion S (lbs/day) - Pressate S (lbs/day)	3	lbs/day
Fiber N (lbs/ton) = (Fiber N (lbs/day)/(Separated fiber volume (gal/day)/1000))/4.17	8.12	lbs/ton
Fiber P2O5 (lbs/ton) = (Fiber P2O5 (lbs/day)/(Separated fiber volume (gal/day)/1000))/4.17	14.17	lbs/ton
Fiber K2O (lbs/ton) = (Fiber K2O (lbs/day)/(Separated fiber volume (gal/day)/1000))/4.17	3.00	lbs/ton
Fiber S (lbs/ton) = (Fiber S (lbs/day)/(Separated fiber volume (gal/day)/1000))/4.17	0.13	lbs/ton
Cake Volume and Nutrients		
Cake % DM (Based on manufacturer's testing)	25.0%	
Cake recovery through separation factor (Based on US Biogas, LLC data)	0.64	
Daily mass of cake (lbs/day) = Pressate volume (gal/day) * Cake recovery through separation factor	46,242	lbs/day
Cake density (lbs/gal) (Based on manufacturer's testing)	9.00	lbs/gal
Cale Volume(gal/day) = Daily mass of cake / Cake density	5,138	gals/day
Yearly mass of cake = (Daily mass of cake x Number of days manure going through digester and separator) / 2,000	8,439	tons/yr
Percent N capture in cake (Based on manufacturer's testing)	15.0%	
Percent P2O5 capture in cake (Based on manufacturer's testing)	70.0%	
Percent K2O capture in cake (Based on manufacturer's testing)	5.0%	
Percent S capture in cake (Based on manufacturer's testing)	1.0%	
Cake N (lbs/day) = Pressate N (lbs/day) * Percent N capture in cake	228	lbs/day
Cake P2O5 (lbs/day) = Pressate P2O5 (lbs/day) * Percent P2O5 capture in cake	288	lbs/day
Cake K2O (lbs/day) = Pressate K2O (lbs/day) * Percent K2O capture in cake	59	lbs/day
Cake S (lbs/day) = Pressate S (lbs/day) * Percent S capture in cake	1	lbs/day
Cake N (lbs/ton) = (Cake N (lbs/day)/(Cake volume (gal/day)/1000))/4.17	10.66	lbs/ton
Cake P2O5 (lbs/ton) = (Cake P2O5 (lbs/day)/(Cake volume (gal/day)/1000))/4.17	13.46	lbs/ton
Cake K2O (lbs/ton) = (Cake K2O (lbs/day)/(Cake volume (gal/day)/1000))/4.17	2.77	lbs/ton
Cake S (lbs/ton) = (Cake S (lbs/day)/(Cake volume (gal/day)/1000))/4.17	0.06	lbs/ton
Centrate Volume and Nutrients		
% DM in centrate (Based on manufacturer's testing)	1.10%	
Percent Centrate of Pressate (Based on manufacturer's testing)	92.6%	
Centrate Volume (gals/day) = Pressate volume (gals/day) * Percent Centrate of Pressate	67,128	gals/day
Centrate N (lbs/day) = Pressate N (lbs/day) - Cake N (lbs/day)	1,295	lbs/day
Centrate P2O5 (lbs/day) = Pressate P2O5 (lbs/day) - Cake P2O5 (lbs/day)	124	lbs/day
Centrate K2O (lbs/day) = Pressate K2O (lbs/day) - Cake K2O (lbs/day)	1,128	lbs/day
Centrate S (lbs/day) = Pressate S (lbs/day) - Cake S (lbs/day)	136	lbs/day
Centrate N (lbs/1,000 gals) = Centrate N (lbs/day)/(Cake volume (gal/day)/1000)	19.29	lbs/1,000 gals
Centrate P2O5 (lbs/1,000 gals) = Centrate P2O5 (lbs/day)/(Centrate volume (gal/day)/1000)	1.84	lbs/1,000 gals
Centrate K2O (lbs/1,000 gals) = Centrate K2O (lbs/day)/(Centrate volume (gal/day)/1000)	16.80	lbs/1,000 gals
Centrate S (lbs/1,000 gals) = Centrate S (lbs/day)/(Centrate volume (gal/day)/1000)	2.03	lbs/1,000 gals

Phosphorus Removal Requirements

Percent of P2O5 removal of manure required	60.0%	
Percent of P2O5 removal of substrate required	100.0%	
Total P2O5 in manure and substrates	943	lbs/day
P2O5 removal requirement = (Manure P2O5 * Percent of P2O5 removal of manure required) + (Substrate P2O5 * Percent of P2O5 removal of substrates required)	688	lbs/day
Equivalent P2O5 removal = P2O5 removal requirement / Total P2O5 in manure and substrates	73.0%	
P2O5 limit in product back to farms	255	lbs/day
Product going back to Cooperating farms		
Percent of Centrate back to farms	100.0%	
Percent of Digestate back to farms	25.0%	
Percent of Cake back to farms	0.0%	
Percent of Fiber back to farms	0.0%	
P2O5 in Centrate Product back to farms = (Centrate P205 * Percent of Centrate back to farms)+(Fiber P2O5 * Percent of Fiber back to farms)	124	lbs/day
P2O5 in Digestate Product back to farms = (Post Digestion P205 * (1 - Percent of Post digestion volume to separation system))	943	lbs/day
Volume fo Centrate back to Participating Farms = (Percent of Centrate Back to Farms * Centrate Volume)	67,128	
Volume fo Digestate back to Participating Farms = ((1-Percent of Post digestion total volumeto separation system) * Post digestion total volume)	25,828	
Volume back to farms = (Volume of Centrate back to farms)+(Volume of Digestate back to Particpating Famrs)	92,956	gals/day
Yearly **'Product'** going back to cooperating farms = (Volume back to farms * 365)	**33,928,823**	gals

--- Product going back to Cooperating farms ---					--------- Total nutrients (lbs/1,000 gals) ---------					---- 1st year available nutrients (lbs/1,000 gals) ----				
Nutrient source	Yearly volume (Gals)	% of total to farms	Daily volume (Gals)	Daily volume (ft3)	% D.M.[1]	N[2]	P2O5[3]	K2O[4]	S[5]	Surface N[8]	Incorp N[7]	P2O5[8]	K2O[8]	S[8]
Blue Star Dairy - Centrate	4,559,280	72.2%	12,491	1,670	1.10	19.29	1.84	16.80	2.03	5.79	7.72	1.10	13.44	1.22
Blue Star Dairy - Digestate	1,754,196	27.8%	4,806	643	3.68	21.84	9.13	16.13	1.81	6.55	8.74	5.48	12.90	1.09
Blue Star Dairy - Cake	0	0.0%	0	0	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blue Star Dairy - Fiber	0	0.0%	0	0	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blue Star Dairy - Total	**6,313,476**	**18.6%**	**17,297**	**2,312**	**1.82**	**20.00**	**3.87**	**16.61**	**1.97**	**6.00**	**8.00**	**2.32**	**13.29**	**1.18**
Hensen - Centrate	5,141,135	72.2%	14,085	1,883	1.10	19.29	1.84	16.80	2.03	5.79	7.72	1.10	13.44	1.22
Hensen - Digestate	1,978,066	27.8%	5,419	725	3.68	21.84	9.13	16.13	1.81	6.55	8.74	5.48	12.90	1.09
Hensen - Cake	0	0.0%	0	0	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hensen - Fiber	0	0.0%	0	0	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hensen - Total	**7,119,202**	**21.0%**	**19,505**	**2,608**	**1.82**	**20.00**	**3.87**	**16.61**	**1.97**	**6.00**	**8.00**	**2.32**	**13.29**	**1.18**
Ziegler - Centrate	14,801,302	72.2%	40,552	5,421	1.10	19.29	1.84	16.80	2.03	5.79	7.72	1.10	13.44	1.22
Ziegler - Digestate	5,694,843	27.8%	15,602	2,086	3.68	21.84	9.13	16.13	1.81	6.55	8.74	5.48	12.90	1.09
Ziegler - Cake	0	0.0%	0	0	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ziegler - Fiber	0	0.0%	0	0	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ziegler - Total	**20,496,145**	**60.4%**	**56,154**	**7,507**	**1.82**	**20.00**	**3.87**	**16.61**	**1.97**	**6.00**	**8.00**	**2.32**	**13.29**	**1.18**
Weighted averages					**1.82**	**20.00**	**3.87**	**16.61**	**1.97**	**6.00**	**8.00**	**2.32**	**13.29**	**1.18**
Totals	**33,928,823**	**100.0%**	**185,911**	**24,854**		**678,525**	**131,167**	**563,589**	**66,910**	**203,557**	**271,410**	**78,700**	**450,871**	**40,146**

