NRCS
6200 Jefferson NE Room 305
Albuquerque, NM 87109
Phone: (505) 761-4400 **Fax:** (505) 761 4462
Web www.nm.nrcs.usda.gov

New Mexico AFO/CAFO Fact Sheet 4
September 2014

Planning and Designing Agricultural Waste Systems

A. Producer applies for EQIP or requests technical assistance for animal feeding operation.

1. Applicants must provide compliance documentation for applicable state, local and federal permits by the end of the EQIP application evaluation period (NMED-GWQB Permit and EPA CAFO NPDES Permit, if applicable).

2. If an EQIP plan of operations includes an animal waste storage or treatment facility, the participant must provide for the development and implementation of a comprehensive nutrient management plan.

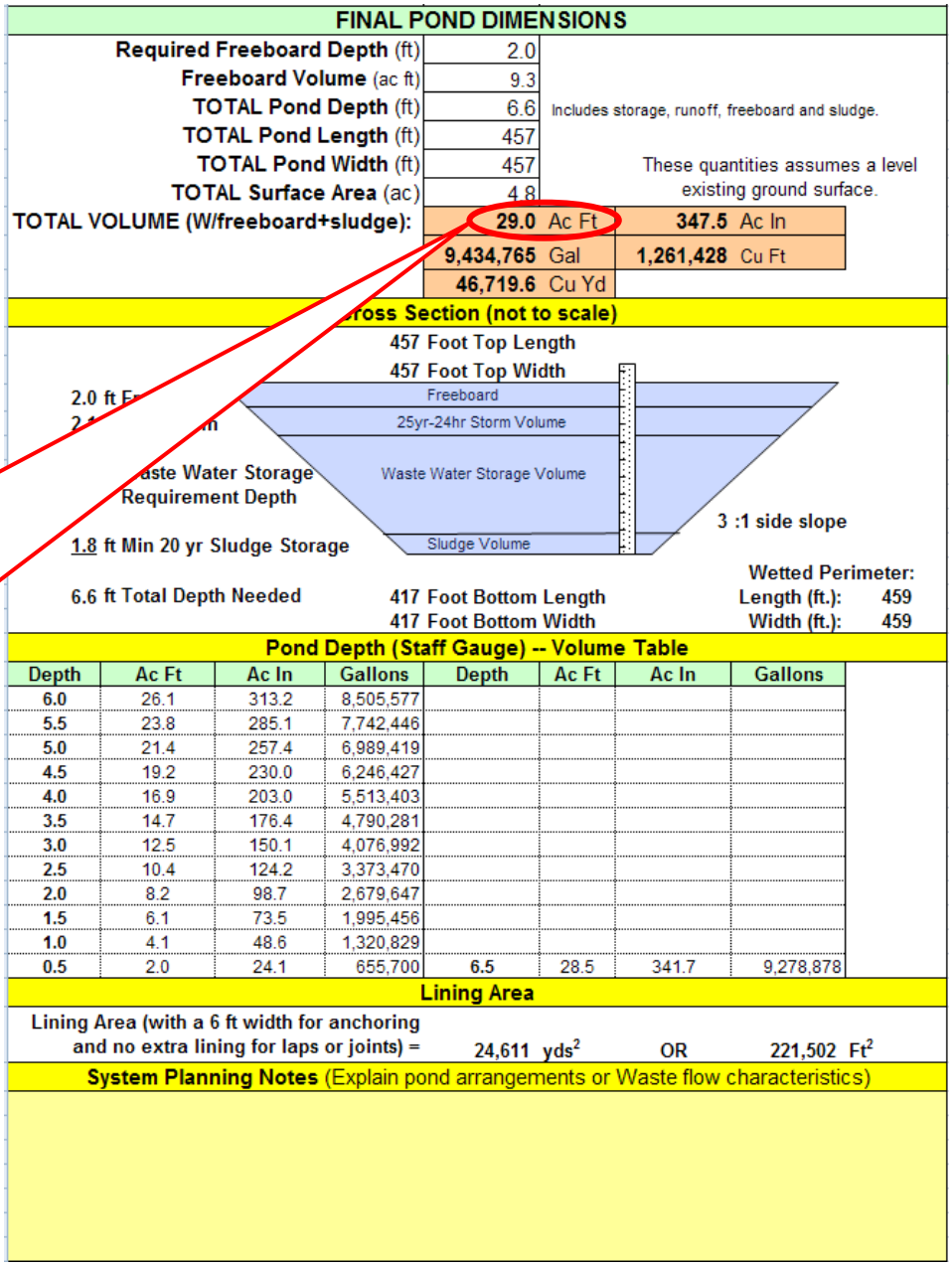
3. It is highly recommended that CNMPs be written and completed prior to contract signing. Advantages include accurate contract information and higher priority for EQIP funding.

