

APPENDIX C

**2011 PANHANDLE REGIONAL WATER PLAN TASK 2 REPORT:
AGRICULTURAL WATER DEMAND PROJECTIONS**

**2011 Panhandle Regional Water Plan
Task 2 Report:
Agricultural Water Demand Projections**

**A Water Planning Report
by**

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2011 Panhandle Regional Water Plan Task 2 Report: Agricultural Water Demand Projections

Executive Summary

In the Texas 2006 Regional Water Plan (2006RWP), over 92% of all water use in Region A occurred by the agricultural sector. Irrigated crop use accounted for almost 98% of the total agricultural water demand, while livestock production used just over two percent. The magnitude of agricultural water demand makes accurate water use assessment of this sector critical in future water planning efforts. Therefore, the overall objective of Task 2 of the regional water planning and management project under the Panhandle 2011 Regional Water Plan (2011RWP) was to update and refine water use estimates as they relate to changed conditions since the 2006RWP. Specific objectives of Task 2 included: 1) Review of prior agricultural water use estimates for eight major irrigated crop categories and the addition of new crop sectors that have emerged within the region; 2) Update acreages, irrigation application data by producers and compute the latest average ET demand data to update irrigation water use estimates; 3) Document the irrigation estimation model assumptions concerning updated producer adoption rates and aquifer water availability; 4) Collect recent data on livestock production, develop anticipated livestock trends and update livestock water use by species; and 5) Develop new agricultural demand estimates for Region A.

The amount of irrigated acreage significantly influences water use estimates. The 2006 – 2008 average irrigated acres by county and crop obtained from the Farm Service Agency (FSA) were used as the basis for making the 2011RWP water uses computations. In cases where significant acreage deviations has occurred from the previous 2006RWP values, comparison was made with another acreage source and analyzed to provide the most appropriate and representative crop acreage for use in calculation of the water use estimates. In counties with major changes in irrigated acreage comparisons with Texas Agricultural Statistics Service (TASS) acreages were reviewed to validate the changes. Differences are provided for each county per crop and represent acreage shifts and reductions within the region. The total crop acreage used in the 2006RWP for Region A was over 1.65 million and the acreage used in the 2011RWP approaches 1.44 million. This difference represents a total irrigated decline of 216,759 acres or 13.1%. The primary change in irrigated acreage occurred in wheat which showed a decrease of 177,103 acres. The change in irrigated wheat acreage accounted for 81.7% of the decrease in irrigated acreage from the 2006RWP to the 2011RWP. Most of the decrease in irrigated wheat acreage can be attributed to a data collection error that occurred in the 2006RWP development process. Several counties showed shifts in crop type, such as, in Carson, Collingsworth, Dallam, Hansford, and Hartley counties. Significant acreage shifts were noted in the counties of Hutchison, Moore, Ochiltree, Roberts and Sherman.

Under Task 2 of the 2011RWP, TAMA (Texas A&M–Amarillo) based water personnel were charged with updating the Region A irrigated water use projections. Using the TAMA model, water demand for irrigated agriculture was estimated utilizing compiled FSA acreage numbers. The total regional water demand estimates using the TAMA model indicates an overall reduction of irrigation demand as compared to the prior 2006RWP estimates. This was in part to regional based acreage changes, crop type shifts, reduced irrigation capacity and higher energy prices. Nonetheless, there are substantial differences in projected irrigation demand for several counties, such as Hartley, resulting from the area dairy demands. As before, Dallam, Hartley,

Moore, and Sherman represent the largest irrigated water use counties in the region. The next largest county based irrigation users are Ochiltree, Hansford and Carson.

Using FSA acreages along with the addition of three crop categories, updated long-term, quadrangle based, average rainfall computations of irrigated water demands indicated that five counties were again responsible for majority of water use in Region A. Additional TAMA model modifications included the water use attributed to “hailed out” crop acreages within the region. Refinements to future year water demands were made by “resetting” the adoption and availability factors from year 2010 which in turn provided new estimates that again were lower as compared to those predicted in the 2006RWP. Available irrigation demand estimates are also presented considering deductions of water demand increases in livestock water use.

Current, livestock inventories were estimated, water use by species and future growth rates were modified, where warranted, under the guidance of three expert advisory committees. The resultant projected water use in the Region A livestock sector is predicted to increase 40% from 2000 to 2060 which represents approximately two to three percent of the total water use in the region. However, the 2011RWP total livestock water use estimates are significantly less (70%) than the 2006RWP projections due to the changes in swine projections and water use by species. The largest livestock water use group is projected to be the fed cattle industry with an annual usage of 25,973 ac-ft/year by 2060. The forecasted expansion of the dairy industry results in a water usage estimate by 2060 of 10,011 ac-ft/year. These two user groups account for 68% of projected livestock water use in 2060. The swine industry is the third largest water user group with a projected annual water use of 5,883 ac-ft/year in 2060.

The 2011RWP total agricultural water use demand was derived using the revised projected irrigation and livestock estimates. Increases in livestock water use past 2010 were designated to be derived from the irrigation sector and the increases were deducted from the 2020 and beyond values accordingly. Overall, agricultural water use projections declined an average of 17% as compared to the prior 2006RWP estimates for 2010 through 2060. Livestock increase reductions to the irrigation demand, however, only represent an average decrease of 2.51% from 2020 through 2060. The 2011RWP estimates indicate a total Region A agricultural water use demand of 1,469,667ac-ft as compared to the previous 2006RWP value of 1,713,466 ac-ft in 2010. The revised value represents a reduction of 14.23%.

2011 Panhandle Regional Water Plan Task 2 Report: Agricultural Water Demand Projections

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Nomenclature regarding the assessment of agricultural demand estimates authorized by Texas Legislative Senate Bill 1 (TWDB, 2009a) and subsequent legislation are herein referred to as the 2001 Regional Water Plan (2001RWP), the 2006 Regional Water Plan (2006RWP) and the 2011 Regional Water Plan (2011RWP).

In the 2006RWP, it was calculated that over 92% of all water use in Region A occurred by the agricultural sector. Irrigated crop use accounted for almost 98% of the total agricultural water use, while livestock production used just over two percent. The magnitude of the water use in agriculture makes accurate water use assessment of this sector critical to future water planning within the region.

The objective of this project task is to update water use estimates for Region A agriculture. The specific objectives are:

1. Review prior agricultural water use estimates for eight major irrigated crop categories and add new crop sectors that have emerged within the region since the prior estimates,
2. Update acreages, irrigation application data by producers and compile the latest average ET demand data to update the irrigation water use estimates,
3. Document the estimation model assumptions concerning updated producer adoption rates and aquifer water availability,
4. Collect recent data on livestock production, develop anticipated livestock trends and update livestock water use by industry type, and
5. Revise and supply new agricultural demands for Region A.

1. Review prior agricultural water use estimates

The amount of irrigated acreage and appropriate crop categories dramatically impact the computation of the regional water use estimates. Accurate acreage values are crucial in water use predictions and high water use crop acreage variations are magnified when projecting water use over the next 50-year planning horizon.

2011RWP Texas A&M–Amarillo Model Crop Categories

Three new crop categories were compiled for the 2011RWP computations and added to the 2006RWP water use categories in the Texas A&M-Amarillo (TAMA) irrigation demand estimation model. The crop categories of alfalfa, forage sorghum and sunflowers were included based on either shifted regional or initiated production acreage trends since year 2000. Thus, the 2011RWP TAMA model resulted in a total of 11 total crop categories. In several counties,

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acreage shift out of a certain crop category resulted in an increase or establishment of a new production category. For example, shifted regional acreage (reduction) of corn to alfalfa, forage sorghum and wheat occurred particularly in response to the new cheese plant located in Dallam County. Area demand in Hartley and Sherman counties also increased forage production to meet the new dairy needs. Other county crop shifts were noted and examined accordingly. Generally, county based reductions in wheat production were identified and seen shifted into other categories from the 2000 to 2008 period, although in some counties an overall reduction was seen.

In addition to the three crop categories, another significant addition to the 2011RWP TAMA model included the amount of hailed out seasonal acreages and accompanying water use. In the TAMA model, it was assumed that 50% of the seasonal crop water was applied at the time of hail out events. These parameter values were selected based on the author(s)' field production experience and typically witnessed events amassed over time from within the region. Thus, the TAMA model now incorporates planted, hailed and harvested acreage data per crop per county.

2. Estimated Irrigated Acreages used in the TAMA Model Water Use Estimations

In the 2006RWP, it was determined that generally the most representative acreage values were derived with use of the Farm Service Agency (FSA) data. Thus, FSA acreage values were again utilized in the projections of Task 2 of the 2011RWP.

For the 2006RWP, estimates of irrigated acreages for the year 2000 were developed for each of eight crop categories by county. Crop categories included corn, cotton, sorghum, hay, pasture, peanuts, soybeans, and wheat. For the 2011RWP, irrigated acreage was determined using an average of FSA reported acreage from years 2006, 2007 and 2008. This average value was determined to provide the "best" representative acreage value(s), particularly as they have been recently influenced by shifts in corn and other alternative oilseed crop production due to recent energy demands and commodity price escalation. Subsequently, a comparison and review of the 2000 to the 2008 average values was computed and reviewed.

The planted irrigated acreages used in the 2006RWP, the 2011RWP and the associated change are presented in Table 2-1. A significant drop in the Region A planted irrigated acres has occurred (decrease of 216,759 acres) between the 2000 base used in the 2006RWP versus the 2006 – 2008 FSA average that was used in the 2011RWP effort. A portion of the decline in planted irrigated acreage was anticipated given rising energy costs and declining water tables leading to abandonment of some irrigated acreage and a reduction in double cropping practices. However, it is believed that a majority of the difference is due to errors in the 2000 planted acreage estimates which lead to an overestimate in the amount of irrigated acres in some counties. In the 2006RWP, FSA provided a summary of the data which had to be queried on a county-by-county basis. This procedure may have lead to errors in the data collection process, in particular, regarding irrigated wheat. In the 2011RWP, all county records were provided from a centralized database from which the A&M team was provided the raw data from each county. Data were assembled for each crop and calculations were spot checked manually to insure accuracy.

Table 2-1. 2006RWP and 2011RWP Region A irrigated acres by county.

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	County Difference, pia
Armstrong	12,233	4,813	-7,420
Carson	96,966	54,940	-42,026
Childress	9,640	8,392	-1,248
Collingsworth	21,459	36,252	14,793
Dallam	251,606	232,707	-18,899
Donley	18,268	21,766	3,498
Gray	29,409	21,901	-7,508
Hall	20,212	22,423	2,211
Hansford	127,128	122,447	-4,681
Hartley	216,022	210,890	-5,132
Hemphill	3,179	1,982	-1,197
Hutchinson	61,292	36,295	-24,997
Lipscomb	12,241	19,012	6,771
Moore	156,302	140,832	-15,470
Ochiltree	96,929	59,607	-37,322
Oldham	4,607	3,917	-690
Potter	5,616	2,859	-2,757
Randall	28,953	20,883	-8,070
Roberts	18,442	5,665	-12,777
Sherman	235,347	180,208	-55,139
Wheeler	9,572	10,873	1,301
Total regional acreage	1,435,423	1,218,664	-216,759

Notes: 1) A negative difference represents a decrease in acreage, and
 2) Irrigated acreages are based on county crop planted irrigated acreage (pia).

The Region A planted irrigated acreages used by county by crop in the 2006RWP, the 2011RWP and the associated changes are presented in Table 2-2. It should be noted that three crops were added to the 2011RWP analysis; alfalfa, forage sorghum and sunflowers. These crops had no acreage assigned in the 2006RWP analysis and were “lumped” into other crop categories. Therefore, some slight distortion may occur in the acreages of the crop categories they were assigned in the 2006RWP comparative to the 2011RWP.

The primary change in irrigated acreage occurred in wheat which showed a decrease of 177,103 acres. The change in irrigated wheat acreage accounted for 81.7% of the decrease in irrigated acreage from the 2006RWP to the 2011RWP. Again, most of the decrease in irrigated wheat acreage can be attributed to a data collection error that occurred in the 2006RWP assessment effort.

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference.

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
ARMSTRONG			
Alfalfa:	0	268	268
Corn:	732	718	-14
Cotton:	0	447	447
Hay:	0	0	0
Pasture and Other:	0	45	45
Peanuts:	0	0	0
Sorghum:	2,491	806	-1,685
Forage sorghum:	0	690	690
Soybeans:	1,404	58	-1,346
Sunflowers:	0	0	0
Wheat:	7,606	1,783	-5,823
CARSON			
Alfalfa:	0	800	800
Corn:	15,966	17,039	1,073
Cotton:	682	16,746	16,064
Hay:	926	0	-926
Pasture and Other:	3,660	645	-3,015
Peanuts:	0	0	0
Sorghum:	12,819	6,984	-5,835
Forage sorghum:	0	1,037	1,037
Soybeans:	11,402	695	-10,707
Sunflowers:	0	0	0
Wheat:	51,511	10,994	-40,517
CHILDRESS			
Alfalfa:	0	194	194
Corn:	0	132	132
Cotton:	5,687	5,534	-153
Hay:	87	0	-87
Pasture and Other:	232	219	-13
Peanuts:	1,411	621	-791
Sorghum:	33	117	84
Forage sorghum:	0	267	267
Soybeans:	0	0	0
Sunflowers:	0	0	0
Wheat:	2,190	1,309	-881

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference (continued).

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
COLLINGSWORTH			
Alfalfa:	0	1,179	1,179
Corn:	30	78	48
Cotton:	5,508	16,645	11,137
Hay:	707	0	-707
Pasture and Other:	34	305	271
Peanuts:	14,114	9,463	-4,651
Sorghum:	245	3,245	3,000
Forage sorghum:	0	713	713
Soybeans:	0	0	0
Sunflowers:	0	0	0
Wheat:	821	4,625	3,804
DALLAM			
Alfalfa:	0	3,689	3,689
Corn:	166,949	124,076	-42,873
Cotton:	15	1,441	1,426
Hay:	299	0	-299
Pasture and Other:	3,515	4,770	1,255
Peanuts:	0	82	82
Sorghum:	5,482	7,382	1,900
Forage sorghum:	0	1,720	1,720
Soybeans:	784	545	-239
Sunflowers:	0	2,896	2,896
Wheat:	74,562	86,106	11,544
DONLEY			
Alfalfa:	0	2,378	2,378
Corn:	1,216	1,242	26
Cotton:	5,303	5,951	648
Hay:	2,149	0	-2,149
Pasture and Other:	1,716	3,075	1,359
Peanuts:	2,689	4,485	1,796
Sorghum:	187	601	414
Forage sorghum:	0	1,181	1,181
Soybeans:	323	35	-288
Sunflowers:	0	0	0
Wheat:	4,685	2,819	-1,866

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference (continued).

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
GRAY			
Alfalfa:	0	510	510
Corn:	6,268	6,278	10
Cotton:	54	4,258	4,204
Hay:	572	0	-572
Pasture and Other:	1,564	2,027	463
Peanuts:	0	0	0
Sorghum:	1,210	1,858	648
Forage sorghum:	0	751	751
Soybeans:	3,226	81	-3,145
Sunflowers:	0	0	0
Wheat:	16,515	6,139	-10,376
HALL			
Alfalfa:	0	694	694
Corn:	0	0	0
Cotton:	11,349	17,785	6,436
Hay:	329	0	-329
Pasture and Other:	41	1,467	1,426
Peanuts:	6,379	931	-5,448
Sorghum:	23	292	269
Forage sorghum:	0	201	201
Soybeans:	0	0	0
Sunflowers:	0	45	45
Wheat:	2,091	1,007	-1,084
HANSFORD			
Alfalfa:	0	1,009	1,009
Corn:	31,668	42,829	11,161
Cotton:	0	3,572	3,572
Hay:	859	0	-859
Pasture and Other:	1,452	973	-479
Peanuts:	0	0	0
Sorghum:	6,563	1,378	-5,185
Forage sorghum:	0	2,163	2,163
Soybeans:	6,943	1,378	-5,565
Sunflowers:	0	1,069	1,069
Wheat:	79,643	68,076	-11,567

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference (continued).

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
HARTLEY			
Alfalfa:	0	9,444	9,444
Corn:	131,041	113,581	-17,460
Cotton:	2,925	4,297	1,372
Hay:	1,809	0	-1,809
Pasture and Other:	9,128	1,860	-7,268
Peanuts:	0	0	0
Sorghum:	7,944	9,445	1,501
Forage sorghum:	0	1,994	1,994
Soybeans:	1,052	1,342	290
Sunflowers:	0	3,609	3,609
Wheat:	62,123	65,318	3,195
HEMPHILL			
Alfalfa:	0	90	90
Corn:	0	79	79
Cotton:	250	0	-250
Hay:	449	0	-449
Pasture and Other:	970	404	-566
Peanuts:	0	0	0
Sorghum:	1,180	94	-1,086
Forage sorghum:	0	105	105
Soybeans:	0	37	37
Sunflowers:	0	0	0
Wheat:	330	1,173	843
HUTCHINSON			
Alfalfa:	0	163	163
Corn:	14,401	13,458	-943
Cotton:	0	2,740	2,740
Hay:	198	0	-198
Pasture and Other:	1,644	3,804	2,160
Peanuts:	0	0	0
Sorghum:	4,052	1,496	-2,556
Forage sorghum:	0	359	359
Soybeans:	2,421	176	-2,245
Sunflowers:	0	47	47
Wheat:	38,576	14,052	-24,524

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference (continued).

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
LIPSCOMB			
Alfalfa:	0	244	244
Corn:	4,956	3,608	-1,348
Cotton:	0	249	249
Hay:	175	0	-175
Pasture and Other:	2,390	2,429	39
Peanuts:	0	0	0
Sorghum:	385	919	534
Forage sorghum:	0	582	582
Soybeans:	0	243	243
Sunflowers:	0	827	827
Wheat:	4,335	9,911	5,576
MOORE			
Alfalfa:	0	2,098	2,098
Corn:	83,739	56,732	-27,007
Cotton:	0	16,000	16,000
Hay:	927	0	-927
Pasture and Other:	2,325	1,151	-1,174
Peanuts:	0	0	0
Sorghum:	15,666	21,450	5,784
Forage sorghum:	0	1,199	1,199
Soybeans:	7,556	628	-6,928
Sunflowers:	0	811	811
Wheat:	46,089	40,763	-5,326
OCHILTREE			
Alfalfa:	0	354	354
Corn:	15,626	18,344	2,718
Cotton:	0	3,483	3,483
Hay:	437	0	-437
Pasture and Other:	1,494	693	-801
Peanuts:	0	0	0
Sorghum:	9,367	7,863	-1,504
Forage sorghum:	0	1,668	1,668
Soybeans:	14,578	3,167	-11,411
Sunflowers:	0	577	577
Wheat:	55,427	23,457	-31,970

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference (continued).

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
OLDHAM			
Alfalfa:	0	15	15
Corn:	0	188	188
Cotton:	30	0	-30
Hay:	0	0	0
Pasture and Other:	399	223	-176
Peanuts:	0	0	0
Sorghum:	1,140	1,588	448
Forage sorghum:	0	238	238
Soybeans:	0	0	0
Sunflowers:	0	0	0
Wheat:	3,038	1,666	-1,372
POTTER			
Alfalfa:	0	808	808
Corn:	347	7	-340
Cotton:	225	130	-95
Hay:	1,158	0	-1,158
Pasture and Other:	227	0	-227
Peanuts:	0	0	0
Sorghum:	724	55	-669
Forage sorghum:	0	206	206
Soybeans:	125	0	-125
Sunflowers:	0	64	64
Wheat:	2,810	1,589	-1,221
RANDALL			
Alfalfa:	0	727	727
Corn:	1,824	686	-1,138
Cotton:	2,472	1,169	-1,303
Hay:	697	0	-697
Pasture and Other:	0	1,086	1,086
Peanuts:	0	0	0
Sorghum:	6,804	5,634	-1,170
Forage sorghum:	0	474	474
Soybeans:	120	0	-120
Sunflowers:	0	81	81
Wheat:	17,036	11,026	-6,010

Table 2-2. Comparison of the 2006RWP and the 2011RWP planted irrigated acreage by county and by crop 2000, 2006-2008 average and acreage difference (continued).

County	2006RWP 2000, pia	2011RWP 2006-2008 Average, pia	Acreage difference, ac.
ROBERTS			
Alfalfa:	0	0	0
Corn:	1,971	2,129	158
Cotton:	0	682	682
Hay:	61	0	-61
Pasture and Other:	8,049	494	-7,555
Peanuts:	0	0	0
Sorghum:	921	311	-610
Forage sorghum:	0	374	374
Soybeans:	1,684	351	-1,334
Sunflowers:	0	0	0
Wheat:	5,756	1,325	-4,431
SHERMAN			
Alfalfa:	0	683	683
Corn:	91,741	76,444	-15,297
Cotton:	399	16,861	16,462
Hay:	878	0	-878
Pasture and Other:	1,016	3,028	2,012
Peanuts:	0	0	0
Sorghum:	15,028	12,328	-2,700
Forage sorghum:	0	2,410	2,410
Soybeans:	5,043	492	-4,551
Sunflowers:	0	1,624	1,624
Wheat:	121,242	66,339	-54,903
WHEELER			
Alfalfa:	0	616	616
Corn:	375	1,038	663
Cotton:	2,264	3,063	799
Hay:	123	0	-123
Pasture and Other:	339	207	-132
Peanuts:	692	1,404	712
Sorghum:	1,784	380	-1,404
Forage sorghum:	0	483	483
Soybeans:	120	0	-120
Sunflowers:	0	0	0
Wheat:	3,875	3,681	-194
Total regional crop acreage	1,435,423	1,218,664	-216,759

Note: A negative difference represents a decrease in acreage.

Counties with a change of more than more than 10,000 planted irrigated acres from the 2006RWP to the 2011RWP were flagged for additional scrutiny. These counties included Carson, Collingsworth, Dallam, Hutchinson, Moore, Ochiltree, Roberts and Sherman. In addition, Hartley was included due to the increased irrigation well drilling that has occurred in this county.

To check the validity of acreage estimates used in these selected counties, 2006 – 2007 average FSA acreage for the major irrigated crops (corn, cotton, sorghum, soybeans and wheat) were compared to TASS reported acreage for the same years and crops. A summary of the findings is presented in Table 2-3. The 2006 – 2007 data were used for comparison since the TASS 2008 data by county is not yet available.

Overall, there was very little variation in the total planted irrigated acreage for the major crops between the FSA and TASS data. TASS reported about 12,000 less acres than FSA for a difference of 1.37%. However, Roberts and Collingsworth had significant differences in planted irrigated acreage of 114.46% and 21.18%, respectively. It should be noted the relatively small planted irrigated acreages in these counties tends to distort the magnitude of percentage changes. Second and more importantly, TASS does not report planted acres for crops with relatively low acreages for disclosure reasons resulting in an artificially low irrigated planted acres in those counties. It can be concluded that the FSA acreages used in the 2011RWP effort are reasonably accurate.

Table 2-3. 2006 - 2007 average planted irrigated acres from TASS and FSA for the major crops in selected Region A counties.

Counties	2006-2007 TASS Average Acres	2006-2007 FSA Average Acres	Difference in Sources, acre	Percent Difference in Sources, %
Carson	51,150	51,336	-186	-0.36
Collingsworth	19,300	23,388	-4,088	-21.18
Dallam	220,900	219,539	1,361	0.62
Hartley	189,500	195,862	-6,362	-3.36
Hutchinson	28,200	28,507	-307	-1.09
Moore	130,800	133,347	-2,547	-1.95
Ochiltree	57,800	55,351	2,449	4.24
Roberts	2,250	4,825	-2,575	-114.46
Sherman	172,800	172,506	294	0.17
Totals	872,700	884,661	-11,961	-1.37

Note: The above counties had more than 10,000 acreage decrease from the 2006RWP to the 2011RWP.