Difference between **Total** manure nutrient sources going to digester and Product going back to farms =

Volume Difference (gal/yr.)	7,716,821
Volume Difference (%)	29.4%
Nitrogen Difference (lbs/yr.)	73,774
Nitrogen Difference (%)	12.2%
P2O5 Difference (lbs/yr.)	(101,330)
P2O5 Difference (%)	-43.6%
K2O Difference (lbs/yr.)	777
K2O Difference (%)	0.1%
Sulfur Difference (lbs/yr.)	4,289
Sulfur Difference (%)	6.8%
N:P Ratio of Raw Manure	2.60
N:P Ratio of Product back	5.17

Difference between **Blue Star Dairy** manure nutrients going to digester and Product going back to farms =

Volume Difference (gal/yr.)	1,435,946
Volume Difference (%)	29.4%
Nitrogen Difference (lbs/yr.)	(9,016)
Nitrogen Difference (%)	-6.7%
P2O5 Difference (lbs/yr.)	(24,526)
P2O5 Difference (%)	-50.1%
K2O Difference (lbs/yr.)	(6,788)
K2O Difference (%)	-6.1%
Sulfur Difference (lbs/yr.)	6,647
Sulfur Difference (%)	114.5%
N:P Ratio or Raw Manure	2.76
N:P Ratio of Product back	5.17

Difference between **Henson Bros. Dairy** manure nutrients going to digester and Product going back to farms =

Volume Difference (gal/yr.)	1,619,202
Volume Difference (%)	29.4%
Nitrogen Difference (lbs/yr.)	21,546
Nitrogen Difference (%)	17.8%
P2O5 Difference (lbs/yr.)	(7,728)
P2O5 Difference (%)	-21.9%
K2O Difference (lbs/yr.)	(10,057)
K2O Difference (%)	-7.8%
Sulfur Difference (lbs/yr.)	3,745
Sulfur Difference (%)	36.4%
N:P Ratio or Raw Manure	3.43
N:P Ratio of Product back	5.17

Difference between **Ziegler Dairy** manure nutrients going to digester and Product going back to farms =

Volume Difference (gal/yr.)	4,661,673
Volume Difference (%)	29.4%
Nitrogen Difference (lbs/yr.)	61,245
Nitrogen Difference (%)	17.6%
P2O5 Difference (lbs/yr.)	(69,076)
P2O5 Difference (%)	-46.6%
K2O Difference (lbs/yr.)	17,623
K2O Difference (%)	5.5%
Sulfur Difference (lbs/yr.)	(6,104)
Sulfur Difference (%)	-13.1%
N:P Ratio or Raw Manure	2.35
N:P Ratio of Product back	5.17

[1] = % Dry matter of 'Nutrient source' after digestion * (1 - % Dry matter capture rate of solids separator)

[2] = Total nutrient N of Nutrient sources prior to digestion * (1 - % reduction in N content of separated liquid (Centrate) compared to 'Nutrient sources prior to digestion')

[3] = Total nutrient P_2O_5 of Nutrient sources prior to digestion * (1 - % reduction in P_2O_5 content of separated liquid (Centrate) compared to 'Nutrient sources prior to digestion')

[4] = Total nutrient K_2O of Nutrient sources prior to digestion * (1 - % reduction in K_2O content of separated liquid (Centrate) compared to 'Nutrient sources prior to digestion')

[5] = Total nutrient S of Nutrient sources prior to digestion * (1 - % reduction in S content of separated liquid (Centrate) compared to 'Nutrient sources prior to digestion')

[6]NH_4 - N calculated as 51% of Total N for 'Centrate going back to cooperating farms', based on manure test results at Clear Horizons - Dane

[7]An attempt was made to use preliminary equations developed by Dr. Carrie Laboski of the University of Wisconsin for manipulated manures. However, the 1st year available N calculated higher than the Total N. According to Dr. Laboski, the reason for this is the DM% of the centrate is outside of the lower limits of the DM% used to develop the equations. These equations also rely on the ratio of NH4-N to Total N in the manure source. To date, there is no reliable data on the ratio of NH4-N to Total N for digested manure that has undergone solids separation to remove 60% of the manure P along with 100% of added substrate P. There also is no data to indicate 2nd year N availabilities of these processed manure sources. The current book values for N availabilities (30% surface applied, 40% incorporated 1st year) will be used until the ratio of NH-N to Total N can be tested from representative samples from the facility when it becomes operational and resesearch data is available to develop a University approved equation to determine the N availabilities of these processed manures. The participating farm's NMPs will be updated when UW recommendations for determining 1st & 2nd year availabilities of these manipulated manures become published, the revised recommendations incorporated into the Snap Plus NMP software, and appropriate manure samples can be taken when the digester facility becomes operational.

[8]Est 1st yr avail. Surface N = 1st yr avail. Incorp N - (Total N x 10%). 1st yr avail. nutrients for P2O5, K2O, and S are based on UWEX recommendations prior to the release of the new A2809 publication in Dec 2012, because the new recommendations were not yet available in the SnapPlus software used by agronomists to develop participating farms's NMPs. First year availabilities of P2O5, K2O, and S used are 60%, 80%, and 60% of total nutrients, respectively. An additional 10% 2nd year availability for all nitrients was used. The participating farm's NMPs will be updated when the recommendations from the newly released A2809 are available to agronomists in the Snap Plus nutrient management planning software.

Soil Test Summary

(Summarized from data in Grower's 2012 SNAP Plus NMP submitted to Dane County)

Blue Star Dairy

	Acres	% of Total Acres	pH	OM%	P ppm	K ppm
Area Weighted Average			7.1	3.0	65.0	161.0
Ranges			6.5 - 7.5	2.3 - 4.8	20 - 172	81 - 508
Acres with soil test P (0 -30 ppm)	46.9	5%				
Acres with soil test P (30 -50 ppm)	372.5	40%				
Acres with soil test P (50 -100 ppm)	347.7	38%				
Acres with soil test P (100 -200 ppm)	159.1	17%				
Acres with soil test P (200+ ppm)	0	0%				
	926.2	100%				

Hensen Dairy

	Acres	% of Total Acres	pH	OM%	P ppm	K ppm
Area Weighted Average			7	3.2	73	169
Ranges			6.2 - 7.6	1.8 - 4.5	14 - 224	70 - 369
Acres with soil test P (0 -30 ppm)	139	22%				
Acres with soil test P (30 -50 ppm)	61.5	10%				
Acres with soil test P (50 -100 ppm)	288.2	45%				
Acres with soil test P (100 -200 ppm)	148.6	23%				
Acres with soil test P (200+ ppm)	2.6	0%				
	639.9	100%				

Ziegler Dairy

	Acres	% of Total Acres	pH	OM%	P ppm	K ppm
Area Weighted Average			6.5	3.4	59	146
Ranges			5.1 - 7.6	1.8 - 5.7	6 - 263	52 - 453
Acres with soil test P (0 -30 ppm)	592.5	26%				
Acres with soil test P (30 -50 ppm)	653.2	29%				
Acres with soil test P (50 -100 ppm)	769.4	34%				
Acres with soil test P (100 -200 ppm)	189.8	8%				
Acres with soil test P (200+ ppm)	35.3	2%				
	2240.2	100%				

Estimated Future Soil Test Summary After Complete Rotations

(Summarized from data in Grower's 2013 SNAP Plus NMP submitted to Dane County. These are only estimates and are based on a soil phosphorus buffering capacity of 18 lbs. P_2O_5/1ppm soil test phosphorus. This also assumes no additional inputs of phosphorus into the system.)

