TECHNICAL NOTES

US DEPARTMENT OF AGRICULTURE **NATURAL RESOURCES CONSERVATION SERVICE**
AGRONOMY – 63 revised **Albuquerque, New Mexico**
August, 2014

NEW MEXICO DAIRY POND SIZING SOFTWARE

USE OF MICROSOFT© EXCEL© SPREADSHEET

- **Purpose:** This note will help dairy planners use the New Mexico Dairy Pond Sizing Software (Microsoft© Excel© spreadsheet) to estimate a 2-4 month storage requirement for ponds, evaporative ponds (milk house), and total evaporative combined ponds. This software is for use in New Mexico. It does not estimate the volume needed for treatment lagoons since additional volume is needed for those pond designs. The software can be downloaded at: http://www.nm.nrcs.usda.gov/techserv/TechNotes/agro/ag63.xls the volumes from the software are to be used for conservation planning purposes only. The actual volumes will change as the engineering design is developed.

- **Background:** An Agricultural Feeding Operations/Confined Animal Feeding Operation technical working group made up of NM State University, NM Environment Dept. (Ground Water and Surface Water Bureaus), Livestock Industry Groups, and NRCS have worked for at least 5 years to address the needs for Comprehensive Nutrient Management Planning. The group has considered using a spreadsheet from UT, National Software from Purdue, Animal Waste Management software from the NRCS Water and Climate Center in Portland, and some old software that has been used by NRCS field offices. Most of the programs we reviewed were complicated and data hungry. One of them did not allow the use and management of our own data for NM. After this 5-year period, the technical group decided to use the software that has been used in New Mexico by NRCS.

- **General:** The software is very simple to use and requires very little inventory to size the storage pond(s). Its usefulness is limited to dairies where there is no frozen ground, little runoff from normal precipitation (16-inches or less), and fairly level land. The planning method follows the NRCS Animal Waste Field Handbook (AWFH), Chapter 10. Users should first visit the dairy site to inventory needed input data. Use the New Mexico inventory sheets from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_066636.pdf

  Make sure that you have a computer with Microsoft© Excel© and internet access (to download the software) or a disk which includes the software files. You will also need a basic level of understanding of spreadsheets. Only the tan colored boxes allow data to be entered. The clear boxes have formula or text that should not be changed.

  In the April, 2006 version 2.5, two sheets related to a total evaporation system, where lot runoff and milk house water are combine into one evaporation pond. NRCS used the Soil-Plant-Air-Water Field and Pond Hydrology (SPAW) model, developed by USDA-Agricultural Research Service, to estimate the volume of water generated by the total evaporation system. Due to further review of the recurrence intervals of the weather station data sets used in

SPAW, the usage of the SPAW model will only be adapted to check the results of the Pond Sizing Spreadsheet. The spreadsheet tab labeled SPAW Check will be used to input the SPAW volume and will check that volume with the maximum capacity of the total evaporation lagoon (including the storm volume and the 2' of freeboard). Training on the SPAW model can be requested from the NRCS-NM State Conservation Engineer. NRCS personnel can get the SPAW model from the NRCS-NM website. Consultants will have to download the software from the following website: http://hydrolab.arsusda.gov/SPAW/Index.htm Contact the NRCS-NM State Engineer for the New Mexico climate data files for use in the model.

This usage of SPAW for design for the total evaporation ponds needs to be evaluated closely on the recurrence interval of the weather station data used. If the weather station data set contains large rainfall events, it skews the required SPA volume very large and is not realistic for design.

The rest of this note will lead you through an example of how to use this software. Any problems with the software should be reported to the NRCS-NM State Conservation Engineer.

In February, 2008 version 2.7 incorporated changes in the manure production per animal unit based on a revision of the Agricultural Waste Management Handbook. The manure rates are now based on average milk production in pounds of milk per day of the herd. This change will remain in the March 2012 version 2.9 of the spreadsheet.

DATA NEEDED

- **Planning Data Sheet**

Dairy Name: Name of the dairy the plan is developed for.

Location: Location of the dairy

Dairy Manager: The person that can make the management decisions required for planning.

Planner: The name of the person developing the overall plan. This could be the CNMP planner or the specialist that developed the worksheet.

Flush System used?: This is a yes or no question with a pull-down. It turns off and on the flush part of the worksheet.

Number of cows: This is the number of milking cows that will use the system and the number of dry cows to determine CAFO type.

Milk #/d: Milk production rate average of the herd in pounds per day.:

Average weight of cows: This is the average weight of the milking cows.

% waste from the milking center: Think of this as the time the milking cows spend on the area where the manure will end up in the pond storage area. Typically this is about 15% of the time.

Wash water used in milking center: This is the amount of water used per cow in the milking operation. It can be a number from the Nutrient Mgt. Specification, or an amount from the water meter going into the milk house if it all flows into the waste stream.

Number of months of storage needed: Minimum here is 2 months. It may be wise to consider more storage if there is not enough soil moisture storage capacity available to receive additional water when there is no crop growing. The goal here is to have room in the soil for the pond water **without** leaching or runoff. Indicate here 12 months if an evaporation pond is being planned.

Flush water added: This is **only** used when there is an alley flush system. This is **only** added water not recycled water. The AWFH has some estimates. The dairy producer should have some idea.

Dairy Data for the Flush System: The next four rows of data are used in the flush system. The milking cows and weight come from the above section. The dry cows have the same weight as above.

Print Sheet: After filling out this sheet, print it to document and record decisions. Also print if changes are made to this sheet.

- **Lot Runoff Sheet**

Pond/Lagoon #: Type in an identifier for the pond being sized.

