Rev 12.07.2011

Dairy Waste Management System Evaluation

Date: 17-Dec-12
Time: 1:16 PM
Rev: 10-Mar-12

Ocean View Dairy - Marvin L. Nunes
Dairy ranch

3975 Mark West Station Road, Windsor CA
Address

707.528.3545

Green boxes are for data entry
All cells are unprotected

1. Milk String Confinement Equivalent Days Estimation

Season	Weeks per year	Hours per Day: milk barn	Stall barn	inside feed bunk	outside feed bunk	pasture	
Winter	8.1	4	16	4	0	0	24 hr
Spring	20	4	16	4	0	0	24 hr
Summer	8	4	16	4	0	0	24 hr
Fall	16	4	16	4	0	0	24 hr
Total Weeks	52.1						365 days
Equiv Confined Days/year		61	243	61			
Manured/unconfined Days/year					0		
Equiv Unconfined Days/year						0	

2. Animal Waste Production

Animal Group		No. of Animals	Weight 1000 lb. un	Equivalent Days: Confined	Unconfined	Gallons Manure/ 1000lb./day	Annual Manure Prod Acre-feet: Confined	Unconfined	
Milk Cows	high string	230	322.0	365	0	**14.8**	5.33	0.00	
1400 lbs.	low strings	100	140.0	365	0	**14.8**	2.32	0.00	
Dry Cows (1.5/12 of mi		40	56.0	30	335	**10.0**	0.05	0.57	
1400 lbs.									
2yr->springer		80	96.0	0	365	**7.0**	0.00	0.75	large heifers
900-1500 lbs.									pastured
Med. Heifers		80	56.0	0	365	**4.8**	0.00	0.30	pastured
500-900 lbs.									
Smal Heifers		80	30.4	365	0	**1.7**	0.06	0.00	pastured
250-500 lbs.									
Baby Calves		83	14.0	365	0	**1.7**	0.03	0.00	calf pen
100-250 lbs.									
On Site Totals		610	700				7.79	1.63	

3. Total Animal Waste

9.41 Acre Feet

4. Additions to the Confinement Waste Management System:

Notes:
3 20T loads/year sand
4 20T loads/year straw

Assume 0.5% of 50lb ration/day, milk strings at 40 lb/cu ft

Imported manure, whey, other

	Units/Year	Acre Feet	
Animal Bedding Makeup sand	60.0 tons	0.02	recycled from
Animal bedding Straw/organic	80.0 tons	0.09	assumed, pe
Damaged feed or silage	15.1 tons	0.02	40 lb/ft^3 der
External inputs	0 10 cy loads	0.00	
Dry lot scrapings plus imports to compost pile	20 10 cy loads	0.12	
Subtotal		0.26	

5. Wash and Process Water Produced Annually

		Rate Gal/min	Use Hr/day	Gal/Day	Ac/ft per yr	Percent of Total
Milking System Wash Water				200	0.22	21.3
Milking System Backflush @ .25 gal/unit				165	0.18	17.6
Milk Tank Wash Water				60	0.07	6.4
Milk claw Wash Water	Gal H2O/cow	0.25		165	0.18	17.6
	Milkings/day	2				
Sprinkler Pen Water				0	0.00	0.0
Milking Parlor Wash Water		5	1.00	300	0.34	31.9
Recycled wash water, per day		0	0.00	0	0.00	0.0
Vacuum Pump Water		0	0	0	0.00	0.0
Air Comp/Milk Cooler Water		0	0	0	0.00	0.0
Leaking troughs, other losses		0	24	0	0.00	0.0
Spring flows to manure storage		0	24	0	0.00	0.0
Flush System Added Water			Calf pen cleanup	50	0.06	5.3
			days/year	365		
Total Wash and Process Water				940	1.05	100.0
				Gal/day	Acre Feet	

Section IV. Rain Water Additions to Waste System

Rainfall Data for Discretionary Design

Local average annual rainfall, inches	36.0	Local average per SCWA isohyetal map, rev June 83.	**5.4**	25-year, 24-hr storm Inches @ 3.8*(local avg/25.5) @ Petaluma.
10-year Wet-Winter Annual Rainfall, inches	53.6	10-year wet winter prorated based on 46-year Petaluma data with 38.0" 10-year wet winter relative to 25.5" avg annual rainfall (O'Connor, 2000).		

Rainfall Runoff Entering Waste Management System

Surface areas from Areas tab	Acres	Runoff Coefficient	Average Acre-feet	Wet Acre-feet	
Manured Concrete	0.23	1.00	0.68	1.01	
Silage Pad Runoff	0.52	1.00	1.57	2.33	
Manure Storage, liquid	2.09	1.00	6.26	9.33	
Manured non-concrete	3.11	0.50	4.67	6.96	
Crop/pasture	2.03	0.40	2.44	3.64	
Total watershed area	7.46		15.62	23.27	10-year Winter Storage Required
				3.34	25 year, 24-hour Storage Required

Pump size required to handle 25 year, 24-hour storm:

Hours pumped per day	Days pumped	Required Pump size, Gal/min	Pump Size OK? Pump period available? (Y/N; caps only)
12	4	378	N

Section V. Total Annual Waste Flows

Total System Evaluation

Estimate Annual Waste Storage Requirement at Dairy

	Acre Feet	Percent of Total	
On-Site Animal Waste	7.79	24.1	
Off-site additions to system Bedding, feed, liquids	0.26	0.8	
Wash and Process Water	1.05	3.2	
Manured-area Rainfall, 10-year wet winter	23.27	71.9	
Subtotal - Annual wastewater volume	32.37	100.0	baseline

Storage Reduction Adjustments

			Reduction Acre-Feet	Adjusted Storage Volume Acre-Feet	% of Total
Evaporation	Feet	3.00	6.26	26.10	80.7
Pond drained before use?	Feet	0.0	0.00	26.10	80.7
Solids Separation	12% reduction	Y	0.93	25.17	77.8
Mech. Manure Separation? (Y/N; caps only)					
Slurry Transport	Gal/load	4000			
Daily drawdown of sump or pond	Load/day	0	0.00	25.17	77.8
independent of annual cleanout	Day/yr	180			
Solids Transport	Cu Yd/load	10	0 loads/year		
Compost or solids removal	Load/day	0	0.00	25.17	77.8
independent of annual cleanout	Day/yr	20			
Irrigation Disposal	Gal/min	200	0 loads/year		
Daily drawdown of sump or pond	Hr/day	0.0	0.00	25.17	77.8
independent of annual cleanout	Day/year	30.0			

Add 25-year, 24-hour storm runoff if insufficient pump capacity or cycle time	3.34	10.3
Total Annual Waste Flows Requiring Storage Capacity	28.51	88.1

Section VI. Evaluate Capacity of Existing Storage System

Waste Storage Capacity	Acre Feet
Design storage capacity of waste ponds. (from Areas worksheet)	18.00
Design storage capacity of other facilities. (add, if any)	
Total Storage Capacity (Add cells 19,21)	18.00

Waste Storage Capacity Reductions (Incomplete annual pond cleanout, etc)	15.00
Manure Handling and Storm Water Management Capability	
Working Storage Capacity (cell 3-cell 4)	3.00

Calculation indicates that:	**Total Capacity**
Manure Production Exceeds Storage Capacity	**Required**
Additional Capacity Required: **25.5** Acre-Feet	**28.5** Acre-Feet

Dairy Pond Size Estimation - Data Summary Sheet

Ocean View Dairy - Marvin L. Nunes 707.528.3545 17-Dec-12
3975 Mark West Station Road, Windsor CA 1:16 PM

Unconfined manure production		1.63	acre feet			
Confined manure production		7.79	acre feet		**7.79**	acre-feet
Total waste production		9.41	acre feet			
Additions to the Confinement Waste Management System						
Animal Bedding	Makeup sand	0.02	acre feet			
	Straw/organic	0.09	acre feet			
	External inputs	0.00	acre feet		**0.26**	acre-feet
	Damaged feed	0.02	acre feet			
	Milking System Wash Water	0.29	acre feet			
Milking System Backflush @ .25 gal/unit		0.18	acre feet			
	Milk claw Wash Water	0.18	acre feet			
	Sprinkler Pen Water	0.00	acre feet			
	Milking Parlor Wash Water	0.34	acre feet	940 gal/day	**1.05**	acre-feet
	Recycled wash water, per day	0.00	acre feet			
	Vac Pump/Air Comp/Cooler	0.00	acre feet			
	Leaks/Springs	0.00	acre feet		**9.09**	af wastewate
	Flush System Added Water	0.06	acre feet		28	% of total