4. When a CNMP and/or practice designs cannot be completed prior to contract signing, use the "Initial Planning of Liners, AFO/CAFO Fact Sheet 2" and the New Mexico Dairy Pond Sizing Software. NM Technical Notes Agro-63 http://efotg.sc.egov.usda.gov/references/public/NM/PondSizingTechnoteAg63a1Rev2014.pdf

   Data Sheet available at: http://efotg.sc.egov.usda.gov/references/public/NM/ag63a2-Pond_Size_vs2.8.xlsx (NOTE: the data sheet pops up but may not be visible. Check behind the Word document)

Guidance for estimating the approximate area of synthetic lining that may be required and the preliminary pond requirements. For EQIP cost estimate, use final pond dimensions: total volume in ac. ft. for waste storage facility (this already includes cost of liner, but does not include fencing cost). **See Figure 1**

Figure 1



FINAL POND DIMENSIONS

Required Freeboard Depth (ft)	2.0	
Freeboard Volume (ac ft)	9.3	
TOTAL Pond Depth (ft)	6.6	Includes storage, runoff, freeboard and sludge.
TOTAL Pond Length (ft)	457	
TOTAL Pond Width (ft)	457	These quantities assumes a level existing ground surface.
TOTAL Surface Area (ac)	4.8	
TOTAL VOLUME (W/freeboard+sludge):	29.0 Ac Ft	347.5 Ac In
	9,434,765 Gal	1,261,428 Cu Ft
	46,719.6 Cu Yd	

Cross Section (not to scale)

457 Foot Top Length
457 Foot Top Width
2.0 ft F
Freeboard
25yr-24hr Storm Volume
aste Water Storage Requirement Depth
Waste Water Storage Volume
1.8 ft Min 20 yr Sludge Storage
Sludge Volume
3 :1 side slope
6.6 ft Total Depth Needed
417 Foot Bottom Length
417 Foot Bottom Width
Wetted Perimeter:
Length (ft.): 459
Width (ft.): 459

Pond Depth (Staff Gauge) -- Volume Table

Depth	Ac Ft	Ac In	Gallons	Depth	Ac Ft	Ac In	Gallons
6.0	26.1	313.2	8,505,577				
5.5	23.8	285.1	7,742,446				
5.0	21.4	257.4	6,989,419				
4.5	19.2	230.0	6,246,427				
4.0	16.9	203.0	5,513,403				
3.5	14.7	176.4	4,790,281				
3.0	12.5	150.1	4,076,992				
2.5	10.4	124.2	3,373,470				
2.0	8.2	98.7	2,679,647				
1.5	6.1	73.5	1,995,456				
1.0	4.1	48.6	1,320,829				
0.5	2.0	24.1	655,700	6.5	28.5	341.7	9,278,878

Lining Area

Lining Area (with a 6 ft width for anchoring and no extra lining for laps or joints) = 24,611 yds^2 OR 221,502 Ft^2

System Planning Notes (Explain pond arrangements or Waste flow characteristics)

For EQIP cost estimate, use final pond dimensions: total volume in ac. ft. for waste storage facility (this already includes cost of liner, but does not include fencing cost)

5. CNMPs must be developed and approved by one of the following certified planners:
   - NRCS CNMP planners (CTA)
   - Client-hired TSP from the TechReg website.