Practice Name: List the practice being designed (Pond 378, Waste Storage Facility 313, etc.).

Pond Location: Select the climate location for the structure from the pull down.

Acre in WS area (column): Enter the acres of the watershed that will drain into the pond**.**

RUNOFF CURVE NUMBER: Runoff curves are used to determine how much runoff will come from the lot. Unpaved feed lots will use **90,** and paved or concrete areas will use **95.** The first two lines of the table are for the paved and unpaved areas of the watershed. The remaining lines can be used to add areas with different curve numbers. Each line in the table will be a different curve number and are used to make up the average weighted curve number. Fill in the table to match the watershed inventory.

CHANNEL-LOSS FACTOR: This will always be one (1) for dairies.

RAINFALL 24-HR, DIRECT RUNOFF, and NET RUNOFF (Q*CLF): is now calculated.

VOLUME OF RUNOFF: The output used for sizing the runoff pond is the acre-feet needed for the 25-yr, 24-hr storm.

Print Sheet: After filling out this sheet, print it to document and record decisions. Also print if changes are made to this sheet.

- **Pond Vol Sheet**

Pond Location (Climate): This was selected in the previous Lot Runoff Sheet.

Annual Lake Evap map: This is the annual lake evaporation at the site of the pond. Click on the Evap-NM tab and read evaporation from the map for the location being planned. Enter the direct number of inches of evaporation from the map.

Pond/Lagoon Surface Area: This is the estimated amount of surface area of the pond at the mid-depth of the pond storage volume.

The sheet will give an estimate of the depth in feet for the storage period. On this page the volume is calculated to a cube shaped structure. Find depth on the lower right hand side of the table. The goal here is to adjust the surface area to make a reasonable depth to build the pond. Since this depth represents storage volume only not including freeboard, storm rainfall, runoff and sludge, a practical depth for this sheet is 6-feet or less.

If you want to design an **evaporation pond** (where the milk house is the only source of water), select the “Evaporation” pond type. Then adjust the surface area until there is at least one zero in column J. This will establish the needed area for an evaporation pond. One zero in the column indicates that one month out of the year the pond will be dry.

If you want to design a **total evaporation pond** (milk house and barn lot runoff) you must select an evaporation pond type and increase the surface area so that several months of the year the pond is estimated to be dry. The more zeros in column J, the more conservative the pond will be.

Note: This sheet calculates the storage required for the greatest two months or four months of storage over a year as well as a one year evaporation pond (milk house only) and a total evaporation pond where both the milk house and the barn lot water are combined into one pond.

Print Sheet: After filling out this sheet, print it to document and record decisions. Also print if changes are made to this sheet.

- **SPAW Check**

If the user wants to test the design of a total evaporation pond, using SPAW, the planner inputs data into the SPAW model and completes the iterative model runs. After the SPAW model runs are completed the total volume from SPAW is entered on the bottom of the SPAW worksheet.

The calculated volume of SPAW is checked with the total volume of the proposed evaporation pond which includes the manure, wash water, 25yr 24 hr storm lot runoff and the 2' freeboard, to see if any overtopping occurs. If the design overtops and spills, check the recurrence interval of the SPAW input data. The data set might contain precipitation events that far exceed the 25 year storm, and model for a recurrence interval storm that is unrealistic for the proposed design. The last tab in the Pond size spreadsheet contains the main weather station recurrence intervals for all major stations used in calculating the SPAW runoff volumes. Intervals calculated are 1, 2, 4, 7, and 10 days.

- **Rec. Pond Size Sheet**

Note: This sheet can design either a square or rectangular pond. Select the correct type of design by clicking in the check boxed to indicate a milk house only or a combined type of pond.

ESTIMATE NUMBER OF YEARS BEFORE CLEANING POND: Planners must estimate the number of year before the pond will be cleaned. The dairy producer should make this decision based on his management and equipment available.

SOLID SEPERATION: If there are one or more separators in the waste stream they can be selected using the pull-down. Then the default value of separation can be adjusted as appropriate. This will calculate the volume of the solids delivered to the pond in one year.

SLUDGE VOLUME: The sludge volume is calculated by using a factor, listed in Chapter 10 of the AWMFH, for solid accumulation in lagoons. **Solid accumulation is based entirely on management of the waste stream and how the pond is dewatered.** If the dairy manager agitates the pond before dewatering, few solids will build up. If little or no separation is done and the pond is dewatered from the top without agitation, then solids will accumulate.

POND STORAGE CAPACITY: Shows the four required storage volumes and their total. The lot storm volume is only added into the total if this is a combined pond (one that captures water from the milking center, flush system, and feedlot). The user selects this option at the top of the sheet.

WASTE WATER STORAGE REQUIREMENT:

POND LENGTH: Enter the desired Length. An estimated length is given to start the process for a square pond. Any shape rectangular pond can be designed by changing the length to match a particular site.

POND WIDTH: Set by the calculation of the surface area from the Pond Vol sheet.

SIDE SLOPE: Enter the desired side slope. Slopes can be no steeper than 3H:1V.

POND Depth: Enter a depth (nearest 0.1 foot) to calculate the POND Volume. The spreadsheet compares this computed volume to the required volume, which is shown in the Pond Storage Capacity section. A note on the right tells the user that either the depth must be increased or the volume is ok. When the volume is ok, the note is lit the there is enough pond depth.

STORAGE OF THE 25 YR-24 HOUR STORM:

STORM Depth: Enter a depth to calculate the STORM Volume. The spreadsheet compares this computed volume to the required volume. A note on the right again tells the user that either the depth must be increased or the volume is ok.