Estimated Crop Evapotranspiration (ET)

Estimation of crop evapotranspiration (ET) can and does have a significant impact on water demand computations. All ET data in the water use estimates were based on ET data recorded and acquired from the North Plains ET network (NPET, 2009 - a part of the Texas High Plains ET network - TXHPET, 2009). Crop ET variations can and do occur per year due to differing climatic demands as shown in Figure 2-1; however, an averaged ET demand approach is typically more applicable and desirable for predictive water planning purposes. The variation in corn demand for Moore County using 2005 versus 2007 ET values shown in Figure 2-1 would result in corn water

use seasonal fluctuation of over 15,200 ac-ft. Extrapolating such fluctuations accurately over a 50-year time period would be truly difficult and, thus, it appears not the best approach given available, representative data.

The respective crop ET values used in the 2011RWP TAMA model calculations from year 2000 to 2010 were determined using a proportional and weighted type computational approach. From year 2000 through 2008, the annual county crop ET was based on a proportional change per annum between the two values. The relationship could be either increasing or decreasing per crop between the two time periods and was observed to have occurred, as such, within the various crops of the counties. In computation of the projected 2010 value, the long-term average (LTA) ET value was added to the proportioned 2000 to 2008 values, thus, resulting in a “weighted type” decadal value for year 2010. This per crop value was then used as the ET value(s) for the decadal year computations of 2020 through 2060. A plot of the proportional ET trend for Moore County is illustrated in Figure 2-2 for years 2008 through 2010. (The vertical scale of the plot is kept the same as Figure 2-1 for comparative purposes.) A comparison of the irrigation demand between Figures 2-1 and 2-2 results in approximately the same total decadal value. Thus, for predictive purposes, the proportionally weighted crop ET values of 2010 were computed for each county and crop and used in computations for the decadal years of 2020 through 2060.

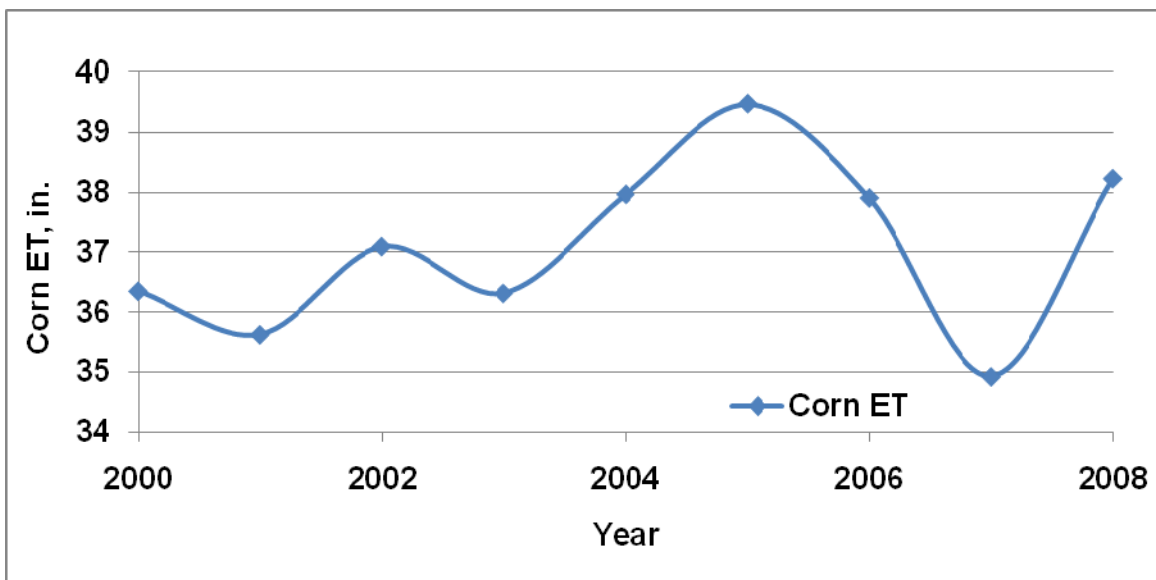


Figure 2-1. North Plains ET Network corn ET for years 2000 through 2008 for Moore County, Texas.

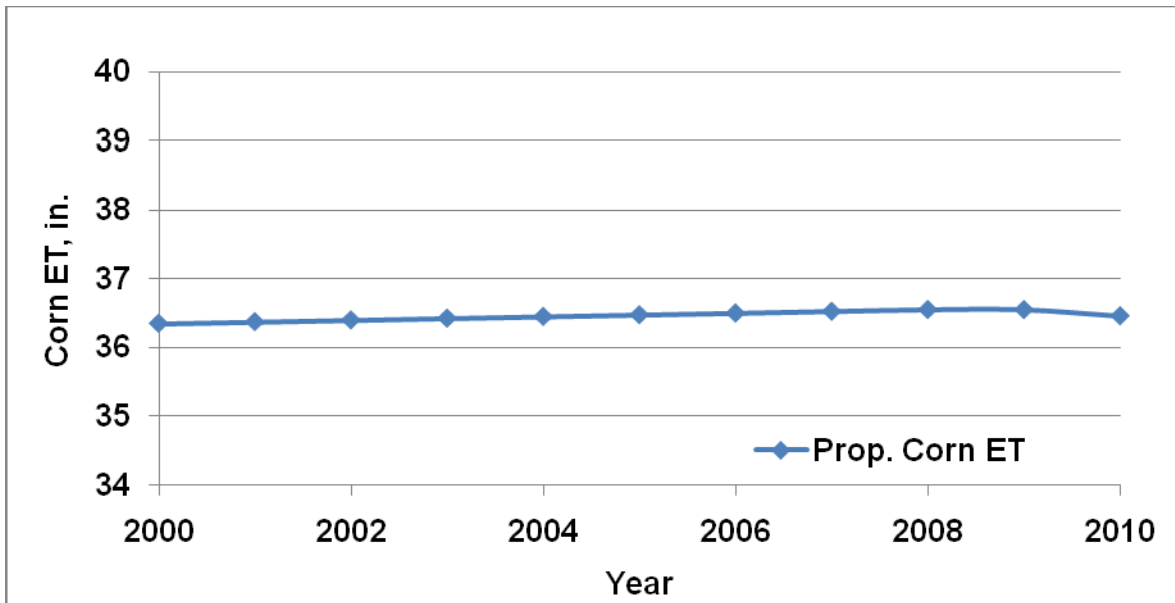


Figure 2-2. Proportional derived corn ET values used in the TAMA model for years 2000 through 2010 for Moore County, Texas.

Region A grower water application data were reviewed and remained at the same values as used in the 2006RWP computations. New producer application values were estimated for alfalfa based on increased hay values, for sunflowers based on cotton ET values and for sorghum forage on sorghum ET values.

3. TAMA Model assumptions

Methodology Review and Update

The Texas A&M-Amarillo (TAMA) model methodology utilizes a categorized crop, ET based, water use approach. As mentioned earlier, the number of crop categories was increased and previously defined to reflect regional crop production changes since the 2006RWP estimates. Inputs to the TAMA model include acreages provided through the Farm Service Agency (FSA) upon which producer payments are based. The TAMA model requires county-by-county input data regarding crop ET, a term referred to as a “grower factor” (which represents the amount of ET pumped and includes the percent of crop ET generally applied by producers using all irrigation system types and associated system application efficiencies), rainfall, soil water type and holding capacity, and seasonal soil profile moisture used per crop planted. The grower factor could be synonymously labeled as a “pumpage factor” within Region A; however, it may not be a representative term in other regions.

The TAMA model is based on the crop water use equation as follows:

$$ET_C * P_T = IRR_C + ER + SSM_D \tag{1}$$

where:

- ET_C = Crop evapotranspiration (or crop water use) for maximum production potential (in.),
- P_T = Grower factor which represents a fraction of the crop evapotranspiration pumped on a crop's seasonal basis and includes all irrigation systems and associated efficiencies (can be more or less than 1.0 reference crop ET, ET_c),
- IRR_C = Irrigation applied on a seasonal basis to a crop (in.),
- ER = Effective rainfall computed from seasonal rainfall occurring during the crop season (in.), and
- SSM_D = Seasonal soil moisture depletion used in crop production which is extracted from the soil profile during the respective growing season (in.).

Rearranging and solving for IRR_C yields:

$$IRR_C = ET_C * P_T - ER - SSM_D \quad (2)$$

The summary equation for all categorized crops grown per county is:

$$IRR_{CTY} = \sum_1^n (IRR_C / 12 * A_C) \quad (3)$$

where:

- n = Number of categorized crops of interest per county,
- IRR_{CTY} = Total quantity of irrigation volume applied (or pumped) to the crops grown within a county in a given year or season, (ac-ft), and
- A_C = Acreage of crop c in a given county.

Similarly, the summary equation for the counties within a region is:

$$IRR_{REG} = \sum_1^n IRR_{CTY} \quad (4)$$

where:

- IRR_{REG} = Total quantity of irrigation volume applied (or pumped) to crops grown within a region in a given year or crop season, (ac-ft).

Crop ET data were utilized from the North Plains ET network (Howell, 1998; Marek et al., 1998) as it relates to Region A counties using a modified Penman-Monteith equation for calculation of potential evapotranspiration (PET) from the meteorological data. Upgrading of the network data sets was done using the ASCE Standardized Reference Evapotranspiration Equation for Agriculture Crops (ASCE-EWRI, 2005). The NPET network uses a well-watered grass reference for reference ET, but also now computes an alfalfa-based reference for comparative purposes with other ET data sets. Data are specifically available for eight of the 21 counties in Region A. The remainder of the counties was computed using a correlation matrix attributing each NPET meteorological station's respective percentage of influence due to elevation, longitude and latitude considering known cropping differences of particular counties. A portion of the

correlation matrix indicating attribution used in the computations is presented in Table 2-4. Crop season and effective rainfall season periods used in Region A per crop are presented in Table 2-5.

Table 2-4. Selected meteorological station correlation (proportioning) matrix identifying station attribution used in computing county crop ET values in Region A.

NPET Meteorological Station	Dallam	Hartley	Hansford	Sherman
Dalhart	1.00	0.40	-	0.20
Dimmitt	-	-	-	-
Etter	-	0.40	-	0.60
JBF	-	0.20	-	-
Morse	-	-	0.50	0.20
Perryton	-	-	0.50	-
Wellington	-	-	-	-
White Deer	-	-	-	-

Another significant topic is effective rainfall and was left unchanged as to the computational equations used in the 2006RWP. The procedure is based upon the Natural Resource Conservation Service (NRCS) method (N.E.H., 1993) of computing effective rainfall. Long-term monthly quadrangle rainfall data obtained from the Texas Water Development Board (TWDB, 2009b) were utilized to update and calculate the respective seasonal crop rainfall. This was desired given the spatial representation error of single point rainfall sites. The quad based rainfall data were, thus, deemed more representative and applicable.

The next model variable required for the water use calculations was an estimation of the “grower factor” associated with each respective crop by producers within Region A. As in the previous 2006RWP estimates, data were obtained and analyzed from ancillary research/extension/producer projects that had been conducted within Region A and from comparative parts of Region O. This information was compiled from a 10-year effort from 548 specific crop irrigation and production field demonstrations with 448 cooperating growers on 71,000 acres (New, 2008). These irrigated fields were monitored in terms of water applied (pumped volume) per crop. The resulting irrigation application information is used in equation 2. In addition, over 21 producer’s fields were monitored for irrigation applied and used from the production area surrounding the North Plains Research Field in Moore County.

Table 2-5. Seasonal periods and crop categories used in effective rainfall computations, Region A.

Crop	Growing Season Used in Crop ET Computations	Season Used in Effective Rainfall (ER) Computations	Number of Months Used in ER Calculations
Corn	April 15 - October 15	April 15- August 15	4
Cotton	May 15-October 15	May 15-October 15	5
Grain Sorghum	May 15-October 15	May 15-October 15	5
Hay	April 1-November 1	April 1-November 1	7
Pasture & Other	April 1-November 1	April 1-November 1	7
Peanuts	May 1-November 1	May 1-November 1	6
Soybeans	June 1-November 1	June 1-November 1	5
Wheat	October 1-July 1	October 1-July 1	9
Alfalfa	April 1-November 1	April 1-November 1	7
Forage Sorghum	May 15-September 15	May 15- September 15	4
Sunflowers	May 15-October 15	May 15-October 15	5

Differential soil profile moisture was assumed to be available to each crop at a level of 50% per respective crop within Region A. This is commonly referred as the Managed Available Depletion (MAD - Marek et al., 2009). The respective available soil profile water used in the 2011RWP calculations is included in Table 2-6.

Table 2-6. Average differential seasonal soil moisture, producer applied NPET network crop ET percentages and 2000 and 2010 acreage weighted crop water values of Region A.

Crop	Differential Seasonal Soil Moisture , (inches)	Percent of NPET Crop ET Applied by Producers	Irrigation Water Pumped, in./ac.	
			2000 Acreage Weighted Average	2010 Acreage Weighted Average
Corn	2.41	0.86	18.50	19.11
Cotton	4.22	0.91	10.67	6.70
Grain Sorghum	3.62	0.84	9.66	9.66
Hay	1.50	0.95	31.30	-
Pasture and Other	2.50	0.80	22.35	27.40
Peanuts	2.20	1.35	17.05	17.03
Soybeans	3.11	0.91	9.95	10.05
Wheat	3.84	0.79	10.35	7.73
Alfalfa	1.50	0.95	-	26.11
Forage Sorghum	3.62	0.84	-	9.70
Sunflowers	4.22	0.91	-	3.70

Water use by crop was multiplied by the harvested irrigated acreage (hia) in each respective county to attain the harvested crop irrigation demand estimates (in the 2011RWP, harvested irrigated acreage equals the planted irrigated acreage minus the hauled out irrigated acreage). In addition, the hauled out crop water use was added to the harvested irrigated crop water

use to obtain the total water use per crop per county. Hailed out crop water use was estimated at 50% of the normal full season crop water use value. The 2000 versus 2010 water use per crop by county comparison is provided in Appendix A.

Irrigation Demand Reduction Assumptions (Modification of Future Water Use Projections)

Declines in the Ogallala aquifer supply availability are considered virtually inevitable, as they were projected within the 2006RWP. This availability constraint is considered due to the fact that the Ogallala aquifer has a very small or minimal rate of recharge within the planning region and for the time period of interest. In previous Region A analysis efforts, it was demonstrated that irrigated crop use per unit of water pumped had the lowest return as compared to other water use sectors. Therefore, any projected reduction in water use due to limited availability is expected to occur in the irrigation water sector. Furthermore, any anticipated increases in water use by other water use sectors are expected to come at the “expense” of irrigation sector.

In the 2006RWP, the estimated irrigation demand shape over time resembled that of a “curved” depletion scenario due to reduced aquifer availability, adoption of more advanced irrigation technologies and possible pumpage regulations were to be anticipated with future conditions. The reduction rate shape included a “mild” declination rate during the initial period of the forecasted horizon, steeper in the middle and then a reduced or “relaxed” rate near year 2060. The respective periods’ “change rate” coincide with the philosophy and past experience that at first 1) Change, adoption or conformance takes time by clientele and occurs relatively slowly on a regional basis (whether to technology or to regulation), 2) Then in the mid-years, the decline rate steepens as technologies and compliance become fully adopted along with cultural practice changes and diminished economics, and 3) Finally, in the later years, with reduced water availability and altered production potentials, the decline resembles the declination rate reflective of the first stage. In this 2011RWP effort, the 2006RWP declination curve rates were reset to begin again starting at year 2010. The general shape and shift of the reduction curve is illustrated in Figure 2-3 for the 2006RWP and the 2011RWP.

The shape of the declination curve is also predicated on that producers are not likely to rapidly change current operational practices due to management and equipment changeover costs. Thus, a rapid decline in current irrigation demand is not foreseen from current or existing pumpage values. The principal altering variable that would have the most impact in this early stage would be energy costs, but economics dictate that high production be maintained to cover current fixed irrigation system costs. During the middle decades, it is anticipated that irrigation will fall sharply as systems wear out or are paid off allowing producers to either terminate irrigation or adjust to lower water use crops in response to reduced irrigation profitability. It is expected that by the final decade of the planning horizon that the decline in irrigation will moderate as adjustments in acreage and crop mix reach a sustainable and possibly even marginal “long-term equilibrium” state.

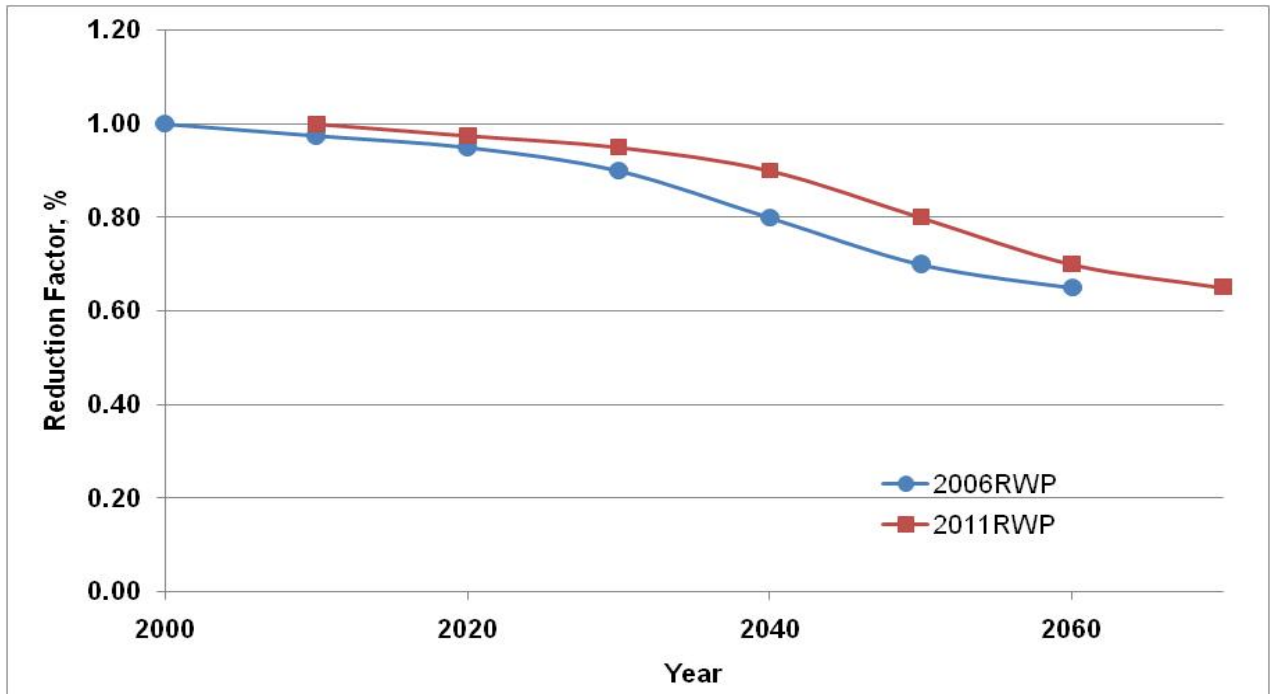


Figure 2-3. Declination shape of irrigation water demand curve with time based on technology adoption, aquifer availability and regulation parameters.

2011RWP Irrigation Demand Estimates for Region A

Using the TAMA model with input parameters as designated in previous sections, updated county based irrigation water demand calculations utilizing FSA based acreage numbers are presented in Table 2-7.

Table 2-7. 2011RWP Region A estimated irrigation water demand by county for selected years, acre-feet.

County	2000	2010	2020	2030	2040	2050	2060
Armstrong	10,544	5,118	4,688	4,544	4,305	3,827	3,349
Carson	97,345	58,775	49,230	47,982	45,457	36,368	35,355
Childress	10,304	7,418	5,519	5,350	5,068	4,505	3,942
Collingsworth	25,607	28,693	21,907	21,236	20,118	17,883	15,648
Dallam	320,475	292,031	283,315	274,642	260,187	231,278	202,368
Donley	21,019	32,000	29,676	28,771	27,257	24,228	21,200
Gray	25,499	22,705	20,410	19,785	18,744	16,661	14,578
Hall	20,789	16,719	10,731	10,403	9,855	8,760	7,665
Hansford	138,389	130,694	115,027	111,506	105,637	93,899	82,162
Hartley	289,008	294,932	281,648	273,026	258,657	229,917	201,177
Hemphill	3,779	1,825	1,705	1,653	1,566	1,392	1,218
Hutchinson	63,208	43,104	39,971	38,748	36,708	32,630	28,551
Lipscomb	14,789	16,956	15,546	15,070	14,277	12,690	11,104
Moore	180,594	147,471	135,001	130,869	123,981	110,205	96,430
Ochiltree	104,220	60,844	51,839	50,252	47,607	42,317	37,028
Oldham	5,223	4,235	3,914	3,794	3,594	3,195	2,795
Potter	8,009	6,226	5,697	5,525	5,234	4,652	4,071
Randall	30,302	22,477	19,900	19,291	18,275	16,245	14,214
Roberts	22,890	6,084	5,639	5,466	5,179	4,603	4,028
Sherman	294,703	220,372	200,521	194,437	182,913	163,736	143,269
Wheeler	8,335	11,311	9,488	9,198	8,713	7,745	6,777
Total	1,695,031	1,429,989	1,311,372	1,271,546	1,203,332	1,066,738	936,929

From the graphical data in Figure 2-4, it is obvious in 2011RWP for year 2000 that several Region A counties were responsible for the majority of water use with over a 150,000 acre-foot irrigation demand per year. These counties were Dallam, Hartley, Moore, and Sherman. The next three counties above or near 100,000 acre-foot irrigation demand level were Carson, Hansford and Ochiltree. For year 2010 in Figure 2-5, the same counties exhibit similar irrigation demand volumes but at a reduced level.

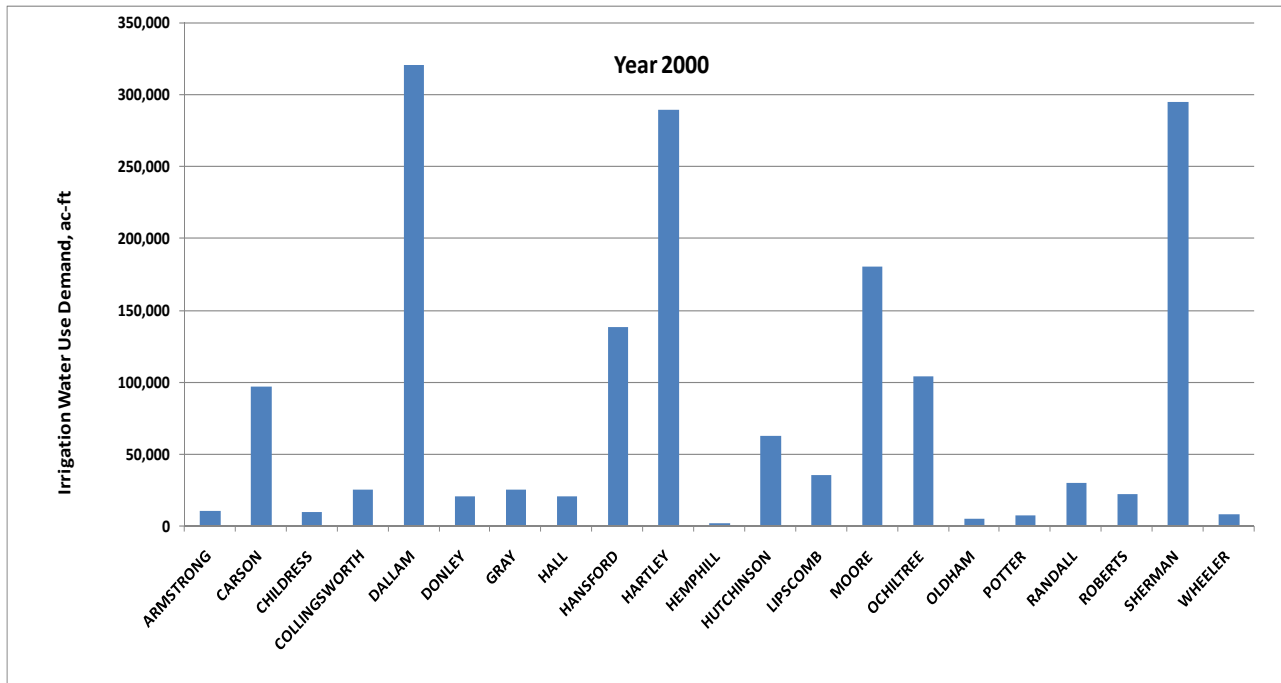


Figure 2-4. Region A total irrigated water use by county for year 2000.