Rainfall Data for Discretionary Design	Acres	Coefficient	runoff, ac-ft	Design rain	Avg rain
				53.6	36.0
Manured Concrete	0.23	1.00	1.01		
Silage Pad Runoff	0.52	1.00	2.33		
Manure Storage, liquid	2.09	1.00	9.33		
Manured non-concrete	3.11	0.50	6.96		
Crop/pasture	2.03	0.40	3.64	ac ft	ac ft
Total Runoff	7.46	na	23.27	**23.27**	15.62
Subtotal - Annual wastewater volume			Total:	**32.37**	24.71
Evaporation:				-6.26	-6.26
Solids separator:				-0.93	-0.93
Pond drawdown:				0.00	0.00
Slurry Transport	4000 Gal/load	0 loads/yr		0.00	0.00
Solids Transport	10 Cu Yd/load	0 loads/year		0.00	0.00
Irrigation Disposal	200 Gal/min	0 hr/yr		0.00	0.00
Adjusted storage volume, acre-feet per year:			-7.19	**25.17**	17.52
5.36 inches	25-year, 24-hr storm	Inches @ 3.8*(local avg/25.5) @ Petaluma.			
	Pump size required to handle 25 year, 24-hour storm:			**3.34**	2.24
	12 hr/day				
	4 day/yr	378 gal/min			
Total Annual Waste Flows Requiring Storage Capacity				**28.51**	19.75

Waste Storage Capacity		
Design storage capacity of waste ponds.	18.00	acre-feet
Design storage capacity of other facilities.	0.00	acre-feet
Waste Storage Capacity Reductions	15.00	acre-feet
Working Storage Capacity	**3.00**	acre-feet

Calculation indicates that:		**Total Capacity**
Manure Production Exceeds Storage Capacity		**Required**
Additional Capacity Required: **25.5** Acre-Feet	**28.5**	Acre-Feet

Runoff and Pond Areas Calculation Worksheet

Ocean View Dairy - Marvin L. Nunes Date: 17-Dec-12
3975 Mark West Station Road, Windsor CA Time: 1:16 PM
Measure areas and report in the space provided. Rev: 11-Mar-12

1. Concrete Manured Areas; 100% runoff coefficient

Includes feed lots, alley ways, holding corrals, sick pens, calf lots, compost piles, solids storage areas, outside loafing areas, and similar hardened or manured areas with 100% runoff to manure storage

Area	Width	Length	Sq Ft	Location Notes	Acres
alley	20	492.5	9850	concrete alley between barns	0.23
			0		0.00
			0		0.00
			0		0.00
			0		0.00
			0		0.00
			9850 Square Feet	0.23 Acres	Used in Sec IV, Cell 4 Cell 3 / 43560.

2. Roof Areas; 100% runoff coefficient

Includes feed lots, alley ways, holding corrals, sick pens, calf lots, compost piles, solids storage areas, outside loafing areas, and similar hardened or manured areas with 100% runoff to manure storage

Area	Width	Length	Sq Ft	Location Notes	Acres
1	70	325	22750	silage pad, concreted	0.52
2			0		0.00
3			0		0.00
4			0		0.00
5					0.00
6			0		0.00
			22750 Square Feet	0.52 Acres	Used in Sec IV, Cell 4 Cell 3 / 43560.

3. Manure Pit and Liquid Storage Ponds: 100% catchment

Includes wastewater ponds, manure pits, flush water recycle ponds, manure sumps, etc.

Note: When measuring the waste storage capacity of ponds, include the capacity of pit(s) and other collection facilities. If more than one pond is used, measure all ponds. Allow for two feet of freeboard in the last pond when making measurements.

Pond/Pit	Width	Length	Sq Ft	**Avg** depth	Capacity	Location Notes	Acres
1	180	275.0	49500	8.8	10.00	Pond 1	1.14
2	150	276.0	41400	8.4	8.0	Pond 2	0.95
3			0		0.0		0.00
4			0		0.0		0.00
5			0		0.0		0.00
7			0		0.0		0.00
8			0		0.0		0.00
9			0		0.0		0.00
10			0		0.0		0.00
			90900 Square Feet	2.09 Acres	18.0 Acre-feet	Used in Sec IV, Cell 3, Section VI Cell 1	

Notes: Width and length adjusted to provide surface area per GPS and CAD-based aerial measurements
Average depth adjusted to provide spreadsheet-based capacity value based on surface area

4. Non-Concrete Manured Areas Draining to Storage

Includes tributary areas of clean water around barns and corrals that drain to manure ponds.

Area	Width	Length	Sq Ft	Location Notes	Acres
1	53.3	180	9600	corral 1	0.22
2	110.6	180	19900	corral 2	0.46
3	59.4	180	10700	corral 3	0.25
4	55.3	180	9950	corral 4	0.23
5	128.4	180	23120	manure storage 1	0.53
6	254.0	200	50800	manure storage 2	1.17
7	70	164.3	11500	manure storage 3	0.26
8			0		0.00
9			0		0.00
10					0.00
			135570 Square Feet	3.11 Acres	Cell 3 / 43560 Used in Sec IV, Cell 4

5. Crop and Pasture Areas Draining to Manure Storage Areas

Includes tributary areas of clean water away from dairy that drain to manure ponds.

Area	Width	Length	Sq Ft	Location Notes	Acres
1	50	1062.8	53140	Pond tributary areas per CAD	1.22
2	100	355	35500	hillside west of barns	0.81
3			0		0.00
4			0		0.00
5			0		0.00
			88640 Square Feet	2.03 Acres	Cell 3 / 43560 Used in SecIV, Cell 9

Nutrient Budgeting Worksheet

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This worksheet is intended to provide guidance for nutrient budgeting for management of manure produced by animals in both confined and unconfined conditions. It will partially fulfill facilities management plans as recommended by regulatory agencies.

Complete the **Producer** and **Area** worksheets prior to entering nutrient bugeting information. Provide inputs as required in empty green-shaded boxes in the Nutrient Bugeting worksheet. Calculation results are shown in non-shaded boxes.

Nutrient budgeting may include confined or unconfined animals, irrigated and non-irrigated land, fertilized or non-fertilized inputs, and may use lab or handbook data for stored manure nutrient values. **Several runs of this computer spreadsheet worksheet will be needed to evaluate confined animal manures, unconfined animal manures, and individual fields, either on-site or off-site, because of the large number of possible nutrient input combinations.** Take care when evaluating individual fields to include all inputs, and to eliminate duplicate accounting with such items as animals pastured elsewhere or fertilizer and irrigation water used elsewhere. Total ranch nutrient budgeting can be accomplished using total headcounts, acreages, etc., and will represent average conditions rather than site-specific conditions.

Results are based on a large number of input assumptions, and represent general nutrient budgeting trends, rather than an exact detail accounting of site-specific conditions. Detailed assessments will require concentration sampling and quantity measurements of soil, forage, crops, irrigation water, stored manure, and other inputs and outputs to the nutrient input, waste management, and nutrient consumption systems.

Section I. Producer Information

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Land Areas	**On-Site** Acres	**Off-Site** Acres	**Total** Acres
Total Property	172	0	172
Housing, corrals barn	17	0	17
Riparian, pond, swale, inaccessible	25		25
All Crop Lands	55		55
Pasture Lands Irrigated or dry	75	0	75

	Acres	Acres	Manure disposal Acres
Total Crop and Pasture	130	0	130

Section II: Pasture and Crop Nutrient Demand

Table 1. Plant Food Utilization by Various Crops

Total uptake in harvested portion. Reference: Table 4.1, Western Fertilizer Handbook

			Pounds per Acre		
	Crop	Yield	N	P_2O_5	K_2O
Field Crops	Corn - grain	5t/180bu	240	100	240
	Corn - silage	30t	250	105	250
	Grain sorghum	4t / 150bu	250	90	200
	Oats	1.6t/100bu	115	40	145
	Wheat	3t/100bu	175	70	200
	Barley	2.5t / 100bu	160	60	160
Fruit and Nut Crops	Apples	15t	120	55	215
	Grapes	15t	125	45	195
Forage Crops	Alfalfa	8t	480	95	480
	Bromegrass	5t	220	65	315
	Clover-grass	6t	300	90	360
	Orchardgrass	6t	300	100	375
	Sorghum-sudan	8t	325	125	475

Note: These paramete values may be adjustec as desired to best matc existing site conditions.

Change numbers in this table to adjust nutrient demands to reflect soils, slope, aspect, rainfall, other paramete affecting plant vigor an nutrient demand.