Blue Star Dairy

	Acres	% of Total Acres	pH	OM%	P ppm	K ppm
Area Weighted Average					44	
Ranges					3 - 148	
Acres with soil test P (0 -30 ppm)	402.7	43%				
Acres with soil test P (30 -50 ppm)	214.4	23%				
Acres with soil test P (50 -100 ppm)	245.2	26%				
Acres with soil test P (100 -200 ppm)	63.9	7%				
Acres with soil test P (200+ ppm)	0	0%				
	926.2	100%				

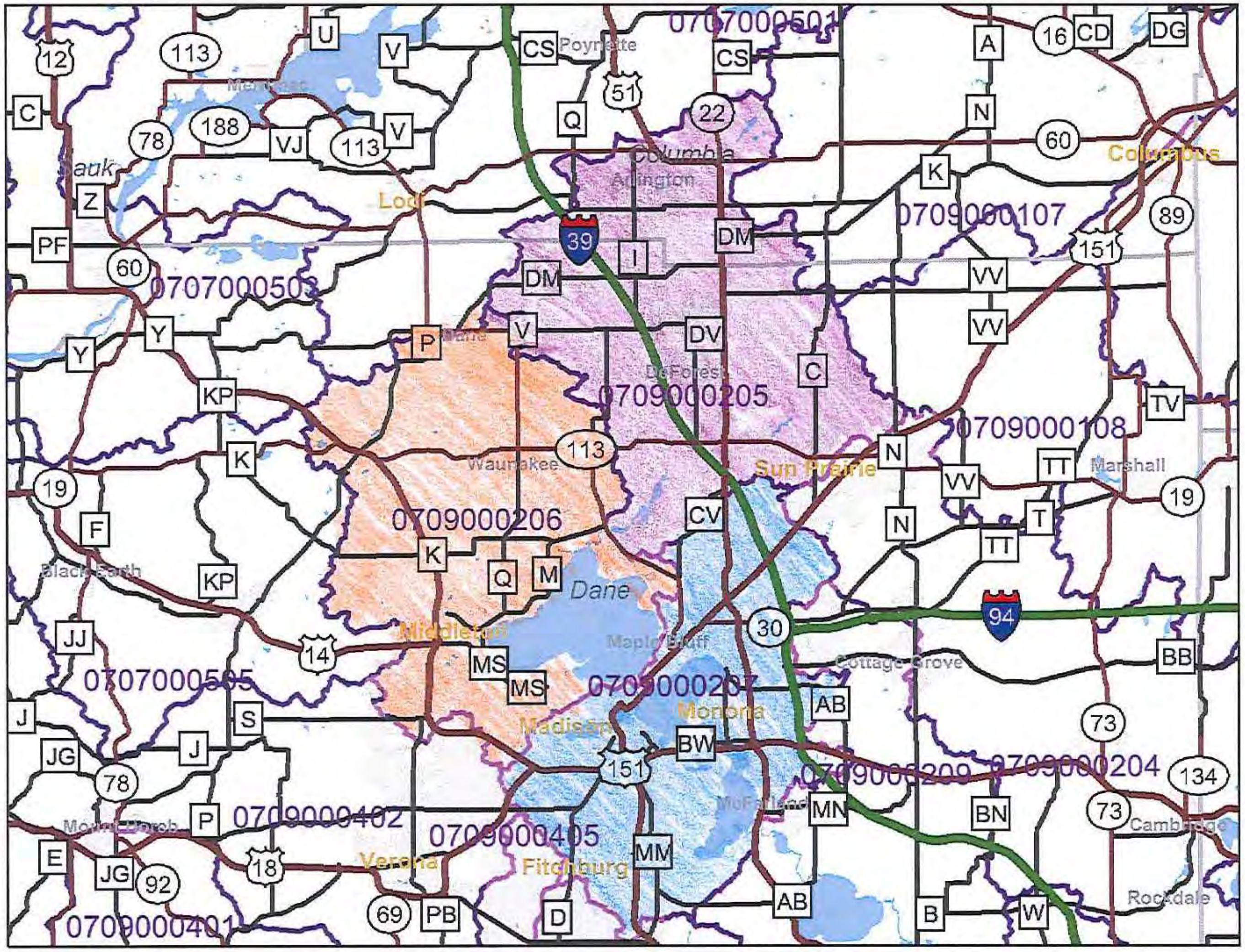
Hensen Dairy

	Acres	% of Total Acres	pH	OM%	P ppm	K ppm
Area Weighted Average					54	
Ranges					8 - 191	
Acres with soil test P (0 -30 ppm)	209.5	33%				
Acres with soil test P (30 -50 ppm)	137.1	21%				
Acres with soil test P (50 -100 ppm)	249.3	39%				
Acres with soil test P (100 -200 ppm)	44	7%				
Acres with soil test P (200+ ppm)	0	0%				
	639.9	100%				

Ziegler Dairy

	Acres	% of Total Acres	pH	OM%	P ppm	K ppm
Area Weighted Average					41	
Ranges					0 - 231	
Acres with soil test P (0 -30 ppm)	1196.5	53%				
Acres with soil test P (30 -50 ppm)	323	14%				
Acres with soil test P (50 -100 ppm)	587.3	26%				
Acres with soil test P (100 -200 ppm)	108.6	5%				
Acres with soil test P (200+ ppm)	24.8	1%				
	2240.2	100%				

Map Created on Jan 09, 2013



Legend

Major Highways

- Interstate
- State Highway
- U.S. Highways
- County Roads
- 100K Open Water
- County Boundary

Municipalities

- Village
- City
- 10-digit HUC

0 6.5 13 19.5 mi.

Scale: 1:358,155

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

LAND SPREADING PLAN FOR DIGESTED AND SOLID MANURE
MIDDLETON COMMUNITY DIGESTER
2/28/2013

ASSUMPTIONS:

- All liquid manure from the participating farms will be directed to the digester. In order to balance nutrient needs of the initial 3 participating farms and avoid importing commercial Phosphorus into the area, up to 25% of the daily volume of Digestate (Digested Manure and Substrates) may bypass the solids separation equipment. This percentage will be evaluated annually as part of the project performance reporting outlined in # 3 below. This Digestate volume will be directed to storage at the digester facility or at the participating farms for land application to crop fields in a manner that matches lower soil test phosphorus levels, nutrient loadings, and crop nutrient needs, in accordance with approved Nutrient Management Plans.

- The Digestate processed by the solids separation process must transfer at least 60% of the phosphorus in manure and 60% - 100% of the phosphorus in the substrates from the digestate into the digester solids as specified in Table 1. The liquid from the separation process, Centrate will be directed to storage at the Middleton Digester site or approved storage at participating farms for land application, in accordance with approved Nutrient Management Plans.

Table 1: Minimum Phosphorus Removal Requirements

Operational Period	Removal Phosphorus In Manure	Removal of Phosphorus in Other Substrates
Year 1	60%	60%
Year 2	60%	70%
Year 3	60%	80%
Year 4	60%	90%
Year 5 and forward	60%	100%

- If at any time during the term of this agreement the nutrient management plan of the participating farms requires additional phosphorous to meet crop up take requirements, the permittee may apply for a permit modification to adjust the phosphorus removal requirements as outlined in Table 1. This modification request would be needed to avoid the importing and applying of commercial phosphorus.

- Digester solids may be returned to the participating farms for bedding or for application on crop fields with low organic matter meeting specific field criteria that will be identified prior to permit issuance. All other digester solids must be removed from the following watersheds: Lake Mendota - Yahara River, Lake Monona - Yahara River, and the Headwaters - Yahara River. A map is attached.

- Based on existing contracts, the solid manure could be retained by the participating farms, or directed to the digester, at the farmers' discretion. The total solid manure produced by the 3 farms is about 3,600 tons/year. Some of the solid manure is planned to be directed to the digester site.

- Cropland receiving solid manure (non-digested solid manure) or digester nutrients (centrate and digestate) need to have a current NRCS 590 nutrient management plan and apply the nutrients according to their plan. WPDES permitted farms must also follow their approved Nutrient Management Plan.

- A plan for addressing emergencies and land application of manure during other critical times shall be developed for this project prior to permit issuance. This plan shall provide a reserve capacity during the period of Dec. 1 through May 1 of each year. The reserve capacity shall be at least 200,000 gallons/month. The plan will also define the terms, fees, and conditions for manure going into the digester and digested manure being returned to the farms.

DIGESTER NUTRIENTS, and/or SOLID MANURE LAND SPREADING

1) This project was selected to assist with Phosphorus removal efforts from the watersheds draining into Lake Mendota consistent with recommendations from Yahara Clean and the Clean Lakes Alliance. In order to lower soil test phosphorus levels in the area watersheds and to reduce the delivery of Phosphorus to receiving waters in the Yahara Watersheds, all fields involved in this project must be included in an approved NRCS 590 Nutrient Management Plan. Digester nutrients and/or solid manure must be land spread according to the soil test phosphorus levels and crop uptake needs of each land spreading field as follows:

   - Fields with soil test P < 50 - can spread up to the crop N needs.
   - Fields with soil test P levels between 51 – 100 ppm - can be spread up to 75% of the crop P needs, for crops to be grown over a maximum rotation length of 4 years (CAFOs) or 8 years (all others), *
   - Fields with soil test P levels between 101 – 200 ppm - can be spread up to 50% of the crop P needs, for crops to be grown over a maximum rotation length of 4 years (CAFOs) or 8 years (all others),
   - Fields with soil test P > 200 - spreading phosphorus is prohibited.