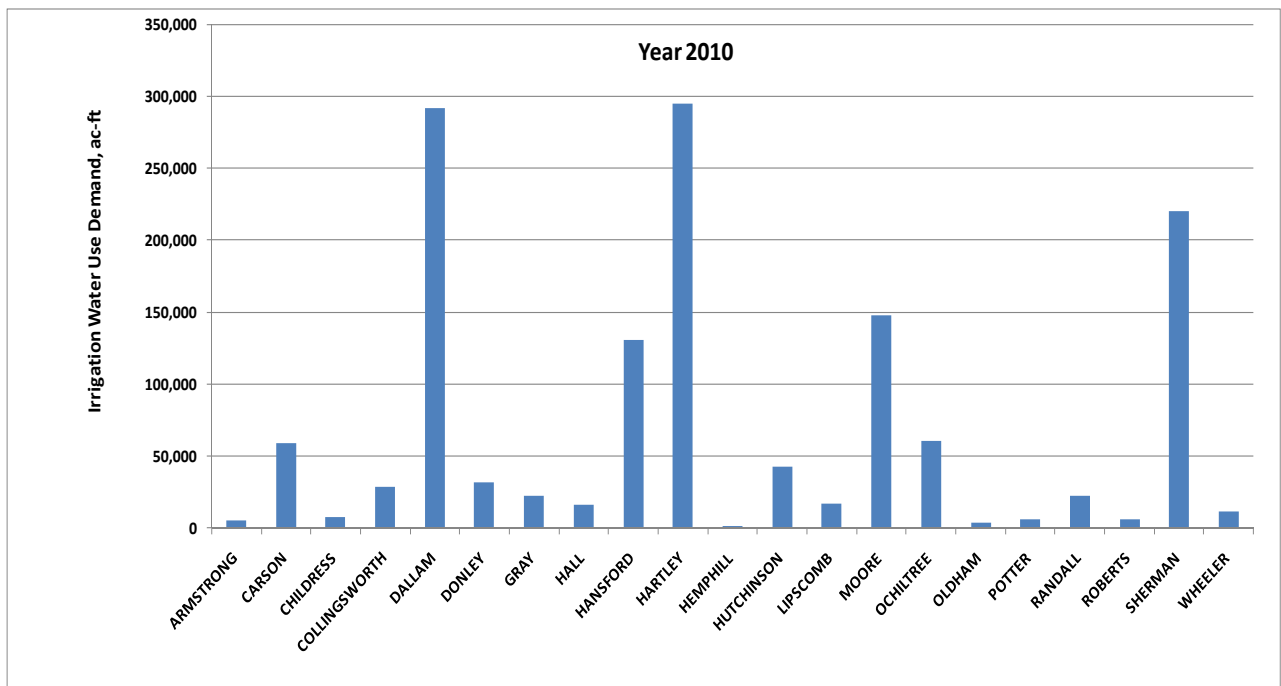


Figure 2-5. Region A total irrigated water use by county for year 2010.

A graphical breakdown of the crop category irrigation water demand use is presented in Figure 2-6. Generally, each major county has declines from year 2000 to 2010 with the exception of Hartley County. Counties, such as, Carson and Sherman experience significantly more decline than other counties. In Figure 2-7, the crop category irrigation demand per decade are illustrated, and it is apparent that corn has overwhelming the dominant crop water demand over the planning period. The next largest crop demand is for wheat.

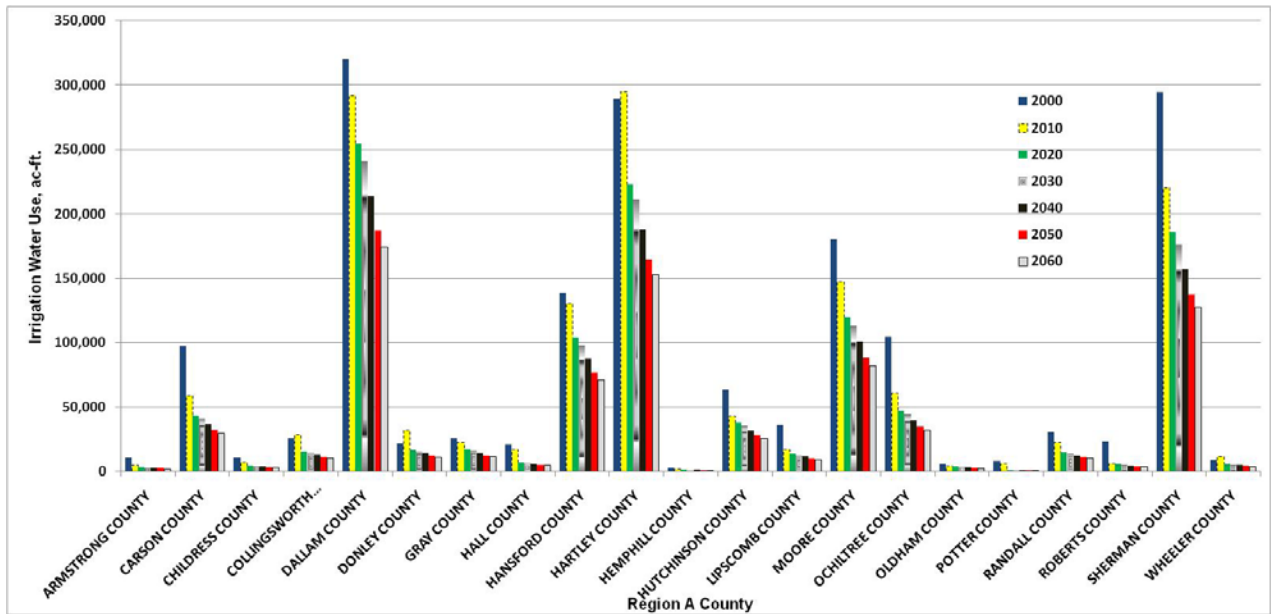


Figure 2-6. Region A total irrigated water use by county for selected years, 2000 – 2060.

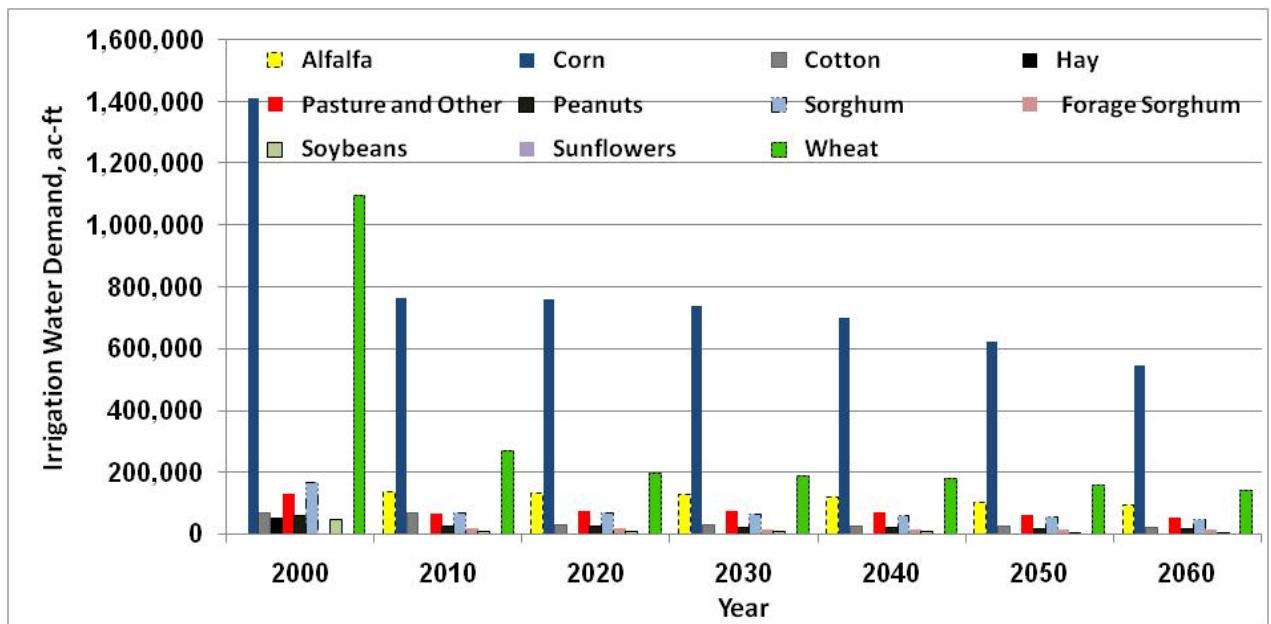


Figure 2-7. Region A total irrigated water use by crop for selected years, 2000 – 2060.

The total regional irrigation water demand estimates over the planning period as illustrated in Figure 2-8 indicate a reduction as compared to the previous 2006RWP forecasted demand values beginning from 2010. Not surprising, the four northwest counties still present the greatest demand and usage. The counties are Dallam, Moore, Hartley and Sherman. In these counties, the TAMA projected water use is to be reduced by 14.4% overall and 18.5%, 16.6%, 11.4%, 10.4% and 15.3% less for the decadal years of 2020 through 2060 as compared to the 2006RWP estimates, respectively. This does not indicate that the 2006RWP future estimates were in error, but rather that the forecasted irrigated demand conditions have changed and are now reflected with the changed 2011RWP estimates.

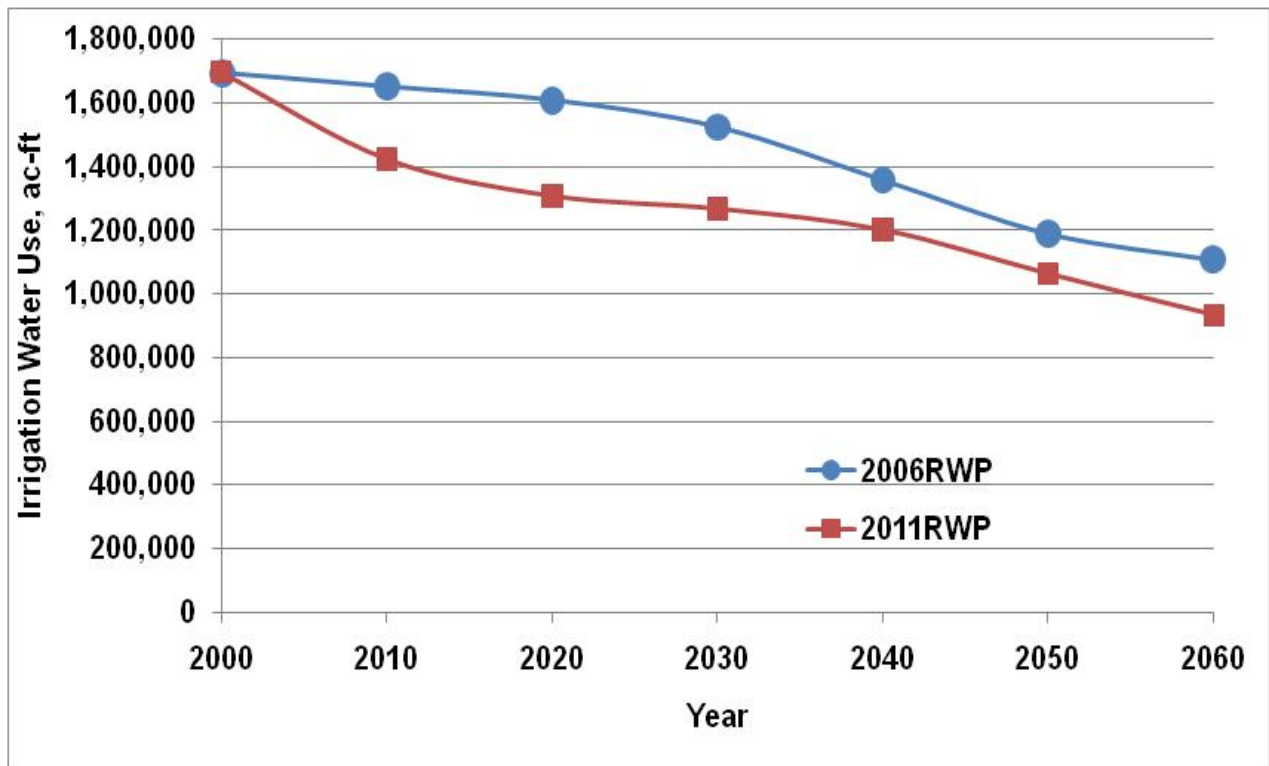


Figure 2-8. 2006RWP versus 2011RWP irrigation demands, 2000 - 2060.

4. Livestock Water Demand Estimates

It was estimated in the 2006RWP that livestock operations accounted for 2% - 3% of the water use in Region A. The anticipated rapid growth of the livestock industry makes on-going monitoring of this sector relevant. Given the importance of livestock to the region's economy, an objective of the 2011RWP is to review/revise/modify, where necessary, regional livestock water use projections. Specific objectives were to:

1. Refine livestock inventory projections for 2010 used in the 2006RWP given current inventories (Appendix B),
2. Review/revise, where necessary, future livestock growth projections through 2060, and
3. Review/revise, where necessary, water use estimates per species.

2010 Livestock Inventory Estimates

Livestock inventories by species were estimated for each county of Region A for 2000 in the 2006RWP effort. County determination of livestock numbers is vital to the accurate estimation of water use. The planning committee has identified eight livestock water use groups. They include beef cows, fed beef, summer stockers, winter stockers, dairy cattle, equine, swine and poultry. The procedure utilized to develop the 2000 county level estimates by species varied depending on the data sources available.

In the 2011RWP, updated inventory projections were estimated and utilized to replace 2010 inventory projections to improve the accuracy of the base for making future projections. Texas Agricultural Statistics Service (TASS, 2007) was used as the primary source of livestock

inventory estimates. However, TASS does not provide county level livestock inventory estimates for all species. In some species, only crop reporting district or state level estimates are made. In these instances, other sources of information including the 2007 Census of Agriculture, Milk Market Administrator, Extension or Industry specialists, and advisory groups were used to refine/improve county level estimates.

Beef Cows

TASS inventory estimates of 2008 beef cow numbers by county were assumed to be equal to the 2010 inventories (TASS, 2007).

Fed Beef

TASS only estimates fed beef by inventories on a crop reporting district basis. In the 2006RWP, county level estimates were made by establishing the feedlot capacity in each county (SPS, 2000). Inventory estimates were calculated as 85% of the total permitted capacity. The 85% “occupancy rate” was determined from TASS data and feedlot turnover data provided by the Texas Cattle Feeders Association (TCFA), Amarillo, Texas. In the 2011RWP, TCFA personnel updated county level feedlot inventories via secondary data and personal communications with feedlot managers.

Summer Stockers

The procedure for estimating the number of summer stockers was revisited and refined. In the 2006RWP, the number of summer stockers in a county was adjusted depending on the change in beef cow inventory (TASS, 1997). If the beef inventory increased (from 1997 to 2000), it was assumed the number of summer stockers decreased because of less pasture being available. The change was calculated on the basis of 0.7 cow units being equivalent to 1 stoker unit. The basic assumption was pasture not being grazed by beef cows was being utilized for summer stoker production. For example, if County A had 20,000 acres of pasture, a 500 cow inventory with an estimated stocking rate of 25 acres per cow, then the estimated number of summer stockers would be 429 $((20,000 - 500 * 25)/(25 * .7))$. In the 2011RWP, the projected 2010 summer stoker numbers were adjusted based on the TASS 2008 (TASS, 2007) beef cow inventory estimates. However, a second adjustment was added to the calculation. Previously, a stocking rate was estimated assuming permanent pasture/rangeland. The cropland used for the grazing purposes in this category was identified via the 2007 Census of Agriculture and stocking rate on that acreage was doubled to reflect its improved grazing capacity relative to typical pastureland (McCollum and Amosson, 2009).

Winter Stockers

A decrease in the number of stoker cattle grazing wheat have been observed over the last five years. A survey of Texas AgriLife County Extension Agents in the major wheat producing counties was conducted to ascertain changes in wheat pasture grazing. Based on the survey, the percentage of irrigated and dryland wheat assumed to be grazed, on average, was reduced to 60% and 20%, respectively. In addition, winter stoker numbers were adjusted to reflect the new wheat crop acreage base (2006 – 2008 average). These changes in winter stockers were reflected in the 2010 estimated inventory.

Dairy Cattle

The TASS 2000 dairy cow inventory numbers by county were used for Region A in 2006RWP. In the 2011RWP, 2010 projections were modified to reflect current inventories. Inventories for counties with three or more dairies were estimated based on the December 2008 milk production (Milk Market Administrator, 2008) assuming a cow produces 60 pounds of milk per day. In counties with less than three milking dairies, the number of cows was estimated using the latest inventory counts made by TCEQ (Tucker, 2008).

Equine

In the 2006RWP, the county level distribution provided by the 1997 Census was utilized and adjusted upward to reflect the 2000 inventory number reported by TASS. For example, if a county had 1,000 equine according to the 1997 Census data (Census of Ag., 1997), the 2000 inventory number was scaled up by multiplying the 2000 TASS state inventory (600,000) divided by the 1997 Census state total (241,000). TASS has since stopped making these estimates; therefore, the 2010 inventories were modified to reflect the estimates made in the 2007 Census of Agriculture.

Swine

TASS only estimates swine inventory numbers on a crop reporting district basis. The distribution of hog inventories by county determined in the 2001RWP was utilized (TASS, 1997). The one exception was Lipscomb County where the inventory estimate was reduced from 40,000 to 10,000. These estimates were “scaled up” in a similar manner as described above for dairy cattle. Each county inventory number was adjusted by multiplying it by 1.042 (780,000/748,236 or 2000 TASS inventory/1997 in the 2001RWP inventory) to arrive at the 2006RWP inventory estimates. These estimates by county were verified through TCEQ permits and validated by a focus group of swine producers from the region.

Currently, four companies control the commercial hog production in Region A. In the 2011Water Plan, these companies were surveyed directly in the winter of 2009 with the assistance of the Texas Pork Producers Association (Horton, 2009) to determine the actual inventories to use in the 2011RWP effort. The 2007 Census of Agriculture was utilized to estimate inventories in counties without commercial scale operations (Census of Ag, 2007).

Poultry

Virtually no poultry currently exists within Region A. In the 2006RWP, 2000 inventory numbers were arbitrarily set at 1,000 birds per county. The same assumption is being utilized in Water Plan 2011.

Livestock Growth Projections

An objective of this study was to review and revise, where warranted, projected growth assumptions in the livestock sector made in the 2006RWP for use in the 2011RWP cycle. Resulting from this review, no changes were recommended in the projected growth rates used in the 2001RWP for beef cows and equine. The expansion in the poultry industry has basically

remained unchanged with the exception of the size of incoming operations was doubled (Table 2-8). Growth rates for fed beef and stockers were modified slightly while major changes were recommended for swine and dairy.

Table 2-8. Region A 2006RWP and 2011RWP projected livestock inventory growth by species, 2000 – 2060 and annual growth rate.

Species	2006RWP	2011RWP
(----- Annual Growth Rates -----)		
Beef Cows:		
2010 – 2060	0.00%	0.00%
Fed Beef:		
2000 – 2010	1.00%	2010 Inventory estimated by TCFA.
2010 – 2060	1.15% annual growth rate from 2010 – 2020, and 0.60% annual growth rate 2020 – 2060.	10% growth per decade in Dallam, Hansford, Hartley, Moore, Ochiltree, and Sherman Counties. No growth in other counties.
Summer Stockers:		
2010 - 2060	0.50%	0.00%
Winter Stockers:		
2010 - 2060	0.50%	0.25%
Dairy Cattle:		
2000 - 2010	In 2010, 28.75% of TCEQ current and pending permit capacity and add 4,000 cow units in Sherman and Oldham Counties.	
2010 - 2020	In 2020, 57.50% of TCEQ current and pending capacity.	In 2020, 60,000 cows allocated to Dallam, Hartley, Moore and Sherman Counties based on percentage of current TCEQ permits
2020 - 2060	0.00%	1.00% annual growth rate in all dairy counties.
Equine		
2010 - 2060	1.00%	1.00%
Poultry:		
2000 - 2060	In 2020, add 500,000 capacity operations in Childress, Collingsworth, Hemphill, Lipscomb, and Wheeler Counties. No other growth is assumed.	In 2020, add 1,000,000 capacity operations in Armstrong, Carson, Childress, Collingsworth, Gray, Oldham, and Wheeler Counties. No other growth is assumed.
Swine:		
2000 - 2010	57.50% of TCEQ total permit capacity and add 10,000 hog units to Hemphill County.	2010 inventories determined by a survey of swine producers.
2010 - 2020	100% of current TCEQ permit capacity.	0.00%
2020 - 2060	0.00%	0.00%

Fed Beef

The beef advisory committee (Sweeten, Casey, Amosson, and Weinheimer, 2009) decided to lower the growth projections that existed in the 2006RWP on the recommendation of Texas Cattle Feeders Association (TCFA) staff working in consultation with feedlot operators. The growth of the ethanol industry in the Midwest and the slowdown in the economy which already resulted in lower than expected projected 2010 inventories were the basis for this recommendation. In the 2011RWP, it is assumed Dallam, Hansford, Hartley, Moore, Ochiltree and Sherman counties would experience a 10% growth per decade for the 2010 – 2060 time periods. No growth was assumed in other Region A counties.

Summer and Winter Stockers

The annual projected growth rate in summer and winter stockers was reduced from a half percent used in the 2006RWP to a no-growth level and a 0.25% level, respectively, for the 2011RWP. In the 2006RWP, it was thought that the continued growth of the fed cattle industry, improved pastures exiting the Conservation Reserve Program (CRP), and an increase in dryland wheat production as irrigation declined would result in a half percent annual growth rate. While growth in the fed beef industry is still expected to occur, it will be at a slower rate than anticipated. Given the reauthorization of the CRP in the 2007 Farm Bill, it was decided to go with zero growth for summer stockers. With the realization that some of the growth in dryland winter wheat pasture would come at the expense of irrigated wheat pasture with higher stocking rates, it was decided to reduce the anticipated growth rate of winter stocker inventories by half.

Dairy Cattle

The building of the Hilmar Cheese Plant (Phase 1) in Dalhart, since the 2006RWP effort justified revising 2010 inventory numbers for the 2011RWP. Hilmar Cheese Plant's planned expansion (Phase 2) which should occur within the next five years will require an additional 80,000 cows suggests inventory projections need to be revised upward.

Of the 80,000 cows needed to meet the milk requirements of Hilmar's Phase 1 construction, 52.5% were located in the four northwest counties of Region A (Dallam, Hartley, Moore and Sherman) with the remaining milk required coming from outside the Region and primarily from Region O. These existing operations are permitted to handle an additional 100,000 cows. Therefore, in the 2011RWP, it is assumed that 75% (60,000 cows) of the Phase 2 expansion will occur in these counties in existing or new operations with the remainder being located outside Region A. The 60,000 cows were added to the appropriate counties' 2020 inventory based on their portion of current TCEQ permits. A one percent annual growth rate in all counties with dairy cow inventories was assumed for the 2020 - 2060 time period on the recommendation of the dairy advisory group (Cowan, 2009).

Swine

The most significant change in inventory projections between the 2006RWP and the 2011RWP was in the swine industry. In the 2006RWP, a dramatic increase in hog inventories was projected based on the speculation of another packing plant being built specifically in Region A. However, plans to build that packing plant have been dropped, and it is no longer even a

consideration. Representatives of the four major swine operations have indicated that they expect no future growth in the industry.