STORAGE OF SLUDGE:

SLUDGE DEPTH: Enter a depth to calculate the SLUDGE Volume. The spreadsheet compares this volume to the required volume. Again, a note on the right tells the user that either the depth must be increased or the volume is ok. When the volume is ok, the note is lit the there is enough pond depth.

FINAL POND DIMENSIONS:

Note: This section summarizes the depth, length, width, and surface area of the pond.

DEPTH OF 21-DAY STORAGE WITHIN THE 60 DAY STORAGE:

Depth of 21-Day Storage: Enter a depth to calculate the 21-day storage volume. The spreadsheet compares this to the required volume and display a note telling the user to either increase the depth or the depth is ok. This volume is a portion of the 60-day storage and is required to remain empty by Surface Water Bureau of the NMED.

CROSS SECTION:

Note: Shows a not to scale graphic of the pond cross section.

Pond Depth (Staff Gauge) – Volume Table: Provides a table of depth versus volume. This table is used to estimate volumes in the finished pond.

Lining Area: Estimates the area (in square feet and square yards) of lining material needed.

System Planning Notes: Write any notes needed to explain the calculations.

Print Sheet: After filling out this sheet, print it to document and record decisions. Also print if changes are made to this sheet.

- **Lot Runoff Pond Sheet**

Note: This sheet operates very similar to the Rect. Pond Size sheet and is used to size runoff ponds only that do not contain any milk house flush water. It can be used to size any other ponds needed for the dairy. Sometimes the milking center waste is stored in more than one pond. This sheet can size the volumes of each pond assuming that the established depth on the single pond design (Rect. Pond Design) is maintained in the three ponds.

Existing ponds can be evaluated if the average length, width, depth, and side slopes are known.

Note: For Lot Runoff Ponds and other ponds, changes may be needed on the Lot Runoff or Pond Vol sheets. The user must revisit those spreadsheet tabs and print all changes in order to fully document each pond design.

Print Sheet: After filling out this sheet, print it to document and record decisions. Also print if changes are made to this sheet.

- **Total Evap Pond Size**

This is similar to the rectangular pond size sheet except that the volume for the 25-year 24-hour storm is included. The sludge storage time is set to the life of the liner, a minimum of 20 years, unless cleaning will be done. The final volume calculation contains the 20 year sludge storage, the minimum waste water storage, the 25 year storm and the 2 feet of freeboard.

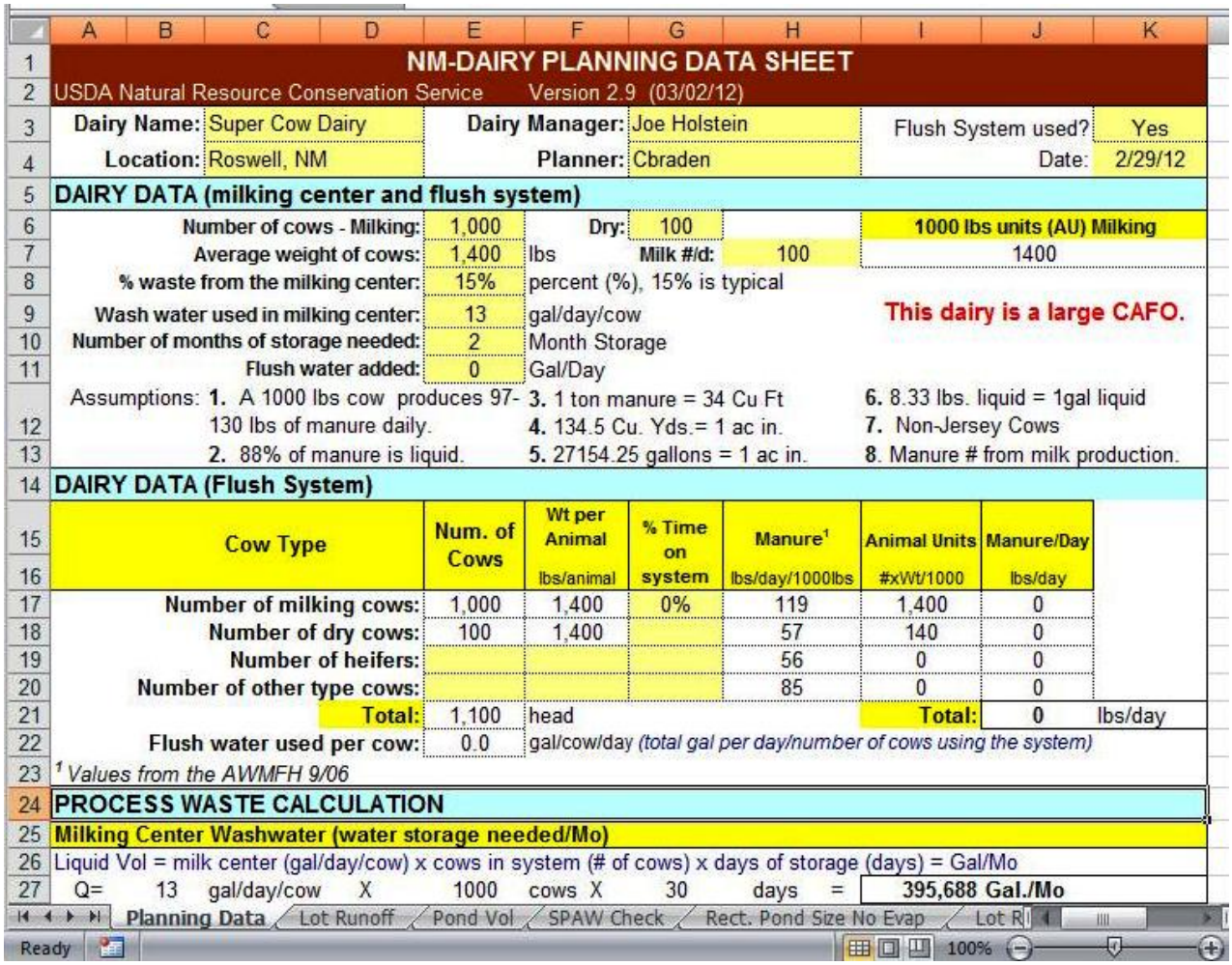
Print Sheet: After filling out this sheet, print it to document and record decisions. Also print if changes are made to this sheet.