Timothy	4t	150	55	250
Vetch	7t	390	105	320
Coastal Dryland Pasture		200	80	175
Irrigated Pasture		275	90	300

Section III: Nutrient Composition of Manure

Nutrient concentration of manure depends on animal species and age, feed materials and additives, source of manure, storage method, length of storage, rainwater dilution, disposal method, and other factors. The most accurate nutrient budgeting estimates will be obtained if lab samples for nutrient concentration are taken from the storage area. A composite sample from several surface locations and depths within the storage is required for a representative value. The average table values shown from USDA-SCS Ag Waste Management Field Handbook are used for calculations if you do not provide site-specific nutrient concentrations.

Table 2. USDA-NRCS Ag Waste Handbook
Nutrients, lb/day/1000lb of animal

Nutrient Parameter	milking	dry	heifer
Nitrogen, N:	0.45	0.36	0.31
Phosphorous, P:	0.07	0.05	0.04
Potassium, K:	0.26	0.23	0.24
Copper, Cu:		22	

Table 3. Commercial Laboratory Analysis
of your stored liquid manure

	If available, enter data here	
Parameter	Milligrams/liter	Equivalent lb/gal
Nitrogen, N:		0.00000
Phosphorous, P:		0.00000
Potassium, K:		0.00000
Copper, Cu:		0.00000

Section IV. Annual Production of Animal Waste for All Livestock

Nutrient quantities stored in containment facilities are estimated in one of two ways:

1) USDA handbook N-P-K values are used with confined animal counts and manure production estimates obtained from the **Producer** worksheet.
2) If commercial lab analysis data for N-P-K is entered above, nutrient quantities are based on the lab concentration data times the pond storage volume obtained from the **Producer** worksheet.

Note that total nutrient quantity estimates in storage facilities may be significantly different using the two different approaches. Lab data from the storage pond will tend to be most accurate. This is because factors affecting nutrient concentration are taken into account, including seasonal dilution, process and wash water, actual manure quantities collected, external inputs to storage, changes during storage, and similar factors. Wide variation between individual facilities can be expected.

1. Handbook Method Animal counts from the companion **Producer worksheet** are multiplied by the appropriate table values for N, P, and K above to determine nutrient production.

Table 4. Unconfined Animal Nutrients
Production based on Handbook Values

	Unconfined Cubic Feet	Total Pounds of Nutrients N	P	K
Milk Cows	0	0	0	0
1400 lbs.	0	0	0	0
Dry Cows (1.5 1400 lbs.	25047	6754	938	4315
2yr->springer 900-1500 lbs.	32748	10862	1402	8410
Med. Heifers 500-900 lbs.	13099	6336	818	4906
Smal Heifers 250-500 lbs.	0	0	0	0
Baby Calves 100-250 lbs.	0	0	0	0
On Site Totals	70893	23952	3157	17630

Table 5. Confined Animal Nutrients
Production based on Handbook Values

Confined Cubic Feet	Total Pounds of Nutrients N	P	K
232236	52889	8227	30558
100972	22995	3577	13286
2243	756	118	437
0	0	0	0
0	0	0	0
2518	4993	777	2885
1162	2304	358	1331
339131	83936	13057	48497

2. Lab Data Method: Laboratory nutrient analysis of existing storage liquid is multiplied by existing pond storage volume to estimate total nutrient quantities in storage. Only for CONFINEMENT manure.

Note: If ponds are pumped to maintain adequate winter storage, or if storage encroaches into freeboard requirements, the working storage capacity is not a true measure of animal manure production and storage. Indicate additional storage in the box provided to account for total annual production.

Working storage capacity, from Producer Worksheet, Section VI: Acre-feet	Storage Additons, Acre-feet
-22.51	0.00

Cells G130+g134-F159 main sheet

Table 6. Confined Animal Manure Storage Nutrients

Based on lab sampling data, lb.		
N	P	K
0	0	0

3. Calculation Method for Acreage Requirments:

The remainder of this worksheet is used to determine the acres required for consumption of N - P - K nutrients in keeping with good crop management practices. Application rates consistent with crop uptake needs will maximize economic benefits of applied manures and will reduce chance of impairing surface water runoff quality.

Area requirement calculations are based on total nutrients produced. Indicate in the box below if the calculations for stored liquid and solid manures should be based on : 1 = Handbook values, or 2 = Lab Data values. Unconfined animal nutrient values are based on handbook information, because lab data for grazed animal manures is difficult to obtain.

CONFINED ONLY Animal Manure Nutrient Calculation Method: 1 (1 = Handbook Values, 2 = Lab Data Values)

Section V: Manure Nutrient Quantity Adjustments

1. Manure Storage Method

Nutrient losses from manure occur during collection, storage, application, and after land application. Losses can vary widely, depending on collection method, collection frequency, temperature, precipitation, type of handling system, duration, type, and location of storage, and other factors.

About half the N in fresh manure is inorganic, and subject to significant losses.
The table from Oregon State University publication EC1094 provides an estimate of NPK retained by various storage systems.
Lab nutrient analyses of manure take these storage losses into account. Use these adjustment values in Table 14 and Table 16

Table 7. Percentage of Original Manure Nutrient Content Retained by Storage System

	N	P	K
Daily Spread	80	90	90
Dry, under roof	70	90	90
Earth storage	55	60	70
Lagoon/flush	30	40	60
Open lot	60	70	65
Pits under slats	75	95	95
Scrape/storage tank	70	90	90
None (grazing)	100	100	100

2. Manure Spreading Method

Nitrogen nutrient losses from manure can occur during spreading (Fresh manure odor is mostly volatized ammonia). Essentially all phosphorus and potassium applied will be available to the crop. The table from OSU publication EC1094 summarizes percent nutrient delivered to cropland and available for plant uptake, based on application and preutilization losses. Use these adjustment values in Table 14 and Table 16 below.

Table 8. Percentage of Original Manure Nutrient Content Delivered to Crop and Available for Uptake

	N	P	K
Injection	95	100	100
Broadcast	80	100	100
Broadcast/cultivate	95	100	100
Sprinkling	75	100	100
Grazing	85	100	100

Section VI: Additional Nutrient Inputs

1. Commercial Fertilizer

Many ranchers provide supplemental fertilizer to pasture or silage crops, on an annual or other intermittent basis. These nutrients should be accounted for in a complete nutrient budget. Fertilizer may be applied in pastures where unconfined animals are grazed, in irrigated pastures, where manure is disposed, and in crop areas. This section estimates total nutrients available based on the fertilizer formulation used, the application rate, and the application frequency. Fertilizer composition data is from Western Fertlilzer Handbook, Table 5-5.

Table 9. Nutrient Value of Selected Commercial Fertilizers

Western Fertilizer Handbook Table 5-5 Fertilizer Formulation	Total Nitrogen N%	Available Phosphoric Acid P_2O_5%	Water-soluble Potash K_2O%
Ammonium nitrate	34		
Monoammonium phosphate	11	48	
Ammonium phosphate 1	13	39	
Ammonium phosphate 2	16	20	
Ammonium phosphate 3	27	12	
Diammonium phosphate	17	47	
Ammonium sulfate	21		
Anhydrous ammonia	82		
Aqua ammonia	20		
Sodium nitrate	16		
Urea	45		
Urea ammonium nitrate	32		
Single superphosphate		18	
Triple superphosphate		45	
Phosphoric acid		53	
Superphosphoric acid		80	
Potassium chloride			61
Potassium nitrate	13		44
Potassium sulfate			51
Sulfate of potash-magnesia			22

Indicate tons of fertilizer applied, area covered in acres, and how many years between applications for the commercial fertilizers noted. Formulations in Table 9 are used to estimate NPK application rates by fertilizer classification, using multipliers for elemental nutrients NPK.

You will need to rerun the spreadsheet to determine effects on individual fields, if all fields are not treated the same. Entering two kinds of fertilizer on a single field will result in acreage duplication in the Table 10 summary and errors in the nutrient budget summary in Table 14.

For simplicity, fertilizer nutrient values are included in both confined and unconfined animal manure disposal area evaluations, further down the spreadsheet. You will need to rerun the spreadsheet to individually evaluate confined and unconfined manure disposal areas, if both are not treated with equal amounts of commercial fertilizer.