Poultry

A few adjustments were made to the poultry projections. The advisory committee still believes that poultry operations are coming to Region A and will be located in the eastern counties of the Region or close to I-40 to have greater access to markets. The anticipated size of the operations was increased from 500,000 birds to a 1,000,000 birds based on industry trends. Poultry operations were projected to be opened in Armstrong, Carson, Childress, Collingsworth, Gray, Oldham, and Wheeler counties from 2010 – 2020. No further growth is anticipated from 2020 to 2060.

Inventory Projection Summary

A summary of the impacts of changes in livestock inventories and future projections utilized in the 2011RWP compared to the 2006RWP is given in Table 2-9. The livestock inventories for 2000 are the same for 2006RWP and 2011RWP. The 2010 inventories were changed in 2011RWP to reflect current inventories that were estimated based on 2007 – 2009 data. Projected growth rates were altered to account for changing industry conditions. The 2011RWP ending inventories (2060) of fed beef are expected to be almost 200,000 lower while dairy cow numbers are projected to be 70,000 cows higher than the 2006RWP estimates. The most significant change in inventory projections was in the swine industry where ending inventory was dropped more than 4,500,000 head. Again, this was due to the elimination of plans to build a much anticipated hog packing plant in the Region.

Table 2-9. Region A 2000, 2010 and 2060 inventories by species for 2006RWP and 2011RWP.

Species	2006RWP and 2011RWP	2006RWP	2011RWP	2006RWP	2011RWP
	2000	2010	2010	2060	2060
(----- Number of Head -----)					
Beef Cows	237,000	237,000	251,000	237,000	251,000
Fed Beef	1,182,241	1,414,145	1,312,739	2,052,513	1,854,972
Summer Stockers	372,053	391,080	368,921	501,844	368,921
Winter Stockers	646,946	680,031	467,971	872,633	530,198
Dairy Cattle	4,400	50,662	49,137	92,425	162,490
Equine	24,806	27,402	16,882	45,006	26,372
Poultry	21,000	21,000	21,000	2,516,000	7,014,000
Swine	779,999	3,449,057	1,182,371	5,611,617	1,093,971

Livestock Water Use by Species

Three advisory committees consisting of industry experts were formed to review 2006RWP water use estimates by species and recommend changes, as warranted. The dairy advisory committee consisted of Drs. Ellen Jordan and Todd Bilby (2009), Texas AgriLife Extension Dairy Specialists and John Cowan (2009), Executive Director of the Texas Association of Dairymen. The Swine advisory group was coordinated by Ken Horton (2009), Executive Vice President of the Texas Pork Producers Association and included representatives of the four major hog producing organizations in Region A. The Beef and other species committee included Drs. John Sweeten, Ken Casey and Steve Amosson (2009), all of the Texas A&M AgriLife Center in Amarillo, and Ben Weinheimer (2009), Vice President of the Texas Cattle Feeders Association. In addition, other experts were consulted to provide input into the committee process. All recommended changes in water use were implemented beginning with the 2010 time period.

The dairy focus group recommended that daily water use per animal by dairies be reduced from 65 gallons/day to 55 gallons/day (Table 2-10). This was based on improvements employed by West Texas dairies to more efficiently use operational wastewater which has led to most new dairies requesting TCEQ permits at the 50 gallon/day level. This usage level is consistent with what has recently been adopted in Region O planning effort.

Swine water use was changed from a regionally used 5 gallons/day in the 2006RWP (focus committee recommendation) to what estimated actual water use is by the hog operations specific to each county (Horton, 2009). Water use estimates varied from 2.5 gallons/day to 8.5 gallons/day. The primary reason for the variance in water use estimates was differences in the composition in operations (farrow, nursery or finish) within the county. A secondary reason was differences in the cleaning system (pull-plug vs. flush).

The Beef and other species committee decided to leave water use estimates for equine (Baker, Gibbs, and Pipkin, 2009) poultry and beef cows unchanged from the 2006RWP estimates (Sweeten, Casey, Amosson and Weinheimer, 2009). However, after reviewing recent research findings, water use estimates for fed beef, summer stockers and winter stockers were reduced. Fed beef, summer stockers and winter stockers were estimated to use 15, 12 and 12 gallons/day, respectively, in the 2006RWP and were reduced to 12.5, 10 and 8 gallons/day, respectively, in the 2011RWP.

Table 2-10. 2006RWP and 2011RWP livestock water use estimates per animal in Region A.

Species	2006RWP (gal/day)	2011RWP (gal/day)
Beef Cows	20	20
Fed Beef	15	12.5
Summer Stockers	12	10
Winter Stockers	12	8
Dairy Cattle	65 ^{a)}	55
Equine	12	12
Poultry	0.09	0.09
Swine	5 ^{a)b)}	2.5 – 8.5

^{a)} Focus group of dairy and swine producers, permit specialist and industry experts.

^{b)} In 2000, Dallam County swine water use was 8 gallons/head.

TAMA 2011RWP Livestock Projected Water Use

Region A annual livestock water use projections by species for selected years during the 2011RWP 50-year horizon are presented in Table 2-11 and is illustrated by county in Figure 2-9. Overall, water use in the Region A livestock sector is predicted to increase 40% from 38,176 ac-ft usage in 2000 to 53,287 ac-ft in 2060. While this increase is significant, it still will only represent approximately three to four percent of the total water use within the region.

The largest livestock water use group is projected to be the fed cattle industry with an annual usage of 25,973 ac-ft per year by 2060. The anticipated expansion of the dairy industry will make it the second largest user group by 2060 (10,011 ac-ft per year). These two user groups account for 68% of projected livestock water use in 2060.

The swine and beef cow sectors are forecasted to have zero growth, however, will still use more than 10% each of the livestock water with an estimated demand of 5,883 and 5,623 ac-ft per year, respectively. Summer and winter stockers follow in importance using an estimated 2,755 and 1,980 ac-ft per year, respectively. Poultry and equine accounted for less than two percent of the projected livestock water consumption in 2060.

Table 2-11. 2011RWP estimated annual livestock water use (acre-feet) by species in Region A for selected years.

Species	2000	2010	2020	2030	2040	2050	2060
(----- acre-feet/year-----)							
Beef Cows	5,310	5,623	5,623	5,623	5,623	5,623	5,623
Fed Beef	19,864	18,381	19,625	20,992	22,497	24,152	25,973
Summer Stockers	3,334	2,755	2,755	2,755	2,755	2,755	2,755
Winter Stockers	3,623	1,747	1,792	1,837	1,883	1,931	1,980
Dairy Cattle	320	3,027	6,724	7,427	8,204	9,063	10,011
Equine	333	216	238	263	291	321	355
Poultry	2	2	707	707	707	707	707
Swine	5,390	5,917	5,883	5,883	5,883	5,883	5,883
Totals	38,176	37,668	43,347	45,487	47,843	50,435	53,287

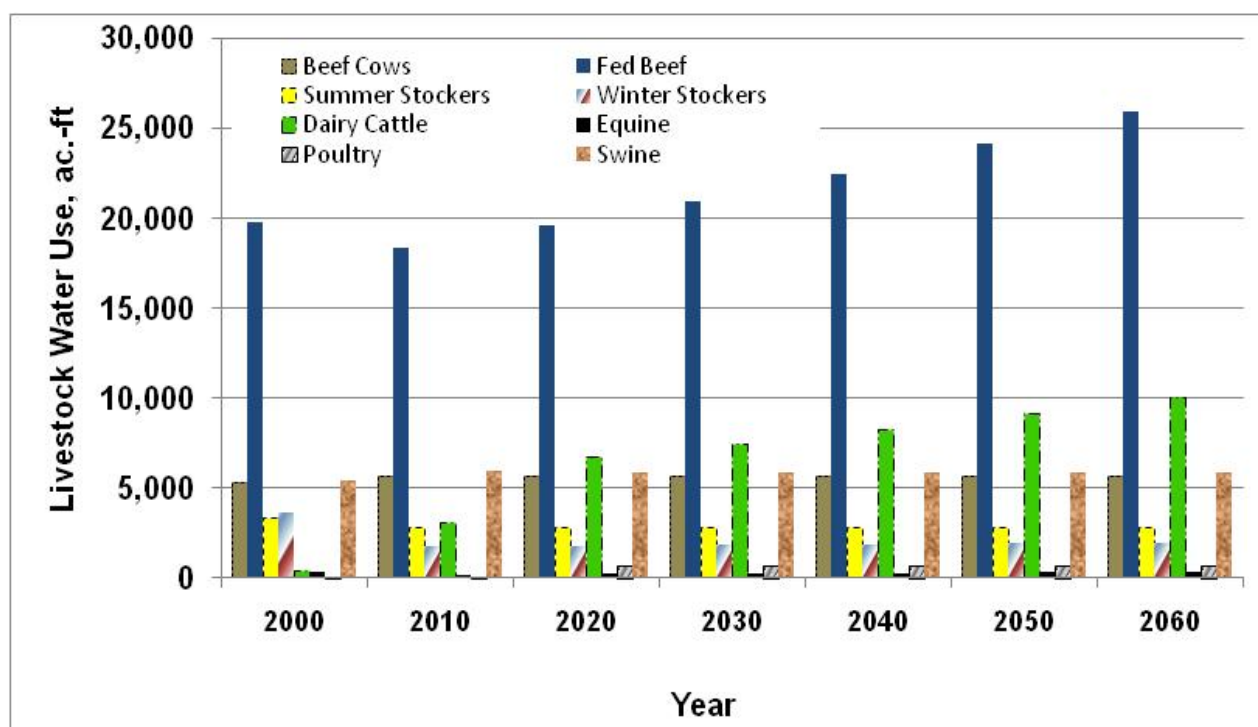


Figure 2-9. Estimated annual livestock water use (acre-feet) by species for selected years.

Estimated livestock water use by county for selected years is provided in Table 2-12. In 2000, the top five counties in livestock water use were Dallam, Ochiltree, Hansford, Hartley and Sherman using 5,689, 4,168, 4,088, 3,572 and 2,995 acre-feet, respectively. By 2060, Hartley County is expected to be the largest water use for livestock (10,024 acre-feet) due to anticipated expansion of the dairy and feedlot industries in the county. Other major users are expected to be Sherman, Dallam, Hansford and Moore pumping 7,019, 6,246, 5,346 and 5,120 acre-feet, respectively, on an annual basis.

Table 2-12. 2011RWP estimated annual livestock water use (acre-feet) by county in Region A for selected years.

County	2000	2010	2020	2030	2040	2050	2060
(-----acre/ft/year-----)							
Armstrong	573	566	670	673	677	681	685
Carson	945	607	711	716	720	725	730
Childress	288	368	470	472	473	475	477
Collingsworth	578	461	564	566	569	571	574
Dallam	5,689	3,509	4,654	4,996	5,373	5,788	6,246
Donley	1,100	1,267	1,268	1,270	1,271	1,273	1,275
Gray	1,706	1,348	1,451	1,474	1,499	1,527	1,557
Hall	297	329	330	331	332	334	335
Hansford	4,088	3,683	3,956	4,256	4,586	4,948	5,346
Hartley	3,572	5,106	7,103	7,731	8,422	9,184	10,024
Hemphill	1,408	1,276	1,281	1,285	1,290	1,296	1,301
Hutchinson	596	685	689	698	708	720	732
Lipscomb	589	1,005	1,007	1,028	1,051	1,076	1,104
Moore	2,684	2,831	3,605	3,931	4,290	4,685	5,120
Ochiltree	4,168	3,367	3,463	3,605	3,761	3,932	4,119
Oldham	1,635	1,154	1,257	1,259	1,262	1,265	1,267
Potter	478	502	504	505	507	509	511
Randall	2,751	2,732	2,741	2,756	2,772	2,789	2,808
Roberts	534	385	385	386	387	388	388
Sherman	2,995	4,933	5,579	5,889	6,230	6,606	7,019
Wheeler	1,504	1,554	1,657	1,660	1,662	1,664	1,667
Total*	38,178	37,668	43,346	45,488	47,843	50,435	53,286

*Year totals may not sum exactly due to rounding of species values.

2006RWP and 2011RWP Region A Livestock Water Use Comparison

Projected total livestock water use in the 2006RWP and the 2011RWP are presented graphically in Figure 2-10. The 2011RWP annual water use estimates by 2060 are estimated to be approximately 70% less than those made during the 2006RWP process. However, this still represents almost a 40% increase by 2060 relative to the 2000 estimated water use by the livestock sector. This dramatic drop in anticipated water use can be attributed basically to two factors. First and foremost, the revision downward in swine inventory projections due to the scrapping of plans to build a packing plant in the region. Second, the refinement downward in water use estimates for dairy cows, fed beef, summer stockers and winter stockers. A detailed breakdown of the 2011RWP county level livestock water use projections is presented in Appendix B.

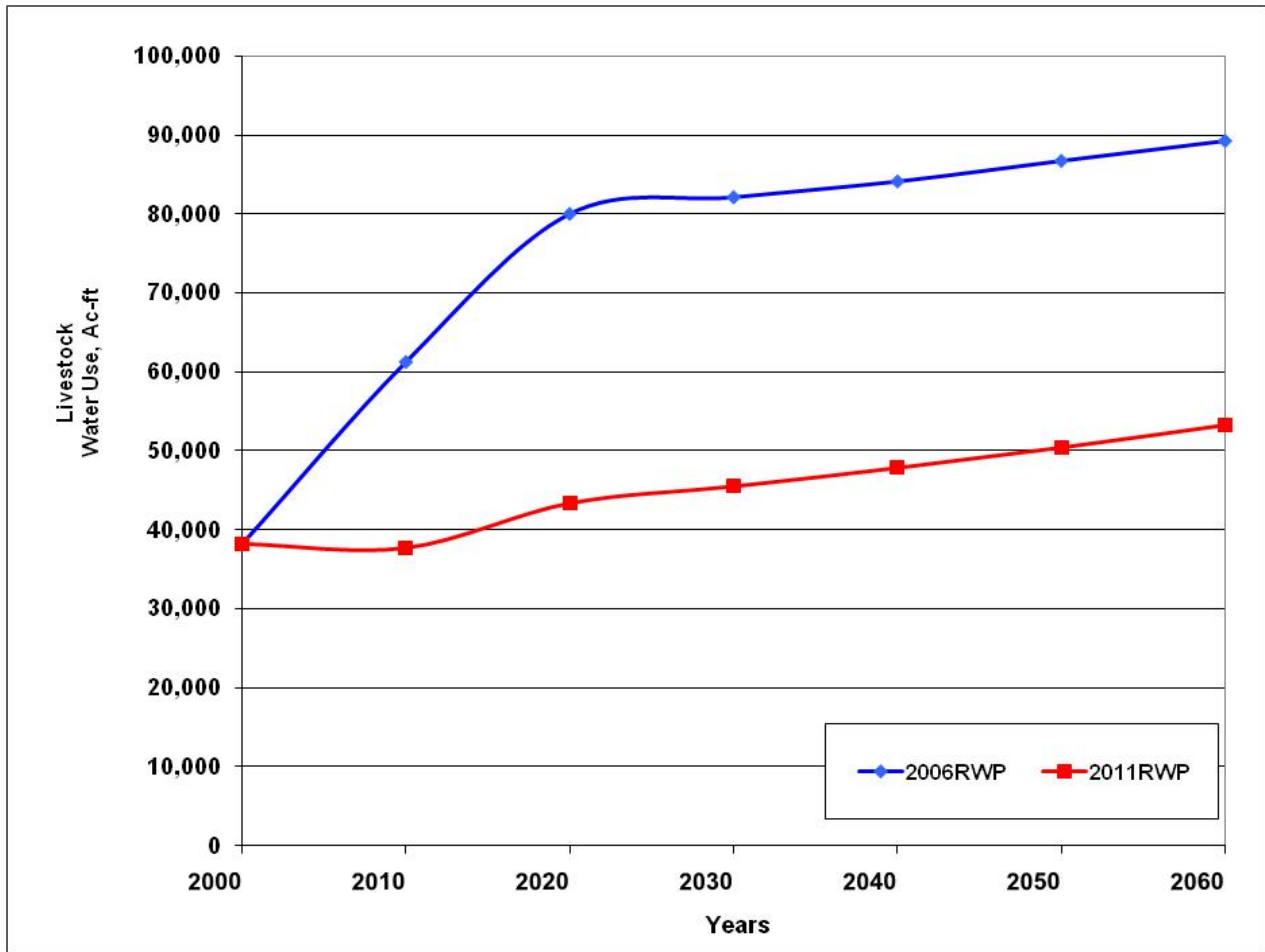


Figure 2-10. Comparison of livestock water use estimates (acre-feet) for the 2006RWP and the 2011RWP, 2000 - 2060.

Summary and Conclusions

The objectives of Task 2B were to: Refine livestock inventory projections for 2010 used in the 2006RWP given current inventories; Review/revise, where necessary, future livestock growth projections though 2060; and Review/revise, where necessary, water use estimates per species made in the 2006RWP for use in the 2011RWP cycle. Resulting from this review, inventory estimates for all species were updated with changes being implemented in the 2010 inventories.

No changes were recommended in the projected growth rates used in the 2006RWP for beef cows, equine and poultry. However, anticipated poultry operations were increased in size from 500,000 to one million birds in Armstrong, Carson, Childress, Collingsworth, Gray, Oldham, and Wheeler counties. Growth rates for fed beef and stockers were modified downward slightly reflecting the impacts of the ethanol industry and changes in the economy. Major changes in the future growth rate were recommended for swine and dairy. The failure to build a packing plant in the region lead the swine group to recommend a zero growth rate resulting in a projected 2060 inventory of 1.1 million versus 5.6 million in the 2006RWP. Conversely, the building and expected expansion of the Hilmar Cheese Plant in Dalhart resulted in a relative 70,000 increase in projected 2060 dairy cow numbers.

Advisory committees were set up to review and revise water use by species, as warranted. No changes were recommended for beef cows, equine or poultry. Swine water use was changed from a regionally used 5 gallons/day in the 2006RWP to what estimated actual water use is by the hog operations specific to each county. Daily water use per animal by dairies was reduced from 65 gallons/day to 55 gallons/day based on improvements employed by West Texas dairies to more efficiently use operational wastewater. After reviewing recent research findings, water use estimates for fed beef, summer stockers and winter stockers were reduced to 12.5, 10 and 8 gallons/day from 15, 12 and 12 gallons/day, respectively.

Overall, water use in the Region A livestock sector is predicted to increase 40% from 2000 to 2060 which represents approximately two to three percent of the total water use in the region. However, the 2011RWP total livestock water use estimates are significantly less (70%) than the 2006RWP projections due to the changes in swine projections and water use by species. The largest livestock water use group is projected to be the fed cattle industry with an annual usage of 25,973 ac-ft/year by 2060. The forecasted expansion of the dairy industry results in usage estimate by 2060 of 10,011 ac-ft/year. These two user groups account for 68% of projected livestock water use in 2060. The swine industry is the third largest water user group with a projected annual water use of 5,883 ac-ft/year in 2060.

5. 2011RWP Agricultural Water Use estimates

The total agricultural water use demand is derived from combining the irrigation and livestock use demands. However, recognizing that increases in future livestock growth and water use will be achieved through a reduction from irrigation, estimates of the irrigation water use considering (deducting) the increases in livestock water use, results in available water use per county and total values as presented in Table 2-13. These deductions begin in 2020 and were carried out through 2060. Graphically, the difference is illustrated in Figure 2-11. Although the projected increase in livestock water use appears dramatic, livestock water use is still minimal when compared to the irrigation demand.

Table 2-13. Annual agricultural water use projections (acre-feet) by county in Region A for selected years.

Region A County	2010 Ag. Water Use, ac-ft	2020 Ag. Water Use, ac-ft	2030 Ag. Water Use, ac-ft	2040 Ag. Water Use, ac-ft	2050 Ag. Water Use, ac-ft	2060 Ag. Water Use, ac-ft
Armstrong	5,683	5,150	5,003	4,760	4,278	3,795
Carson	59,381	49,732	48,480	45,950	36,857	35,839
Childress	7,786	5,784	5,614	5,331	4,766	4,201
Collingsworth	29,154	22,264	21,591	20,471	18,233	15,994
Dallam	295,541	285,680	276,665	261,833	232,508	203,141
Donley	33,267	30,941	30,034	28,518	25,488	22,458
Gray	24,053	21,654	21,007	19,941	17,831	15,718
Hall	17,048	11,060	10,730	10,181	9,085	7,989
Hansford	134,377	118,437	114,615	108,417	96,317	84,182
Hartley	300,038	284,757	275,507	260,446	230,944	201,365
Hemphill	3,102	2,978	2,921	2,829	2,649	2,469
Hutchinson	43,789	40,653	39,420	37,370	33,280	29,189
Lipscomb	17,961	16,549	16,052	15,236	13,624	12,010
Moore	150,302	137,058	132,600	125,353	111,183	96,972
Ochiltree	64,211	55,110	53,381	50,581	45,120	39,643
Oldham	5,389	4,965	4,843	4,640	4,238	3,836
Potter	6,728	6,198	6,023	5,731	5,147	4,564
Randall	25,209	22,622	21,998	20,967	18,919	16,870
Roberts	6,468	6,023	5,849	5,561	4,985	4,409
Sherman	225,305	204,808	198,414	186,548	166,997	146,116
Wheeler	12,866	10,940	10,647	10,161	9,190	8,219
Counties Total	1,469,667	1,345,382	1,303,424	1,232,864	1,093,689	961,038

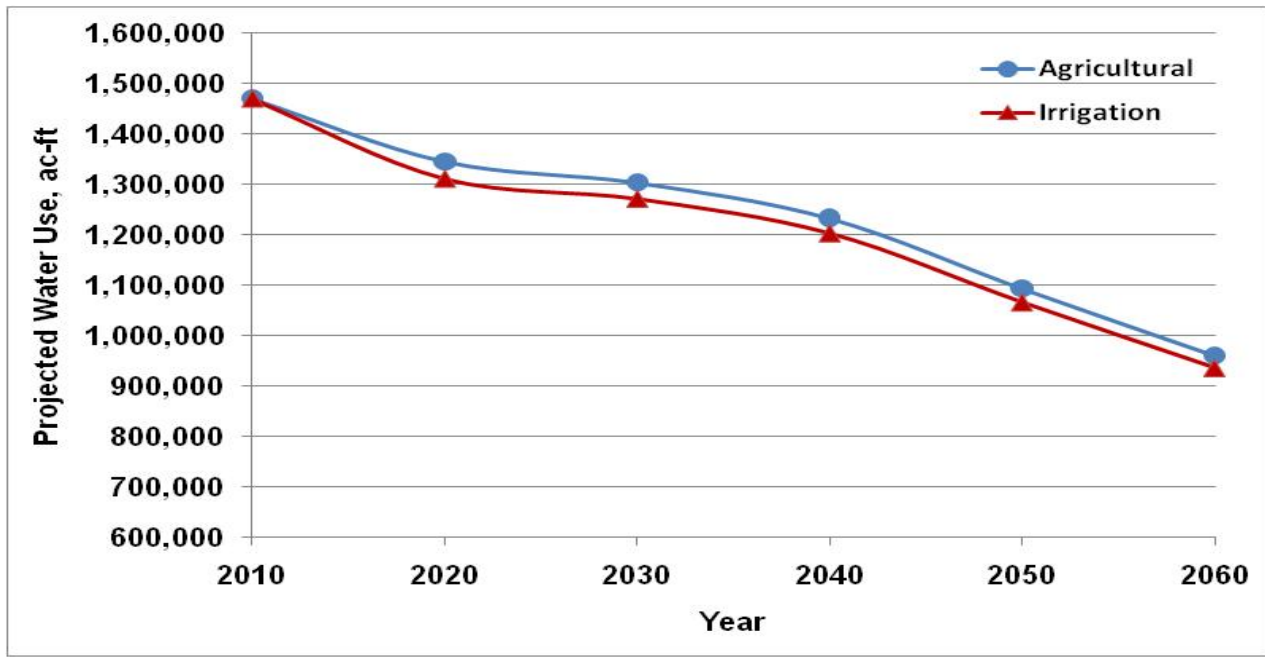


Figure 2-11. Region A projected irrigation and total agricultural water use, 2010 to 2060.

