Appendix 14-B

Calculating Use-Value Guidelines for Agricultural Land Assessment

Beginning in 1998, the assessed value of farmland for property tax purposes in Wisconsin is based on the productive capacity of the land. Use-values are determined using an income approach to value. Net income generated from farming the land is capitalized to estimate a value-in-use. The basic valuation model is:

Value = Income / Rate

Subtracting expenses from gross income determines the net income that the land is capable of generating. Income is related to the productive capability of the soil. The capitalization rate reflects the risks involved in the agricultural investment, which includes the cost of money, the expected rate-of-return, and the municipal effective tax rate.

Chapter Tax 18, which specifies the use-value calculation, has been revised to estimate rental income based upon the income an agricultural landowner receives from a crop-share lease. The revisions are effective for the 2018 assessment year. Under a crop-share lease, landowners and farm operators share the cost and income from growing a crop. In agreement with the agricultural industry standards for crop-share leases, gross income and direct operational costs are equally distributed between the landowner and farm operator. Property taxes are incurred by the landowner and labor and machinery costs are incurred by the farm operator. These specifications, which determine landowner net income, are discussed in further detail below.

This appendix describes how the full use-value of Wisconsin farmland was estimated for 2016 under the provisions of a crop-share lease. It explains the methodology and identifies the sources of the data. The Town of Christiana, located in southeast Dane County, is used as an example municipality.

Steps in the Process

Determine the estimated average gross income/acre for each county
Calculate the five year average base corn yield/acre
Calculate the five year average corn price received by farmers in Wisconsin ($/bu)
Calculate the average county gross income per acre under a crop-share lease ($/ac)
Yield/Acre x Price/Bushel = Gross income/Acre

Determine the estimated average net income/acre for each county
Calculate the landowner's net income per acre under a crop-share lease ($/ac)
Subtract return to management and cost of production from gross income

Determine the capitalization rate
Determine the capitalization rate
Capitalization rate = municipal tax rate + 5 year average ag loan rate or 11%, whichever is greater

Estimate use-value
Calculate the return for grade 2 and grade 3 land in the municipality
Calculate the return for pasture land in the municipality
Determine preliminary use-values ($/ac)
Net income/Cap rate = Use value/Acre
Determine the statewide use-value percentage change.
Calculate the annual statewide percentage change in the agricultural use values.
Calculate the annual statewide percentage change in Equalized Values.
Determine final 2015 use values.

Determine the Estimated Average Gross Income/Acre for Each County

The use-value law requires that the value of agricultural land be determined by the income that is or could be generated from its rental for agricultural use. The economic rent of agricultural land is related to the productivity of the soil. Many factors influence crop yields including weather conditions, technological change, and local soil conditions. With equivalent effort, productive soils will generally produce greater yields per acre than poor soils. Productive lands are generally more profitable and more valuable commanding higher rents in the agricultural marketplace.

County corn yields reported by the Wisconsin Agricultural Statistics Service are the chosen measure of productivity for estimating an average gross income/acre. Annual county corn yields reflect variability in weather, changes in technology, and the prevalent soil conditions in each county. Reliable corn yield data is only available at the county level. Therefore, the calculation of a *county* average gross income/acre is the base value in the model.

Calculate the Five-Year Average Base Corn Yield/Acre

The Wisconsin Agricultural Statistics Service (WASS) of the Wisconsin Department of Agriculture, Trade, and Consumer Protection collects data on Wisconsin crop production. WASS annually reports the acres of corn planted and harvested and the bushels of corn produced in each county in the state[1]. WASS aggregates Wisconsin's counties into nine agricultural statistical districts (see Attachment A). In any given year, some northern counties may not have yield figures published due to a low number of planted acres. In such cases, data from a county near the subject county will serve as a proxy. The tabulated average is adjusted by the relationship between the subject county and the substituted county. This relationship is established through the measurement of the difference between the subject county and the substitute when data was available for the subject county in the past. The yield function for Douglas County is:

$$Y(D) = 5.2629 + 0.8038*(\text{Sawyer County Yield})$$

The value of 5.2629 is the intercept term and the slope coefficient is 0.8038. The slope coefficient implies the yield for Douglas County changes 0.8038 bushels for each change of 1 bushel in the yield for Sawyer County. Table 1 provides the linear yield equations for counties without yield data.