6. The EQIP contract practice is to be based on existing resource needs, and will not exceed the existing discharge permit. From the New Mexico Dairy Pond Sizing Software, Planning Data Sheet, take sum

of washwater and liquid needed per month (plus alley flush liquids where used), divide by 30 for daily liquid waste; this sum should be equal to or less than the allowable discharge in the facility's current GWQB discharge permit. Contracts will not fund future expansion projects. See **Figure 2**

Figure 2

NM-DAIRY PLANNING DATA SHEET

USDA Natural Resource Conservation Service Version 2.8 (03/21/12)

Dairy Name:	Super Cow Dairy	**Dairy Manager:**	Joe Holstein	Flush System used?	Yes
Location:	Roswell, NM	**Planner:**	Cbraden	Date:	3/22/12

DAIRY DATA (milking center and flush system)

Number of cows - Milking:	1,000	Dry:	100	1000 lbs units (AU) Milking	
Average weight of cows:	1,400	lbs	Milk #/d: 100	1400	
% waste from the milking center:	15%	percent (%), 15% is typical			
Wash water used in milking center:	13	gal/day/cow		This dairy is a large CAFO.	
Number of months of storage needed:	2	Month Storage			
Flush water added:	0	Gal/Day			

Assumptions: **1.** A 1000 lbs cow produces 97-130 lbs of manure daily. **2.** 88% of manure is liquid. **3.** 1 ton manure = 34 Cu Ft **4.** 134.5 Cu. Yds.= 1 ac in. **5.** 27154.25 gallons = 1 ac in. **6.** 8.33 lbs. liquid = 1gal liquid **7.** Non-Jersey Cows **8.** Manure # from milk production.

DAIRY DATA (Flush System)

Cow Type	Num. of Cows	Wt per Animal lbs/animal	% Time on system	Manure[1] lbs/day/1000lbs	Animal Units #xWt/1000	Manure/Day lbs/day
Number of milking cows:	1,000	1,400	0%	119	1,400	0
Number of dry cows:	100	1,400		57	140	0
Number of heifers:				56	0	0
Number of other type cows:				85	0	0
Total:	1,100	head			Total:	0 lbs/day
Flush water used per cow:	0.0	gal/cow/day *(total gal per day/number of cows using the system)*				

[1] *Values from the AWMFH 9/06*

PROCESS WASTE CALCULATION

Milking Center Washwater (water storage needed/Mo)

Liquid Vol = milk center (gal/day/cow) x cows in system (# of cows) x days of storage (days) = Gal/Mo

Q= 13 gal/day/cow X 1000 cows X 30 days = **395,688 Gal./Mo**

(Gal/27154.25) OR = **14.6 ac. in.**

Milking Center Manure Production (liquid storage needed/Mo)

Liquid Vol = AU (#) X manure (lbs/day) X % liquid (88%) X % time (%) X 30 (days) = Lbs/Mo

Q = 1,400 AU X 118.9 lbs/day X 88% X 15% X 30 days = 669,020 Lbs/Mo.

Liquid storage needed = liquid (lbs/Mo) / 8.33 lbs/Gal = Gal/Mo

669,020 (lbs/Mo) / (8.33 lbs/gal) = **80,314 Gal/Mo**

(Gal/27154.25) OR = **3.0 ac. in./Mo**

Milking Center Manure Production (solid storage needed/Mo)

Solids Storage = 1000 lbs units X manure (lbs/day) X % solids (12%) X storage (30days) X barn time (%) = Lbs/Mo

Vol = 1400 AU X 119 lbs/day X 12% X 30 X 15% = **91,230 Lbs/Mo**

(lbs/mo)/2000 lbs/ton) **45.6 tons/mo.** (cu. ft.) / (27 cu ft/cu yd) **58 cu. yds./Mo**