Summary and Conclusions

Under Task 2 of the 2011RWP, Texas A&M personnel are charged with updating the Region A irrigated water use demand estimates. This information is to be used to assist the Panhandle Regional Planning Committee (PRPC) through the Panhandle Water Planning Group (PWPG) in evaluating the proposed Texas Water Development Board (TWDB) irrigated water use estimates for the region. In addition, the updated Texas A&M–Amarillo (TAMA) model can be used to provide the planning group members a “first and possibly best representative look” at the effectiveness of any proposed water conservation strategy in subsequent analyses.

Refinements in the previously developed methodology for estimating irrigation water use demands for Region A in the Texas Panhandle were accomplished and include the addition of new crop categories and updated crop ET data, where available. Subsequently, updated water demand estimates were computed using the Texas A&M–Amarillo (TAMA) model utilizing Farm Service Agency (FSA) acreages with average based grower factors compiled from many years of field data, soil moisture values and long term quadrangle rainfall data. The updated water use values include hauled out crop acreage water use.

Declining water levels in the groundwater aquifers and the marginal profitability of irrigated crop production in the region suggest future reductions in irrigation capacity will occur. Revised computations indicate that an average 35 percent reduction in irrigation is assumed to occur over the next 50-year planning horizon. The irrigation decrease is anticipated to occur in a progressive, declination type pattern reflecting expected trends in cultural practice, well capacity, water conservation and efficiency technology transfers and adoption considerations along with pumpage reductions by potential regulation. Future water demand estimates should continue to improve in accuracy as compared to actual conditions as influenced by longer term records of crop ET, effective rainfall and complete county acreages from FSA.

References

- ASCE-EWRI. 2005. The ASCE Standardized Reference Evapotranspiration Equation. Report by the American Society of Civil Engineers (ASCE) Task Committee on Standardization of Reference Evapotranspiration. Allen, R.G., I.A. Walter, R.L. Elliot, T.A. Howell, D. Itenfisu, M.E. Jensen, and R.L. Snyder (eds.), ASCE, 0-7844-0805-X, Reston, VA. 216 pp.
- Amosson, Steve. 2009. Personal communication. Regents Fellow and Professor and Extension Economist, Texas AgriLife Research and Extension Center at Amarillo, Amarillo, TX.
- Baker, L. 2009. Personal communication. Associate Professor - Animal Science Department, West Texas A&M University, Canyon, TX.
- Bilby, Todd. 2009. Personal communication. Associate Professor and Extension Dairy Specialist, Texas AgriLife Research and Extension Center at Stephenville, Stephenville, TX.
- Casey, Ken. 2009. Personal communication. Assistant Professor of Air Quality Engineering, Texas AgriLife Research and Extension Center at Amarillo, Amarillo, TX.
- Census of Agriculture. 1997. National Agricultural Statistics Service, Washington, D.C.
- Census of Agriculture. 2007. National Agricultural Statistics Service, Washington, D.C.
- Cowan, John. 2009. Personal communication. Executive Director, Texas Association of Dairymen, Grapevine, TX.
- Gibbs, P. 2009. Associate Agency Director, Texas AgriLife Extension Service, College Station, TX.
- Horton, Ken. 2009. Personal Communication. Executive Vice President, Texas Pork Producers Association, Austin, TX.
- Howell, T., T. Marek, L. New and D. Dusek. 1998. The Texas North Plains PET Network. In: Proceedings of 1998 North Plains Research Field Ag Day Report. pp. 12-17.
- Jordan Ellen. 2009. Personal communication. Professor and Extension Dairy Specialist, Texas AgriLife Research and Extension Center at Dallas, Dallas, Texas.
- Marek, T., D. Dusek, L. New, G. Fipps, T. Howell and J. Sweeten. 1998. Potential Evapotranspiration Networks in Texas: Design, Coverage and Operation. Proceedings of the 25th Water for Texas Conference, Austin, TX. December. 1-2. pp. 115-124.
- Marek, T., D. Porter, T. Howell, N. Kenny and P. Gowda. 2009. Understanding ET and Its Use in Irrigation Scheduling. Texas AgriLife Research – Amarillo, TX. AREC 09-02. 61 pp.
- McCollum, T. 2009. Personal communication. Professor and Extension Beef Cattle Specialist, Texas AgriLife Research and Extension Center at Amarillo, Amarillo, TX.

Milk Market Administrator. Milk Marketed from Each County of Texas by Selected Producers for 2008. Retrieved February 2, 2009 from http://www.dallasma.com/order_stats/prod_stats/pc.

N.E.H. 1993. Part 623 of Chapter 2 of the NRCS National Engineering Handbook – Irrigation Water Requirements.

New, L. 2008. Ten Year Overview and Summary – Panhandle AgriPartner programs. Texas AgriLife Extension Service. Amarillo, TX.

<http://amarillo.tamu.edu/programs/agripartners/Irrigation2007/AgriPartners10-yrOverviewSlides.pdf>

NPET. 2009. North Plains Evapotranspiration Network. Available at:

<http://amarillo2.tamu.edu/nppet/station.htm>.

Peabody, Ted. 2009. Farm Service Agency, 2006 – 2008 County Records, College Station, TX.

Pipkin, J. 2009. Personal communication. Equine Program Director, Professor of Animal Science, West Texas A&M University, Canyon TX.

SPS. 2000. Cattle-Feeding Capital of the World. Southwestern Public Service Company , Amarillo, TX.

Sweeten. John. 2009. Personal communication. Resident Director and Professor, Texas AgriLife Research and Extension Center at Amarillo, Amarillo, TX.

TASS. 1997. 1997 Texas Agricultural Statistics. United States Department of Agriculture, National Agricultural Statistics Service, Austin, TX.

TASS. 2007. 2007 Texas Agricultural Statistics United States Department of Agriculture, National Agricultural Statistics Service, Austin, TX.

Texas High Plains Evapotranspiration Network. 2009. Available at:

<http://txhighplainset.tamu.edu/>.

Tucker, C. Personal communication. 2008. CAFO Environmental Investigator, Texas Commission on Environmental Quality, Amarillo, Texas.

TWDB. 2009a. Texas Water Development Board. <http://www.twdb.state.tx.us/wrpi/rwp/rwp.htm>

TWDB. 2009b. Texas Water Development Board.

<http://midgewaterwww.twdb.state.tx.us/Evaporation/evap.htmlassistance/conservation/ASPApps/Survey.asp>.

Weinheimer, Ben. 2009. Personal communication. Vice President, Texas Cattle Feeders Association, Amarillo, TX.

APPENDIX A

TEXAS A&M UNIVERSITY 2011 PANHANDLE REGIONAL WATER PLAN REGION A IRRIGATION WATER APPLIED PER ACRE BY CROP AND COUNTY, 2000, 2010 & AVERAGE

Table A-1. Irrigation water applied per acre by crop and county.

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
ARMSTRONG			
Alfalfa:	0.00	27.94	27.94
Corn:	19.71	19.70	19.70
Cotton:	12.60	7.69	10.15
Hay:	32.83	39.15	35.99
Pasture and Other:	24.04	29.24	26.64
Peanuts:	20.40	20.46	20.43
Sorghum:	9.79	9.88	9.84
Forage Sorghum:	0.00	9.87	9.87
Soybeans:	10.49	10.38	10.43
Sunflowers:	0.00	2.95	2.95
Wheat:	9.60	7.70	8.65
CARSON			
Alfalfa:	0.00	26.50	26.50
Corn:	18.70	18.83	18.76
Cotton:	12.11	7.99	10.05
Hay:	31.41	37.40	34.41
Pasture and Other:	22.87	27.80	25.34
Peanuts:	19.90	20.05	19.97
Sorghum:	9.65	9.83	9.74
Forage Sorghum:	0.00	9.90	9.90
Soybeans:	9.69	9.71	9.70
Sunflowers:	0.00	3.99	3.99
Wheat:	9.98	7.34	8.66
CHILDRESS			
Alfalfa:	0.00	25.90	25.90
Corn:	19.35	19.32	19.33
Cotton:	12.27	8.08	10.17
Hay:	30.89	36.80	33.84
Pasture and Other:	22.35	27.20	24.78
Peanuts:	19.71	19.80	19.76
Sorghum:	9.81	9.93	9.87
Forage Sorghum:	0.00	9.99	9.99
Soybeans:	9.50	9.45	9.48
Sunflowers:	0.00	4.08	4.08
Wheat:	8.15	5.50	6.82

Table A-1. Irrigation water applied per acre by crop and county (continued).

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
COLLINGSWORTH			
Alfalfa:	0.00	24.53	24.53
Corn:	16.83	16.74	16.79
Cotton:	8.72	4.06	6.39
Hay:	29.14	35.03	32.09
Pasture and Other:	20.85	25.68	23.26
Peanuts:	16.41	16.38	16.40
Sorghum:	6.93	6.87	6.90
Forage Sorghum:	0.00	6.73	6.73
Soybeans:	7.36	7.23	7.29
Sunflowers:	0.00	0.00	0.00
Wheat:	5.06	2.52	3.79
DALLAM			
Alfalfa:	0.00	25.66	25.66
Corn:	17.50	18.65	18.07
Cotton:	10.57	7.51	9.04
Hay:	29.24	35.32	32.28
Pasture and Other:	21.43	26.46	23.94
Peanuts:	19.05	19.87	19.46
Sorghum:	9.15	9.85	9.50
Forage Sorghum:	0.00	10.45	10.45
Soybeans:	9.39	9.99	9.69
Sunflowers:	0.00	4.64	4.64
Wheat:	10.50	8.31	9.40
DONLEY			
Alfalfa:	0.00	25.14	25.14
Corn:	17.58	17.50	17.54
Cotton:	9.69	4.96	7.32
Hay:	30.04	35.92	32.98
Pasture and Other:	21.59	26.41	24.00
Peanuts:	17.31	17.30	17.31
Sorghum:	7.63	7.59	7.61
Forage Sorghum:	0.00	7.49	7.49
Soybeans:	7.93	7.80	7.87
Sunflowers:	0.00	0.44	0.44
Wheat:	5.83	3.29	4.56

Table A-1. Irrigation water applied per acre by crop and county (continued).

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
GRAY			
Alfalfa:	0.00	25.09	25.09
Corn:	17.92	17.94	17.93
Cotton:	10.84	6.51	8.67
Hay:	29.58	35.78	32.68
Pasture and Other:	21.09	26.17	23.63
Peanuts:	18.23	18.33	18.28
Sorghum:	8.38	8.50	8.44
Forage Sorghum:	0.00	8.53	8.53
Soybeans:	8.18	8.17	8.17
Sunflowers:	0.00	2.31	2.31
Wheat:	6.46	3.76	5.11
HALL			
Alfalfa:	0.00	25.35	25.35
Corn:	17.97	17.79	17.88
Cotton:	9.97	5.19	7.58
Hay:	30.16	36.04	33.10
Pasture and Other:	21.76	26.58	24.17
Peanuts:	17.59	17.50	17.55
Sorghum:	7.89	7.79	7.84
Forage Sorghum:	0.00	7.65	7.65
Soybeans:	8.24	8.04	8.14
Sunflowers:	0.00	0.67	0.67
Wheat:	6.25	3.54	4.89
HANSFORD			
Alfalfa:	0.00	27.28	27.28
Corn:	20.13	20.02	20.07
Cotton:	12.93	7.82	10.37
Hay:	33.25	38.64	35.94
Pasture and Other:	24.57	29.01	26.79
Peanuts:	20.75	20.84	20.79
Sorghum:	10.17	10.23	10.20
Forage Sorghum:	0.00	10.28	10.28
Soybeans:	11.14	10.93	11.04
Sunflowers:	0.00	3.03	3.03
Wheat:	10.23	7.71	8.97

Table A-1. Irrigation water applied per acre by crop and county (continued).

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
HARTLEY			
Alfalfa:	0.00	26.42	26.42
Corn:	18.52	19.09	18.81
Cotton:	11.57	7.70	9.64
Hay:	30.82	36.78	33.80
Pasture and Other:	22.63	27.55	25.09
Peanuts:	19.66	20.12	19.89
Sorghum:	9.43	9.87	9.65
Forage Sorghum:	0.00	10.18	10.18
Soybeans:	9.87	10.14	10.01
Sunflowers:	0.00	4.00	4.00
Wheat:	10.63	8.36	9.50
HEMPHILL			
Alfalfa:	0.00	24.38	24.38
Corn:	16.80	16.82	16.81
Cotton:	9.12	4.65	6.88
Hay:	28.96	34.94	31.95
Pasture and Other:	20.60	25.50	23.05
Peanuts:	16.70	16.76	16.73
Sorghum:	7.11	7.17	7.14
Forage Sorghum:	0.00	7.09	7.09
Soybeans:	7.30	7.26	7.28
Sunflowers:	0.00	0.29	0.29
Wheat:	5.16	2.53	3.84
HUTCHINSON			
Alfalfa:	0.00	26.18	26.18
Corn:	19.21	19.32	19.27
Cotton:	12.08	7.22	9.65
Hay:	31.94	37.43	34.69
Pasture and Other:	23.31	27.83	25.57
Peanuts:	19.79	19.95	19.87
Sorghum:	9.44	9.55	9.49
Forage Sorghum:	0.00	9.54	9.54
Soybeans:	10.08	10.03	10.05
Sunflowers:	0.00	2.53	2.53
Wheat:	9.71	7.17	8.44

Table A-1. Irrigation water applied per acre by crop and county (continued).

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
LIPSCOMB			
Alfalfa:	0.00	25.83	25.83
Corn:	17.16	17.06	17.11
Cotton:	9.59	4.92	7.26
Hay:	30.41	36.36	33.39
Pasture and Other:	22.08	26.96	24.52
Peanuts:	17.45	17.39	17.42
Sorghum:	7.67	7.58	7.62
Forage Sorghum:	0.00	7.48	7.48
Soybeans:	8.23	8.06	8.14
Sunflowers:	0.00	0.53	0.53
Wheat:	7.24	4.62	5.93
MOORE			
Alfalfa:	0.00	24.81	24.81
Corn:	17.78	18.01	17.90
Cotton:	10.99	6.80	8.90
Hay:	29.59	35.20	32.39
Pasture and Other:	21.44	26.06	23.75
Peanuts:	18.47	18.66	18.56
Sorghum:	8.51	8.75	8.63
Forage Sorghum:	0.00	8.88	8.88
Soybeans:	8.98	9.02	9.00
Sunflowers:	0.00	2.77	2.77
Wheat:	8.67	6.64	7.65
OCHILTREE			
Alfalfa:	0.00	24.92	24.92
Corn:	19.26	19.25	19.25
Cotton:	12.15	7.18	9.66
Hay:	32.21	36.59	34.40
Pasture and Other:	23.56	27.15	25.35
Peanuts:	19.86	20.05	19.96
Sorghum:	9.46	9.62	9.54
Forage Sorghum:	0.00	9.74	9.74
Soybeans:	10.18	10.09	10.14
Sunflowers:	0.00	2.48	2.48
Wheat:	11.97	7.76	9.86

Table A-1. Irrigation water applied per acre by crop and county (continued).

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
OLDHAM			
Alfalfa:	0.00	30.19	30.19
Corn:	21.68	21.79	21.74
Cotton:	14.56	9.64	12.10
Hay:	35.65	41.92	38.78
Pasture and Other:	26.59	31.77	29.18
Peanuts:	22.61	22.79	22.70
Sorghum:	11.71	11.91	11.81
Forage Sorghum:	0.00	12.00	12.00
Soybeans:	11.92	11.92	11.92
Sunflowers:	0.00	4.95	4.95
Wheat:	12.60	9.82	11.21
POTTER			
Alfalfa:	0.00	28.70	28.70
Corn:	20.51	20.65	20.58
Cotton:	13.65	8.80	11.22
Hay:	34.27	40.43	37.35
Pasture and Other:	25.22	30.28	27.75
Peanuts:	21.63	21.82	21.73
Sorghum:	10.81	11.02	10.91
Forage Sorghum:	0.00	11.10	11.10
Soybeans:	10.90	10.90	10.90
Sunflowers:	0.00	4.10	4.10
Wheat:	11.15	8.37	9.76
RANDALL			
Alfalfa:	0.00	29.06	29.06
Corn:	21.20	21.27	21.24
Cotton:	13.99	9.09	11.54
Hay:	34.64	40.79	37.71
Pasture and Other:	25.58	30.64	28.11
Peanuts:	21.97	22.14	22.06
Sorghum:	11.15	11.33	11.24
Forage Sorghum:	0.00	11.41	11.41
Soybeans:	11.25	11.24	11.24
Sunflowers:	0.00	4.40	4.40
Wheat:	11.10	8.05	9.57

Table A-1. Irrigation water applied per acre by crop and county (continued).

COUNTY	2000 Water Use per Crop (in./ac.)	2010 Water Use per Crop (in./ac.)	Average Water Use per Crop (in./ac.)
ROBERTS			
Alfalfa:	0.00	25.13	25.13
Corn:	18.94	18.92	18.93
Cotton:	11.64	6.94	9.29
Hay:	30.42	36.23	33.32
Pasture and Other:	21.78	26.54	24.16
Peanuts:	19.09	19.23	19.16
Sorghum:	8.92	9.07	9.00
Forage Sorghum:	0.00	9.12	9.12
Soybeans:	9.24	9.13	9.19
Sunflowers:	0.00	2.37	2.37
Wheat:	6.33	3.93	5.13
SHERMAN			
Alfalfa:	0.00	28.51	28.51
Corn:	20.19	20.40	20.30
Cotton:	13.36	8.74	11.05
Hay:	33.71	39.73	36.72
Pasture and Other:	25.00	29.95	27.47
Peanuts:	21.35	21.59	21.47
Sorghum:	10.83	11.03	10.93
Forage Sorghum:	0.00	11.20	11.20
Soybeans:	11.06	11.10	11.08
Sunflowers:	0.00	4.41	4.41
Wheat:	11.59	8.96	10.27
WHEELER			
Alfalfa:	0.00	25.33	25.33
Corn:	18.28	18.28	18.28
Cotton:	11.38	7.08	9.23
Hay:	29.83	36.06	32.94
Pasture and Other:	21.31	26.40	23.85
Peanuts:	18.72	18.81	18.76
Sorghum:	8.79	8.92	8.85
Forage Sorghum:	0.00	8.97	8.97
Soybeans:	8.47	8.46	8.47
Sunflowers:	0.00	2.92	2.92
Wheat:	6.93	4.12	5.52

APPENDIX B

TEXAS A&M UNIVERSITY 2011 REGIONAL WATER PLAN REGION A PROJECTED LIVESTOCK INVENTORY AND WATER USE BY COUNTY AND REGION, 2000 – 2060

Table B-1. Projected Future Livestock Numbers and Water Use – Beef Cows, Range/Pasture Operations.

<u>County</u>	<u>Beef Cows</u> <u>Beef: Projected Inventory----></u>							<u>Beef Cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>2000</u> <u>Water Use, Beef Cows-----></u>		
	<u>2000</u>	<u>2010*</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	6,000	15,000	15,000	15,000	15,000	15,000	15,000	6,000	20	120,000	7,300	134.4
Carson	11,000	8,000	8,000	8,000	8,000	8,000	8,000	11,000	20	220,000	7,300	246.4
Childress	9,000	10,000	10,000	10,000	10,000	10,000	10,000	9,000	20	180,000	7,300	201.6
Collingsworth	15,000	10,000	10,000	10,000	10,000	10,000	10,000	15,000	20	300,000	7,300	336.0
Dallam	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	20	200,000	7,300	224.0
Donley	21,000	15,000	15,000	15,000	15,000	15,000	15,000	21,000	20	420,000	7,300	470.5
Gray	12,000	7,000	7,000	7,000	7,000	7,000	7,000	12,000	20	240,000	7,300	268.8
Hall	11,000	8,000	8,000	8,000	8,000	8,000	8,000	11,000	20	220,000	7,300	246.4
Hansford	6,000	8,000	8,000	8,000	8,000	8,000	8,000	6,000	20	120,000	7,300	134.4
Hartley	10,000	18,000	18,000	18,000	18,000	18,000	18,000	10,000	20	200,000	7,300	224.0
Hemphill	18,000	23,000	23,000	23,000	23,000	23,000	23,000	18,000	20	360,000	7,300	403.3
Hutchinson	6,000	7,000	7,000	7,000	7,000	7,000	7,000	6,000	20	120,000	7,300	134.4
Lipscomb	10,000	18,000	18,000	18,000	18,000	18,000	18,000	10,000	20	200,000	7,300	224.0
Moore	6,000	8,000	8,000	8,000	8,000	8,000	8,000	6,000	20	120,000	7,300	134.4
Ochiltree	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	20	180,000	7,300	201.6
Oldham	12,000	13,000	13,000	13,000	13,000	13,000	13,000	12,000	20	240,000	7,300	268.8
Potter	5,000	11,000	11,000	11,000	11,000	11,000	11,000	5,000	20	100,000	7,300	112.0
Randall	10,000	13,000	13,000	13,000	13,000	13,000	13,000	10,000	20	200,000	7,300	224.0
Roberts	8,000	9,000	9,000	9,000	9,000	9,000	9,000	8,000	20	160,000	7,300	179.2
Sherman	7,000	6,000	6,000	6,000	6,000	6,000	6,000	7,000	20	140,000	7,300	156.8
Wheeler	35,000	25,000	25,000	25,000	25,000	25,000	25,000	35,000	20	700,000	7,300	784.1
Total	237,000	251,000	251,000	251,000	251,000	251,000	251,000	237,000		4,740,000		5,309.5

Note: Assumes 0.0% growth factor from 2010 through 2060.

*Source: Updated January 1, 2008 inventory estimates from 2007 Texas Agricultural Statistics Service.

Table B-1. Projected Future Livestock Numbers and Water Use – Beef Cows, Range/Pasture Operations (continued).

<u>County</u>	<u>2010</u>		<u>Water Use, Beef Cows-----></u>			<u>2020</u>		<u>Water Use, Beef Cows-----></u>		
	<u>Beef Cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	<u>Beef Cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	15,000	20	300,000	7,300	336.0	15,000	20	300,000	7,300	336.0
Carson	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Childress	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Collingsworth	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Dallam	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Donley	15,000	20	300,000	7,300	336.0	15,000	20	300,000	7,300	336.0
Gray	7,000	20	140,000	7,300	156.8	7,000	20	140,000	7,300	156.8
Hall	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Hansford	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Hartley	18,000	20	360,000	7,300	403.3	18,000	20	360,000	7,300	403.3
Hemphill	23,000	20	460,000	7,300	515.3	23,000	20	460,000	7,300	515.3
Hutchinson	7,000	20	140,000	7,300	156.8	7,000	20	140,000	7,300	156.8
Lipscomb	18,000	20	360,000	7,300	403.3	18,000	20	360,000	7,300	403.3
Moore	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Ochiltree	9,000	20	180,000	7,300	201.6	9,000	20	180,000	7,300	201.6
Oldham	13,000	20	260,000	7,300	291.2	13,000	20	260,000	7,300	291.2
Potter	11,000	20	220,000	7,300	246.4	11,000	20	220,000	7,300	246.4
Randall	13,000	20	260,000	7,300	291.2	13,000	20	260,000	7,300	291.2
Roberts	9,000	20	180,000	7,300	201.6	9,000	20	180,000	7,300	201.6
Sherman	6,000	20	120,000	7,300	134.4	6,000	20	120,000	7,300	134.4
Wheeler	25,000	20	500,000	7,300	560.1	25,000	20	500,000	7,300	560.1
Total	251,000		5,020,000		5,623.2	251,000		5,020,000		5,623.2

Table B-1. Projected Future Livestock Numbers and Water Use – Beef Cows, Range/Pasture Operations (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Beef Cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Beef Cows-----></u>			<u>Beef Cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Beef Cows-----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	15,000	20	300,000	7,300	336.0	15,000	20	300,000	7,300	336.0
Carson	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Childress	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Collingsworth	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Dallam	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Donley	15,000	20	300,000	7,300	336.0	15,000	20	300,000	7,300	336.0
Gray	7,000	20	140,000	7,300	156.8	7,000	20	140,000	7,300	156.8
Hall	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Hansford	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Hartley	18,000	20	360,000	7,300	403.3	18,000	20	360,000	7,300	403.3
Hemphill	23,000	20	460,000	7,300	515.3	23,000	20	460,000	7,300	515.3
Hutchinson	7,000	20	140,000	7,300	156.8	7,000	20	140,000	7,300	156.8
Lipscomb	18,000	20	360,000	7,300	403.3	18,000	20	360,000	7,300	403.3
Moore	8,000	20	160,000	7,300	179.2	8,000	20	160,000	7,300	179.2
Ochiltree	9,000	20	180,000	7,300	201.6	9,000	20	180,000	7,300	201.6
Oldham	13,000	20	260,000	7,300	291.2	13,000	20	260,000	7,300	291.2
Potter	11,000	20	220,000	7,300	246.4	11,000	20	220,000	7,300	246.4
Randall	13,000	20	260,000	7,300	291.2	13,000	20	260,000	7,300	291.2
Roberts	9,000	20	180,000	7,300	201.6	9,000	20	180,000	7,300	201.6
Sherman	6,000	20	120,000	7,300	134.4	6,000	20	120,000	7,300	134.4
Wheeler	25,000	20	500,000	7,300	560.1	25,000	20	500,000	7,300	560.1
Total	251,000		5,020,000		5,623.2	251,000		5,020,000		5,623.2

Table B-1. Projected Future Livestock Numbers and Water Use – Beef Cows, Range/Pasture Operations (continued).