   Digester nutrients can be combined with manure, commercial fertilizer, or other nutrient sources in order to reach the specified % of crop P needs. Milking parlor wastewater is excluded from the restrictions.
   * This requirement can be adjusted up to 100 % for operations that utilize alfalfa in a rotation and can demonstrate a need.

   All fields must meet a Phosphorus Index (PI) of 6 or less throughout the rotation. Starting with Crop Year 2014, no field may have an annual PI of 12 or more. It is a goal of this project to decrease the annual PI of the fields and to decrease the weighted average PI of the fields over the rotation.

2) Winter land spreading of liquid manure, digester nutrients, or solid manure is prohibited on frozen or snow-covered ground. Storage/stacking options shall be consistent with NRCS 590 and NRCS 313, or a participant's WPDES Permit.

3) Project Performance Reporting - The facility, shall convene a meeting on an annual basis, to evaluate project performance, with all project participants including the Department and Dane County. Among the topics to be covered at this meeting is a report (January 1 - for the previous crop year) regarding land application of digester nutrients and solid manure from all participating and emergency use farms. Reporting requirements will include annual spreading reports and updated Nutrient Management Plans (including SNAP + files). Additional information may be shared by attendees, of any applicable surface water sampling results, and other data/documents to assess project benefits along with permit compliance and reductions in Phosphorus loadings. These items will be jointly identified prior to permit issuance.

4) New non-emergency participants shall meet all of the above requirements.

5) Farms needing to transfer manure into the digester under emergency conditions may be required to take back an equivalent amount of digested manure. These farms will be required to have a current NRCS 590 Nutrient Management Plan and adhere to the provisions in the emergency plan which is being written. This plan will be submitted for Department and Dane County approval prior to permit issuance.

6) In order to balance nutrients in the project area and to draw down phosphorus in area fields, a plan to address the application of digester nutrients and solid manure on fields outside of the participant's farms or for addressing manure brought in to the participating farms fields will be submitted and approved by the Department and Dane County, prior to permit issuance.

Proposed Language for # 6

Plan to Balance Nutrients in the Project Area and Drawdown Phosphorus in Area Fields (as required by Land Spreading Plan for Digested and Solid Manure- Item #6)

Fields added to project participant's operations will have a Nutrient Management Plan consistent with the above Land Spreading Plan, NRCS 590 standard, and when applicable NR 243 prior to the application of digested materials (centrate, digestate, digester solids). Any 'new' field additions or changes in nutrient applications will be presented yearly as provided in number 3 above "Project Performance Reporting".

If Digester Nutrients (fiber, centrate and digestate) are distributed to non participant farms, lands receiving the nutrients shall have a current NRCS 590 and winter land spreading shall not be allowed. This will be reviewed and may be modified as agreed by consensus at the Project Performance Reporting meeting in order to assure participant and project success.

GL Dairy Biogas LLC

Emergency Procedures for Non Project Participates

In the event of an Emergency Situation, GL Dairy Biogas, LLC, (Project) is prepared to assist any dairy farmer (Farmer) located in the Yahara Watershed for a reasonable period of time, as determined solely by the Project, for the explicit purpose of minimizing the impact the Emergency Situation may have on the Yahara Watershed.

For purposes of this procedure, Emergency Situation is hereby defined as a) A manure storage facility that has or is on the verge of suffering a breach. b) Circumstances beyond the farmer's control that stops land application of manure as normal operations such as high rainfall or extreme flooding.

1. All emergency deliveries will require 48 hours advance notice to Project , and Project must acknowledge it has the physical capacity to provide assistance before a delivery can be made.
2. Farmer will be assessed an upfront prepaid deposit of $.10 cents per gallon before delivery.
    a. If Farmer takes back effluent and land applies the same volume as delivered in the agreed upon timeframe, $.05 per gallon will be refunded to the Farmer.
    b. If Farmer fails to take back effluent by a predetermined agreed upon time the total deposit will be forfeited. The maximum timed allowed will be three (3) months.
    c. Farmer agrees to enter into a formal agreement outlining these terms and conditions within 48 hours of initial emergency delivery.

3. All manure and effluent transportation to/from the Project will be the responsibility of the Farmer and must be done during normal operating hours.

4. A maximum aggregate of 200,000 gallons per month can be accepted for all

   emergencies.

5. A maximum of three (3) separate occurrences for any individual Farmer is allowed.

6. Manure can not contain any plastics, sand bedding, metals, glass, needles, debris, refuse, garbage, Hazardous Materials or other contaminants or impurities that could harm the Processor Facilities' equipment or interfere with the operations of the Processor Facilities. Liquid manure with 7-15% total solids. Greater than 15% total solid manure may be accepted at Project's discretion.

7. Project reserves the right to reject any product that does not meet the specifications of #6 above.

8. Any manure that is brought into the project on an emergency basis will not be included in the phosphorus removal requirements of the project.

9. All fees are noted above are subject to change at any time.

GL Dairy Biogas, LLC

Approach for inclusion of future dairy farms to Springfield Digester Project

Whereas GL Dairy Biogas, LLC is a privately owned entity, it retains the sole right to accept or deny new participates into the anaerobic digester project located in the Town of Springfield, WI.

For consideration to become a new participant, the dairy farm must agree to the following minimum requirements. Additional requirements may be imposed on a case specific basis.

Minimum Requirements of New Project Participates

1. New participant must have a current NRCS 590 nutrient management plan and/or WPDES permit in place and be capable of land applying the nutrients according to this plan. This plan must be shared with GL project management and Dane County, and when aggregated together with other participant nutrient management plans does not negatively impact GL Dairy Biogas, LLC regulatory compliance.
2. Agree to comply with all conditions in the GL Dairy Biogas, LLC WPDES Permit.
3. Provide and maintain, at new participant's cost, adequate manure storage at farm for the effluent returned to the new participant's farm that meets Wisconsin Department of Natural Resources requirements. The quantity of effluent returned is expected to be the same as the volume of manure supplied. Note - Provision 3 may be waived, in whole or in part, at the sole discretion of GL Dairy Biogas, LLC, dependent on availability of storage capacity at the digester site.

4. Provide and maintain, at new participant’s cost, a central collection point for manure at farm site that meets WI DNR requirements.

5. Provide and maintain, at new participant’s cost, either (a) a load/unload pad with proper pumping equipment and pay for truck transportation costs to/from digester site, or (b) adequate pipeline(s) from new participant’s manure collection point to digester site .

6. Manure can not contain any plastics, sand bedding, metals, glass, needles, debris, refuse, garbage, Hazardous Materials or other contaminants or impurities that could harm the Processor Facilities’ equipment or interfere with the operations of the Processor Facilities.

7. Manure must have a total solids content of 7% to 15% subject to routine sampling.

8. Commit to a minimum five (5) year term manure supply agreement.

9. Meet GL Dairy Biogas LLC financial return requirements.

Emergency Response Plan

Site Name: GL Dairy Biogas	Office phone: TBD
Owner/Operator: Gundersen Lutheran Security/TBD (handles public questions and concerns)	24/7 phone: 608-775-4422
Owner/Operator: Gundersen Lutheran Corey Zarecki/TBD	Cell phone: 608-386-3858
Owner/Operator: Gundersen Lutheran Jeff Rich/TBD	Cell phone: 608-738-8402
Main Site Address: Schneider Rd., Middleton, WI	
Main Site Location: **Dane County, Springfield Township; Northeast ¼ of the Southeast ¼ of section 33 T 08N, R08E**	
Emergency Coordinates:	

In Case of Injury, Fire, or Rescue Emergency, Immediately Implement the Following:

1. Assess the condition of the victim, extent of the emergency (fire, rescue) and call for help.
2. Stabilize the victim, use on-site rescue equipment, evacuate buildings, or begin fire suppression as necessary.
3. Brief emergency responders upon arrival on current status of situation.