Table 10. Commercial Fertilizer Application

Fertilizer Formulation	Fertilizer Application Data: Amount applied Tons	Area covered Acres	Application frequency Years	Nutrient Summary Pounds/acre/year: Total Fertilizer	N	P	K
Ammonium nitrate				0	0		
Monoammonium phosphate				0	0	0	
Ammonium phosphate 1				0	0	0	
Ammonium phosphate 2				0	0	0	
Ammonium phosphate 3				0	0	0	
Diammonium phosphate				0	0	0	
Ammonium sulfate				0	0		
Anhydrous ammonia				0	0		
Aqua ammonia				0	0		
Sodium nitrate				0	0		
Urea				0	0		
Urea ammonium nitrate				0	0		
Single superphosphate				0		0	
Triple superphosphate				0		0	
Phosphoric acid				0		0	
Superphosphoric acid				0		0	
Potassium chloride				0			0
Potassium nitrate				0	0		0
Potassium sulfate				0			0
Sulfate of potash-magnesia				0			0
Subtotals:		0	Acres	0	0	0	0

Average pounds per acre per year

2. Irrigation Water

Some dairy ranches utilize reclaimed water for irrigation purposes. This water may contain significant amounts of nutrients that must be included in the nutrient budget in order to obtain accurate results. This section estimates total nutrient availability based on lab data for the water and total application rate, in inches of water per year.

Enter nutrient concentrations in mg/l for N, P, and K. If nutrient concentrations are reported in other units, provide appropriate conversions before entering data. For example, multiply P_2O_5 by .4365 to obtain P and multiply K_20 by .8301 to obtain K.

For simplicity, irrigation water nutrient values are included in both confined and unconfined animal manure disposal area evaluations, further down the spreadsheet. You will need to rerun the spreadsheet to individually evaluate confined and unconfined manure disposal areas, if both are not treated with equal amounts of irrigation water.

Irrigated Area: 39 Acres per Year

Irrigation application: 6 inches per acre/year

Table 11. Irrigation Water Nutrients

Commercial Laboratory Analysis of your irrigation water

(City of Santa Rosa typical data, 1995)

Nutrient Parameter	If available, enter data here: Milligrams/liter	Equivalent lb/gal
Nitrogen, N:	30.6	0.00026
Phosphorous, P:	1.2	0.00001
Potassium, K:	2.0	0.00002
Copper, Cu:	0.02	0.00000

Table 12. Irrigation Water Nutrient Application Rate

Based on lab concentrations and inches/year

	Pounds/acre/year
N:	42
P:	2
K:	3
Cu:	0.0

Section VII: Manure Management on Available Acreage

1. Unconfined Animals on Seasonal Pastures:

Unconfined animals are grazed on pasture or crop stubble, with manure spread naturally by the animals. All manure nutrient content is retained by the system, and the only losses are due to denitirfication prior to plant uptake. Evaluate nutrient budgeting for unconfined animals by comparing annual NPK production to recommended NPK uptake for forage production on available acreage.

Indicate grazed acreage in Table 13 below. Nutrient demand is estimated based on published values in Table 1 above. Compare your yield values to those stated in Table 1. If your yields are significantly higher or lower, adjust the Table 1 nutrient demand values up or down to reflect actual crop demand based on local productivity.

Table 13. Grazed acreage for unconfined animals.

	On-Site Acres		Nutrient Demand, Pounds N	P_2O_5	K_2O
Field Crops					
Corn - grain			0	0	0
Corn - silage			0	0	0
Grain sorghum			0	0	0
Oats			0	0	0
Wheat			0	0	0
Barley			0	0	0
Fruit and Nut Crops					
Apples			0	0	0
Grapes			0	0	0
Forage Crops					
Alfalfa			0	0	0
Bromegrass			0	0	0
Clover grass	75.0		22500	6750	27000
Orchardgrass			0	0	0
Sorghum-sudan			0	0	0
Timothy			0	0	0
Vetch			0	0	0
Dryland Pasture			0	0	0
Irrigated Pasture			0	0	0
Subtotals:	75.0	acres pastured	22500	6750	27000

Table 14. Unconfined Animal Nutrient Balance Estimation

Note: This evaluation for grazed pasture areas is based on **handbook nutrient values**, since lab data for animal-distributed manure is difficult to obtain. It assumes that common acreage is used for livestock pasture and application of both commercial fertilizer and irrigation water. Unconfined animal counts are reported in the **Producer** worksheet. Return to previous sections if necessary to adjust animal counts, acreages, irrigation application, and commercial fertilizer application so that a valid evaluation may be made for pastured areas where unconfined animals are kept. Acre counts for Pastured, Irrigated, and Fertilized should be the same. Acres used for nutrient consumption should be equal to or less than total available on-site and off-site acres.

Acreage Check:	75.0	Pastured acres (Table 14)	130	On-site acres (Section 1)
		Irrigated acres (Table 11)	0	Off-site acres (Section 1)
	0	Fertilized acres (Table 10)	130	Total acres (Section 1)

irrigated acres = d281

1. Nutrient Inputs:

	N	P	K	
Table 4: NPK Production, lb:	23952	3157	17630	lb/yr
Table 7: Storage adjustment (grazing)	1.00	1.00	1.00	
Table 8: NPK delivery adjustment (grazing):	0.85	1.00	1.00	

Revise these adjustments to match your operation.

Estimated manure application rate by grazing animals:
29 tons/acre Based on Table 5 animal production quantities, pastured acres.

Available from manure:	Manure NPK available , lb:	20360	3157	17630	lb/yr
	Manure NPK available , lb/ac:	271	42	235	lb/ac
External Inputs:	**Table 10**: Comm'l Fert, lb NPK/ac:	0	0	0	lb/ac
	Table 12: Irrig Water, lb NPK/ac:				
	Subtotal Inputs:	271	42	235	lb/ac

42

2. Crop Nutrient Demands:	N	P	K	
Adjustment factor for elemental nutrient:	1.0000	0.4365	0.8301	
Table 13: Adjusted NPK requirement, lb:	300	39	299	lb/ac

3. Nutrient Balance:				
Subtotal Manure, Fertilizer, Irrigation Inputs, lb/yr:	271	42	235	lb/ac
Subtotal Crop and Pasture Consumption, lb/yr:	300	39	299	lb/ac
Difference, Inputs minus Outputs, lb/yr:	-29	3	-64	lb/ac

4. Nutrient Application Recommendations

Analysis based on total pastured acres.
cows on clover grass pasture

271	lb/ac N applied. Additional N permissible.	29	lb/ac additional N permissible.
42	lb/ac P applied. Reduce P inputs or increase acres.	3	lb/ac excess P application.
235	lb/ac K applied. Additional K permissible.	64	lb/ac additional K permissible.

2. Confined Animal Manure Disposal on Remote Fields:

Manure from confined animals is normally applied to pasture or crop stubble. The nutrient budget evaluation may be completed using either handbook values or lab analysis values. Manure nutrient quality may be adjusted for storage losses and application losses. Evaluate nutrient budgeting for seasonally-confined animals by comparing annual N-P-K production in storage to recommended N-P-K uptake for forage production on disposal acreage.

Table 15. Manure disposal acreage for confined animals.

	On-Site Acres		Nutrient Demand, Pounds N	P_2O_5	K_2O
Field Crops					
Corn - grain			0	0	0
Corn - silage			0	0	0
Grain sorghum			0	0	0
Oats			0	0	0
Wheat			0	0	0
Barley			0	0	0
Fruit and Nut Crops					
Apples			0	0	0
Grapes			0	0	0
Forage Crops					
Alfalfa			0	0	0
Bromegrass			0	0	0
Clover-grass	55.0		16500	4950	19800
Orchardgrass			0	0	0
Sorghum-sudan			0	0	0
Timothy			0	0	0
Vetch			0	0	0
Dryland Pasture			0	0	0
Irrigated Pasture			0	0	0
Subtotals:	55.0	acres spread	16500	4950	19800

Table 16. Confined Animal Nutrient Balance Estimation

Note: This evaluation for pasture and crop areas assumes that common acreage is used for stored manure disposal and application of both commercial fertilizer and irrigation water. Confined animal counts are reported in the **Producer** worksheet. Return to previous sections if necessary to adjust animal counts, confinement season, acreages, irrgation amounts, and commercial fertilizer amounts so that a valid evaluation may be made for pasture or crop areas where confined animal manures are disposed. Acre counts for Pastured, Irrigated, and Fertilized areas should be the same. Acres used for nutrient consumption should be equal to or less than total available on-site and off-site acres.

Acreage	55.0	manure disposal acres (Table 15)	130	On-site acres (Section 1)
Check:	39	irrigated acres (Table 11	0	Off-site acres (Section 1)
	0	fertilized acres (Table 1(	130	Total acres (Section 1)

Handbook values used for Liquid Manure nutrient estimation.

1. Nutrient Inputs:

		N	P	K	
Table 4: NPK Production, lb:		83936	13057	48497	lb/yr
Table 7:	Storage Adjustment (Earthen):	0.55	0.60	0.70	
Table 8:	Delivery Adjustment (Broadcast):	0.80	1.00	1.00	

Revise these parameters to match your operation.
(All storage adjustments = 1.00 for lab data approach)

Required manure application rate for disposal:
185 tons/acre Based on Table 5 animal production quantities, spread acres.