[1] CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin (WASS)

Table 1 Counties Without Corn Yield Data

Counties Without Data	Replacement County	Linear Yield Equations
Clark County	Marathon County	Y=-1.197423921+1.046069822(Marathon County)
Taylor County	Marathon County	Y= 4.434996752+1.011681398 (Marathon County)
Milwaukee County	Racine County	Y= 47.547429+0.552679(Racine County Yield)
Ozaukee County	Racine County	Y= 32.356227+0.665578(Racine County Yield)
Langlade County	Marinette County	Y= 34.7538532+0.647031(Marinette County Yield)
Sawyer County	Rusk County	Y= 13.1225867+0.784931(Rusk County Yield)
Ashland County	Price County	Y = 18.3696 + 0.7292 (Price County Yield)
Bayfield County	Rusk County	Y = 24.919654 + 0.699497 (Rusk County Yield)
Douglas County	Rusk County	Y = 19.66912 + 0.7324738 (Rusk County Yield)
Florence County	Marinette County	Y = -7.44327 + 1.011157(Marinette County Yield)
Forest County	Marinette County	Y = -24.72910 + 1.268253 (Marinette County Yield)
Iron County	Price County	Y = 0.2958 + 0.9233 (Price County Yield)
Oneida County	Marinette County	Y = -12.24965 +1.075145 (Marinette County Yield)
Vilas County	Price County	Y = 13.245303 +.7733247 (Price County Yield)
Menominee County	Shawano County	Y= 13.2498+1.09114*(Shawano County Yield)

Figure 1 shows Dane County's reported corn yield for the last five years and the five-year moving average. The calculated average yield for Dane County is 163 bushels per acre (rounded to the nearest whole bushel).

Figure 1

Calculation of 5-Year Average Corn Yield (Dane County)

Year	Yield (bu/ac)
2011	164
2012	112
2013	176
2014	181
2015	184
5-Year Average	**163**

Calculate the Five-Year Average Corn Price Received by Farmers in Wisconsin

The five-year moving average corn price per bushel is calculated on a 60-month basis. Use of a 60-month average price incorporates monthly market price fluctuations resulting in a smoother year-to-year average price than five annual averages or five single-month prices. The price of corn, like other commodities, may exhibit volatility within any particular year. A 60-month average (five years) will dampen the effect of unusual monthly price changes within a year, yet preserve the general price trend within the five-year moving average period. The United States Department of Agriculture's National Agricultural Statistics Service (NASS) reports monthly corn prices for Wisconsin (see Figure 2).

Figure 2

Prices received by farmers, by year, by month (Wisconsin corn for grain, 2011-2015)

	Year		**J**an	**F**eb	**M**arch	**A**pril	**M**ay	**J**une	**J**uly	**A**ug	**S**ept	**O**ct	**N**ov	**D**ec
Corn	2011	55	4.90	5.59	5.60	6.27	6.47	6.40	6.27	7.09	6.95	5.56	5.75	5.73
Corn	2012	55	5.78	6.07	6.25	6.15	6.17	6.44	6.64	7.39	7.05	6.33	6.90	6.80
Corn	2013	55	6.93	7.03	7.06	6.95	6.77	6.80	6.80	6.18	5.68	4.68	4.38	4.31
Corn	2014	55	4.40	4.30	4.47	4.55	4.72	4.56	4.28	3.80	3.53	3.67	3.61	3.67
Corn	2015	55	3.74	3.75	3.72	3.73	3.48	3.48	3.78	3.67	3.58	3.57	3.42	3.38

60 Month Average = 5.28

Calculate the Average County Gross Income per Acre for a Landowner's Crop-Share Lease

The average gross income per acre (*GI*) is calculated for agricultural land within each county. Corn yield data from NASS does not include production information by tillable soil grade. The model assumes that corn is only grown on the best soils, namely Grade 1. Once a value for Grade 1 soil is estimated, the estimated values for other soil grades will be determined from the relationship between the productivity ratings[2] of each grade across the state. Figure 3 is an example of the gross income calculation for Grade 1 land in Dane County. Based on reported statistical data over the five-year period from 2011 through 2015 the average corn yield per acre of land in Dane County was 163 bushels (Y). The five-year average income received by a landowner under a crop-share lease, where income and direct operating costs are equally shared between the landowner and farm operator, is $5.28÷ 2, or $2.64 per bushel (P). As illustrated in Figure 3, a yield of 155 bushels generates a landowner an average gross income of $430.11 per acre.