In Case of a Spill, Leak, or Failure at the Storage Facility, During Transport, or Land Application, Immediately Implement the Following:

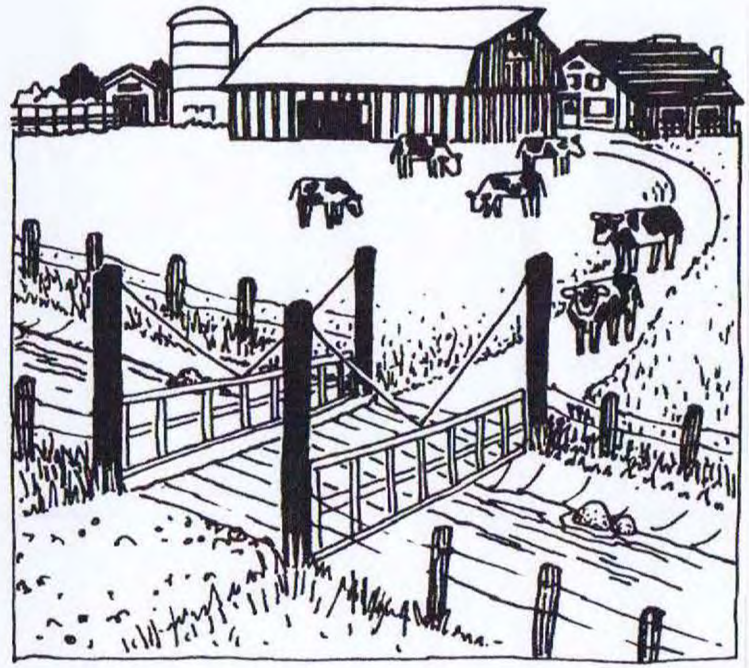
1. Stop the source of the leak or spill. For example:
   - Turn off all pumps/valves and clamp hoses or park tractor on hoses to stop the flow of manure.
2. Assess the situation and make appropriate calls for people, equipment, and materials. See contacts below.
   - Notify DNR spill hotline: 1-800-943-0003 (Spill reporting is mandatory by state law.)
   - Call sheriff's office if spilled on public roads or its right-of-ways for traffic control.
   - Clear the road and roadside of spilled material immediately.
3. Contain the spill and prevent spillage from entering surface waters, tile intake, or waterways.
   - Use a skid loader or tractor with a blade to build dikes to contain or divert the spill or leak.
   - Insert sleeves around tile intakes (or plug/cap intakes) and block down slope culverts.
   - Use tillage implements to work up the ground ahead of the spill or use absorptive materials.
4. Begin cleanup.
   - Use pumps to recover liquids.
   - Land apply on approved cropland at appropriate rates.
5. Document your actions.

Emergency Contacts	Contact Person (or Company)	Phone Number
Fire/Rescue	Middleton FD	**911** or (608)827-7522
Dane County Sheriff	West Precinct	**911** or (608)267-4936
Site Safety Coordinator	Gundersen Lutheran, TBD	TBD
DNR Hazardous Spill Line		1-800-943-0003
DNR Permit Contact/Warden	Mark Cain	(608) 275-3252
Site Emergency Contact	Gundersen Lutheran, TBD	TBD
Equipment/Supplies	**Contact Person (or Company)**	**Phone Number**
On-Farm Equipment Operator	Greg Ziegler	(608) 575-0515
Excavation Contractor	LMS Construction, Louis Meister	(608) 575-3040
Manure Hauler	Greg Ziegler	(608) 575-0515
Vacuum Tank Pumping Truck	LMS Construction, Louis Meister	(608) 575-3040
Local Government Contacts	**Contact Person**	**Phone Number**
Town Chairman	Don Hoffman	(608) 212-0459
LCD County Conservationist	Kevin Connors	(608) 224-3737
NRCS District Conservationist	Adam Dowling	(608) 577-3782

Be prepared to provide the following information:

- Your name and contact information
- Site address, location and other pertinent identification information.
- Nature of emergency (employee injury, fire, discharge of manure or hazardous materials).
- Emergency equipment and personnel that are needed.
- Potential for manure or hazardous materials to reach surface waters or major field drains.
- Current status of containment efforts.
- Location of hazardous/flammable materials, fire suppression equipment, emergency cut off switches or valves.

Agricultural Spills and How to Handle Them



A Guide from the

Wisconsin Dept. of Natural Resources

in cooperation with the

Wisconsin Dept. of Agriculture, Trade, and Consumer Protection

Pub-RR-687
August 2002

Wisconsin Department of Natural Resources

Think about all of the activity that takes place on a farm during any given day. There are various types of hazardous substances needed to get the job done– petroleum products, pesticides, and anhydrous ammonia, to name just a few. Now think of things that you might not usually consider hazardous—like manure, commercial fertilizers, and waste milk. Should an accident occur, these can also be hazardous if they are released in large quantities or in sensitive locations. In the course of a day, a month, a year, the likelihood of some of these substances spilling onto the ground is probably very high. Depending on the nature of the spill, there are important actions that you need to be aware of to ensure your safety and to be in compliance with state and federal laws.

The **Wisconsin Department of Natural Resources** (DNR) regulates when to report spills of hazardous substances that may be used on farms, and how to clean them up.

The **Wisconsin Department of Agriculture, Trade and Consumer Protection** (DATCP) specifically regulates the cleanup of agricultural pesticides and commercial fertilizers used on a farm.

What if I need help?

Let the DNR and DATCP assist you. These state agencies want to assist you when it comes to agricultural spills. Their job is to protect the environment—they have the education and experience to deal with all kinds of spills. They want to provide you with information and advice that will make spill containment and cleanup easier and faster, and that will ultimately reduce your costs and liabilities.

Both the DNR and DATCP are resources for you to use. Both agencies share responsibilities for agricultural spills, and both work to ensure that cleanup efforts meet legal standards. Working together, the DNR and DATCP will help you respond to a spill in the quickest and most efficient way.

Let the DNR and DATCP work with you.

This document is the result of a joint effort between the Runoff Management and the Remediation and Redevelopment Programs of the Wisconsin Department of Natural Resources. This document contains information about certain state statutes and rules but does not necessarily include all of the details found in the statutes and rules. Readers should consult the actual language of the statutes and rules to answer specific questions.

This project has been funded wholly or in part by the U.S. Environmental Protection Agency under assistance agreement (BG97550701-0) to the Wisconsin Department of Natural Resources. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Some of the information in this guide originally appeared in the publication *Spills on Logging Operations* from the Forest Industry Safety & Training

PRINTED ON RECYCLED PAPER

How do I dispose of spilled materials?

The best way to safely dispose of contaminated materials will vary. Manure-related spills (from a tanker, spreader, or storage facility) can be collected and land-applied, according to the site's nutrient management plan. This is true for most soils contaminated by commercial fertilizers or pesticides as well, although you must first obtain a permit from DATCP to do so. Fully recovered dry fertilizer spills can be stored or spread as originally intended. Some asphalt plants, bio-piles, or licensed landfills will accept petroleum-contaminated soils, but you will want to check with them in advance. Small amounts of petroleum-contaminated soil may be field-spread, with *prior* DNR approval.

When transporting contaminated waste, keep it covered so none is lost en route. And for you own protection, keep a copy of any receipts you get, and take pictures of the incident and clean-up actions. These are often needed to document your actions for the DNR and DATCP. You may be required to submit written documentation regarding the spill and clean-up actions.

Is there something I should be doing to prevent spills?

The best way to protect yourself from the costs and efforts of responding to a spill is to stop it from ever occurring. Inspect lines and hoses regularly. Use safety containers to transport and store fuel and other hazardous materials. When you complete a job, make certain all valves are closed, hoses are empty, and pumps are turned off. Examine equipment for kinks, excessive wear, abrasions on hoses or any other damage that could result in a spill or leak. And document your findings. Keeping a written record of your equipment's condition could protect you if a future spill occurs.

The bottom line:
Never intentionally dump any hazardous materials.
Call the DNR immediately if you have a spill.
And be sure spills are cleaned up before they have
a chance to become a larger problem.

What spills are regulated and need to be reported?

Spills of *hazardous substances* require immediate notification and cleanup. Hazardous substances are ones that could potentially pose a hazard to human health or the environment. A spill may be considered hazardous due to the substance's quantity, concentration, or physical, chemical or infectious characteristics, or the location it occurs in. Examples of hazardous substances found on a farm include petroleum products, pesticides, herbicides, cleaning solutions and manure.