(tons/Mo) X 34.5 cu. ft./ton **1574 cu ft/mo.** (cu. yds.) / (134.5 cu yds/ac in) **0.43 ac. in./Mo**

Alley Flush Manure Production (liquid storage needed/Mo)

Liquid Vol = Manure weight (lbs/day) x percent liquid (0.88) x storage (30days) = Lbs/Mo

Q = 0 (lbs/day) X 88% X 30 days = 0 Lbs/Mo

Liquid Vol = (cow liquid (lbs) / 8.33 lbs/gal) + (added flush water X 30days) = gal. storage need

0 lbs/mo. / 8.33 lbs/gal + (0 gal/day X 30) = **0 Gal/Mo**

(gal/27154.25) OR = **0.0 ac. in./Mo**

Alley Flush Manure Production (solid storage needed/Mo)

Solid Vol = Manure weight (lbs/day) x percent solid (0.88) x storage (30days) = Lbs/Mo

Q = 0 (lbs/day) X 12% X 30 days = 0 Lbs/Mo

Solid Vol = liquid (lbs) / 8.33 lbs/gal = gal. storage need

0 lbs/Mo / 8.33 lbs/gal = **0 Gal/Mo**

Take sum of milking center wash water and liquid storage needed per month (plus alley flush liquids where used), divide by 30 for daily liquid waste; this sum should be equal to or less than the allowable discharge in the facility's current GWQB discharge permit

7. NRCS planners should always provide planning assistance for future expansion projects, within limitations of the existing permit. EQIP contract funds, however, will cover only the existing resource needs.

8. Contract modification involving increased FA obligations cannot be approved without proper justification, as per Conservation Plan Contract regulations.

B. Development of Comprehensive Nutrient Management Plan

1. See NM requirements:
   http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_066953.pdf

2. A certified CNMP Planner and certified CNMP Specialists for New Mexico conduct on-site visit (s) with the producer. Interdisciplinary (including engineering specialist and planner) and interagency (including consultant, permit writer) coordination is recommended early on in the process. Complete the following:

   a. Identify existing and potential resource issues in the planning area.
   b. Obtain copies of soil test, manure, effluent, irrigation water, monitoring well, and other applicable analyses. Document cropping, tillage, nutrient and pest management histories. Compile soils information.
   c. Determine runoff area and direction as well as waste stream parameters, locations of structures, fields, monitoring wells, irrigation wells, and other applicable sites for map and plan development.
   d. Obtain other necessary information for filling out inventory checklist.
   e. Photo document where applicable with producer's consent.
   f. Obtain copies of applicable permits if these have not been provided already for EQIP contract.

3. Complete conservation planning for the animal feeding operation. Work with the producer to identify and select alternatives that address the identified resource concerns.

   a. Complete worksheets, including Dairy Pond Sizing Software, Leaching Index, Phosphorus Index, Wind Erosion Equation, RUSLE2, to determine pond size and ensure quality criteria has been met for resource concerns for planned resource management system.
   b. Complete the CPA-052 form – Environmental Assessment and Resource Inventory Checklist, and any necessary consultation forms.
   c. Select conservation practices to address resource concerns and landowner objectives.
   d. Develop conservation plan and contract (if cost shared).
   e. Complete job sheets for each planned conservation practices included in conservation plan (cropland minimum – Nutrient Management, Pest Management (if applicable), Irrigation Water Management, Conservation Crop Rotation; headquarters typical– Pond Lining, Waste Storage Facility, Manure Transfer)

4. Complete development of Comprehensive Nutrient Management Plan using the Manure Management Planner and the New Mexico Smart Document template.
   http://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1257527&ext=zip

5. Clients should revise the CNMP as operation or discharge permit changes occur.

6. The producer must be informed that in order to avoid needing a dam safety permit from the New Mexico Office of State Engineer Dam Safety Bureau, the finished design of the waste storage facility will be significantly buried into existing ground surface. By rule of thumb, the majority of the dairies with a herd of approximately 2000 head, the berm will be 2 ft or less above the existing

ground. This will avoid the 10/10 rule (greater than or equal to 10 ft. higher than ground level or greater than or equal to 10 ac ft presently requires a dam safety permit).