Example Problem

Inventory Data: The Super Cow Dairy managed by Joe Holstein has a 1000 cow milking herd and 100 head of dry cows near Roswell, NM. Mr. Holstein wants to size an evaporative pond for both milk parlor and runoff and determine how large the pond will have to be. He wants the pond to be square. We have visited the site and determined that there is about 28 acres of unpaved lot where the cows spent about 85% of the time. The cows are in the milking area 15% of the time, and he uses about 13 gal/cow in his spray wash system (13,000 gal/day/1000 cows). The average weight of the cows is 1400 lbs. He plans to clean the pond every twenty five years. He thinks that an incline screen will save about 25% of the solids in the waste stream.

Step 1 – Open the NM-Dairy Planning Excel spreadsheet, select the **Planning Data** sheet, and enter the row 3 and 4 data: Dairy Name, Dairy Manger, Location, Planner, and Yes for the Flush System Question.

Step 2 – Enter the Dairy Data on row 6 through 11: Number of cows, weight per cow, time at the milking center, wash water added, number of months of storage, and zero for flush water added. Flush data would be added if the dairy uses a flush system (Be sure to enter "yes" in the box for flush system on row 3).



NM-DAIRY PLANNING DATA SHEET

USDA Natural Resource Conservation Service Version 2.9 (03/02/12)

Dairy Name:	Super Cow Dairy	Dairy Manager:	Joe Holstein	Flush System used?	Yes
Location:	Roswell, NM	Planner:	Cbraden	Date:	2/29/12