		N	P	K	
Available from manure:	Manure NPK available , lb:	36932	7834	33948	lb/yr
	Manure NPK available , lb/ac:	671	142	617	lb/ac
External Inputs:	**Table 10**: Comm'l Fert, lb NPK/ac:	0	0	0	lb/ac
	Table 12: Irrig Water, lb NPK/ac	42	2	3	lb/ac
	Subtotal Inputs:	713	144	620	lb/ac

2. Crop Nutrient Demands:	N	P	K	
Adjustment factor for elemental nutrient:	1.0000	0.4365	0.8301	
Table 15: Adjusted NPK requirement, lb:	300	39	299	lb/ac

3. Nutrient Balance:				
Subtotal Manure, Fertilizer, Irrigation Inputs, lb/yr:	713	144	620	lb/ac
Subtotal Crop and Pasture Consumption, lb/yr:	300	39	299	lb/ac
Difference, Inputs minus Outputs, lb/yr:	413	105	321	lb/ac

4. Nutrient Application Recommendations Analysis based on total manure disposal acres.

713 lb/ac N applied. Reduce N inputs or increase acres. 413 lb/ac excess N application.
144 lb/ac P applied. Reduce P inputs or increase acres. 105 lb/ac excess P application.
620 lb/ac K applied. Reduce K inputs or increase acres. 321 lb/ac excess application

Table 17. Fertilizer Economic Value

Relative value of animal manure and irrigation water nutrients may be determined by comparison to commercially available bulk grannular fertilizer. Enter comparative retail costs for Ammonium sulfate (16-20-0)and for Potassium Chloride KCl (0-0-60) below for use as benchmark values. Handling and spreading costs vary for each producer and are not considered in the evaluation.

Animal manures as fertlizer provide additional intangible benefits such as micronutrients, microbial populations, and organic matter for soil building.

1. Benchmark economic values Enter current fertilizer costs

Ammonium Sulfate (16-20-0), bulk grannular delivered to ranch:	$ 700.00	per ton
Potassium Chloride (0-0-60), bulk grannular delivered to ranch:	$ 600.00	per ton

	N	P	K		
Equivalent value, $/lb:	$ 0.0560	$ 0.0306	$ 0.1494		
Unconfined animal manure	$1,140	$96	$2,634	$3,871	unconfined
Confined animal manure	$2,068	$239	$5,073	$7,380	confined
Irrigation water	$91	$2	$16		
Applied Nutrient Values:	$3,299	$338	$7,723	Total Values	

Total Applied Nutrient Value: 11,360

This Nutrient Budgeting worksheet was developed to assist dairy ranch operators in evaluating waste management facilities and non-point source nutrient loading on their property, in order to better manage manures and protect fresh water resources. Developing and implementing a waste management plan based on appropriate management strategies will aid in preventing code violation through discharge of nutrient-laden materials into the waters of the region. The plan is the effort of the Gold Ridge Resource Conservation District, in cooperation with the University of California Cooperative Extension, Sonoma Marin Animal Waste Committee, North Coast Regional Water Quality Control Board, Natural Resource Conservation Service, and Western United Dairymen. The plan is a self-monitoring aid and may be used by anyone. The document may be copied and used freely. No warranty is expressed or implied and the authors are not responsible for facilities construction or operation or management decisions made on the basis of program outputs. Credit to the authors will be appreciated. L.R. Erickson Ph.D. Gold Ridge

Stage-Capacity Data
Erickson Engineering Inc.
Data from CAD

File: c:xl2k\project\Ocean View Pond 1
Property: Nunes Dairy
Project: Pond Volume Estimate
Location: Mark West Station Road
Date: 17-Dec-12 01:16 PM
Revised: 10-Mar-12

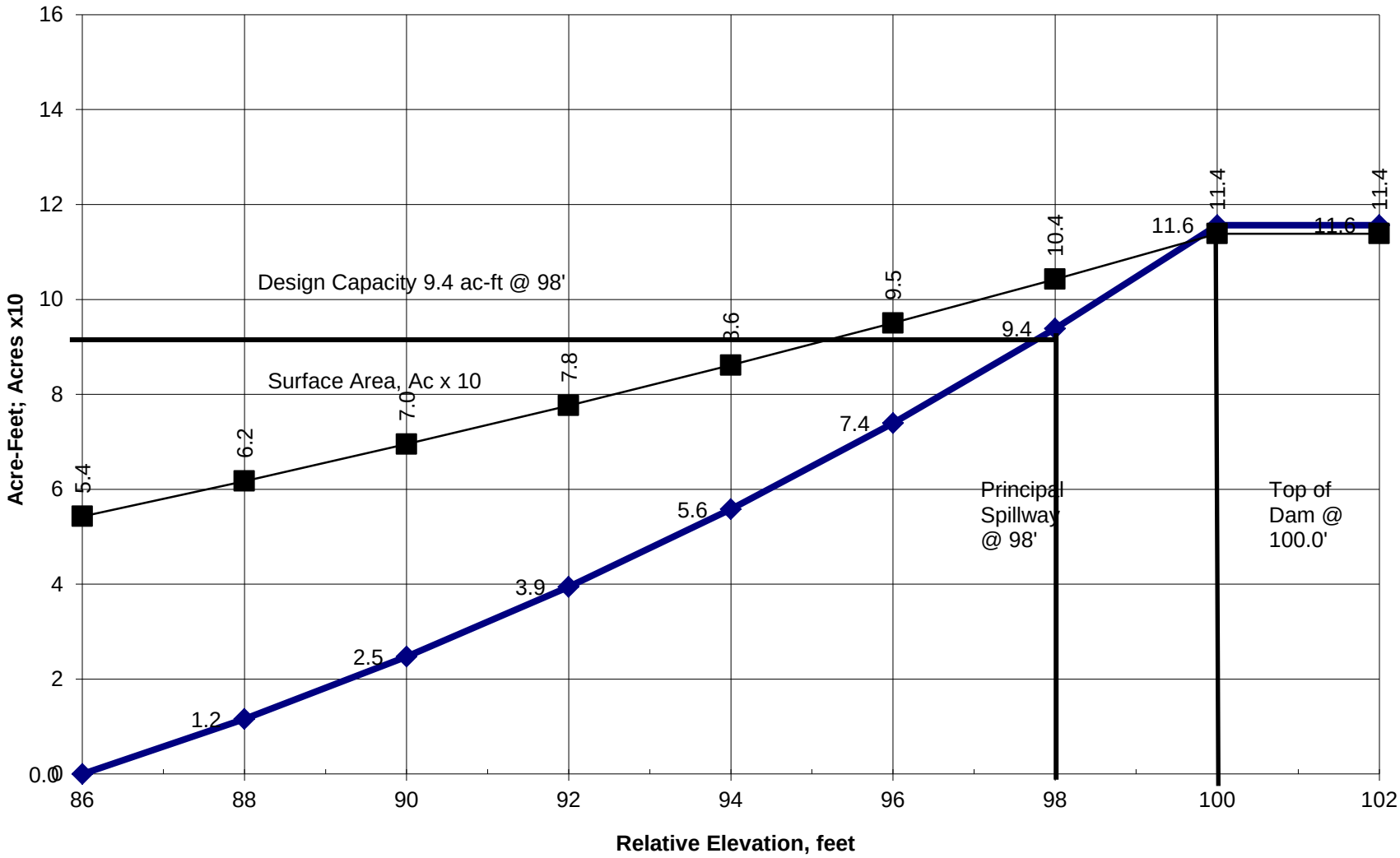
Elevation	Water Sq Ft	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Water Acre-Feet	H2O Area, Acres x 10	Water Gal x 10^6
112					11.57	11.38	
110			0	503870	11.57	11.38	3.774
108		0	0	503870	11.57	11.38	3.774
106		0	0	503870	11.57	11.38	3.774
104		0	0	503870	11.57	11.38	3.774
102			0	503870	11.57	11.38	3.774
100	49590	47500	95000	503870	11.57	11.38	3.774
98	45410	43400	86800	408870	9.39	10.42	3.062
96	41390	39460	78920	322070	7.39	9.50	2.412
94	37530	35675	71350	243150	5.58	8.62	1.821
92	33820	32050	64100	171800	3.94	7.76	1.287
90	30280	28583	57165	107700	2.47	6.95	0.807
88	26885	25268	50535	50535	1.16	6.17	0.379
86	23650		0	0	0.00	5.43	0.000
84			0	0	0.00	0.00	0.000
82		0	0	0	0.00	0.00	0.000
80		0	0	0	0.00	0.00	0.000
78		0	0	0	0.00	0.00	0.000
76		0	0	0	0.00	0.00	0.000
74		0	0	0	0.00	0.00	0.000
72		0	0	0	0.00	0.00	0.000
70		0	0	0	0.00	0.00	0.000
68		0	0	0	0.00	0.00	0.000
66		0	0	0	0.00	0.00	0.000
64		0	0	0	0.00	0.00	0.000
62		0	0	0	0.00	0.00	0.000
		0	0	0	0.00	0.00	0.000
		0	0	0	0.00	0.00	0.000
	288555	251935					