C. Designing Agricultural Waste Management Structures

1. The process begins with a request for preparing a design. A completed Form NM-ENG-252 is preferable, but a memorandum is acceptable. The following is part of the "Checklist for Completed Comprehensive Nutrient Management Plan:"

   1. Items to be forwarded to designer:

   - Include available maps, sketches, and preliminary designs resulting from the planning process that may be useful to the engineer in the design of practices
   - If a land survey was completed, provide a hard copy and an electronic copy of raw survey data. The coordinates of benchmarks, well corners, hydrant bonnets, concrete slabs, separators, and other permanent elements are to be reported. Coordinates should be latitude/longitude, UTM, or state plane coordinates. If a local coordinate system was used (such as 5,000N and 10,000E), the benchmarks used must be in the local coordinate system AND if possible, locate the benchmarks using a survey grade GPS and report the latitude/longitude, UTM, or state plane coordinates. Identify the vertical datum used for surveys.
   - Provide a definition of all abbreviations used for survey (point code terminology such as GRD, TOPLAG, FNC, *et cetera*), features on sketches or drawings (such as WRL, CSL, MW, *et cetera*), and text.
   - If a land survey was not conducted, sketch the proposed improvements (such as a waste storage pond, a storm runoff pond, *et cetera*) with measurements identifying the distance from the corners of the proposed work to easily located permanent structures. The measurements could be achieved using a tape, chain, electronic device, *et cetera*.
   - Provide electronic versions of maps using ArcGIS or AutoCAD if possible. The use of AutoCAD is preferable.
   - Identify all known or supposed utilities -- public or private -- in all areas where improvements may be installed.
   - Provide documentation of soils/geologic information, if any is available.
   - A geotechnical investigation of the sites for all ponds will be necessary during the design effort. If the landowner is currently using the area to grow crops, verify that the driller/backhoe operator has permission to enter the area and that crops may be lost. The driller/backhoe operator must have a utility location service at least 48 hours prior to the work; otherwise, the work will not be done. If the investigation has to be rescheduled, a project delay will occur.

   2. Items to be Sent to the Planner after the Design has been Approved:

   - Construction Drawings
   - Construction Specifications
   - Design Engineer's Report
   - Construction Practice Job Sheets

2. The designer then checks to determine if sufficient data has been provided to initiate the design.

3. The following checklist has been found to be useful:

CHECKLISTS FOR THE DESIGN OF AG-WASTE STRUCTURES

I. IDENTIFICATION	(Information obtained by CNMP and/or NM-ENG-252)
A. Client	
B. Farm/Ranch	
C. Tract	
D. Farm Number	
E. Field Number	
F. County	
G. Contract Number	
H. Drawing Number	
I. NMED DP Number	
J. Location	

II. REVIEW OF INITIAL DATA (Date Initial Data Rec'd.:	Yes	No	
A. Comprehensive Nutrient Management Plan prepared			
B. Facility Information Data complete			
C. Signatures			
1. Certified Planner			
2. Certified Specialist - Manure & Wastewater Handling & Storage			
3. Certified Specialist - Land Treatment Practices			
4. Certified Specialist - Nutrient Management			
5. Client			
D. Conservation Plan (AD-1155E or equivalent)			
E. Environment Assessment checklist (CPA-052) complete			
F. Survey			
1. Permanent and Temporary benchmarks identified with: (Note that at least two permanent **and** two temporary benchmarks are needed.)			
a) local grid system			
b) latitude/longitude			
c) UTM			
d) other			
e) elevation			
f) datum			
g) map projection			
2. Topography in project area completed with "ground truthing"			
3. Electronic survey data submitted			
4. Monitoring wells surveyed			
5. Existing utilities surveyed			
6. Existing structures in immediate construction area surveyed			
G. General Plan			
1. Existing structures identified			
2. Approximate location of utilities			
3. General area of proposed improvements (ponds, et cetera)			
4. Electronic version of general plan submitted			