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)*				

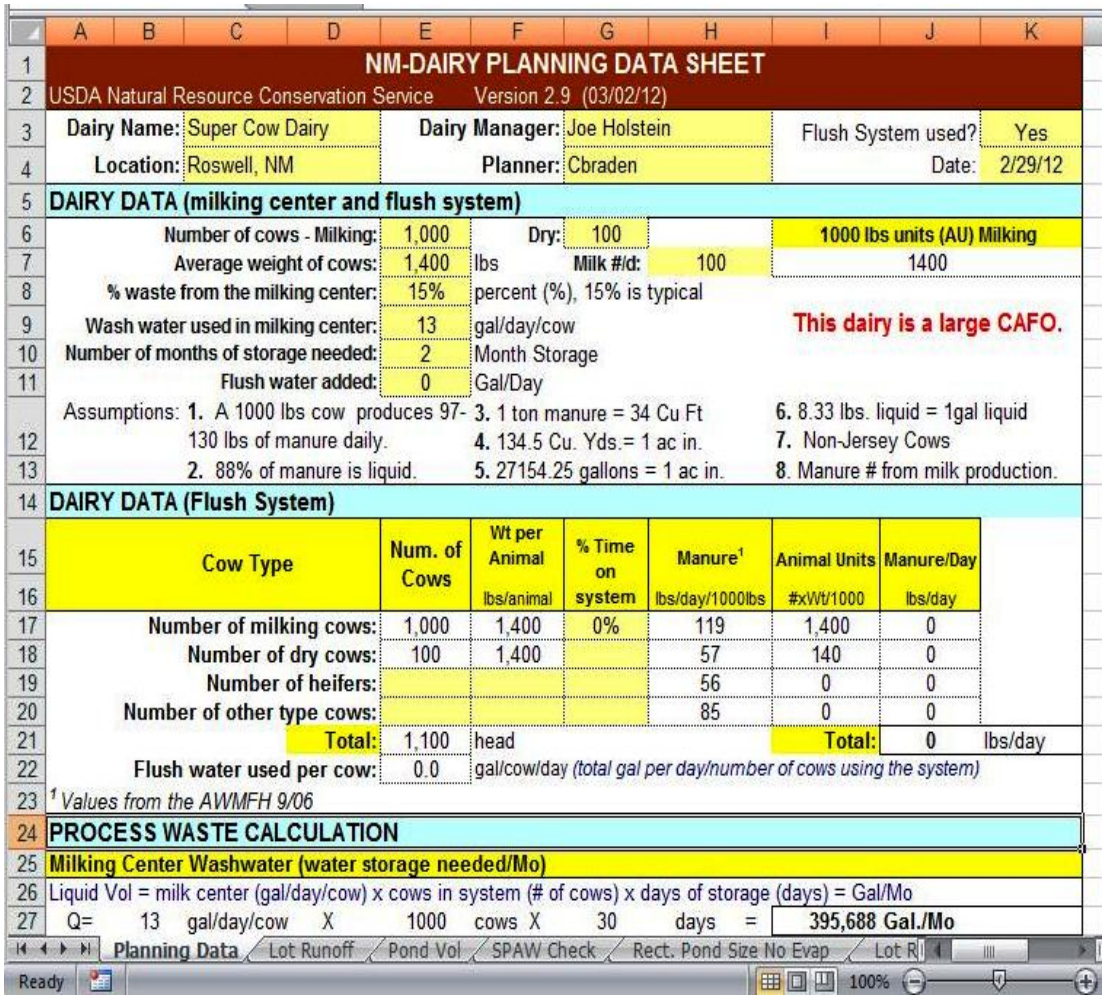
[1] *Values from the AWMFH 9/06*

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**



NM-DAIRY PLANNING DATA SHEET										
USDA Natural Resource Conservation Service Version 2.9 (03/02/12)										
Dairy Name:	Super Cow Dairy			Dairy Manager:	Joe Holstein			Flush System used?	Yes	
Location:	Roswell, NM			Planner:	Cbraden			Date:	2/29/12	
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.		3. 1 ton manure = 34 Cu Ft						6. 8.33 lbs. liquid = 1gal liquid		
2. 88% of manure is liquid.		4. 134.5 Cu. Yds.= 1 ac in.						7. Non-Jersey Cows		
		5. 27154.25 gallons = 1 ac in.						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		

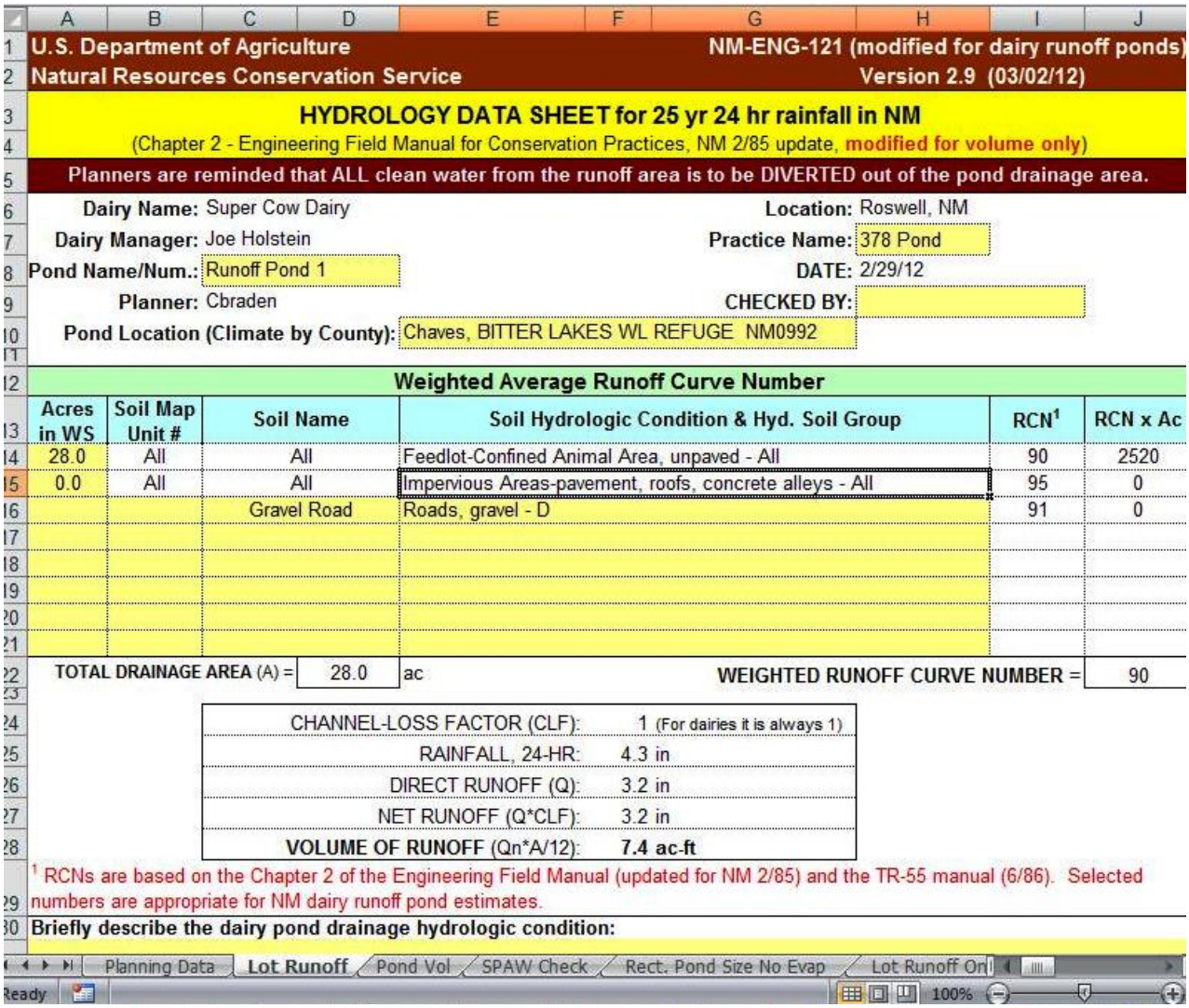
Planning Data | Lot Runoff | Pond Vol | SPAW Check | Rect. Pond Size No Evap | Lot R

Ready 100%

Step 3 – Print this Planning Data tab before moving to the next sheet (or tab).

Step 4 – Change to the **Lot Runoff** sheet. Identify the Pond type in the Pond Name/Num. filed (for example: Runoff Pond 1), and in the Practice Name field, enter the practice number and name (for example, 378 Pond). Click in the yellow box to the right of Pond Location (Climate by County) and use the dropdown list to select the climate station closest to the pond's location. For our example, select "Chavez Bitter Lakes WL Refuge, NM0992."

Enter the area within the watershed.