<u>County</u>	<u>2050</u>		<u>Water Use, Beef Cows-----></u>			<u>2060</u>		<u>Water Use, Beef Cows-----></u>		
	<u>Beef cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	<u>Beef cows</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	15,000	20	300,000	7,300	336.0	15,000	20	120,000	7,300	336.0
Carson	8,000	20	160,000	7,300	179.2	8,000	20	220,000	7,300	179.2
Childress	10,000	20	200,000	7,300	224.0	10,000	20	180,000	7,300	224.0
Collingsworth	10,000	20	200,000	7,300	224.0	10,000	20	300,000	7,300	224.0
Dallam	10,000	20	200,000	7,300	224.0	10,000	20	200,000	7,300	224.0
Donley	15,000	20	300,000	7,300	336.0	15,000	20	420,000	7,300	336.0
Gray	7,000	20	140,000	7,300	156.8	7,000	20	240,000	7,300	156.8
Hall	8,000	20	160,000	7,300	179.2	8,000	20	220,000	7,300	179.2
Hansford	8,000	20	160,000	7,300	179.2	8,000	20	120,000	7,300	179.2
Hartley	18,000	20	360,000	7,300	403.3	18,000	20	200,000	7,300	403.3
Hemphill	23,000	20	460,000	7,300	515.3	23,000	20	360,000	7,300	515.3
Hutchinson	7,000	20	140,000	7,300	156.8	7,000	20	120,000	7,300	156.8
Lipscomb	18,000	20	360,000	7,300	403.3	18,000	20	200,000	7,300	403.3
Moore	8,000	20	160,000	7,300	179.2	8,000	20	120,000	7,300	179.2
Ochiltree	9,000	20	180,000	7,300	201.6	9,000	20	180,000	7,300	201.6
Oldham	13,000	20	260,000	7,300	291.2	13,000	20	240,000	7,300	291.2
Potter	11,000	20	220,000	7,300	246.4	11,000	20	100,000	7,300	246.4
Randall	13,000	20	260,000	7,300	291.2	13,000	20	200,000	7,300	291.2
Roberts	9,000	20	180,000	7,300	201.6	9,000	20	160,000	7,300	201.6
Sherman	6,000	20	120,000	7,300	134.4	6,000	20	140,000	7,300	134.4
Wheeler	25,000	20	500,000	7,300	560.1	25,000	20	700,000	7,300	560.1
Total	251,000		5,020,000		5,623.2	251,000		4,740,000		5,623.2

Table B-2. Projected Future Livestock Numbers and Water Use – Dairy Operations.

<u>County</u>	<u>Dairy Cows (Milkers & dry cows + heifers)</u>							<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>2000 Water Use, Dairy-----></u>		
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	0	0	0	0	0	0	0	0	0	0	0	0.0
Carson	0	0	0	0	0	0	0	0	0	0	0	0.0
Childress	0	0	0	0	0	0	0	0	0	0	0	0.0
Collingsworth	0	0	0	0	0	0	0	0	0	0	0	0.0
Dallam	1,900	5,504	21,029	23,229	25,659	28,344	31,309	1,900	65	123,500	23,725	138.3
Donley	0	0	0	0	0	0	0	0	0	0	0	0.0
Gray	1,600	3,100	3,100	3,424	3,783	4,178	4,615	1,600	65	104,000	23,725	116.5
Hall	0	0	0	0	0	0	0	0	0	0	0	0.0
Hansford	0	0	0	0	0	0	0	0	0	0	0	0.0
Hartley	0	21,936	49,842	55,057	60,817	67,179	74,208	0	0	0	0	0.0
Hemphill	0	0	0	0	0	0	0	0	0	0	0	0.0
Hutchinson	0	865	865	955	1,055	1,166	1,288	0	0	0	0	0.0
Lipscomb	0	3,000	3,000	3,314	3,661	4,044	4,467	0	0	0	0	0.0
Moore	0	8,359	17,809	19,672	21,730	24,004	26,515	0	0	0	0	0.0
Ochiltree	0	0	0	0	0	0	0	0	0	0	0	0.0
Oldham	0	0	0	0	0	0	0	0	0	0	0	0.0
Potter	0	0	0	0	0	0	0	0	0	0	0	0.0
Randall	900	800	800	884	976	1,078	1,191	900	65	58,500	23,725	65.5
Roberts	0	0	0	0	0	0	0	0	0	0	0	0.0
Sherman	0	5,573	12,692	14,020	15,487	17,107	18,897	0	0	0	0	0.0
Wheeler	0	0	0	0	0	0	0	0	0	0	0	0.0
Total	4,400	49,137	109,137	120,555	133,168	147,100	162,490	4,400		286,000		320.4

Note: Assumes expansion in Region A will occur in the four counties in the northwest quadrant.

TCEQ inventory count data used for Sherman, Gray, Hutchinson, Lipscomb, and Randall Counties.

December 2008 Milk Market Administrator records were used to estimate 2010 inventories in Dallam, Hartley, and Moore Counties.

Assumes 75% of the Phase II expansion of Hilmar Cheese Plant (80,000 cows) occurs in the four counties of Region A with the remaining 25% "leakage" to Region O or out-of state.

Assumes a growth rate of 1.00%/year from 2020 to 2060.

Water use per cow was reduced to 55 gallons per day effective 2010 on recommendations of the dairy advisory committee.

Table B-2. Projected Future Livestock Numbers and Water Use – Dairy Operations (continued).

<u>County</u>	<u>2010</u>					<u>2020</u>				
	<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Dairy-----></u>			<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Dairy-----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	0	0	0	0	0.0	0	0	0	0	0.0
Carson	0	0	0	0	0.0	0	0	0	0	0.0
Childress	0	0	0	0	0.0	0	0	0	0	0.0
Collingsworth	0	0	0	0	0.0	0	0	0	0	0.0
Dallam	5,504	55	302,720	20,075	339.1	21,029	55	1,156,595	20,075	1,295.6
Donley	0	0	0	0	0.0	0	0	0	0	0.0
Gray	3,100	55	170,500	20,075	191.0	3,100	55	170,500	20,075	191.0
Hall	0	0	0	0	0.0	0	0	0	0	0.0
Hansford	0	0	0	0	0.0	0	0	0	0	0.0
Hartley	21,936	55	1,206,480	20,075	1,351.4	49,842	55	2,741,310	20,075	3,070.7
Hemphill	0	0	0	0	0.0	0	0	0	0	0.0
Hutchinson	865	55	47,575	20,075	53.3	865	55	47,575	20,075	53.3
Lipscomb	3,000	55	165,000	20,075	184.8	3,000	55	165,000	20,075	184.8
Moore	8,359	55	459,745	20,075	515.0	17,809	55	979,495	20,075	1,097.2
Ochiltree	0	0	0	0	0.0	0	0	0	0	0.0
Oldham	0	0	0	0	0.0	0	0	0	0	0.0
Potter	0	0	0	0	0.0	0	0	0	0	0.0
Randall	800	55	44,000	20,075	49.3	800	55	44,000	20,075	49.3
Roberts	0	0	0	0	0.0	0	0	0	0	0.0
Sherman	5,573	55	306,515	20,075	343.3	12,692	55	698,060	20,075	781.9
Wheeler	0	0	0	0	0.0	0	0	0	0	0.0
Total	49,137		2,702,535		3,027.3	109,137		6,002,535		6,723.8

Table B-2. Projected Future Livestock Numbers and Water Use – Dairy Operations (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Dairy-----></u>			<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Dairy-----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	0	0	0	0	0.0	0	0	0	0	0.0
Carson	0	0	0	0	0.0	0	0	0	0	0.0
Childress	0	0	0	0	0.0	0	0	0	0	0.0
Collingsworth	0	0	0	0	0.0	0	0	0	0	0.0
Dallam	23,229	55	1,277,600	20,075	1,431.1	25,659	55	1,411,266	20,075	1,580.8
Donley	0	0	0	0	0.0	0	0	0	0	0.0
Gray	3,424	55	188,338	20,075	211.0	3,783	55	208,042	20,075	233.0
Hall	0	0	0	0	0.0	0	0	0	0	0.0
Hansford	0	0	0	0	0.0	0	0	0	0	0.0
Hartley	55,057	55	3,028,112	20,075	3,392.0	60,817	55	3,344,919	20,075	3,746.8
Hemphill	0	0	0	0	0.0	0	0	0	0	0.0
Hutchinson	955	55	52,552	20,075	58.9	1,055	55	58,051	20,075	65.0
Lipscomb	3,314	55	182,263	20,075	204.2	3,661	55	201,331	20,075	225.5
Moore	19,672	55	1,081,972	20,075	1,212.0	21,730	55	1,195,170	20,075	1,338.8
Ochiltree	0	0	0	0	0.0	0	0	0	0	0.0
Oldham	0	0	0	0	0.0	0	0	0	0	0.0
Potter	0	0	0	0	0.0	0	0	0	0	0.0
Randall	884	55	48,603	20,075	54.4	976	55	53,688	20,075	60.1
Roberts	0	0	0	0	0.0	0	0	0	0	0.0
Sherman	14,020	55	771,093	20,075	863.7	15,487	55	851,766	20,075	954.1
Wheeler	0	0	0	0	0.0	0	0	0	0	0.0
Total	120,555		6,630,533		7,427.2	133,168		7,324,233		8,204.3

Table B-2. Projected Future Livestock Numbers and Water Use – Dairy Operations (continued).

<u>County</u>	<u>2050</u>					<u>2060</u>				
	<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Dairy-----></u>			<u>Dairy Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Dairy-----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	0	0	0	0	0.0	0	0	0	0	0.0
Carson	0	0	0	0	0.0	0	0	0	0	0.0
Childress	0	0	0	0	0.0	0	0	0	0	0.0
Collingsworth	0	0	0	0	0.0	0	0	0	0	0.0
Dallam	28,344	55	1,558,915	20,075	1,746.2	31,309	55	1,722,012	20,075	1,928.9
Donley	0	0	0	0	0.0	0	0	0	0	0.0
Gray	4,178	55	229,808	20,075	257.4	4,615	55	253,851	20,075	284.4
Hall	0	0	0	0	0.0	0	0	0	0	0.0
Hansford	0	0	0	0	0.0	0	0	0	0	0.0
Hartley	67,179	55	3,694,872	20,075	4,138.8	74,208	55	4,081,437	20,075	4,571.8
Hemphill	0	0	0	0	0.0	0	0	0	0	0.0
Hutchinson	1,166	55	64,124	20,075	71.8	1,288	55	70,833	20,075	79.3
Lipscomb	4,044	55	222,395	20,075	249.1	4,467	55	245,663	20,075	275.2
Moore	24,004	55	1,320,211	20,075	1,478.8	26,515	55	1,458,335	20,075	1,633.6
Ochiltree	0	0	0	0	0.0	0	0	0	0	0.0
Oldham	0	0	0	0	0.0	0	0	0	0	0.0
Potter	0	0	0	0	0.0	0	0	0	0	0.0
Randall	1,078	55	59,305	20,075	66.4	1,191	55	65,510	20,075	73.4
Roberts	0	0	0	0	0.0	0	0	0	0	0.0
Sherman	17,107	55	940,879	20,075	1,053.9	18,897	55	1,039,316	20,075	1,164.2
Wheeler	0	0	0	0	0.0	0	0	0	0	0.0
Total	147,100		8,090,510		9,062.6	162,490		8,936,957		10,010.8

Table B-3. Projected Future Livestock Numbers and Water Use – Beef Cattle Feedlots.

<u>County</u>	<u>Beef Feedlots:Projected Inventory----></u>							<u>2000</u>	<u>Water Use</u>	<u>Water Use, beef feedlots</u>		
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>	<u>Inventory</u>	<u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	5,722	4,250	4,250	4,250	4,250	4,250	4,250	5,722	15.0	85,833.0	5,475	96.1
Carson	12,572	12,750	12,750	12,750	12,750	12,750	12,750	12,572	15.0	188,572.5	5,475	211.2
Childress	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Collingsworth	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Dallam	132,651	132,600	145,860	160,446	176,491	194,140	213,554	132,651	15.0	1,989,765.0	5,475	2,228.8
Donley	26,010	52,700	52,700	52,700	52,700	52,700	52,700	26,010	15.0	390,150.0	5,475	437.0
Gray	60,690	43,350	43,350	43,350	43,350	43,350	43,350	60,690	15.0	910,350.0	5,475	1,019.7
Hall	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Hansford	174,267	190,315	209,347	230,281	253,309	278,640	306,504	174,267	15.0	2,614,005.0	5,475	2,928.1
Hartley	170,799	197,200	216,920	238,612	262,473	288,721	317,593	170,799	15.0	2,561,985.0	5,475	2,869.8
Hemphill	44,217	42,500	42,500	42,500	42,500	42,500	42,500	44,217	15.0	663,255.0	5,475	742.9
Hutchinson	12,572	12,325	12,325	12,325	12,325	12,325	12,325	12,572	15.0	188,572.5	5,475	211.2
Lipscomb	694	12,750	12,750	12,750	12,750	12,750	12,750	694	15.0	10,404.0	5,475	11.7
Moore	123,201	134,300	147,730	162,503	178,753	196,629	216,291	123,201	15.0	1,848,010.5	5,475	2,070.1
Ochiltree	92,769	87,549	96,304	105,934	116,528	128,180	140,999	92,769	15.0	1,391,535.0	5,475	1,558.7
Oldham	42,483	39,950	39,950	39,950	39,950	39,950	39,950	42,483	15.0	637,245.0	5,475	713.8
Potter	2,254	5,950	5,950	5,950	5,950	5,950	5,950	2,254	15.0	33,813.0	5,475	37.9
Randall	117,045	142,800	142,800	142,800	142,800	142,800	142,800	117,045	15.0	1,755,675.0	5,475	1,966.6
Roberts	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Sherman	127,883	146,200	160,820	176,902	194,592	214,051	235,457	127,883	15.0	1,918,237.5	5,475	2,148.7
Wheeler	36,414	55,250	55,250	55,250	55,250	55,250	55,250	36,414	15.0	546,210.0	5,475	611.8
Total	1,182,241	1,312,739	1,401,555	1,499,253	1,606,721	1,724,936	1,854,972	1,182,241		17,733,618.0		19,864.4

Note: County level inventory estimates made in early 2009 by TCFA were assumed to equal 2010 inventories.

Six counties include growth projections at a rate of 10% per decade from 2010 to 2060 including: Dallam, Hansford, Hartley, Moore, Ochiltree, and Sherman.

No growth was projected for the remaining counties from 2010-2060.

Water use per head was reduced from 15.0 gallon/hd/day to 12.5 gallons/hd/day starting in 2010 based on the advisory committee recommendations.

Table B-3. Projected Future Livestock Numbers and Water Use – Beef Cattle Feedlots (continued).

<u>County</u>	<u>2010</u>					<u>2020</u>				
	<u>Feedlots</u> <u>Inventory</u>	<u>Water Use</u> <u>gal/hd/day</u>	<u>Water Use, beef feedlots</u>			<u>Feedlots</u> <u>Inventory</u>	<u>Water Use</u> <u>gal/hd/day</u>	<u>Water Use, beef feedlots</u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	4,250	12.5	53,125.0	4,563	59.5	4,250	12.5	53,125.0	4,563	59.5
Carson	12,750	12.5	159,375.0	4,563	178.5	12,750	12.5	159,375.0	4,563	178.5
Childress	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Collingsworth	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Dallam	132,600	12.5	1,657,500.0	4,563	1,856.7	145,860	12.5	1,823,250.0	4,563	2,042.3
Donley	52,700	12.5	658,750.0	4,563	737.9	52,700	12.5	658,750.0	4,563	737.9
Gray	43,350	12.5	541,875.0	4,563	607.0	43,350	12.5	541,875.0	4,563	607.0
Hall	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Hansford	190,315	12.5	2,378,937.5	4,563	2,664.8	209,347	12.5	2,616,831.3	4,563	2,931.3
Hartley	197,200	12.5	2,465,000.0	4,563	2,761.2	216,920	12.5	2,711,500.0	4,563	3,037.3
Hemphill	42,500	12.5	531,250.0	4,563	595.1	42,500	12.5	531,250.0	4,563	595.1
Hutchinson	12,325	12.5	154,062.5	4,563	172.6	12,325	12.5	154,062.5	4,563	172.6
Lipscomb	12,750	12.5	159,375.0	4,563	178.5	12,750	12.5	159,375.0	4,563	178.5
Moore	134,300	12.5	1,678,750.0	4,563	1,880.5	147,730	12.5	1,846,625.0	4,563	2,068.5
Ochiltree	87,549	12.5	1,094,362.5	4,563	1,225.9	96,304	12.5	1,203,798.8	4,563	1,348.4
Oldham	39,950	12.5	499,375.0	4,563	559.4	39,950	12.5	499,375.0	4,563	559.4
Potter	5,950	12.5	74,375.0	4,563	83.3	5,950	12.5	74,375.0	4,563	83.3
Randall	142,800	12.5	1,785,000.0	4,563	1,999.5	142,800	12.5	1,785,000.0	4,563	1,999.5
Roberts	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Sherman	146,200	12.5	1,827,500.0	4,563	2,047.1	160,820	12.5	2,010,250.0	4,563	2,251.8
Wheeler	55,250	12.5	690,625.0	4,563	773.6	55,250	12.5	690,625.0	4,563	773.6
Total	1,312,739		16,409,237.5		18,380.9	1,401,555		17,519,442.5		19,624.5

Table B-3. Projected Future Livestock Numbers and Water Use – Beef Cattle Feedlots (continued).

<u>County</u>	<u>2030</u>						<u>2040</u>				
	<u>Feedlots</u>	<u>Water Use</u>	<u>Water Use, beef feedlots</u>			<u>Feedlots</u>	<u>Water Use</u>	<u>Water Use, beef feedlots</u>			
	<u>Inventory</u>	<u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	<u>Inventory</u>	<u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	
Armstrong	4,250	12.5	53,125.0	4,563	59.5	4,250	12.5	53,125.0	4,563	59.5	
Carson	12,750	12.5	159,375.0	4,563	178.5	12,750	12.5	159,375.0	4,563	178.5	
Childress	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0	
Collingsworth	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0	
Dallam	160,446	12.5	2,005,575.0	4,563	2,246.6	176,491	12.5	2,206,132.5	4,563	2,471.2	
Donley	52,700	12.5	658,750.0	4,563	737.9	52,700	12.5	658,750.0	4,563	737.9	
Gray	43,350	12.5	541,875.0	4,563	607.0	43,350	12.5	541,875.0	4,563	607.0	
Hall	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0	
Hansford	230,281	12.5	2,878,514.4	4,563	3,224.4	253,309	12.5	3,166,365.8	4,563	3,546.8	
Hartley	238,612	12.5	2,982,650.0	4,563	3,341.0	262,473	12.5	3,280,915.0	4,563	3,675.1	
Hemphill	42,500	12.5	531,250.0	4,563	595.1	42,500	12.5	531,250.0	4,563	595.1	
Hutchinson	12,325	12.5	154,062.5	4,563	172.6	12,325	12.5	154,062.5	4,563	172.6	
Lipscomb	12,750	12.5	159,375.0	4,563	178.5	12,750	12.5	159,375.0	4,563	178.5	
Moore	162,503	12.5	2,031,287.5	4,563	2,275.4	178,753	12.5	2,234,416.3	4,563	2,502.9	
Ochiltree	105,934	12.5	1,324,178.6	4,563	1,483.3	116,528	12.5	1,456,596.5	4,563	1,631.6	
Oldham	39,950	12.5	499,375.0	4,563	559.4	39,950	12.5	499,375.0	4,563	559.4	
Potter	5,950	12.5	74,375.0	4,563	83.3	5,950	12.5	74,375.0	4,563	83.3	
Randall	142,800	12.5	1,785,000.0	4,563	1,999.5	142,800	12.5	1,785,000.0	4,563	1,999.5	
Roberts	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0	
Sherman	176,902	12.5	2,211,275.0	4,563	2,477.0	194,592	12.5	2,432,402.5	4,563	2,724.7	
Wheeler	55,250	12.5	690,625.0	4,563	773.6	55,250	12.5	690,625.0	4,563	773.6	
Total	1,499,253		18,740,668.0		20,992.4	1,606,721		20,084,016.1		22,497.2	

Table B-3. Projected Future Livestock Numbers and Water Use – Beef Cattle Feedlots (continued).

<u>County</u>	<u>2050</u>					<u>2060</u>				
	<u>Feedlots</u> <u>Inventory</u>	<u>Water Use</u> <u>gal/hd/day</u>	<u>Water Use, beef feedlots</u>			<u>Feedlots</u> <u>Inventory</u>	<u>Water Use</u> <u>gal/hd/day</u>	<u>Water Use, beef feedlots</u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	4,250	12.5	53,125.0	4,563	59.5	4,250	12.5	53,125.0	4,563	59.5
Carson	12,750	12.5	159,375.0	4,563	178.5	12,750	12.5	159,375.0	4,563	178.5
Childress	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Collingsworth	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Dallam	194,140	12.5	2,426,745.8	4,563	2,718.3	213,554	12.5	2,669,420.3	4,563	2,990.2
Donley	52,700	12.5	658,750.0	4,563	737.9	52,700	12.5	658,750.0	4,563	737.9
Gray	43,350	12.5	541,875.0	4,563	607.0	43,350	12.5	541,875.0	4,563	607.0
Hall	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Hansford	278,640	12.5	3,483,002.4	4,563	3,901.5	306,504	12.5	3,831,302.6	4,563	4,291.6
Hartley	288,721	12.5	3,609,006.5	4,563	4,042.6	317,593	12.5	3,969,907.2	4,563	4,446.9
Hemphill	42,500	12.5	531,250.0	4,563	595.1	42,500	12.5	531,250.0	4,563	595.1
Hutchinson	12,325	12.5	154,062.5	4,563	172.6	12,325	12.5	154,062.5	4,563	172.6
Lipscomb	12,750	12.5	159,375.0	4,563	178.5	12,750	12.5	159,375.0	4,563	178.5
Moore	196,629	12.5	2,457,857.9	4,563	2,753.2	216,291	12.5	2,703,643.7	4,563	3,028.5
Ochiltree	128,180	12.5	1,602,256.1	4,563	1,794.8	140,999	12.5	1,762,481.7	4,563	1,974.3
Oldham	39,950	12.5	499,375.0	4,563	559.4	39,950	12.5	499,375.0	4,563	559.4
Potter	5,950	12.5	74,375.0	4,563	83.3	5,950	12.5	74,375.0	4,563	83.3
Randall	142,800	12.5	1,785,000.0	4,563	1,999.5	142,800	12.5	1,785,000.0	4,563	1,999.5
Roberts	0	0.0	0.0	0	0.0	0	0.0	0.0	0	0.0
Sherman	214,051	12.5	2,675,642.8	4,563	2,997.1	235,457	12.5	2,943,207.0	4,563	3,296.8
Wheeler	55,250	12.5	690,625.0	4,563	773.6	55,250	12.5	690,625.0	4,563	773.6
Total	1,724,936		21,561,698.9		24,152.4	1,854,972		23,187,150.0		25,973.2

Table B-4. Projected Future Livestock Numbers and Water Use – Equine Operations.