Elevation	Cut SF	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Tot Excav Acre-Feet	Cum Cuts Cu Yd/1000
112			0	0	0.0	0.000
110		0	0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000

78	0	0	0	0.0	0.000
76	0	0	0	0.0	0.000
74	0	0	0	0.0	0.000
72	0	0	0	0.0	0.000
70	0	0	0	0.0	0.000
68	0	0	0	0.0	0.000
66	0	0	0	0.0	0.000
64	0	0	0	0.0	0.000
62	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0					

Elevation	Fill Cu Ft	Avg Cu Ft	Volume Cu Ft	Cumulative Cu Ft	Fill Acre-Feet	Cum Fill Cu Yd/1000
112			0	0	0.0	0.000
110			0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000
78		0	0	0	0.0	0.000
76		0	0	0	0.0	0.000
74		0	0	0	0.0	0.000
72		0	0	0	0.0	0.000
70		0	0	0	0.0	0.000
68		0	0	0	0.0	0.000
66		0	0	0	0.0	0.000
64		0	0	0	0.0	0.000
62		0	0	0	0.0	0.000
0			0	0	0.0	0.000
0		0	0	0	0.0	0.000
0		0	0	0	0.0	0.000
	0	0	0		cut/fill ratio:	#DIV/0!

Ocean View Dairy
Pond 1 Estimated Capacity
2.5:1 slopes, 14' depth, surface area per GE aerial photo



Stage-Capacity Data
Erickson Engineering Inc.
Data from CAD

File: c:xl2k\project\Ocean View Pond 1
Property: Nunes Dairy
Project: Pond Volume Estimate
Location: Mark West Station Road
Date: 17-Dec-12 01:16 PM
Revised: 10-Mar-12

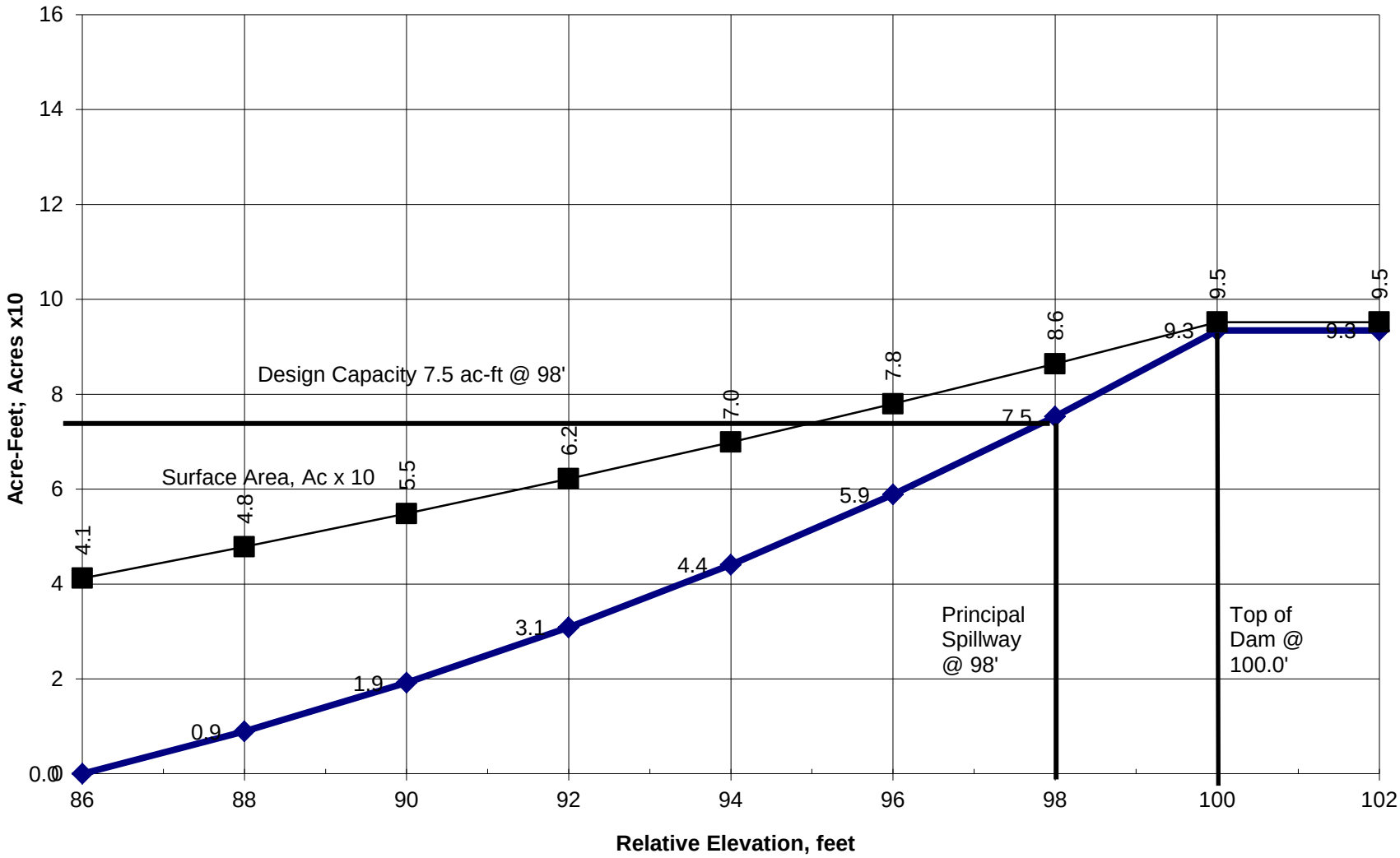
Elevation	Water Sq Ft	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Water Acre-Feet	H2O Area, Acres x 10	Water Gal x 10^6
112					9.35	9.52	
110			0	407100	9.35	9.52	3.049
108		0	0	407100	9.35	9.52	3.049
106		0	0	407100	9.35	9.52	3.049
104		0	0	407100	9.35	9.52	3.049
102			0	407100	9.35	9.52	3.049
100	41470	39555	79110	407100	9.35	9.52	3.049
98	37640	35800	71600	327990	7.53	8.64	2.457
96	33960	32200	64400	256390	5.89	7.80	1.920
94	30440	28760	57520	191990	4.41	6.99	1.438
92	27080	25480	50960	134470	3.09	6.22	1.007
90	23880	22360	44720	83510	1.92	5.48	0.625
88	20840	19395	38790	38790	0.89	4.78	0.291
86	17950		0	0	0.00	4.12	0.000
84			0	0	0.00	0.00	0.000
82		0	0	0	0.00	0.00	0.000
80		0	0	0	0.00	0.00	0.000
78		0	0	0	0.00	0.00	0.000
76		0	0	0	0.00	0.00	0.000
74		0	0	0	0.00	0.00	0.000
72		0	0	0	0.00	0.00	0.000
70		0	0	0	0.00	0.00	0.000
68		0	0	0	0.00	0.00	0.000
66		0	0	0	0.00	0.00	0.000
64		0	0	0	0.00	0.00	0.000
62		0	0	0	0.00	0.00	0.000
		0	0	0	0.00	0.00	0.000
		0	0	0	0.00	0.00	0.000
	233260	203550					

Elevation	Cut SF	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Tot Excav Acre-Feet	Cum Cuts Cu Yd/1000
112			0	0	0.0	0.000
110		0	0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000

78	0	0	0	0.0	0.000
76	0	0	0	0.0	0.000
74	0	0	0	0.0	0.000
72	0	0	0	0.0	0.000
70	0	0	0	0.0	0.000
68	0	0	0	0.0	0.000
66	0	0	0	0.0	0.000
64	0	0	0	0.0	0.000
62	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0					

Elevation	Fill Cu Ft	Avg Cu Ft	Volume Cu Ft	Cumulative Cu Ft	Fill Acre-Feet	Cum Fill Cu Yd/1000
112			0	0	0.0	0.000
110			0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000
78		0	0	0	0.0	0.000
76		0	0	0	0.0	0.000
74		0	0	0	0.0	0.000
72		0	0	0	0.0	0.000
70		0	0	0	0.0	0.000
68		0	0	0	0.0	0.000
66		0	0	0	0.0	0.000
64		0	0	0	0.0	0.000
62		0	0	0	0.0	0.000
0			0	0	0.0	0.000
0		0	0	0	0.0	0.000
0		0	0	0	0.0	0.000
	0	0	0		cut/fill ratio:	#DIV/0!