U.S. Department of Agriculture — NM-ENG-121 (modified for dairy runoff ponds)
Natural Resources Conservation Service — Version 2.9 (03/02/12)

HYDROLOGY DATA SHEET for 25 yr 24 hr rainfall in NM
(Chapter 2 - Engineering Field Manual for Conservation Practices, NM 2/85 update, modified for volume only)

Planners are reminded that ALL clean water from the runoff area is to be DIVERTED out of the pond drainage area.

Dairy Name:	Super Cow Dairy	**Location:**	Roswell, NM
Dairy Manager:	Joe Holstein	**Practice Name:**	378 Pond
Pond Name/Num.:	Runoff Pond 1	**DATE:**	2/29/12
Planner:	Cbraden	**CHECKED BY:**	
Pond Location (Climate by County):	Chaves, BITTER LAKES WL REFUGE NM0992		

Weighted Average Runoff Curve Number

Acres in WS	Soil Map Unit #	Soil Name	Soil Hydrologic Condition & Hyd. Soil Group	RCN[1]	RCN x Ac
28.0	All	All	Feedlot-Confined Animal Area, unpaved - All	90	2520
0.0	All	All	Impervious Areas-pavement, roofs, concrete alleys - All	95	0
		Gravel Road	Roads, gravel - D	91	0

TOTAL DRAINAGE AREA (A) = 28.0 ac — **WEIGHTED RUNOFF CURVE NUMBER** = 90

CHANNEL-LOSS FACTOR (CLF):	1 (For dairies it is always 1)
RAINFALL, 24-HR:	4.3 in
DIRECT RUNOFF (Q):	3.2 in
NET RUNOFF (Q*CLF):	3.2 in
VOLUME OF RUNOFF (Qn*A/12):	**7.4 ac-ft**

[1] RCNs are based on the Chapter 2 of the Engineering Field Manual (updated for NM 2/85) and the TR-55 manual (6/86). Selected numbers are appropriate for NM dairy runoff pond estimates.

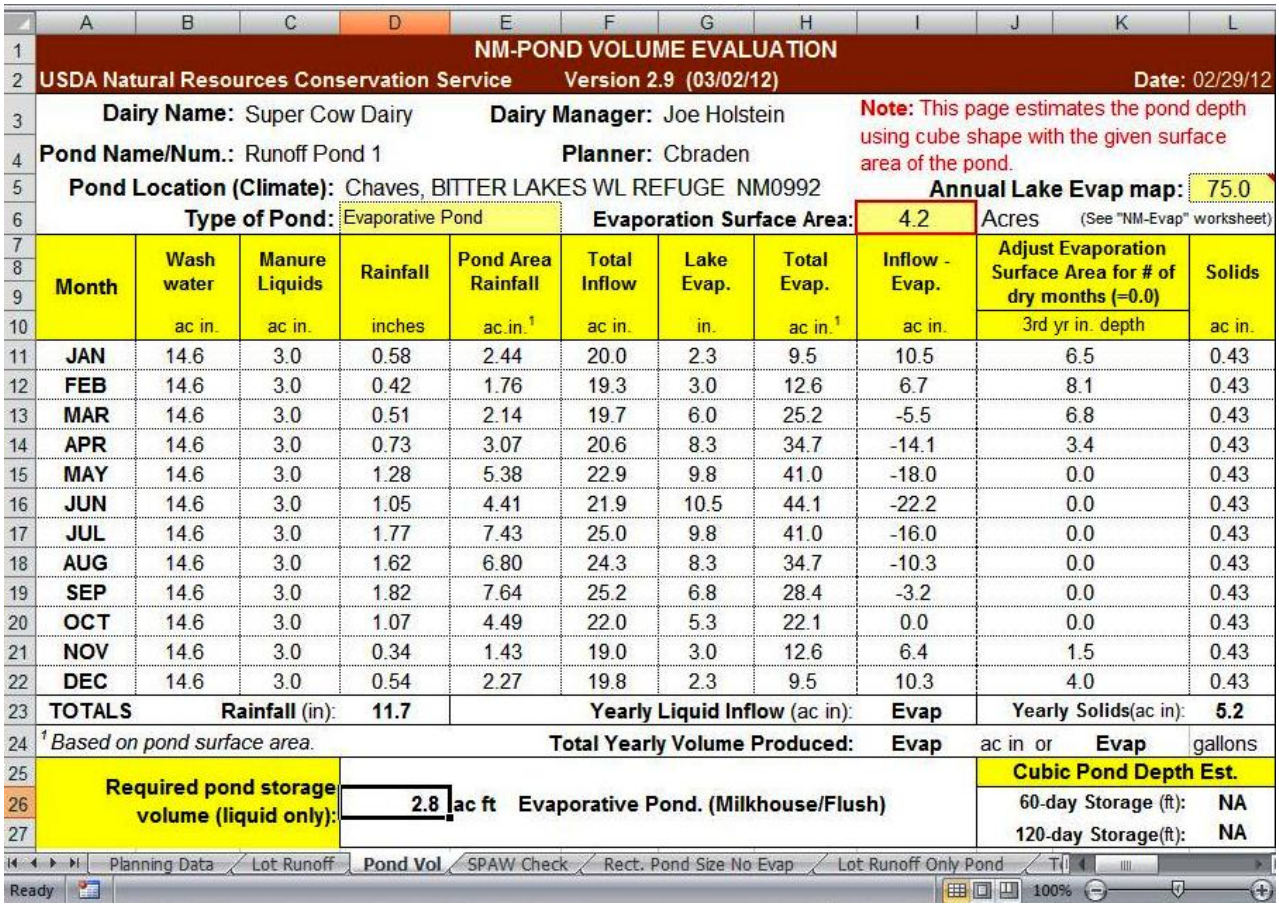
Briefly describe the dairy pond drainage hydrologic condition:

Planning Data | Lot Runoff | Pond Vol | SPAW Check | Rect. Pond Size No Evap | Lot Runoff On

Ready — 100%

Step 5 – Print this Lot Runoff tab before moving to the next sheet (or tab).