Figure 3

Gross income formula

GI = Y $_{\text{5-year}}$	X	P $_{\text{5-year}}$
GI = 163 bu/acre	X	$2.64/bu = $430.32

[2] Land Capability and Yields Per Acre of Crops and Pasture from USDA/NRCS county soil surveys.

Determine the Estimated Average Net Income Per Acre by County

Calculate the Landowner's Net Income per Acre Under a Crop-Share Lease

Once gross income per acre is calculated, production and management expenses must be subtracted. The US Department of Agriculture publishes cost data for corn production. The five-year average cost of production is estimated to be $498.25 per acre. The cost of production per acre is not constant across all soils and counties. Costs will vary depending upon the yield expected given local soil and weather conditions (factors in productivity). Therefore, we calculate a unit cost (cost per bushel) by dividing the average cost per acre by the average yield per acre. The unit cost per bushel is derived from five-year averages for the Northern Crescent Region. The five-year average corn yield for the Northern Crescent Region (2011-2015) is 148 bushels per acre. The five-year average direct production costs for corn is $280.18/acre, which includes the cost of seed, fertilizer, soil conditioners, manure, chemicals, custom operations, other variable cash expenses, and interest on operating capital. The unit cost of production per bushel is $280.18 ÷ 148, or $1.89 per bushel. The amount incurred by a landowner under a crop-share lease agreement, where income and direct operating costs are equally shared between the landowner and farm operator, is $1.89 ÷ 2, or $.95 per bushel.

The per acre cost of production for Dane County is $.95 x 163 bu/acre, (5yr ave of corn 2011-2015) or $154 / acre (rounded). A management expense of 7.5 percent is deducted from gross income. The management expense accounts for administrative and land maintenance expenses that are incurred by the landowner. Land maintenance expenses will typically include weed eradication, laser leveling, irrigation ditch construction, and any other costs of maintaining or improving the agricultural productivity of the land. The management expense (M) is $32.27/acre. Figure 4 shows that the average net operating income (NOI) is calculated at $243.20 by subtracting the cost of production and management expense from gross income. Because the purpose of the calculation is property assessment, property taxes are realized in the capitalization rate and not as an expense.

Figure 4

Net Income per Acre

NOI	= GI	- OE	-	ME	
NOI	= $430.32	- $154.85	-	$32.27	=$243.20

Determine the Capitalization Rate

Now that net operating income has been determined, a capitalization rate is constructed. The capitalization rate is the sum of an agricultural loan interest rate and the effective full value tax rate, or 11 percent, whichever is greater. The administrative rule[3] for the assessment of agricultural property specifies the interest rate component as the five-year average of the effective 1-year adjustable rate mortgage interest rate for medium-sized agricultural loans. The rate is set as of January 1 of the five years prior to the assessment year. The rates are derived from a survey of each federal land credit associations (FLCA) and each agricultural credit association (ACA) in Wisconsin. For example, the current five-year interest rate history in Wisconsin is shown in Figure 5.

Figure 5

Agricultural Interest Rates

	Interest rate on January 1[4]
2013	3.80%
2014	4.05%
2015	4.18%
2016	4.40%
2017	4.53%
5-Year Average =	4.19%

The second component of the capitalization rate is specified as the effective full value tax rate. This is the net full value tax rate of each municipality for the property tax levied two years prior to the assessment year (the most recent data). The 2017 effective tax rate for the Town of Christiana in Dane County was 0.01490 or 1.49 percent. The overall capitalization rate (OCR) is the sum of the agricultural loan interest rate and the effective full value tax rate, or 11 percent, whichever is greater. As shown in Figure 6, the calculated rate for 2018 is 5.62 percent and lower than 11 percent. The actual 2018 capitalization rate is 11 percent.