Ocean View Dairy
Pond 2 Estimated Capacity
2.5:1 slopes, 14' depth, surface area per GE aerial photo



Stage-Capacity Data
Erickson Engineering Inc.
Data from CAD

File: c:xl2k\project\Ocean View Stored 1
Property: Nunes Dairy
Project: Storage Volume Estimate
Location: Mark West Station Road
Date: 17-Dec-12 01:16 PM
Revised: 10-Mar-12

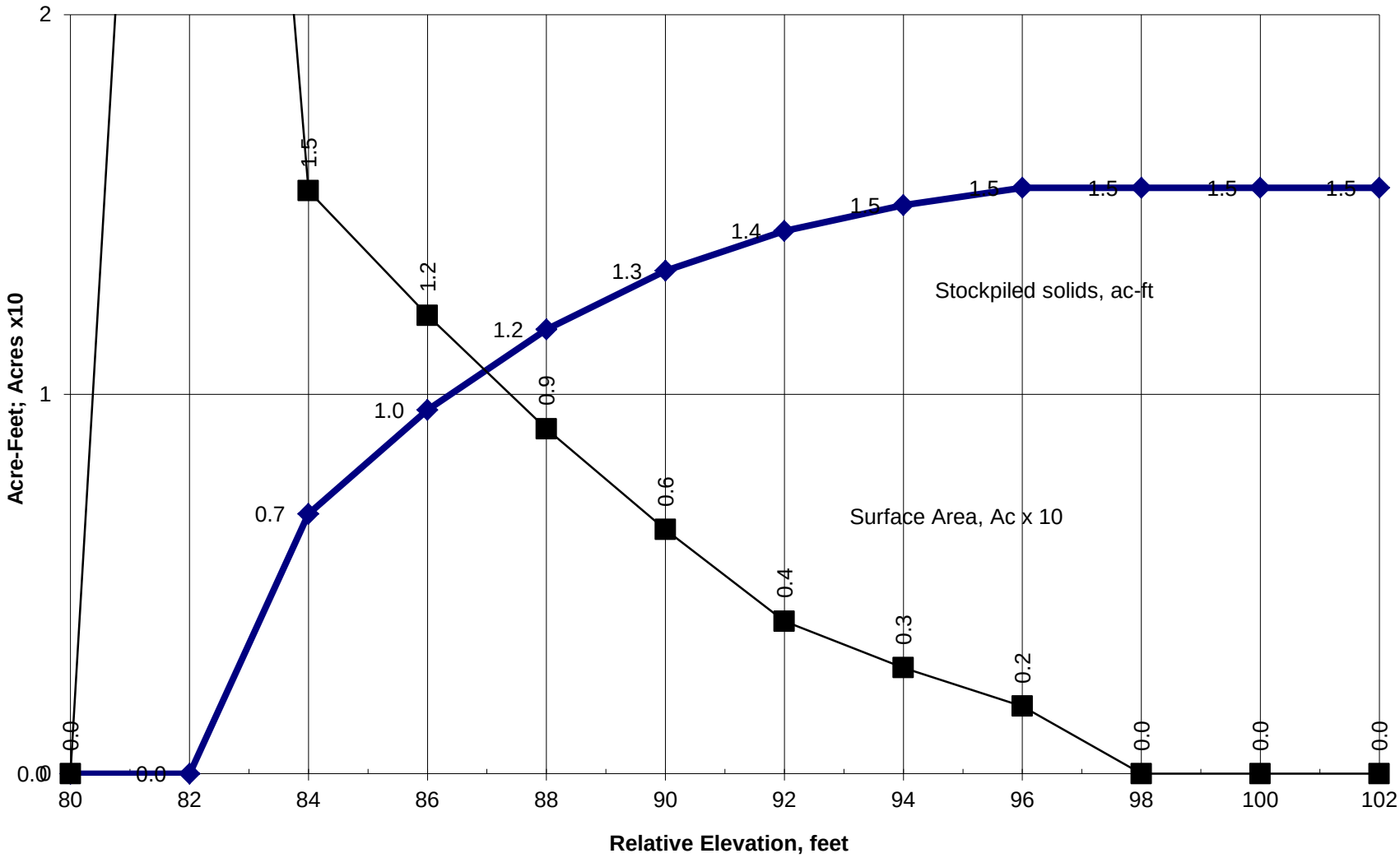
Elevation	Stored Sq Ft	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Manure Acre-Feet	Area, Acres x 10
112					1.54	0.00
110			0	67249	1.54	0.00
108		0	0	67249	1.54	0.00
106		0	0	67249	1.54	0.00
104		0	0	67249	1.54	0.00
102			0	67249	1.54	0.00
100		0	0	67249	1.54	0.00
98			0	67249	1.54	0.00
96	775	996	1991	67249	1.54	0.18
94	1216	1483	2966	65258	1.50	0.28
92	1750	2276	4552	62292	1.43	0.40
90	2802	3380	6760	57740	1.33	0.64
88	3958	4610	9219	50980	1.17	0.91
86	5261	5976	11951	41761	0.96	1.21
84	6690	14905	29810	29810	0.68	1.54
82	23120		0	0	0.00	5.31
80		0	0	0	0.00	0.00
78		0	0	0	0.00	0.00
76		0	0	0	0.00	0.00
74		0	0	0	0.00	0.00
72		0	0	0	0.00	0.00
70		0	0	0	0.00	0.00
68		0	0	0	0.00	0.00
66		0	0	0	0.00	0.00
64		0	0	0	0.00	0.00
62		0	0	0	0.00	0.00
		0	0	0	0.00	0.00
		0	0	0	0.00	0.00
	45572	33625				

Elevation	Cut SF	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Tot Excav Acre-Feet	Cum Cuts Cu Yd/1000
112			0	0	0.0	0.000
110		0	0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000

78	0	0	0	0.0	0.000
76	0	0	0	0.0	0.000
74	0	0	0	0.0	0.000
72	0	0	0	0.0	0.000
70	0	0	0	0.0	0.000
68	0	0	0	0.0	0.000
66	0	0	0	0.0	0.000
64	0	0	0	0.0	0.000
62	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0					

Elevation	Fill Cu Ft	Avg Cu Ft	Volume Cu Ft	Cumulative Cu Ft	Fill Acre-Feet	Cum Fill Cu Yd/1000
112			0	0	0.0	0.000
110			0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000
78		0	0	0	0.0	0.000
76		0	0	0	0.0	0.000
74		0	0	0	0.0	0.000
72		0	0	0	0.0	0.000
70		0	0	0	0.0	0.000
68		0	0	0	0.0	0.000
66		0	0	0	0.0	0.000
64		0	0	0	0.0	0.000
62		0	0	0	0.0	0.000
0			0	0	0.0	0.000
0		0	0	0	0.0	0.000
0		0	0	0	0.0	0.000
	0	0	0		cut/fill ratio:	#DIV/0!

Ocean View Dairy
Area 1 Stored solids volume
1.5:1 slopes, variable depth, surface area per GE aerial photo



Stage-Capacity Data
Erickson Engineering Inc.
Data from CAD

File: c:xl2k\project\Ocean View Stored 2
Property: Nunes Dairy
Project: Storage volume estimate
Location: Mark West Station Road
Date: 17-Dec-12 01:16 PM
Revised: 10-Mar-12