Step 6 – Change to the **Pond Vol** sheet. Select Evaporative Pond. Move to the Annual Lake Evap map cell and enter 75.0 inches per year. This is the annual lake evaporation found on the Evap-NM tab for the location of the pond. Adjust the surface area up or down until the preferred number of dry months is wanted. This example shows 6 zeros or dry months is expected during the year.



NM-POND VOLUME EVALUATION

USDA Natural Resources Conservation Service **Version 2.9 (03/02/12)** **Date:** 02/29/12

Dairy Name: Super Cow Dairy **Dairy Manager:** Joe Holstein

Pond Name/Num.: Runoff Pond 1 **Planner:** Cbraden

Pond Location (Climate): Chaves, BITTER LAKES WL REFUGE NM0992

Type of Pond: Evaporative Pond **Evaporation Surface Area:** 4.2 Acres (See "NM-Evap" worksheet)

Note: This page estimates the pond depth using cube shape with the given surface area of the pond.

Annual Lake Evap map: 75.0

Month	Wash water ac in.	Manure Liquids ac in.	Rainfall inches	Pond Area Rainfall ac.in.[1]	Total Inflow ac in.	Lake Evap. in.	Total Evap. ac in.[1]	Inflow - Evap. ac in.	Adjust Evaporation Surface Area for # of dry months (=0.0) 3rd yr in. depth	Solids ac in.
JAN	14.6	3.0	0.58	2.44	20.0	2.3	9.5	10.5	6.5	0.43
FEB	14.6	3.0	0.42	1.76	19.3	3.0	12.6	6.7	8.1	0.43
MAR	14.6	3.0	0.51	2.14	19.7	6.0	25.2	-5.5	6.8	0.43
APR	14.6	3.0	0.73	3.07	20.6	8.3	34.7	-14.1	3.4	0.43
MAY	14.6	3.0	1.28	5.38	22.9	9.8	41.0	-18.0	0.0	0.43
JUN	14.6	3.0	1.05	4.41	21.9	10.5	44.1	-22.2	0.0	0.43
JUL	14.6	3.0	1.77	7.43	25.0	9.8	41.0	-16.0	0.0	0.43
AUG	14.6	3.0	1.62	6.80	24.3	8.3	34.7	-10.3	0.0	0.43
SEP	14.6	3.0	1.82	7.64	25.2	6.8	28.4	-3.2	0.0	0.43
OCT	14.6	3.0	1.07	4.49	22.0	5.3	22.1	0.0	0.0	0.43
NOV	14.6	3.0	0.34	1.43	19.0	3.0	12.6	6.4	1.5	0.43
DEC	14.6	3.0	0.54	2.27	19.8	2.3	9.5	10.3	4.0	0.43
TOTALS		Rainfall (in):	11.7		Yearly Liquid Inflow (ac in):			Evap	Yearly Solids(ac in):	5.2

[1] *Based on pond surface area.* Total Yearly Volume Produced: Evap ac in or Evap gallons

Required pond storage volume (liquid only): 2.8 ac ft Evaporative Pond. (Milkhouse/Flush)

Cubic Pond Depth Est.

60-day Storage (ft): NA

120-day Storage(ft): NA

Planning Data | Lot Runoff | Pond Vol | SPAW Check | Rect. Pond Size No Evap | Lot Runoff Only Pond | T

Ready 100%

Step 7 – Print this Pond Vol tab before moving to the next sheet (or tab).

Step 8 – Select the Total Evap Pond Size tab.

The upper portion of the sheet contains the input for the years before pond cleaning. Usually the life of the pond is generally 20 years. Also you select the type of solid separator installed in the facility. There is an adjustment made for the efficiency of the installed separator.

1	**NM-POND SIZE DETERMINATION for Total Evaporation Ponds**				
2	**USDA Natural Resources Conservation Service**	**Version 2.9 (03/02/12)**		**Date:**	2/29/2012
3	**Dairy Name:**	Super Cow Dairy	**Dairy Manager:**	Joe Holstein	
4	**Location:**	Roswell, NM	**Planner:**	Cbraden	
5	**Pond Name/Num.:**	Runoff Pond 1	**Type of Pond:**	Total Evap Pond	
6	**Estimate Number of Years Before Cleaning Pond:**		20	years (min 20 yrs needed)	
7	**Pond designed for:**	Total Evaporation of the Feedlot Runoff plus Optional Milkhouse/Flush Water in a combined pond.			
8	**SOLIDS SEPARATION** *(adjustment to total storage requirements)*				
9	**Solids Produced (ac in/yr from Pond Vol sheet):**				**5.2**
10	**Type of Separators**	**% Reduced (default value)**	**% Adjust. (+/-)**	**Separation Value (%)**	**Storage Need (ac in)**
11	Static Incline Screen (36 mesh)	15%	25%	19%	4.2
12					
13					
14	**Total Volume of Solids:**	**4.2** ac in/yr		**0.4**	ac ft/yr
15	**POND STORAGE CAPACITY**				
16	**Evaporation Surface Area** (starting at the bottom of the pond):				**4.2 ac.**
17	**POND Volume** (equal to milkhouse flush and liquid manure):				**2.8 ac. ft.**
18	**STORM Volume** (25 year-24 hour Rainfall over Pond):				**1.7 ac. ft.**
19	**STORM Volume** (25 year-24 hrs Storm Runoff from Lot):				**7.4 ac. ft.**
20	**Sludge Storage Volume** (based on yrs before cleaning):				**7.0 ac. ft.**
21	**Total Storage Required:**				**19.0 ac. ft.**

The required storage volume is calculated at 19.0 acre feet, which includes flush, storm, and sludge volumes.