If you have a spill and are not sure whether it needs to be reported, the safest course of action is to call the spill reporting hotline at (800) 943-0003 to be certain that you have complied with regulations and to obtain information about cleanup options.

There may be federal reporting requirements that apply to your spill, as well. If you have a livestock or poultry operation with a Wisconsin Pollutant Discharge Elimination System (WPDES) permit, you should also refer to your WPDES permit for any additional reporting requirements.

Are certain spills exempt from reporting requirements?

There are some exemptions to reporting spills to the DNR, if the spill does not cause or threaten to cause adverse impacts to human health, safety or the environment*. ***Remember, however, that all spills need to be cleaned up regardless of whether they need to be reported to the DNR.***

* The DNR has a fact sheet titled "Wisconsin Spill Reporting Requirements", Publication No. RR-558, which explains these exemptions in detail (available on the DNR Web site at http://dnr.wi.gov/org/aw/rr).

Specific exemptions of products that may not need to be immediately reported to the DNR include discharges of:

- Gasoline or other petroleum products if the spill is completely contained on an impervious surface (one that is not penetrable to water, like pavement).
- Less than one gallon of gasoline or 5 gallons of other petroleum products if the spill is onto a surface that is not impervious or runs off an impervious surface.
- Dry fertilizer if the amount is less than 250 pounds.
- Liquid fertilizer if the amount is less than 25 gallons.
- Pesticides registered for use in Wisconsin if the amount discharged when diluted as indicated on the pesticide label would cover less than one acre of land if applied according to label instructions.

When in doubt, the safest course of action is to call the 24-hour toll-free reporting hotline: (800) 943-0003.

Why should I report a spill?

Reporting a spill is always in your best interest! Reporting spills can minimize potential legal consequences. Accurate information protects you from future false accusations, establishes a record on your follow up activities cleaning up the spill, and documents that your responses are in compliance with DNR and/or DATCP regulations. Reporting a spill doesn't mean you're a bad operator or have done something wrong. Not reporting spills is where problems start.

Even if you have already contained and cleaned up the spill, you should still report it. If the DNR receives any calls on a particular spill, documentation of clean-up efforts will help to resolve problems that might arise.

How do I clean up a spill?

For some spills of particularly hazardous substances, your best solution is to hire a specialist to contain and clean, as well as document these efforts. To save time and money, it is in your best interest to contain and clean up a spill as soon as possible. You can always contact DNR and DATCP field staff for technical advice on cleaning up your spill. Keeping the following items at your site could save you time, effort, and expense in the long run:

- Clamps and plugs that fit your equipment's hoses and pipes.
- Oil Dry® (or other broadcast absorbent).
- Drums, barrels, or buckets.
- Tarp(s) and shovel(s).
- Excavation equipment or the name of a contractor in your area.

In general, actions to address the spill include:

✓ Stopping it from getting bigger. Clamp the hose, plug the leak, and place a bucket under the leak.
✓ Stopping the spill from spreading. Build a dike around the spill area, or use absorbent materials like Oil Dry® or Kitty Litter®. (These work well on hard or frozen areas.)
✓ Isolating the contaminated soil. Dig up the contaminated soil, and place it in a container or on a tarp.
✓ Protecting the contaminated area. Cover the area with a tarp and/or divert runoff from that area.

Never put yourself into a dangerous situation that exposes you to unhealthy levels of hazardous substances or in situations that you can't get out of.

Call for help if a spill is too big to handle with existing equipment or personnel.

DATCP has a specific fund, the Agricultural Chemical Cleanup Program (ACCP), to help you pay for the cleanup costs associated with agricultural pesticides and commercial fertilizers. This fund is from fees that you pay when you purchase pesticides and fertilizers. For more information on this fund, check out the DATCP web site at: http://datcp.state.wi.us. For other substances, you may have private insurance that can pay for the response action costs.

What information will I have to provide to authorities when reporting a spill?

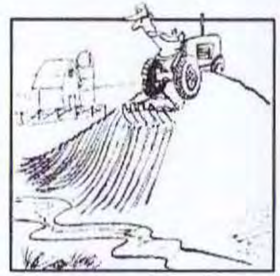
When you report a spill, you will need to provide the following information.

- Your name and address and the location of the spill, along with the property owner's name.
- The physical state, quantity, and chemical characteristics of the discharged substances.
- Where the substance was spilled, and where the spill ended up.
- Actions that you took to stop the release and/or minimize the impact to the environment.
- The actual or potential impacts to human health and the environment.

An accidental spill is not illegal. Failure to report is.

Am I responsible when a spill occurs?

Whoever causes a spill to occur is responsible for that spill. In addition, whoever possesses or controls the hazardous substance that is spilled also shares legal responsibility for the spill. Under the spill law (s. 292.11, Wis. Stats.), these parties are responsible for taking actions to clean up the spill and restore the environment.



For example, if Joe is working for Company X and a spill occurs during his job, both Joe and Company X are responsible for cleaning up the spill. Or if Company X causes a spill of your materials on your property, both you and Company X are responsible – you as the property owner who possesses or controls the hazardous substance, and Company X as the one who caused the spill to occur.

Failure to clean up a spill can lead to high costs to you and/or your company or operation. The DNR can impose penalties for failure to take appropriate actions. Typically cleanup costs increase dramatically as the spilled substance spreads through the environment. Spills that are not quickly responded to can leak into the groundwater resulting in expensive investigations and cleanups. If the DNR has to clean up the spill, you will be billed for those costs as well as the costs for DNR staff time. The DNR cleanup requirements are contained in chapter NR 700–726, Wis. Adm. Code.

The Toll-Free Hotline for Reporting Agricultural Spills
(800) 943-0003

24 hours a day 7 days a week

DNR Regional Spill Coordinators

Northeast Region: Green Bay
(920) 662-5492

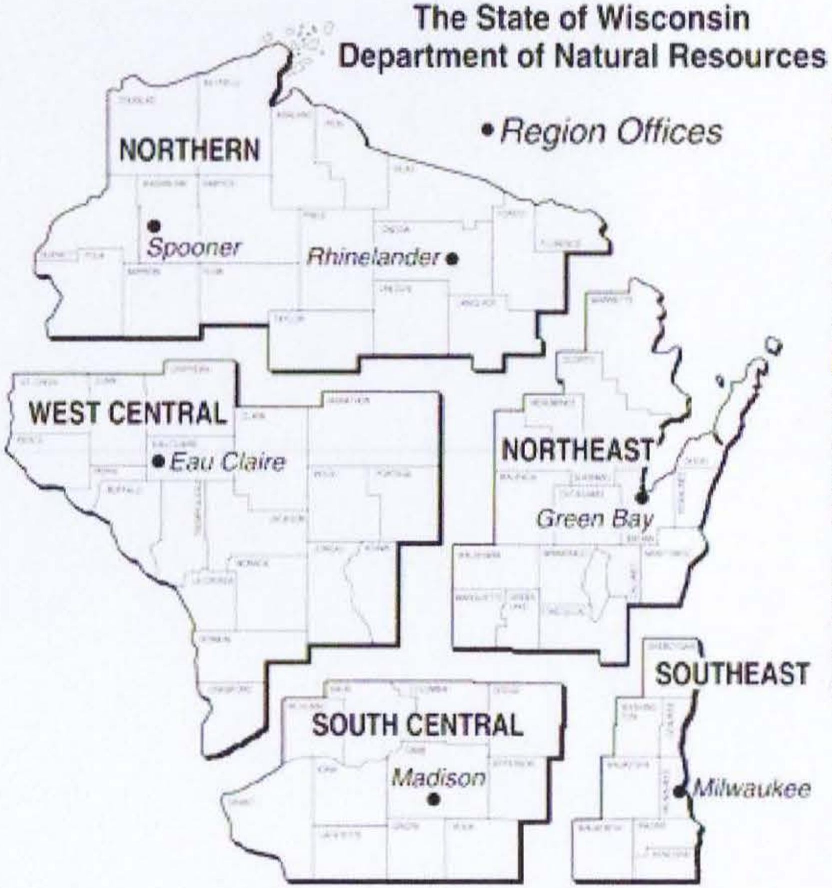
Southeast Region: Milwaukee
(414) 263-8685