<u>County</u>	<u>Equine: Projected Inventory---></u>							<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>2000 Water Use, Equine---></u>		
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	769	688	760	839	927	1,024	1,132	769	12	9,231.4	4,380	10.3
Carson	483	559	617	682	753	832	919	483	12	5,795.8	4,380	6.5
Childress	697	361	399	440	487	537	594	697	12	8,365.1	4,380	9.4
Collingsworth	1,738	492	543	600	663	733	809	1,738	12	20,852.9	4,380	23.4
Dallam	1,110	555	613	677	748	826	913	1,110	12	13,324.3	4,380	14.9
Donley	1,845	655	724	799	883	975	1,077	1,845	12	22,137.5	4,380	24.8
Gray	1,648	742	820	905	1,000	1,105	1,220	1,648	12	19,777.4	4,380	22.2
Hall	326	312	345	381	421	465	513	326	12	3,913.7	4,380	4.4
Hansford	1,387	747	825	911	1,007	1,112	1,229	1,387	12	16,640.5	4,380	18.6
Hartley	1,056	394	435	481	531	587	648	1,056	12	12,667.1	4,380	14.2
Hemphill	1,646	2,601	2,873	3,174	3,506	3,873	4,278	1,646	12	19,747.5	4,380	22.1
Hutchinson	1,155	1,064	1,175	1,298	1,434	1,584	1,750	1,155	12	13,862.1	4,380	15.5
Lipscomb	742	506	559	617	682	753	832	742	12	8,902.8	4,380	10.0
Moore	685	448	495	547	604	667	737	685	12	8,215.7	4,380	9.2
Ochiltree	963	630	696	769	849	938	1,036	963	12	11,561.7	4,380	13.0
Oldham	1,168	557	615	680	751	829	916	1,168	12	14,011.5	4,380	15.7
Potter	1,080	813	898	992	1,096	1,210	1,337	1,080	12	12,965.8	4,380	14.5
Randall	3,286	2,624	2,899	3,202	3,537	3,907	4,316	3,286	12	39,435.3	4,380	44.2
Roberts	702	257	284	314	346	383	423	702	12	8,424.8	4,380	9.4
Sherman	588	522	577	637	704	777	858	588	12	7,050.5	4,380	7.9
Wheeler	1,733	508	561	620	685	756	835	1,733	12	20,793.1	4,380	23.3
Total	24,806	16,035	17,713	19,566	21,613	23,874	26,372	24,806		297,676.5		333.4

Notes: Assumes growth of 1.00% / year from 2010-2060.

Source: 2000 equine inventory obtained from Texas Agricultural Statistics Service for Senate Bill 2.

For Senate Bill 3, the equine inventory was obtained from the 2007 Census of Agriculture and utilized for the future 2010 estimates.

Source: Water consumed by equine was validated of Dr. John Pipkin (WTAMU), Dr. Lance Baker (WTAMU), & Dr. Pete Gibbs (TAMU).

Table B-4. Projected Future Livestock Numbers and Water Use – Equine Operations (continued).

<u>County</u>	<u>2010</u>		<u>Water Use, Equine---></u>			<u>2020</u>		<u>Water Use, Equine---></u>		
	<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	688	12	8,256.0	4,380	9.2	760	12	9,119.8	4,380	10.2
Carson	559	12	6,708.0	4,380	7.5	617	12	7,409.8	4,380	8.3
Childress	361	12	4,332.0	4,380	4.9	399	12	4,785.2	4,380	5.4
Collingsworth	492	12	5,904.0	4,380	6.6	543	12	6,521.7	4,380	7.3
Dallam	555	12	6,660.0	4,380	7.5	613	12	7,356.8	4,380	8.2
Donley	655	12	7,860.0	4,380	8.8	724	12	8,682.3	4,380	9.7
Gray	742	12	8,904.0	4,380	10.0	820	12	9,835.6	4,380	11.0
Hall	312	12	3,744.0	4,380	4.2	345	12	4,135.7	4,380	4.6
Hansford	747	12	8,964.0	4,380	10.0	825	12	9,901.8	4,380	11.1
Hartley	394	12	4,728.0	4,380	5.3	435	12	5,222.7	4,380	5.9
Hemphill	2,601	12	31,212.0	4,380	35.0	2,873	12	34,477.5	4,380	38.6
Hutchinson	1,064	12	12,768.0	4,380	14.3	1,175	12	14,103.8	4,380	15.8
Lipscomb	506	12	6,072.0	4,380	6.8	559	12	6,707.3	4,380	7.5
Moore	448	12	5,376.0	4,380	6.0	495	12	5,938.4	4,380	6.7
Ochiltree	630	12	7,560.0	4,380	8.5	696	12	8,350.9	4,380	9.4
Oldham	557	12	6,684.0	4,380	7.5	615	12	7,383.3	4,380	8.3
Potter	813	12	9,756.0	4,380	10.9	898	12	10,776.7	4,380	12.1
Randall	2,624	12	31,488.0	4,380	35.3	2,899	12	34,782.3	4,380	39.0
Roberts	257	12	3,084.0	4,380	3.5	284	12	3,406.7	4,380	3.8
Sherman	522	12	6,264.0	4,380	7.0	577	12	6,919.4	4,380	7.8
Wheeler	508	12	6,096.0	4,380	6.8	561	12	6,733.8	4,380	7.5
Total	16,035		192,420.0		215.5	17,713		212,551.4		238.1

Table B-4. Projected Future Livestock Numbers and Water Use – Equine Operations (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Equine---></u>			<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Equine---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	839	12	10,073.9	4,380	11.3	927	12	338,471.8	4,380	12.5
Carson	682	12	8,185.0	4,380	9.2	753	12	275,008.4	4,380	10.1
Childress	440	12	5,285.9	4,380	5.9	487	12	177,599.3	4,380	6.5
Collingsworth	600	12	7,204.0	4,380	8.1	663	12	242,046.7	4,380	8.9
Dallam	677	12	8,126.5	4,380	9.1	748	12	273,040.5	4,380	10.1
Donley	799	12	9,590.7	4,380	10.7	883	12	322,237.0	4,380	11.9
Gray	905	12	10,864.6	4,380	12.2	1,000	12	365,037.9	4,380	13.4
Hall	381	12	4,568.4	4,380	5.1	421	12	153,493.0	4,380	5.7
Hansford	911	12	10,937.8	4,380	12.3	1,007	12	367,497.7	4,380	13.5
Hartley	481	12	5,769.1	4,380	6.5	531	12	193,834.2	4,380	7.1
Hemphill	3,174	12	38,084.6	4,380	42.7	3,506	12	1,279,600.6	4,380	47.1
Hutchinson	1,298	12	15,579.4	4,380	17.5	1,434	12	523,450.6	4,380	19.3
Lipscomb	617	12	7,409.0	4,380	8.3	682	12	248,934.2	4,380	9.2
Moore	547	12	6,559.7	4,380	7.3	604	12	220,400.3	4,380	8.1
Ochiltree	769	12	9,224.6	4,380	10.3	849	12	309,937.9	4,380	11.4
Oldham	680	12	8,155.8	4,380	9.1	751	12	274,024.4	4,380	10.1
Potter	992	12	11,904.2	4,380	13.3	1,096	12	399,967.4	4,380	14.7
Randall	3,202	12	38,421.3	4,380	43.0	3,537	12	1,290,915.8	4,380	47.5
Roberts	314	12	3,763.1	4,380	4.2	346	12	126,435.0	4,380	4.7
Sherman	637	12	7,643.3	4,380	8.6	704	12	256,805.7	4,380	9.5
Wheeler	620	12	7,438.3	4,380	8.3	685	12	249,918.1	4,380	9.2
Total	19,566		234,789.0		263.0	21,613		7,888,656.4		290.5

Table B-4. Projected Future Livestock Numbers and Water Use – Equine Operations (continued).

<u>County</u>	<u>2050</u>			<u>2060</u>						
	<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Equine---></u>			<u>Equine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Equine---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	1,024	12	12,292.1	4,380	13.8	1,132	12	13,578.1	4,380	15.2
Carson	832	12	9,987.3	4,380	11.2	919	12	11,032.2	4,380	12.4
Childress	537	12	6,449.8	4,380	7.2	594	12	7,124.5	4,380	8.0
Collingsworth	733	12	8,790.3	4,380	9.8	809	12	9,709.9	4,380	10.9
Dallam	826	12	9,915.8	4,380	11.1	913	12	10,953.2	4,380	12.3
Donley	975	12	11,702.5	4,380	13.1	1,077	12	12,926.8	4,380	14.5
Gray	1,105	12	13,256.8	4,380	14.8	1,220	12	14,643.8	4,380	16.4
Hall	465	12	5,574.3	4,380	6.2	513	12	6,157.5	4,380	6.9
Hansford	1,112	12	13,346.2	4,380	14.9	1,229	12	14,742.5	4,380	16.5
Hartley	587	12	7,039.3	4,380	7.9	648	12	7,775.8	4,380	8.7
Hemphill	3,873	12	46,470.4	4,380	52.1	4,278	12	51,332.2	4,380	57.5
Hutchinson	1,584	12	19,009.8	4,380	21.3	1,750	12	20,998.7	4,380	23.5
Lipscomb	753	12	9,040.4	4,380	10.1	832	12	9,986.2	4,380	11.2
Moore	667	12	8,004.1	4,380	9.0	737	12	8,841.5	4,380	9.9
Ochiltree	938	12	11,255.8	4,380	12.6	1,036	12	12,433.4	4,380	13.9
Oldham	829	12	9,951.6	4,380	11.1	916	12	10,992.7	4,380	12.3
Potter	1,210	12	14,525.4	4,380	16.3	1,337	12	16,045.0	4,380	18.0
Randall	3,907	12	46,881.3	4,380	52.5	4,316	12	51,786.2	4,380	58.0
Roberts	383	12	4,591.7	4,380	5.1	423	12	5,072.0	4,380	5.7
Sherman	777	12	9,326.2	4,380	10.4	858	12	10,302.0	4,380	11.5
Wheeler	756	12	9,076.1	4,380	10.2	835	12	10,025.7	4,380	11.2
Total	23,874		286,487.2		320.9	26,372		316,460.1		354.5

Table B-5. Projected Future Livestock Numbers and Water Use – Poultry, Laying Hens or Broilers.

<u>County</u>	<u>Poultry: Projected Inventory----></u>							<u>2000</u>	<u>Water Use, Poultry----></u>			
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>	<u>Poultry Head</u>	<u>Water use gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Carson	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Childress	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Collingsworth	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Dallam	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Donley	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Gray	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Hall	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Hansford	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Hartley	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Hemphill	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Hutchinson	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Lipscomb	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Moore	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Ochiltree	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Oldham	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Potter	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Randall	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Roberts	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Sherman	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0.09	90.0	32.85	0.1
Wheeler	1,000	1,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000	0.09	90.0	32.85	0.1
Total	21,000	21,000	7,014,000	7,014,000	7,014,000	7,014,000	7,014,000	21,000		1,890.0		2.1

Note: Assumed growth in counties on the eastern side of the Panhandle, closest to urban markets or close to I-40 for transportation purposes.

Table B-5. Projected Future Livestock Numbers and Water Use – Poultry, Laying Hens or Broilers (continued).

<u>County</u>	<u>2010</u>					<u>2020</u>				
	<u>Poultry</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Poultry----></u>			<u>Poultry</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Poultry----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
Carson	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
Childress	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
Collingsworth	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
Dallam	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Donley	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Gray	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
Hall	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hansford	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hartley	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hemphill	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hutchinson	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Lipscomb	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Moore	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Ochiltree	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Oldham	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
Potter	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Randall	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Roberts	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Sherman	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Wheeler	1,000	0.09	90.0	32.85	0.1	1,000,000	0.09	90,000.0	32.85	100.8
					0.0					
Total	21,000		1,890.0		2.1	7,014,000		631,260.0		707.1

Table B-5. Projected Future Livestock Numbers and Water Use – Poultry, Laying Hens or Broilers (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Poultry</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Poultry----></u>			<u>Poultry</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Poultry----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Carson	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Childress	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Collingsworth	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Dallam	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Donley	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Gray	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Hall	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hansford	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hartley	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hemphill	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hutchinson	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Lipscomb	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Moore	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Ochiltree	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Oldham	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Potter	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Randall	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Roberts	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Sherman	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Wheeler	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Total	7,014,000		631,260.0		707.1	7,014,000		631,260.0		707.1

Table B-5. Projected Future Livestock Numbers and Water Use – Poultry, Laying Hens or Broilers (continued).

<u>County</u>	<u>2050</u>					<u>2060</u>				
	<u>Poultry</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Poultry----></u>			<u>Poultry</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Poultry----></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Carson	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Childress	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Collingsworth	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Dallam	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Donley	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Gray	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Hall	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hansford	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hartley	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hemphill	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Hutchinson	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Lipscomb	1,000	0.09	90.0	32.85	0.1	1,000	0.00	0.0	0.00	0.0
Moore	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Ochiltree	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Oldham	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Potter	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Randall	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Roberts	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Sherman	1,000	0.09	90.0	32.85	0.1	1,000	0.09	90.0	32.85	0.1
Wheeler	1,000,000	0.09	90,000.0	32.85	100.8	1,000,000	0.09	90,000.0	32.85	100.8
Total	7,014,000		631,260.0		707.1	7,014,000		631,170.0		707.0

Table B-6. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Winter Pasture Operations (5 mo/yr).

<u>County</u>	<u>Stocker Cattle -- Winter Pasture -- Projected Inventory----></u>							<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>2000</u> <u>Water Use, Stocker Cattle---></u>		
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	15,420	24,914	25,544	26,189	26,851	27,530	28,226	15,420	12	185,040.0	1,825	86.4
Carson	46,445	35,013	35,898	36,806	37,737	38,691	39,669	46,445	12	557,340.0	1,825	260.1
Childress	11,357	10,788	11,061	11,340	11,627	11,921	12,222	11,357	12	136,284.0	1,825	63.6
Collingsworth	18,567	17,916	18,368	18,833	19,309	19,797	20,298	18,567	12	222,804.0	1,825	104.0
Dallam	77,692	16,512	16,930	17,358	17,797	18,247	18,708	77,692	12	932,304.0	1,825	435.1
Donley	3,410	5,680	5,824	5,971	6,122	6,277	6,436	3,410	12	40,920.0	1,825	19.1
Gray	29,585	16,491	16,908	17,336	17,774	18,224	18,684	29,585	12	355,020.0	1,825	165.7
Hall	3,245	6,046	6,199	6,355	6,516	6,681	6,850	3,245	12	38,940.0	1,825	18.2
Hansford	105,594	59,796	61,308	62,858	64,447	66,077	67,748	105,594	12	1,267,128.0	1,825	591.4
Hartley	27,263	17,719	18,166	18,626	19,097	19,580	20,075	27,263	12	327,156.0	1,825	152.7
Hemphill	6,469	5,076	5,205	5,336	5,471	5,610	5,751	6,469	12	77,628.0	1,825	36.2
Hutchinson	17,107	23,435	24,027	24,635	25,258	25,896	26,551	17,107	12	205,284.0	1,825	95.8
Lipscomb	25,801	9,113	9,344	9,580	9,822	10,070	10,325	25,801	12	309,612.0	1,825	144.5
Moore	43,892	36,152	37,066	38,003	38,964	39,949	40,959	43,892	12	526,704.0	1,825	245.8
Ochiltree	51,464	63,861	65,476	67,131	68,829	70,569	72,353	51,464	12	617,568.0	1,825	288.2
Oldham	37,327	15,674	16,070	16,476	16,893	17,320	17,758	37,327	12	447,924.0	1,825	209.1
Potter	9,909	4,503	4,617	4,734	4,854	4,976	5,102	9,909	12	118,908.0	1,825	55.5
Randall	44,959	59,187	60,684	62,218	63,791	65,404	67,058	44,959	12	539,508.0	1,825	251.8
Roberts	7,240	3,256	3,338	3,423	3,509	3,598	3,689	7,240	12	86,880.0	1,825	40.5
Sherman	57,215	21,849	22,402	22,968	23,549	24,144	24,755	57,215	12	686,580.0	1,825	320.4
Wheeler	6,985	14,989	15,368	15,757	16,155	16,564	16,982	6,985	12	83,820.0	1,825	39.1
Total	646,946	467,971	479,803	491,934	504,372	517,124	530,198	646,946		7,763,352.0		3,623.4

Note: Assumes 0.25%/year growth in this beef cattle industry sector, 2010-2060.

Gal/hd/day (8 gal) resulted from focused group meeting between Dr. Steve Amosson, Dr. John Sweeten, Dr. Ken Casey, and Ben Weinheimer.

Inventories were re-estimated for 2010 based on planted wheat and grazing practices.

Table B-6. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Winter Pasture Operations (5 mo/yr) (continued).

<u>County</u>	<u>2010</u>			<u>2020</u>						
	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>			<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	24,914	8	199,308.8	1,217	93.0	25,544	8	204,348.0	1,217	95.4
Carson	35,013	8	280,104.6	1,217	130.7	35,898	8	287,186.5	1,217	134.0
Childress	10,788	8	86,303.1	1,217	40.3	11,061	8	88,485.1	1,217	41.3
Collingsworth	17,916	8	143,324.0	1,217	66.9	18,368	8	146,947.7	1,217	68.6
Dallam	16,512	8	132,099.7	1,217	61.7	16,930	8	135,439.6	1,217	63.2
Donley	5,680	8	45,441.7	1,217	21.2	5,824	8	46,590.6	1,217	21.7
Gray	16,491	8	131,931.2	1,217	61.6	16,908	8	135,266.9	1,217	63.1
Hall	6,046	8	48,366.8	1,217	22.6	6,199	8	49,589.7	1,217	23.1
Hansford	59,796	8	478,370.5	1,217	223.3	61,308	8	490,465.2	1,217	228.9
Hartley	17,719	8	141,748.0	1,217	66.2	18,166	8	145,331.9	1,217	67.8
Hemphill	5,076	8	40,611.7	1,217	19.0	5,205	8	41,638.5	1,217	19.4
Hutchinson	23,435	8	187,478.5	1,217	87.5	24,027	8	192,218.5	1,217	89.7
Lipscomb	9,113	8	72,904.9	1,217	34.0	9,344	8	74,748.2	1,217	34.9
Moore	36,152	8	289,212.6	1,217	135.0	37,066	8	296,524.8	1,217	138.4
Ochiltree	63,861	8	510,890.3	1,217	238.4	65,476	8	523,807.2	1,217	244.5
Oldham	15,674	8	125,389.2	1,217	58.5	16,070	8	128,559.4	1,217	60.0
Potter	4,503	8	36,027.1	1,217	16.8	4,617	8	36,938.0	1,217	17.2
Randall	59,187	8	473,500.0	1,217	221.0	60,684	8	485,471.6	1,217	226.6
Roberts	3,256	8	26,047.6	1,217	12.2	3,338	8	26,706.2	1,217	12.5
Sherman	21,849	8	174,794.8	1,217	81.6	22,402	8	179,214.2	1,217	83.6
Wheeler	14,989	8	119,914.7	1,217	56.0	15,368	8	122,946.5	1,217	57.4
Total	467,971		3,743,769.9		1,747.3	479,803		3,838,424.2		1,791.5

Table B-6. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Winter Pasture Operations (5 mo/yr) (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>			<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	26,189	8	209,514.6	1,217	97.8	26,851	8	214,811.7	1,217	100.3
Carson	36,806	8	294,447.5	1,217	137.4	37,737	8	301,892.0	1,217	140.9
Childress	11,340	8	90,722.3	1,217	42.3	11,627	8	93,016.1	1,217	43.4
Collingsworth	18,833	8	150,663.0	1,217	70.3	19,309	8	154,472.2	1,217	72.1
Dallam	17,358	8	138,863.9	1,217	64.8	17,797	8	142,374.8	1,217	66.5
Donley	5,971	8	47,768.5	1,217	22.3	6,122	8	48,976.3	1,217	22.9
Gray	17,336	8	138,686.8	1,217	64.7	17,774	8	142,193.3	1,217	66.4
Hall	6,355	8	50,843.5	1,217	23.7	6,516	8	52,129.0	1,217	24.3
Hansford	62,858	8	502,865.7	1,217	234.7	64,447	8	515,579.7	1,217	240.6
Hartley	18,626	8	149,006.3	1,217	69.5	19,097	8	152,773.6	1,217	71.3
Hemphill	5,336	8	42,691.3	1,217	19.9	5,471	8	43,770.7	1,217	20.4
Hutchinson	24,635	8	197,078.4	1,217	92.0	25,258	8	202,061.1	1,217	94.3
Lipscomb	9,580	8	76,638.0	1,217	35.8	9,822	8	78,575.7	1,217	36.7
Moore	38,003	8	304,021.9	1,217	141.9	38,964	8	311,708.5	1,217	145.5
Ochiltree	67,131	8	537,050.7	1,217	250.7	68,829	8	550,629.0	1,217	257.0
Oldham	16,476	8	131,809.8	1,217	61.5	16,893	8	135,142.4	1,217	63.1
Potter	4,734	8	37,871.9	1,217	17.7	4,854	8	38,829.4	1,217	18.1
Randall	62,218	8	497,745.8	1,217	232.3	63,791	8	510,330.4	1,217	238.2
Roberts	3,423	8	27,381.4	1,217	12.8	3,509	8	28,073.7	1,217	13.1
Sherman	22,968	8	183,745.3	1,217	85.8	23,549	8	188,390.9	1,217	87.9
Wheeler	15,757	8	126,055.0	1,217	58.8	16,155	8	129,242.0	1,217	60.3
Total	491,934		3,935,471.6		1,836.8	504,372		4,034,972.6		1,883.2

Table B-6. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Winter Pasture Operations (5 mo/yr) (continued).

<u>County</u>	<u>2050</u>					<u>2060</u>				
	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>			<u>Stockers</u> <u>Head</u>	<u>Water use,</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	27,530	8	220,242.9	1,217	102.8	28,226	8	225,811.3	1,217	105.4
Carson	38,691	8	309,524.8	1,217	144.5	39,669	8	317,350.6	1,217	148.1
Childress	11,921	8	95,367.8	1,217	44.5	12,222	8	97,779.0	1,217	45.6
Collingsworth	19,797	8	158,377.8	1,217	73.9	20,298	8	162,382.1	1,217	75.8
Dallam	18,247	8	145,974.5	1,217	68.1	18,708	8	149,665.2	1,217	69.9
Donley	6,277	8	50,214.5	1,217	23.4	6,436	8	51,484.1	1,217	24.0
Gray	18,224	8	145,788.4	1,217	68.0	18,684	8	149,474.4	1,217	69.8
Hall	6,681	8	53,446.9	1,217	24.9	6,850	8	54,798.2	1,217	25.6
Hansford	66,077	8	528,615.2	1,217	246.7	67,748	8	541,980.2	1,217	253.0
Hartley	19,580	8	156,636.2	1,217	73.1	20,075	8	160,596.5	1,217	75.0
Hemphill	5,610	8	44,877.3	1,217	20.9	5,751	8	46,012.0	1,217	21.5
Hutchinson	25,896	8	207,169.9	1,217	96.7	26,551	8	212,407.8	1,217	99.1
Lipscomb	10,070	8	80,562.3	1,217	37.6	10,325	8	82,599.2	1,217	38.6
Moore	39,949	8	319,589.5	1,217	149.2	40,959	8	327,669.7	1,217	152.9
Ochiltree	70,569	8	564,550.6	1,217	263.5	72,353	8	578,824.3	1,217	270.2
Oldham	17,320	8	138,559.2	1,217	64.7	17,758	8	142,062.4	1,217	66.3
Potter	4,976	8	39,811.2	1,217	18.6	5,102	8	40,817.7	1,217	19.1
Randall	65,404	8	523,233.1	1,217	244.2	67,058	8	536,462.1	1,217	250.4
Roberts	3,598	8	28,783.5	1,217	13.4	3,689	8	29,511.2	1,217	13.8
Sherman	24,144	8	193,154.0	1,217	90.2	24,755	8	198,037.6	1,217	92.4
Wheeler	16,564	8	132,509.7	1,217	61.8	16,982	8	135,859.9	1,217	63.4
Total	517,124		4,136,989.4		1,930.9	530,198		4,241,585.4		1,979.7

Table B-7. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Summer Pasture Operations (8 mo/yr).