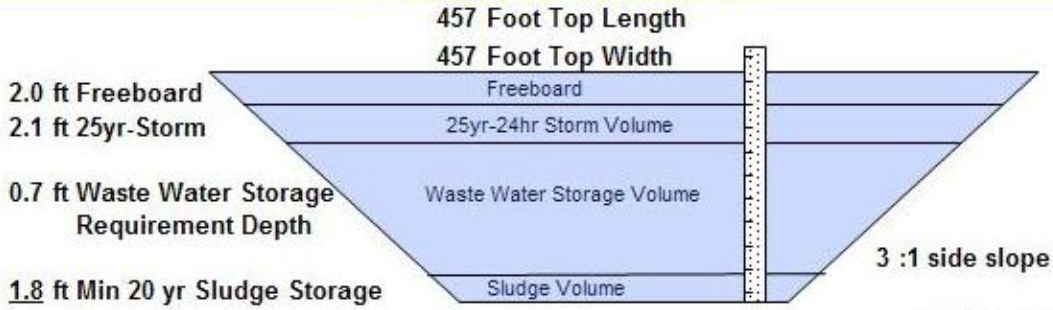
The next three calculations use a trial and error method to balance computed pond volumes with the required storage volumes while establishing a shape that fits within site requirements. The freeboard requirement in New Mexico is 2.0 feet. The pond length and width at the bottom of the pond is input. You adjust the depth up until the flag statement indicates that the depth is OK or that it may be decreased. Then adjust the storm storage depth until the flag statement indicates that the depth is OK or that it may be decreased. Finally adjust the depth of sludge until the flag statement indicates that the depth is OK or that it may be decreased. This requires you to have the all three volumes with the label saying that the Vol is "OK".

	A	B	C	D	E	F	G	H	I
22	**WASTE WATER STORAGE REQUIREMENT**								
23	**POND Length** (at the bottom) (ft)				428	428	(ft) Estimated Length		
24	**SIDE SLOPE (inside)** (from SPAW sheet) (ft:ft)				3.0	:1	GWQB requires ≥ 3:1		
25	**POND Width** (at the bottom) (ft)				428	428	(ft) Estimated Width		E25 modifie
26	**POND Depth** (for required storage) (ft)				0.70		Adjust POND Depth until pond vol balances.		
27	**POND Volume** (for required storage) (ac-ft)				3.0		2.8 ac-ft = Required storage for waste water		
28	**TOP SURFACE AREA** (at the top) (ac)				4.3		The POND Vol. is OK or depth may be decreased.		
29	**Top Length** (at the top) (ft)				432				
30	**Top Width** (at the top) (ft)				432				
31	**STORAGE OF 25 year-24 hour STORM** (lot runoff plus over the pond)								
32	**STORM Depth** (for storage of 25 yr storm) (ft)				2.10				
33	**STORM Volume** (for 25 yr storm storage) (ac-ft)				9.2		9.1 ac-ft = Required storage for 25 yr storm		
34	**TOP SURFACE AREA** (at the top) (ac)				4.5		The STORM Vol. is OK or depth can be decreased.		
35	**Top Length** (at the top) (ft)				445				
36	**Top Width** (at the top) (ft)				445				
37	**STORAGE OF SLUDGE**								
38	**SLUDGE AREA** (bottom of required storage) (ac)				4.2				
39	**SLUDGE Length** (bottom of required storage) (ft)				428.0				
40	**SLUDGE Width** (bottom of required storage) (ft)				428.0		7.04 ac-ft = Required storage for sludge storage		
41	**SLUDGE Depth** (for storage of sludge) (ft)				1.80		The SLUDGE Vol. is OK or depth can be decreased.		
42	**SLUDGE Volume** (designed storage) (ac-ft)				7.4				
43	**FINAL POND DIMENSIONS**								
44	**Required Freeboard Depth** (ft)				2.0				
45	**Freeboard Volume** (ac ft)				9.3				
46	**TOTAL Pond Depth** (ft)				6.6		Includes storage, runoff, freeboard and sludge.		
47	**TOTAL Pond Length** (ft)				457				
48	**TOTAL Pond Width** (ft)				457		These quantities assumes a level		
49	**TOTAL Surface Area** (ac)				4.8		existing ground surface.		
50	**TOTAL VOLUME (includes**				**29.0**	Ac Ft	**347.5** Ac In		
51					**9,434,765**	Gal	**1,261,428** Cu Ft		
52					**46,719.6**	Cu Yd			

Step 8 (Continued) –

The above calculations are summarized in the FINAL POND DIMENSIONS section. Note that the Total Pond Depth is 6.6 feet. Also note that the Top Pond Length and Width is 457 ft. x 457 ft.

Cross Section (not to scale)



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)

– Note that the final top width and length increased to 457 feet due to freeboard requirements.

– The Construction Quantities section provides estimates for excavation volume and area of lining materials needed to construct the pond. These estimates are based on level ground across the pond location. Actual construction quantities are a matter of a complete site built design process.

Step 9 – Print this Evap Pond sheet.