West-Central Region: Eau Claire
(715) 839-1604

Northern Region: Rhinelander
(715) 365-8963

South-Central Region: Fitchburg
(608) 275-3332

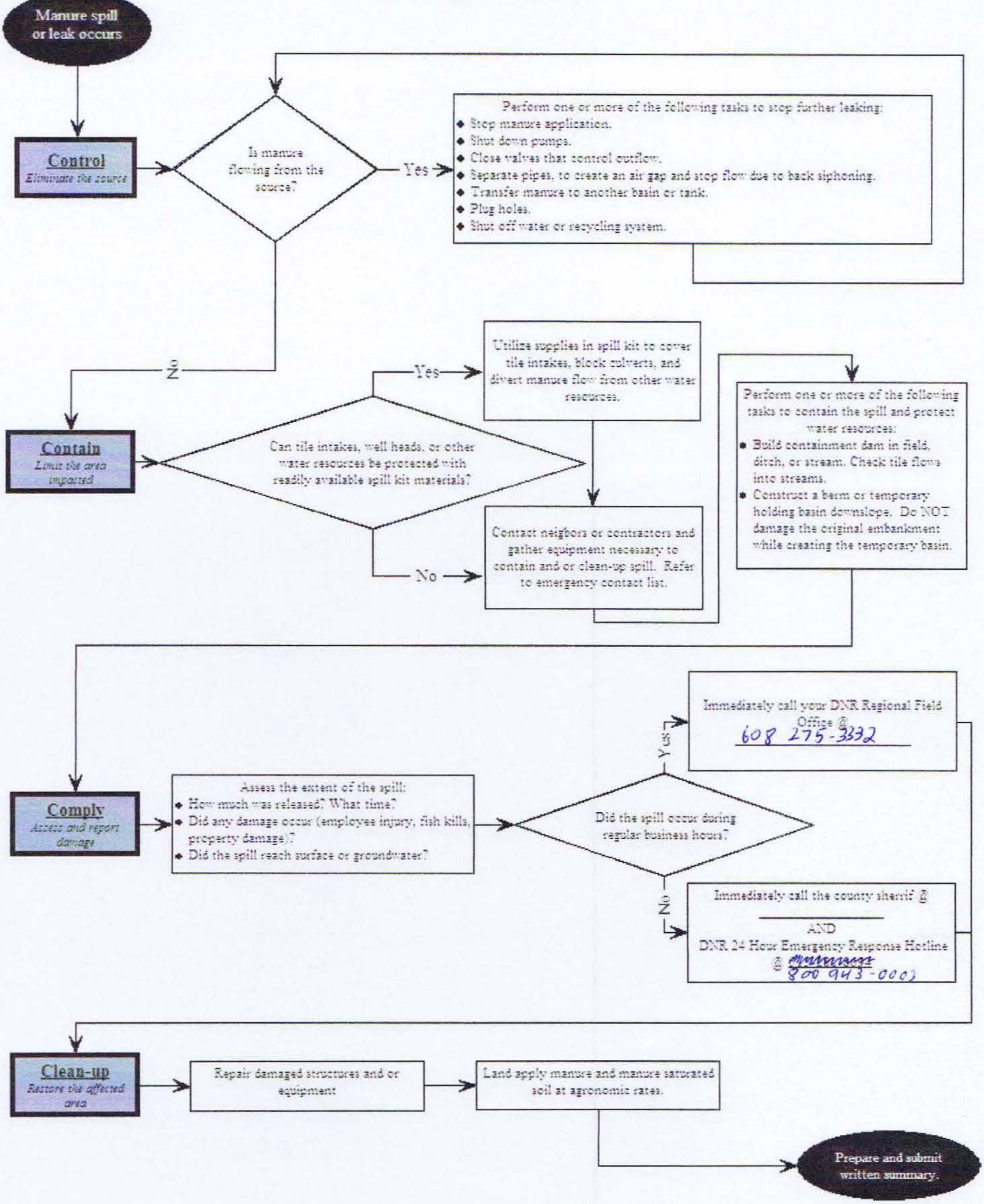
Statewide Coordinator: Green Bay
(920) 662-5488



When you report your spill to the DNR, DNR staff will contact DATCP. DATCP's environmental enforcement specialists are based throughout the state. These field investigators are assigned to long-term clean-up projects, landspreading contaminated soil, and responding to acute pesticide and commercial fertilizer spills.

For questions about DATCP's regulations and procedures, call (608) 224-4500.

Emergency Manure Spill Response Plan of Action



Iowa Farm "A" Syst, A farmstead Assessment System, Iowa Farm Bureau

ROUTINE INSPECTION CHECKLIST
(MANURE BASIN AND TRANSFER)

The manure storage basin, manure transfer system, and associated facilities should be observed at least annually for proper operation and durability to contain the manure and waste water. For documentation purposes, the checklist below will provide a summary of observations. If a yes response is given, identify the concern and propose and appropriate action.

Date___________________

Observer__________________

Yes	No	
☐	☐	Is the basin concrete liner in poor condition (evidence of cracks or broken concrete)?
☐	☐	Are grades allowing clean surface water to flow into the transfer system or pond next to the basin walls?
☐	☐	Is there evidence of overtopping the manure storage basin or leakage?
☐	☐	Is the concrete in the reception tank in poor condition?
☐	☐	Is outflow from basin sub-drain occurring. Is visual evidence of manure residue evident outside the basin?
☐	☐	Is manure escaping or overtopping the manure transfer system?
☐	☐	Is manure accumulation in the transfer tank? If necessary, prepare a plan for removal.

Comments:

ROUTINE INSPECTION CHECKLIST
(FEED STORAGE AREA)

The leachate collection and treatment system(s) should be observed at least monthly and every time it is manually cleaned for proper operation and durability to contain, convey, and treat the stormwater runoff and leachate from the feed storage area. For documentation purposes, the checklist below will provide a summary of observations. If a yes response is given, identify the concern and propose and appropriate action.

Date__________________

Observer__________________

Yes	No	
□	□	Is the concrete in poor condition (evidence of cracks or broken concrete)?
□	□	Are grades allowing clean surface water to flow into the treatment systems?
□	□	Is there evidence of leachate flowing into clean water flowpaths?
□	□	Is stormwater flowing away from the leachate collection systems causing erosion or transporting waste feed residue?
□	□	Is the infiltration basin ponding water for long periods of time after a storm?
□	□	Are solids plugging up or stopping flow through the rock spreaders?
□	□	Is collection tank filled with sediment?
□	□	Is pump operating?

Comments:

OPERATION AND MAINTENANCE PLAN
(MANURE BASIN AND TRANSFER)

Manure accumulated in the storage basin structure shall be removed bi-annually at a minimum as the basins are estimated to have 190 days of storage. The accumulated manure stored in the basin is planned to be mixed and removed. Manure is planned to be pumped out of the basin as a liquid directly into manure spreaders. Manure is planned to be field applied in accordance with a nutrient management plan. A nutrient management plan developed in accordance with NRCS 590 specifications has been prepared by others

Routine Inspections

Routine inspection of the manure storage basin and transfer system should be made at least bi-annually when the basin is emptied. The check list as presented in the basin inspection checklist should be used to document conditions of the manure storage basin and transfer system. Areas damaged by weather or equipment should be repaired as necessary.

Basin General: The manure storage basin should be observed for overall performance in containing manure residue in the basin and protecting against overflow or operational losses. Safety practices should be observed and repaired as appropriate.

Manure Transfer System: The manure transfer system should be observed for overall performance in respect to manure flow from the freestall barns to the proposed basin. Addition of dry or frozen manure or sand laden manure may cause plugging of the transfer pipe so caution needs to be practiced.

Pipes between the reception tank and the storage basin should be checked and cleaned if necessary.

Methods to Monitor Manure Liquid Level

The manure level should be maintained at least 1.4 feet below the top of the manure storage basin (MOL), to maintain 1.0 foot of freeboard, plus the 25 year, 24 hour storm event (0.4 ft) to prevent manure from overflowing containment. The maximum fill level can be shown by mounting a maximum fill line on the basin wall.

Yearly Checks

- ☐ Maintain safety fences, warning signs, and gates.
- ☐ Maintain vegetative cover, riprap areas, and repair/reseed as necessary to maintain a stable embankment.
- ☐ Eliminate the growth of woody plants on embankment side slopes.
- ☐ Periodically remove sediment or soil that may deposit in the waterways to maintain design capacity.

Displacement or other indications of differential movement of the structure should be reported to the Engineer for direction on action which may be needed. Bank erosion or rodent holes should be repaired as soon as possible.