H. Site Investigation/Geotechnical Evaluation			
1. Subsurface investigation completed			
2. Index properties of the subsurface materials identified			
3. Percent organic content of the foundation materials			
4. Groundwater elevation identified			
I. Pond Type			
1. Milking Parlor Only			
2. Storm Runoff Pond Only			
3. Combined Pond			
4. 100% Evaporative Pond			
5. Clay liner proposed in the CNMP			
6. If yes, has owner been advised of current NRCS policy			
7. Current pond sizing software used			

Initial Review Completed by: _____ _____
(name) (date)

4. The District Conservationist is then advised if certain elements are missing or if the materials are complete and preliminary design may begin. The following identifies the major items to be performed associated with a preliminary design:

III. PRELIMINARY DESIGN	Complete	N/A
A. Review hydrologic design		
1. Revise hydrology		
B. Review available geotechnical data		
1. Request additional data if necessary for:		
a) Index properties of subsurface materials		
b) Percent organic content of the foundation materials		
c) Drill at least 5 holes for each pond (4 corners, 1 center)		
d) Drill holes to be at least 5 feet below pond invert		
e) As directed by Geologist, combine samples for testing (Proctor)		
f) Complete site investigation for foundations for new structures		
C. Re-run pond sizing software		
D. Obtain more complete topographical survey data		
E. Obtain more complete utility and/or physical feature data		
F. Establish pond invert		
G. Ensure pond dimensions and elevations "fit" within the given topography		
H. Determine if the pond is a regulatory dam		
1. If yes, immediately discuss with District Conservationist before continuing. (Discuss if lowering the pond is an acceptable alternative to the CNMP.)		
2. If still yes, use checklist prepared by Dam Safety Bureau		
I. Meet with local NRCS personnel and owner		
1. Meeting Date		
2. Review preliminary design		
3. Verify what components are to be part of final design		
4. Verify what components are not to be part of the construction drawings		
J. Modify existing standard details to comply with this project		

5. Complete the draft of the final design. Very often, the checklist above and the checklist below are completed simultaneously.

IV. DRAFT OF FINAL DESIGN	Complete	N/A
A. Construction drawings		
1. Maps		
2. Establish construction baseline		
3. Correlate improvements to construction baseline		
4. Boring logs		
5. Permanent bench marks shown		
6. Temporary bench marks shown		
7. Applicable cross sections		
8. Applicable profiles		
9. Bar scales		
10. North arrow		
B. Construction specifications		
1. Add items of work and construction details if necessary		
C. Construction Quantities		
1. Correlate quantities with bid items if contract established		
D. Job Sheets		
1. Determine job class		
E. Design Report		
F. Draft Pollution Plan		
G. Submit draft to DC to obtain review comments		
1. Date Sent		
2. Date Comments Received		

Designs completed by members of the State Design Unit.
Design Checked by: _____ Date: _____
State Design Engineer

6. Complete the design and distribute the construction materials.

V. INCORPORATE REVIEW COMMENTS AND PRODUCE FINAL PRODUCT	Complete	N/A
A. Construction drawings		
1. Plot in 11” x 17” format		
2. Engineer’s seal on each sheet		
B. Construction specifications		
1. Engineer certification		
2. Engineer seal		
C. Construction Quantities		
D. Job Sheets		
1. All applicable job sheets signed		
E. Design Report		
1. Signed/Sealed by State Design Engineer		
2. Signed/Sealed by State Conservation Engineer		
F. Transmit final documents		

1. Originals to District Conservationist (date)		
2. Copy to District Conservationist (FO files)		
3. Copy to Area Engineer		
4. Copy to SDE (NMSO files)		
5. Copy to SCE		
6. Copy to CNMP planner		

ADDITIONAL INFORMATION & MISCELLANEOUS NOTES

REVIEW COMMENTS (Include a cross-reference to the applicable section.)