Figure 6

Capitalization Rate Construction

Overall capitalization rate for 2018, Town of Christiana, Dane County	
Agricultural loan interest rate:	4.19%
Effective full value tax rate:	1.49%
Calculated rate =	5.62%
Actual rate =	11.00%

[3] Chapter Tax 18.07 - Use-Value

[4] The statutory assessment date is January 1. The Interest rate is determined on the first business day of the new year.

Estimate Use-Value

The traditional capitalization formula used to convert income into value is:

Value = Income / Rate

The first step in the process was to determine the estimated income that farmland is capable of generating from agricultural use. As it is used here, income from farming is synonymous with "rent." The model estimates the net return to the land from farming, or economic rent. The economic rent, sometimes referred to as market rent, is the rental income that a property would most probably command in the open market. Net return to the land is the amount a lessee could pay in rent and still be compensated for their work effort after expenses. Economic rent, in economic terms, refers to the "rent" payments landowners received for the services of their land. Gross income is the amount of money that the land can generate before expenses. Net income, or net return to the land, is derived from gross income. The estimated average county gross income for this process is the product of the five-year average corn price (per bushel) times the county five-year average corn yield.

Calculate the Return for Grades 2 and Grade 3 Land in the Municipality

The Wisconsin Agricultural Statistics Service's nine agricultural districts are grouped into 3 latitudinal "tiers," North, Central and South. The use-value of grades 2 and 3 are determined by the relationships between the average soil productivity for each grade of soil within each agricultural tier. Soil productivity ratios (PR) are established by dividing the average grade 1 productivity by the average grade 2 productivity and the average grade 2 productivity by the average grade 3 productivity in each tier. The productivity ratios for Dane County by grade are shown in Figure 7.

Figure 7

Soil Productivity Ratios (PR)

Dane County - Southern Tier			
	Grade 1	**Grade 2**	**Grade 3**
Average productivity =	163	138	100
Productivity ratio 1:2 =		1.1854	
Productivity ratio 2:3 =			1.3734

Once the productivity relationships have been determined, the 5-year average corn yield (grade 1) in any county can be extended to impute corn yields for grades 2 and 3. Imputed corn yields on grade 2 and 3 lands are substituted into the equation from Figure 3 to derive the estimated gross income from each soil grade. Net income for each grade is calculated following the formula in Figure 4. Figure 8 summarizes these calculations for the Town of Christiana in Dane County.

Figure 8

Return Calculation for Grades 1, 2, & 3

Town of Christiana - Dane County - Southern Tier	Grade 1	Grade 2	Grade 3
5-year average corn yield ($Y_{5\text{-Year}}$)	163	--	--
Productivity ratio (PR)	--	1.1854	1.3734
Imputed yield (Y)		138	100
5-year average corn price ($P_{5\text{-Year}}$)	$5.28	$5.28	$5.28
Gross income/Acre (GI)	$430.32	$364.32	$264.00
Management expense (ME)	($32.27)	($27.32)	($19.80)
Production cost (OE)	($154.85)	($131.10)	($95.00)
Net return/Acre	$243.20	$205.90	$149.20

Calculate the Return for Pasture Land in the Municipality

Data on Wisconsin cropland and pasture rents have been analyzed and a relationship between average cropland rents and average pasture rents established. The rent data indicate that typical pasture rents at approximately 30% of an area's prevailing average cropland rent. This statistical relationship is applied to the average cropland rent for each county and estimated as the average of the net returns to grades 1, 2 and 3 lands. Following the cropland/pasture relationship, the average pasture rent is 30% of average net return across all three grades. Figure 9 shows the pasture calculation for the Town of Christiana.

Figure 9

Pasture Return for T. of Christiana

Grade 1 net return	$ 243.20
Grade 2 net return	$ 205.90
Grade 3 net return	$ 149.20
Average cropland net return	$ 199.40
Pasture net return (30%)	$ 59.83

Determine Preliminary Use-Values ($/ac)

The model assumes that corn is primarily grown on the best soils (Grade 1). The net income per acre of $243.20 capitalized by the rate of 0.110 results in a Grade 1 use-value for land in the Town of Christiana of $2,211 per acre.