OPERATIONS & MAINTENANCE
(FEED STORAGE AREA)

Leachate and Runoff Collection:

The proposed operations plan for the system is as follows:

- The objective is to remove approximately 0.25 inches of runoff from the feed storage area during a precipitation event, and handle the liquids as a waste. Collecting 0.25 inches off of the feed storage area is approximately 19,547 gallons.
- A 5000 gallon precast tank is proposed for leachate collection. Liquid is planned to be pumped 4 times per rain event to the proposed storage basin. The pump needs to operate at a capacity of 100 gpm.
- The feed handling area should be cleaned after use and the settling basin should be cleaned after each precipitation event.
- Check inlets and outlets, repair as needed
- Concrete areas damaged by weather or equipment should be repaired by grouting or caulking as appropriate.
- During silage & haylage harvest, tank should be pumped prior to rain events if possible as tank could be filled with leachate.

Runoff:

The proposed runoff control treatment system is a 285' x 110' VTA with a 1% slope. The proposed operations plan for the VTA system is as follows:

- A rip-rap channel is planned to convey stormwater from the overflow weir to the lime screenings/rock spreader.
- The lime screenings/rock spreader should be cleaned periodically if debris accumulates.
- The vegetation in the VTA should be clipped and harvested annually to remove accumulated plant nutrients and maintain vigorous growth.
- The VTA should be seeded with:
  Mix #1, Smooth Bromegrass-5 lbs/ac PLS, Creeping Red Fescue-2 lbs/ac PLS, Kentucky Bluegrass-2 lbs/ac PLS, & Birdsfoot Trefoil-2 lbs/ac PLS
  or
  Mix #2, Red Top-1 lbs/ac PLS, Timothy 2 lbs/ac PLS, & Red Clover-5lbs/ac PLS
- Stormwater should be diverted from VTA (via sand-bagging or other adequate practices) until the vegetation is well established.
- Periodically remove sediment or soil that may deposit in the VTA or adjacent waterways to maintain design capacity.
- Erosion or rodent holes should be repaired as soon as possible.

Wisconsin Department of Natural Resources

Public invited to comment on Environmental Assessment of proposed manure digester in western Dane County

News Release Published: April 5, 2013 by the South Central Region

Contact(s): Mark Cain 608-275-3252; Russ Anderson 608-275-3467; Eric Heggelund 608-275-3301

FITCHBURG, Wis. – People are invited to comment on the Environmental Assessment for a proposed Dane County Manure Handling Facility, also known as the Middleton Digester, and expansion of the Ziegler Dairy.

Both proposals require issuance of a Wisconsin Pollutant Discharge Elimination System permit (WPDES) to proceed. A public comment period is part of the environmental assessment and WPDES permit process. The comment period is open for 24 days, closing on April 29 at 4:30 p.m.

The proposed projects are not anticipated to cause significant adverse environmental effects. The Department of Natural Resources has made a preliminary determination that an Environmental Impact Statement will not be required for these actions. These will be new permits as the Ziegler farm has not been required to hold a WPDES permit in the past and the digester is a proposed new project. WPDES permits are good for five years; additional permits may be required for other aspects of the proposed projects.

Requests for copies of the Environmental Assessment that led to this preliminary determination and comments should be directed to: Mark Cain, 608-275-3252, DNR, Fitchburg Service Center, 3911 Fish Hatchery Road, Fitchburg, WI 53711, mark.cain@wisconsin.gov.

The proposed digester will be located in the Town of Springfield on Schneider Road. The facility will accept manure from three farms: Hensen Brothers Dairy, Ziegler Dairy, and Blue Star Dairy. The primary purpose of the project is to preserve the water quality of the Yahara River Watershed. The facility will remove as much as 60 percent of the phosphorus from incoming manure. Phosphorus is a leading cause of algae blooms in surface waters during warm months. Participating farms will be required to have a Nutrient Management Plan and will need to abide by land spreading agreements set forth in the WPDES permit. Manure processed by the digester will be returned to the farms for land spreading with a reduced but adequate amount of phosphorus to meet crop needs.

Ziegler Dairy is a family dairy operation located in the Town of Springfield on Schneider Road, just north of the proposed digester location. The facility is at approximately 1000 animal units and wishes to expand to approximately 2,045 animal units. The expansion includes replacing the current liquid manure storage pit with a new centralized liquid manure collection pit, an addition onto their current south barn, construction of a new dairy barn, and the installation of a leachate and runoff collection and treatment system. Collected manure will be transferred to the digester via underground transfer lines.

Excess phosphorus and manure solids will be sold outside of the watershed as a soil amendment product. The digester facility will also produce methane gas which will be used to power on-site generators. Electricity will be sold to Madison Gas & Electric and should be enough to power approximately 2,500 homes.

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101 S. Webster Street . PO Box 7921 . Madison, Wisconsin 53707-7921 . 608.266.2621

Thank you for your comments in support of the project.

Mark R. Cain
Wastewater Engineer
Agricultural Runoff Management Program
South Central Region
Wisconsin Department of Natural Resources
(() phone: (608) 275-3252
(() fax: (608) 275-3338
(() cell: (608) 516-5434
(() e-mail: Mark.Cain@wisconsin.gov

-----Original Message-----
From: Herb Garn [mailto:hsgarn@wisc.edu]
Sent: Wednesday, April 24, 2013 10:12 PM
To: Heggelund, Eric P - DNR; Cain, Mark R - DNR
Cc: Wible,Lyman; Stefanie Brouwer; Emil Haney; Bruce Froehlke; Dawn Meyer
Subject: RE: Manure Digester EA comments

Thank you for the oppportunity to review the EA and send a few comments made on behalf of the Friends of Pheasant Branch.

Generally there is little or no discussion about the ground water resources of the immediate area (Physical environment, P.10; Consequences, p.12). The references below could be of help in describing the ground water system and critical recharge area to lower Pheasant Branch springs and marsh. Subsoils in the area are highly permeable. Depth to ground water at the digester site should be mentioned and evaluated for potential risk of leachate contamination from spills or leakage, especially from the 15 million gal. concrete-lined lagoon if the liner should crack. Would the lagoon be used for storage year-round or only part-time?

Under monitoring, item 22.b. (p.20) it may be desirable to install a couple monitoring wells downgradient from the digester to evaluate background and whether any changes in water quality should occur.

It would be beneficial to approach the Acker Farm as a participant, since it is directly adjacent to the Hensen Farm, to consolidate manure hauling to the digester. The farm has excess manure and was documented as a source of significant agricultural runoff contributing nutrients to the Pheasant Branch Marsh and Lake Mendota (Garn, 2012, river planning grant report).

Overall, we support the construction of the digester to reduce the quantity of manure applied to soils that don't need it.

Herb Garn, P.H.

USGS Scientist Emeritus and

Board member, Friends of Pheasant Branch

Hunt, R.J., and Steuer, J.J., 2000, Simulation of the recharge area for Frederick Springs, Dane County, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 00–4172, 33 p.

http://wi.water.usgs.gov/pubs/wrir-00-4172/

Steuer, J.J., and Hunt, R.J., 2001, Use of a watershed-modeling approach to assess hydrologic effects of urbanization, Middleton, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 01–4113, 49 p.

http://wi.water.usgs.gov/pubs/wrir-01-4113/wrir-01-4113.pdf

On 04/16/13, "Heggelund, Eric P - DNR" wrote:
> Hi Herb,
>
> I apologize for not getting back to you earlier. I have been out of the office in the field since you sent your message. Here is a PDF copy of the EA. The attachments are too large to send via e-mail and I will send you a CD with the documents today. Please let me know if that will not work for you and we can find another means.
>
> Thank you,
>
> Eric
>
> Eric P. Heggelund
> Environmental Analysis & Review Specialist Wisconsin Department of
> Natural Resources
> (*) phone: (608) 275-3301
> (*) fax: (608) 275-3338
> (*) e-mail: eric.heggelund@wisconsin.gov
> Website: dnr.wi.gov
> Find us on Facebook: www.facebook.com/WIDNR
>
>
>
>
> -----Original Message-----
> From: Herb Garn [mailto:hsgarn@wisc.edu](javascript:main.compose()
> Sent: Friday, April 12, 2013 2:36 PM
> To: Heggelund, Eric P - DNR
> Subject: Manure Digester EA

>
> Hi Eric,
> Mark is out of office and indicated to contact you about copy of
> Springfield manure digester EA. If available electronically
> (preferred) , could just email to me at this address. otherwise email
> paper copy to
>
> Herb Garn
> 7005 Cardinal Dr
> Middleton, WI 53562
>
> behalf of Friends of Pheasant Branch, thanks