<u>County</u>	<u>Stocker Cattle --Summer Pasture --Projected Inventory----></u>							<u>Stockers</u>	<u>Water use</u>	<u>2000 Water Use, Stocker Cattle--></u>		
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>	<u>Head</u>	<u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	27,300	9,037	9,037	9,037	9,037	9,037	9,037	27,300	12	327,600.0	2,920	244.6
Carson	24,286	14,288	14,288	14,288	14,288	14,288	14,288	24,286	12	291,432.0	2,920	217.6
Childress	1,429	13,160	13,160	13,160	13,160	13,160	13,160	1,429	12	17,148.0	2,920	12.8
Collingsworth	12,714	21,804	21,804	21,804	21,804	21,804	21,804	12,714	12	152,568.0	2,920	113.9
Dallam	18,557	22,179	22,179	22,179	22,179	22,179	22,179	18,557	12	222,684.0	2,920	166.3
Donley	16,429	21,738	21,738	21,738	21,738	21,738	21,738	16,429	12	197,148.0	2,920	147.2
Gray	12,143	25,203	25,203	25,203	25,203	25,203	25,203	12,143	12	145,716.0	2,920	108.8
Hall	2,771	16,318	16,318	16,318	16,318	16,318	16,318	2,771	12	33,252.0	2,920	24.8
Hansford	15,764	8,645	8,645	8,645	8,645	8,645	8,645	15,764	12	189,168.0	2,920	141.3
Hartley	34,557	9,937	9,937	9,937	9,937	9,937	9,937	34,557	12	414,684.0	2,920	309.7
Hemphill	22,071	15,005	15,005	15,005	15,005	15,005	15,005	22,071	12	264,852.0	2,920	197.8
Hutchinson	15,486	26,790	26,790	26,790	26,790	26,790	26,790	15,486	12	185,832.0	2,920	138.8
Lipscomb	15,611	14,616	14,616	14,616	14,616	14,616	14,616	15,611	12	187,332.0	2,920	139.9
Moore	13,336	15,435	15,435	15,435	15,435	15,435	15,435	13,336	12	160,032.0	2,920	119.5
Ochiltree	3,771	9,001	9,001	9,001	9,001	9,001	9,001	3,771	12	45,252.0	2,920	33.8
Oldham	47,586	31,761	31,761	31,761	31,761	31,761	31,761	47,586	12	571,032.0	2,920	426.4
Potter	28,371	18,819	18,819	18,819	18,819	18,819	18,819	28,371	12	340,452.0	2,920	254.2
Randall	15,714	18,018	18,018	18,018	18,018	18,018	18,018	15,714	12	188,568.0	2,920	140.8
Roberts	34,021	22,374	22,374	22,374	22,374	22,374	22,374	34,021	12	408,252.0	2,920	304.9
Sherman	5,136	13,679	13,679	13,679	13,679	13,679	13,679	5,136	12	61,632.0	2,920	46.0
Wheeler	5,000	21,114	21,114	21,114	21,114	21,114	21,114	5,000	12	60,000.0	2,920	44.8
Total	372,053	368,921	368,921	368,921	368,921	368,921	368,921	372,053		4,464,636.0		3,334.1

Note: In Senate Bill 2, water consumption was 12 gal/hd/day. In Senate Bill 3, a focused group of Dr. Steve Amosson, Dr. John Sweeten, Dr. Ken Casey and Ben Weinheimer determined water consumption at 10 gal/hd/day beginning in 2010. 2010 summer stocker inventories were adjusted based on the change in beef cows reported by TASS.

Table B-7. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Summer Pasture Operations (8 mo/yr) (continued).

<u>County</u>	<u>2010</u>					<u>2020</u>				
	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>se, Stocker Cattle---></u> <u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>se, Stocker Cattle---></u> <u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	9,037	10	90,371.7	2,433	67.5	9,037	10	90,371.7	2,433	67.5
Carson	14,288	10	142,879.1	2,433	106.7	14,288	10	142,879.1	2,433	106.7
Childress	13,160	10	131,600.3	2,433	98.3	13,160	10	131,600.3	2,433	98.3
Collingsworth	21,804	10	218,039.1	2,433	162.8	21,804	10	218,039.1	2,433	162.8
Dallam	22,179	10	221,793.6	2,433	165.6	22,179	10	221,793.6	2,433	165.6
Donley	21,738	10	217,380.6	2,433	162.3	21,738	10	217,380.6	2,433	162.3
Gray	25,203	10	252,025.5	2,433	188.2	25,203	10	252,025.5	2,433	188.2
Hall	16,318	10	163,184.1	2,433	121.9	16,318	10	163,184.1	2,433	121.9
Hansford	8,645	10	86,449.9	2,433	64.6	8,645	10	86,449.9	2,433	64.6
Hartley	9,937	10	99,365.6	2,433	74.2	9,937	10	99,365.6	2,433	74.2
Hemphill	15,005	10	150,054.7	2,433	112.1	15,005	10	150,054.7	2,433	112.1
Hutchinson	26,790	10	267,900.6	2,433	200.1	26,790	10	267,900.6	2,433	200.1
Lipscomb	14,616	10	146,156.2	2,433	109.1	14,616	10	146,156.2	2,433	109.1
Moore	15,435	10	154,352.2	2,433	115.3	15,435	10	154,352.2	2,433	115.3
Ochiltree	9,001	10	90,009.1	2,433	67.2	9,001	10	90,009.1	2,433	67.2
Oldham	31,761	10	317,609.8	2,433	237.2	31,761	10	317,609.8	2,433	237.2
Potter	18,819	10	188,190.6	2,433	140.5	18,819	10	188,190.6	2,433	140.5
Randall	18,018	10	180,183.2	2,433	134.6	18,018	10	180,183.2	2,433	134.6
Roberts	22,374	10	223,737.9	2,433	167.1	22,374	10	223,737.9	2,433	167.1
Sherman	13,679	10	136,790.6	2,433	102.2	13,679	10	136,790.6	2,433	102.2
Wheeler	21,114	10	211,139.0	2,433	157.7	21,114	10	211,139.0	2,433	157.7
Total	368,921		3,689,213.4		2,755.0	368,921		3,689,213.4		2,755.0

Table B-7. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Summer Pasture Operations (8 mo/yr) (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>			<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>Water Use, Stocker Cattle---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	9,037	10	90,371.7	2,433	67.5	9,037	10	90,371.7	2,433	67.5
Carson	14,288	10	142,879.1	2,433	106.7	14,288	10	142,879.1	2,433	106.7
Childress	13,160	10	131,600.3	2,433	98.3	13,160	10	131,600.3	2,433	98.3
Collingsworth	21,804	10	218,039.1	2,433	162.8	21,804	10	218,039.1	2,433	162.8
Dallam	22,179	10	221,793.6	2,433	165.6	22,179	10	221,793.6	2,433	165.6
Donley	21,738	10	217,380.6	2,433	162.3	21,738	10	217,380.6	2,433	162.3
Gray	25,203	10	252,025.5	2,433	188.2	25,203	10	252,025.5	2,433	188.2
Hall	16,318	10	163,184.1	2,433	121.9	16,318	10	163,184.1	2,433	121.9
Hansford	8,645	10	86,449.9	2,433	64.6	8,645	10	86,449.9	2,433	64.6
Hartley	9,937	10	99,365.6	2,433	74.2	9,937	10	99,365.6	2,433	74.2
Hemphill	15,005	10	150,054.7	2,433	112.1	15,005	10	150,054.7	2,433	112.1
Hutchinson	26,790	10	267,900.6	2,433	200.1	26,790	10	267,900.6	2,433	200.1
Lipscomb	14,616	10	146,156.2	2,433	109.1	14,616	10	146,156.2	2,433	109.1
Moore	15,435	10	154,352.2	2,433	115.3	15,435	10	154,352.2	2,433	115.3
Ochiltree	9,001	10	90,009.1	2,433	67.2	9,001	10	90,009.1	2,433	67.2
Oldham	31,761	10	317,609.8	2,433	237.2	31,761	10	317,609.8	2,433	237.2
Potter	18,819	10	188,190.6	2,433	140.5	18,819	10	188,190.6	2,433	140.5
Randall	18,018	10	180,183.2	2,433	134.6	18,018	10	180,183.2	2,433	134.6
Roberts	22,374	10	223,737.9	2,433	167.1	22,374	10	223,737.9	2,433	167.1
Sherman	13,679	10	136,790.6	2,433	102.2	13,679	10	136,790.6	2,433	102.2
Wheeler	21,114	10	211,139.0	2,433	157.7	21,114	10	211,139.0	2,433	157.7
Total	368,921		3,689,213.4		2,755.0	368,921		3,689,213.4		2,755.0

Table B-7. Projected Future Livestock Numbers and Water Use – Stocker Beef Cattle, Summer Pasture Operations (8 mo/yr) (continued).

<u>County</u>	<u>2050</u>		<u>Water Use, Stocker Cattle---></u>			<u>2060</u>		<u>Water Use, Stocker Cattle---></u>		
	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	<u>Stockers</u> <u>Head</u>	<u>Water use</u> <u>gal/hd/day</u>	<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	9,037	10	90,371.7	2,433	67.5	9,037	10	90,371.7	2,433	67.5
Carson	14,288	10	142,879.1	2,433	106.7	14,288	10	142,879.1	2,433	106.7
Childress	13,160	10	131,600.3	2,433	98.3	13,160	10	131,600.3	2,433	98.3
Collingsworth	21,804	10	218,039.1	2,433	162.8	21,804	10	218,039.1	2,433	162.8
Dallam	22,179	10	221,793.6	2,433	165.6	22,179	10	221,793.6	2,433	165.6
Donley	21,738	10	217,380.6	2,433	162.3	21,738	10	217,380.6	2,433	162.3
Gray	25,203	10	252,025.5	2,433	188.2	25,203	10	252,025.5	2,433	188.2
Hall	16,318	10	163,184.1	2,433	121.9	16,318	10	163,184.1	2,433	121.9
Hansford	8,645	10	86,449.9	2,433	64.6	8,645	10	86,449.9	2,433	64.6
Hartley	9,937	10	99,365.6	2,433	74.2	9,937	10	99,365.6	2,433	74.2
Hemphill	15,005	10	150,054.7	2,433	112.1	15,005	10	150,054.7	2,433	112.1
Hutchinson	26,790	10	267,900.6	2,433	200.1	26,790	10	267,900.6	2,433	200.1
Lipscomb	14,616	10	146,156.2	2,433	109.1	14,616	10	146,156.2	2,433	109.1
Moore	15,435	10	154,352.2	2,433	115.3	15,435	10	154,352.2	2,433	115.3
Ochiltree	9,001	10	90,009.1	2,433	67.2	9,001	10	90,009.1	2,433	67.2
Oldham	31,761	10	317,609.8	2,433	237.2	31,761	10	317,609.8	2,433	237.2
Potter	18,819	10	188,190.6	2,433	140.5	18,819	10	188,190.6	2,433	140.5
Randall	18,018	10	180,183.2	2,433	134.6	18,018	10	180,183.2	2,433	134.6
Roberts	22,374	10	223,737.9	2,433	167.1	22,374	10	223,737.9	2,433	167.1
Sherman	13,679	10	136,790.6	2,433	102.2	13,679	10	136,790.6	2,433	102.2
Wheeler	21,114	10	211,139.0	2,433	157.7	21,114	10	211,139.0	2,433	157.7
Total	368,921		3,689,213.4		2,755.0	368,921		3,689,213.4		2,755.0

Table B-8. Projected Future Livestock Numbers and Water Use – Swine Operations.

County	<u>Swine Operations: Projected Inventory----></u>							<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>2000 Water Use, Swine ---></u>		
	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	154	35	35	35	35	35	35	154	5.00	771.4	1,825.0	0.86
Carson	508	685	685	685	685	685	685	508	5.00	2,538.4	1,825.0	2.84
Childress	0	62	62	62	62	62	62	0	0.00	0.0	0.0	0.00
Collingsworth	90	8	8	8	8	8	8	90	5.00	448.3	1,825.0	0.50
Dallam	260,613	171,868	171,868	171,868	171,868	171,868	171,868	260,613	8.50	2,215,206.3	3,102.5	2,481.37
Donley	167	31	31	31	31	31	31	167	5.00	834.0	1,825.0	0.93
Gray	794	45,125	45,125	45,125	45,125	45,125	45,125	794	5.00	3,971.7	1,825.0	4.45
Hall	529	224	224	224	224	224	224	529	5.00	2,642.6	1,825.0	2.96
Hansford	48,995	100,840	100,840	100,840	100,840	100,840	100,840	48,995	5.00	244,975.8	1,825.0	274.41
Hartley	208	107,479	107,479	107,479	107,479	107,479	107,479	208	5.00	1,042.5	1,825.0	1.17
Hemphill	1,042	0	0	0	0	0	0	1,042	5.00	5,212.3	1,825.0	5.84
Hutchinson	35	59	59	59	59	59	59	35	5.00	177.2	1,825.0	0.20
Lipscomb	10,425	31,600	31,600	31,600	31,600	31,600	31,600	10,425	5.00	52,122.5	1,825.0	58.39
Moore	18,764	25	25	25	25	25	25	18,764	5.00	93,820.5	1,825.0	105.09
Ochiltree	370,070	296,800	208,400	208,400	208,400	208,400	208,400	370,070	5.00	1,850,348.8	1,825.0	2,072.68
Oldham	104	25	25	25	25	25	25	104	5.00	521.2	1,825.0	0.58
Potter	632	713	713	713	713	713	713	632	5.00	3,158.6	1,825.0	3.54
Randall	10,425	124	124	124	124	124	124	10,425	5.00	52,122.5	1,825.0	58.39
Roberts	0	25	25	25	25	25	25	0	0.00	0.0	0.0	0.00
Sherman	56,292	426,600	426,600	426,600	426,600	426,600	426,600	56,292	5.00	281,461.5	1,825.0	315.28
Wheeler	152	43	43	43	43	43	43	152	5.00	761.0	1,825.0	0.85
Total	779,999	1,182,371	1,093,971	1,093,971	1,093,971	1,093,971	1,093,971	779,999		4,812,136.8		5,390.34

Note: In 2010, inventories reflect responses from a survey conducted of the major swine operations. 2007 census of agriculture was used to estimate inventories in other counties. No growth is assumed from 2020 - 2060.

For 2000, water use for initial Dallam County inventory was 8.5 gallons/day. Water use for all other counties was to be 5 gallons/day.

In 2010, water use was changed per county based on survey responses in Dallam, Gray, Hansford, Hartley, Lipscomb, Ochiltree, and Sherman Counties.

Table B-8. Projected Future Livestock Numbers and Water Use – Swine Operations (continued).

<u>County</u>	<u>2010</u>					<u>2020</u>				
	<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Swine ---></u>			<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Swine ---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	35	5.00	175.0	1,825.0	0.20	35	5.00	175.0	1,825.0	0.20
Carson	685	5.00	3,425.0	1,825.0	3.84	685	5.00	3,425.0	1,825.0	3.84
Childress	62	5.00	310.0	1,825.0	0.35	62	5.00	310.0	1,825.0	0.35
Collingsworth	8	5.00	40.0	1,825.0	0.04	8	5.00	40.0	1,825.0	0.04
Dallam	171,868	4.44	763,093.9	1,620.6	854.78	171,868	4.44	763,093.9	1,620.6	854.78
Donley	31	5.00	155.0	1,825.0	0.17	31	5.00	155.0	1,825.0	0.17
Gray	45,125	2.64	119,130.0	963.6	133.44	45,125	2.64	119,130.0	963.6	133.44
Hall	224	5.00	1,120.0	1,825.0	1.25	224	5.00	1,120.0	1,825.0	1.25
Hansford	100,840	4.79	483,023.6	1,748.4	541.06	100,840	4.79	483,023.6	1,748.4	541.06
Hartley	107,479	3.69	396,597.5	1,346.9	444.25	107,479	3.69	396,597.5	1,346.9	444.25
Hemphill	0	0.00	0.0	0.0	0.00	0	0.00	0.0	0.0	0.00
Hutchinson	59	5.00	295.0	1,825.0	0.33	59	5.00	295.0	1,825.0	0.33
Lipscomb	31,600	2.50	79,000.0	912.5	88.49	31,600	2.50	79,000.0	912.5	88.49
Moore	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Ochiltree	296,800	4.89	1,451,352.0	1,784.9	1,625.74	208,400	6.82	1,421,288.0	2,489.3	1,592.06
Oldham	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Potter	713	5.00	3,565.0	1,825.0	3.99	713	5.00	3,565.0	1,825.0	3.99
Randall	124	5.00	620.0	1,825.0	0.69	124	5.00	620.0	1,825.0	0.69
Roberts	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Sherman	426,600	4.64	1,979,424.0	1,693.6	2,217.26	426,600	4.64	1,979,424.0	1,693.6	2,217.26
Wheeler	43	5.00	215.0	1,825.0	0.24	43	5.00	215.0	1,825.0	0.24
Total	1,182,371		5,281,916.0		5,916.56	1,093,971		5,251,852.0		5,882.88

Table B-8. Projected Future Livestock Numbers and Water Use – Swine Operations (continued).

<u>County</u>	<u>2030</u>					<u>2040</u>				
	<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Swine ---></u>			<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Swine ---></u>		
			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>
Armstrong	35	5.00	175.0	1,825.0	0.20	35	5.00	175.0	1,825.0	0.20
Carson	685	5.00	3,425.0	1,825.0	3.84	685	5.00	3,425.0	1,825.0	3.84
Childress	62	5.00	310.0	1,825.0	0.35	62	5.00	310.0	1,825.0	0.35
Collingsworth	8	5.00	40.0	1,825.0	0.04	8	5.00	40.0	1,825.0	0.04
Dallam	171,868	4.44	763,093.9	1,620.6	854.78	171,868	4.44	763,093.9	1,620.6	854.78
Donley	31	5.00	155.0	1,825.0	0.17	31	5.00	155.0	1,825.0	0.17
Gray	45,125	2.64	119,130.0	963.6	133.44	45,125	2.64	119,130.0	963.6	133.44
Hall	224	5.00	1,120.0	1,825.0	1.25	224	5.00	1,120.0	1,825.0	1.25
Hansford	100,840	4.79	483,023.6	1,748.4	541.06	100,840	4.79	483,023.6	1,748.4	541.06
Hartley	107,479	3.69	396,597.5	1,346.9	444.25	107,479	3.69	396,597.5	1,346.9	444.25
Hemphill	0	0.00	0.0	0.0	0.00	0	0.00	0.0	0.0	0.00
Hutchinson	59	5.00	295.0	1,825.0	0.33	59	5.00	295.0	1,825.0	0.33
Lipscomb	31,600	2.50	79,000.0	912.5	88.49	31,600	2.50	79,000.0	912.5	88.49
Moore	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Ochiltree	208,400	6.82	1,421,288.0	2,489.3	1,592.06	208,400	6.82	1,421,288.0	2,489.3	1,592.06
Oldham	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Potter	713	5.00	3,565.0	1,825.0	3.99	713	5.00	3,565.0	1,825.0	3.99
Randall	124	5.00	620.0	1,825.0	0.69	124	5.00	620.0	1,825.0	0.69
Roberts	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Sherman	426,600	4.64	1,979,424.0	1,693.6	2,217.26	426,600	4.64	1,979,424.0	1,693.6	2,217.26
Wheeler	43	5.00	215.0	1,825.0	0.24	43	5.00	215.0	1,825.0	0.24
Total	1,093,971		5,251,852.0		5,882.88	1,093,971		5,251,852.0		5,882.88

Table B-8. Projected Future Livestock Numbers and Water Use – Swine Operations (continued).

<u>County</u>	<u>2050</u>					<u>2060</u>				
	<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Swine ---></u>			<u>Swine Head</u>	<u>Water use gal/hd/day</u>	<u>Water Use, Swine ---></u>		
		<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>			<u>gal/day</u>	<u>gal/hd/yr</u>	<u>ac-ft/yr</u>	
Armstrong	35	5.00	175.0	1,825.0	0.20	35	5.00	175.0	1,825.0	0.20
Carson	685	5.00	3,425.0	1,825.0	3.84	685	5.00	3,425.0	1,825.0	3.84
Childress	62	5.00	310.0	1,825.0	0.35	62	5.00	310.0	1,825.0	0.35
Collingsworth	8	5.00	40.0	1,825.0	0.04	8	5.00	40.0	1,825.0	0.04
Dallam	171,868	4.44	763,093.9	1,620.6	854.78	171,868	4.44	763,093.9	1,620.6	854.78
Donley	31	5.00	155.0	1,825.0	0.17	31	5.00	155.0	1,825.0	0.17
Gray	45,125	2.64	119,130.0	963.6	133.44	45,125	2.64	119,130.0	963.6	133.44
Hall	224	5.00	1,120.0	1,825.0	1.25	224	5.00	1,120.0	1,825.0	1.25
Hansford	100,840	4.79	483,023.6	1,748.4	541.06	100,840	4.79	483,023.6	1,748.4	541.06
Hartley	107,479	3.69	396,597.5	1,346.9	444.25	107,479	3.69	396,597.5	1,346.9	444.25
Hemphill	0	0.00	0.0	0.0	0.00	0	0.00	0.0	0.0	0.00
Hutchinson	59	5.00	295.0	1,825.0	0.33	59	5.00	295.0	1,825.0	0.33
Lipscomb	31,600	2.50	79,000.0	912.5	88.49	31,600	2.50	79,000.0	912.5	88.49
Moore	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Ochiltree	208,400	6.82	1,421,288.0	2,489.3	1,592.06	208,400	6.82	1,421,288.0	2,489.3	1,592.06
Oldham	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Potter	713	5.00	3,565.0	1,825.0	3.99	713	5.00	3,565.0	1,825.0	3.99
Randall	124	5.00	620.0	1,825.0	0.69	124	5.00	620.0	1,825.0	0.69
Roberts	25	5.00	125.0	1,825.0	0.14	25	5.00	125.0	1,825.0	0.14
Sherman	426,600	4.64	1,979,424.0	1,693.6	2,217.26	426,600	4.64	1,979,424.0	1,693.6	2,217.26
Wheeler	43	5.00	215.0	1,825.0	0.24	43	5.00	215.0	1,825.0	0.24
Total	1,093,971		5,251,852.0		5,882.64	1,093,971		5,251,852.0		5,882.88

This article can be referenced as follows:

Marek, T., S. Amosson, F. Bretz, B. Guerrero and R. Kotara. 2009. 2011 Panhandle Regional Water Plan Task 2 Report: Agricultural Water Demand Projections. Technical Report for the Texas Water Development Board (Water Planning Division) and Region A Panhandle Regional Planning Group through Freese and Nichols, Inc. Texas A&M AgriLife – Amarillo. April 24. AREC 09-21. pp.83.