Figure 10

Grade 1 Use-Value Calculation

NOI	÷	OCR	=	UV grade 1
$243.20	÷	0.11	=	$2,210.91 or $2,211 /acre

The returns calculated for grade 2, grade 3, and pasture are capitalized in Figure 11.

Figure 11

	Grade 1	Grade 2	Grade 3	Pasture
Return	$243.20	$205.90	$149.20	$59.83
Capitalization Rate	0.11	0.11	0.11	0.11
Use Value	$2,210.91	$1,871.81	$1,356.36	$543.91
Rounded	$2,211/acre	$1,872/acre	$1,356/acre	$544/acre

Determine the Statewide Use-Value Percentage Change

Annual changes in the use-values for agricultural land assessment is limited to the annual statewide change in equalized values less the value of agricultural land and new construction (Tax 18.07). Figure 12 provides the statewide change in Equalized Values from 2017 to 2018 less the value of agricultural land and new construction. The percentage change in the use-values for the 2017 assessment year to 2018 is 2.54 percent for all grades.

Figure 12
Annual statewide percentage change in equalized values

	2016	2017
Equalized Value	$505,124,328,250	$525,984,545,850
Less Net New Construction*	-$7,026,001,600	$8,044,351,000
Less Agricultural Land	-$2,077,862,400	$2,104,285,300
Total	$496,020,464,250	$503,046,465,850
Amount of Change		$12,789,443,700
Percentage Change		2.54%

*Net new construction equals new construction less demolition.