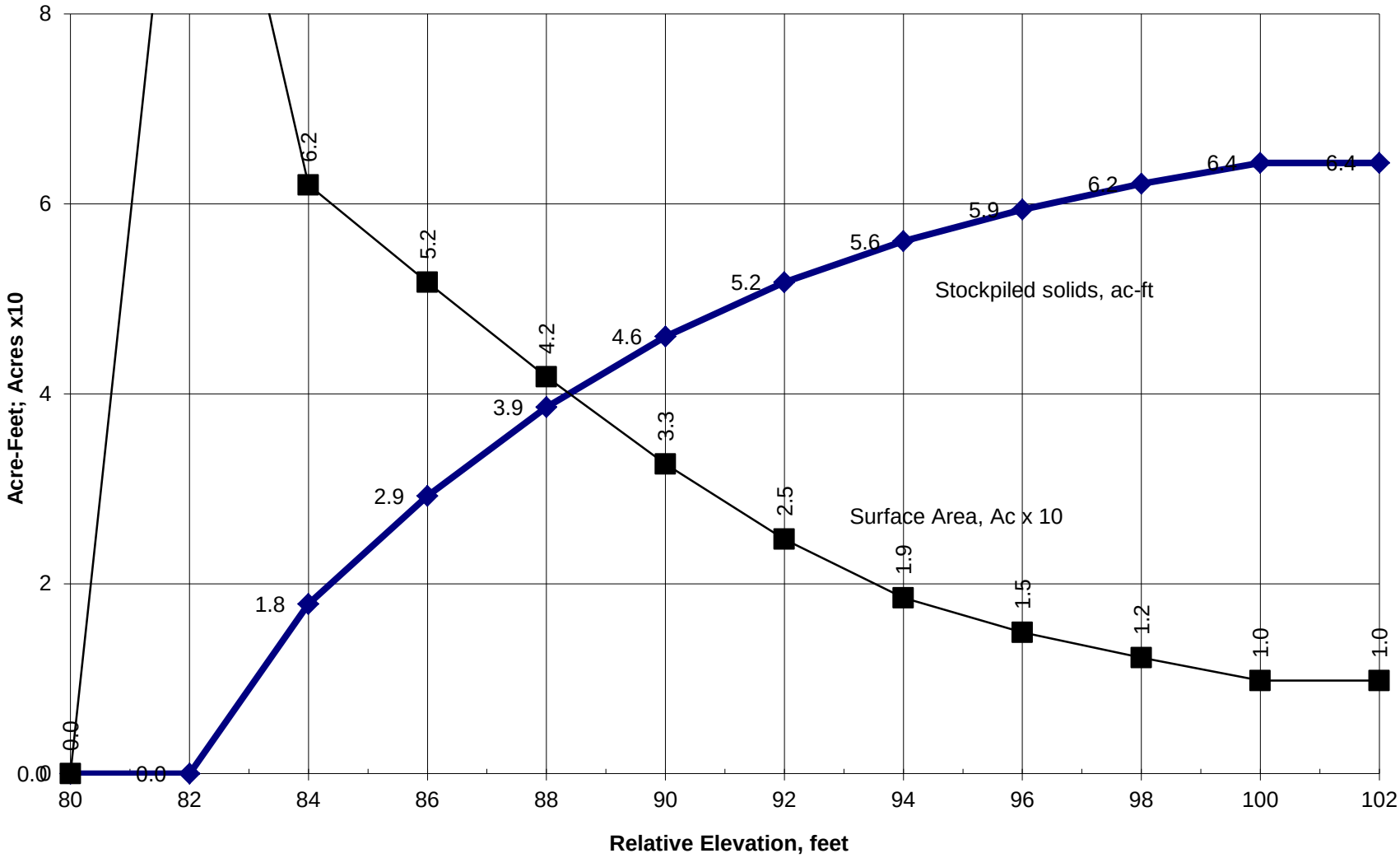
Elevation	Stored Sq Ft	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Manure Acre-Feet	Area, Acres x 10
112					6.43	0.98
110			0	280142	6.43	0.98
108		0	0	280142	6.43	0.98
106		0	0	280142	6.43	0.98
104		0	0	280142	6.43	0.98
102			0	280142	6.43	0.98
100	4266	4792	9584	280142	6.43	0.98
98	5318	5898	11796	270558	6.21	1.22
96	6478	7270	14539	258762	5.94	1.49
94	8061	9406	18811	244223	5.61	1.85
92	10750	12475	24950	225412	5.17	2.47
90	14200	16202	32404	200462	4.60	3.26
88	18204	20368	40735	168058	3.86	4.18
86	22531	24764	49527	127323	2.92	5.17
84	26996	38898	77796	77796	1.79	6.20
82	50800		0	0	0.00	11.66
80		0	0	0	0.00	0.00
78		0	0	0	0.00	0.00
76		0	0	0	0.00	0.00
74		0	0	0	0.00	0.00
72		0	0	0	0.00	0.00
70		0	0	0	0.00	0.00
68		0	0	0	0.00	0.00
66		0	0	0	0.00	0.00
64		0	0	0	0.00	0.00
62		0	0	0	0.00	0.00
		0	0	0	0.00	0.00
		0	0	0	0.00	0.00
	167604	140071				

Elevation	Cut SF	Avg SF	Volume Cu Ft	Cumulative Cu Ft	Tot Excav Acre-Feet	Cum Cuts Cu Yd/1000
112			0	0	0.0	0.000
110		0	0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000

78	0	0	0	0.0	0.000
76	0	0	0	0.0	0.000
74	0	0	0	0.0	0.000
72	0	0	0	0.0	0.000
70	0	0	0	0.0	0.000
68	0	0	0	0.0	0.000
66	0	0	0	0.0	0.000
64	0	0	0	0.0	0.000
62	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0	0	0	0	0.0	0.000
0					

Elevation	Fill Cu Ft	Avg Cu Ft	Volume Cu Ft	Cumulative Cu Ft	Fill Acre-Feet	Cum Fill Cu Yd/1000
112			0	0	0.0	0.000
110			0	0	0.0	0.000
108		0	0	0	0.0	0.000
106		0	0	0	0.0	0.000
104		0	0	0	0.0	0.000
102		0	0	0	0.0	0.000
100		0	0	0	0.0	0.000
98		0	0	0	0.0	0.000
96		0	0	0	0.0	0.000
92		0	0	0	0.0	0.000
88		0	0	0	0.0	0.000
86		0	0	0	0.0	0.000
84		0	0	0	0.0	0.000
82		0	0	0	0.0	0.000
80		0	0	0	0.0	0.000
78		0	0	0	0.0	0.000
76		0	0	0	0.0	0.000
74		0	0	0	0.0	0.000
72		0	0	0	0.0	0.000
70		0	0	0	0.0	0.000
68		0	0	0	0.0	0.000
66		0	0	0	0.0	0.000
64		0	0	0	0.0	0.000
62		0	0	0	0.0	0.000
0			0	0	0.0	0.000
0		0	0	0	0.0	0.000
0		0	0	0	0.0	0.000
	0	0	0		cut/fill ratio:	#DIV/0!

Ocean View Dairy
Area 2 Stored solids volume
1.5:1 slopes, variable depth, surface area per GE aerial photo



Manure Stockpile Volumentric Estimation

Ocean View Dairy - Marvin L. Nunes
3975 Mark West Station Road, Windsor CA

Date: 17-Dec-12
Time: 1:16 PM
Rev: 11-Mar-12

Area matches CAD

Visual estimate

	Width	Length	Sq Ft	**Avg** depth	ft^3	Location Notes	Acres
	100.0	143	14300	3.0	42900	manure storage 0	0.33
	128.4	180	23120	3.0	69360	manure storage 1	0.53
	254.0	200	50800	6.0	304800	manure storage 2	1.17
	10	158	1580	2.0	3160	manure storage 3	0.04
	70	164.3	11500	2.0	23000	manure storage 4	0.26
	100	108	10800	4.0	43200	manure storage 5	0.25
		Totals	112100		486420		
					52	lb/ft^3	18016 cy
					12647	tons	Use these for planning purposes

Contour method

ft^3	Location Notes
41540	manure storage 0
67250	manure storage 1
280140	manure storage 2
3160	manure storage 3
23000	manure storage 4
43200	manure storage 5
458290	
52	lb/ft^3 16974
11916	tons

Pacific Northwest Extension Service
http://cru.cahe.wsu.edu/cepublications/pnw0533/pnw0533.pdf

NPK range of values in storage lb per ton as-is[3]

Type	N lb/ton	N lb	P lb/ton	P lb	K lb/ton	K lb	Solids percent	lb/cy	lb/ft^3
Dry stack dairy	9	113822	1.8	22764	1.6	20235	35	1400	51.9
Separated dairy solids	5	49684	0.9	8943	2.4	23848	19	1100	40.7
Range, tons		57		11		10			
		25		4		12			

Area and volume matches CAD

	Width	Length	Sq Ft	**Avg** depth	ft^3	Location Notes	Acres
	180	275.0	49500	8.8	435600	Pond 1	1.14
	150	276.0	41400	8.4	348480	Pond 2	0.95
	20	60.0	1200	5.0	6000	Pond 3	0.03
		Totals	92100		790080		
					62.4	lb/ft^3	18.1 acre feet
					24650	tons	217.7 acre inches

Liquid storage, total nutrient values

Table 2 Average nutrient levels in dairy waste

Waste type	Total N	Organic	Ammonium	P2O5	K2O
Lagoon lb/ac-in	69	23	46	79	144

lb N	lb P2O5	lb K2O
1502	12036	21939

Table 5 Typical nutrient losses during handling and storage

System	N lost %		P lost %		K lost %
Lagoon, 365 day storage	90		50 to 80[5]		30 to 80[5]