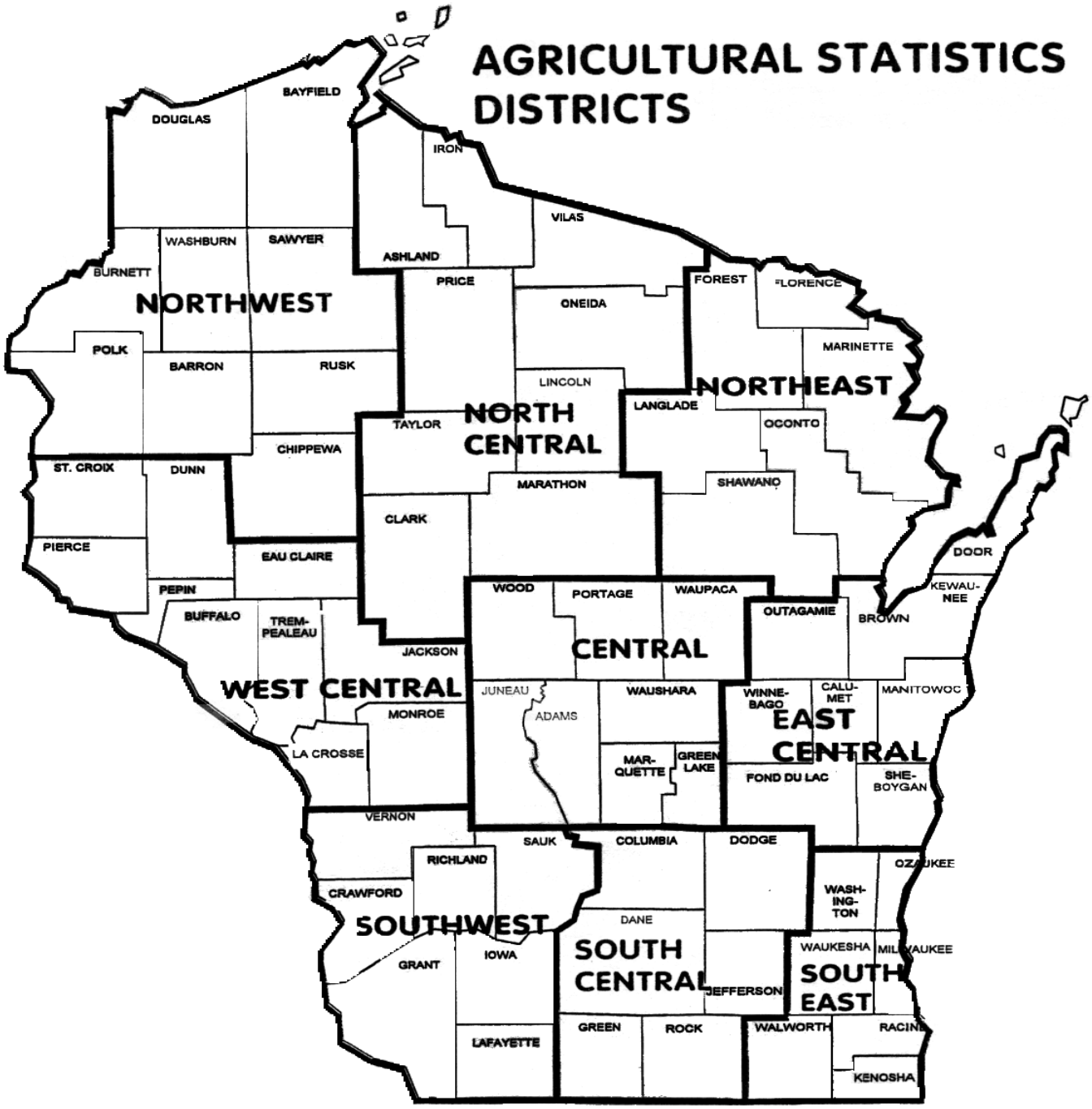
Determine Final 2018 Use-Values

Figure 13 shows the 2018 use-value guidelines for the Town of Christiana.

Figure 13
Town of Christiana, Dane County, final 2018 Use-Values

	Grade 1	Grade 2	Grade 3	Pasture
2017 Use-Value	$289	$244	$177	$71
Amount of Change at 2.54%	$7	$6	$5	$2
2018 Use-Value	$296/acre	$250/acre	$182/acre	$73/acre

Attachment A



Attachment B

Sources of Data

United States Department of Agriculture - *Corn Price, Corn Yield*

National Agricultural Statistics Service
Room 5829
1400 Independence Avenue, SW
Washington D.C. 20250
(202) 727-2707
NASS Hotline: 1-(800)-727-9540
Internet: http://www.nass.usda.gov/About_NASS/index.asp

Economic Research Service - *Corn Cost of Production*
1800 M St., NW
Washington, DC 20036-5831
(202) 219-0515
Internet: http://www.ers.usda.gov/

USDA Economics and Statistics System at Mann Library, Cornell University.
USDA Data Available On-line
Internet: http://usda.mannlib.cornell.edu/MannUsda/homepage.do

Wisconsin Department of Agriculture, Trade, and Consumer Protection

Wisconsin Agricultural Statistics Service - *Corn Price, Corn Yield*
P.O. Box 8934
Madison, WI 53708-8934
(608) 224-4848
Contact: Greg Bussler, State Statistician
Internet: http://www.nass.usda.gov/wi/

Wisconsin Department of Revenue - *Capitalization Rate Components*

Division of State and Local Finance
Office of Assessment Practices - *Agricultural Loan Rate*
P.O. Box 8971
Madison, WI 53708-8971
Contact: Mark Paulat
(608) 266-2317

Local Government Services Bureau- Municipal Property Tax Rate
P.O. Box 8971
Madison, WI 53708-8971
Contact: Valeah Foy
(608) 261-5360
Internet: http://www.revenue.wi.gov/

Attachment C

Farmland Advisory Council Members

Richard G. Chandler	Chair, Secretary of Revenue
Vacant	Agribusiness Person
Herb Tauchen	Farmer
Amber Keller	Agricultural Lender
Bruce Jones	Agricultural Economist - UW System
Tim Hanna	Mayor of a city with population more than 40,000 - City of Appleton
Jordan Lamb	Environmental Expert
Vacant	Non-Agricultural Business Person
Steven Hintz	Professor of Urban Studies
Vacant	Agribusiness Person
Michael Denor	Assessor