2017 Region A RWP Projected Livestock Water Use

TAMUS Estimates

2017 TWDB Livestock Water Use Projections Methodology

1. Estimated inventories for 2005-2009 time period using TASS and Census of Agriculture Data

2. Estimated annual water use by species and county for 2005-2009 time period and then averaged the water use for the 2010 base year.

3. Applied projected changes identified in the Region A 2012 plan for the 2020-2070 projections

2017 TAMUS Livestock Water Use Projections Methodology

1. Estimated 2010 inventories by species and county
    1. 2010 Beef cow and derived stocker inventories were calculated using the 2006-2010 average of TASS data.
    2. Estimated 2010 Fed Beef, Swine and Dairy inventories using Industry information and TASS data.
    3. Utilized the 2007 Census of Agriculture to estimate 2010 inventories of other species.
2. Calculated water use by species and county for 2010 based on the 2010 inventories.

3. Applied projected changes identified in the Region A 2012 plan for the 2020-2070 projections**

TWDB Livestock Draft Projections for 2017 SWP

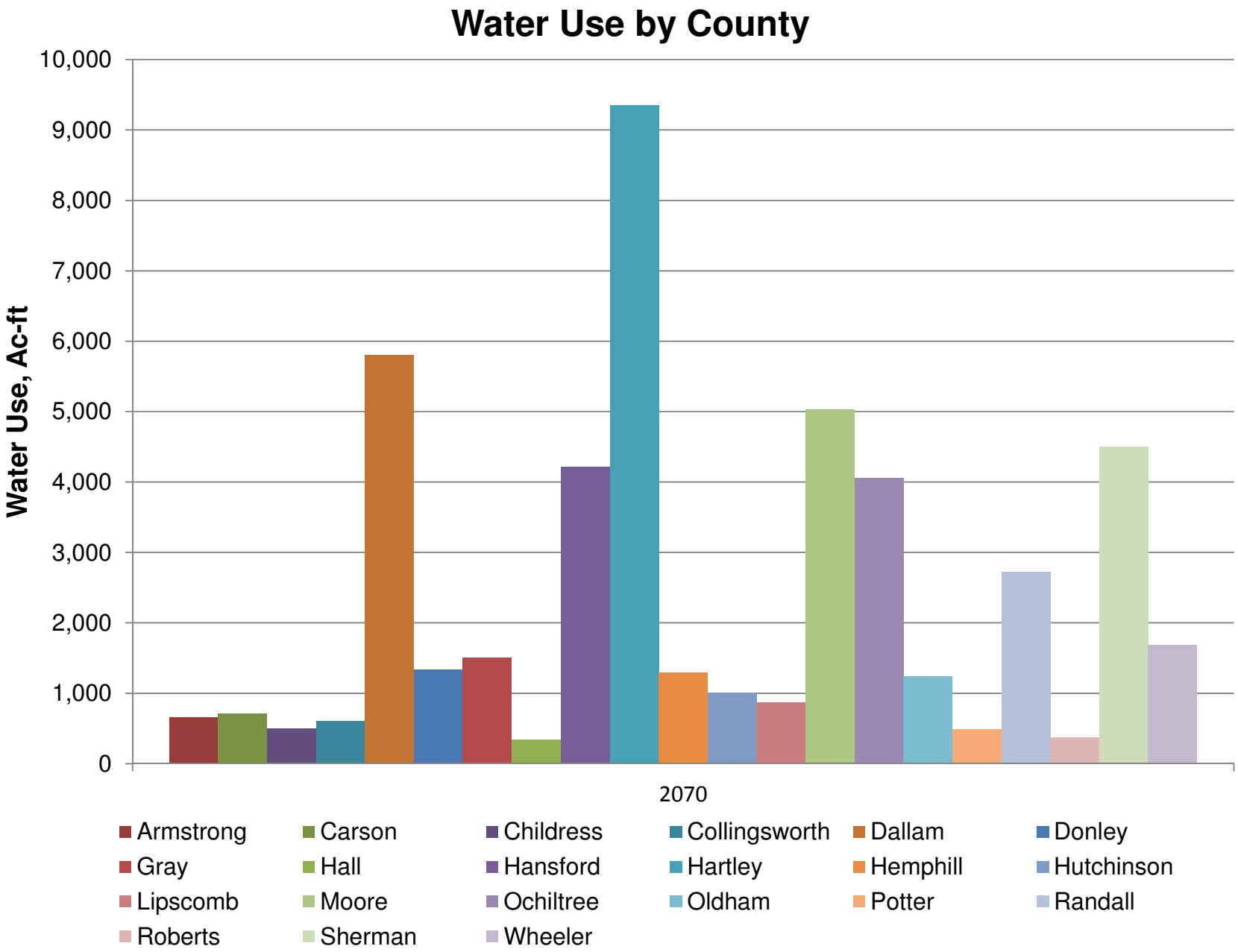
County Name	2020	2030	2040	2050	2060	2070
Armstrong	871	875	880	886	891	928
Carson	832	837	842	848	854	888
Childress	444	446	447	449	451	478
Collingsworth	653	656	659	661	665	697
Dallam	11,605	12,458	13,398	14,433	15,575	18,005
Donley	1,078	1,080	1,080	1,082	1,084	1,085
Gray	2,385	2,423	2,464	2,510	2,560	2,639
Hall	333	334	335	337	338	339
Hansford	5,632	6,059	6,528	7,044	7,610	8,298
Hartley	9,341	10,167	11,076	12,078	13,183	15,722
Hemphill	1,557	1,562	1,568	1,575	1,581	1,588
Hutchinson	648	656	666	677	688	698
Lipscomb	825	842	861	881	904	922
Moore	4,764	5,195	5,669	6,191	6,766	7,860
Ochiltree	2,862	2,980	3,109	3,250	3,405	3,557
Oldham	1,440	1,442	1,446	1,449	1,451	1,480
Potter	699	700	703	706	708	711
Randall	3,790	3,811	3,833	3,857	3,883	3,905
Roberts	419	420	421	422	422	423
Sherman	8,284	8,745	9,251	9,809	10,422	11,304
Wheeler	2,006	2,009	2,012	2,014	2,018	2,047
Total	60,468	63,697	67,248	71,159	75,459	83,574

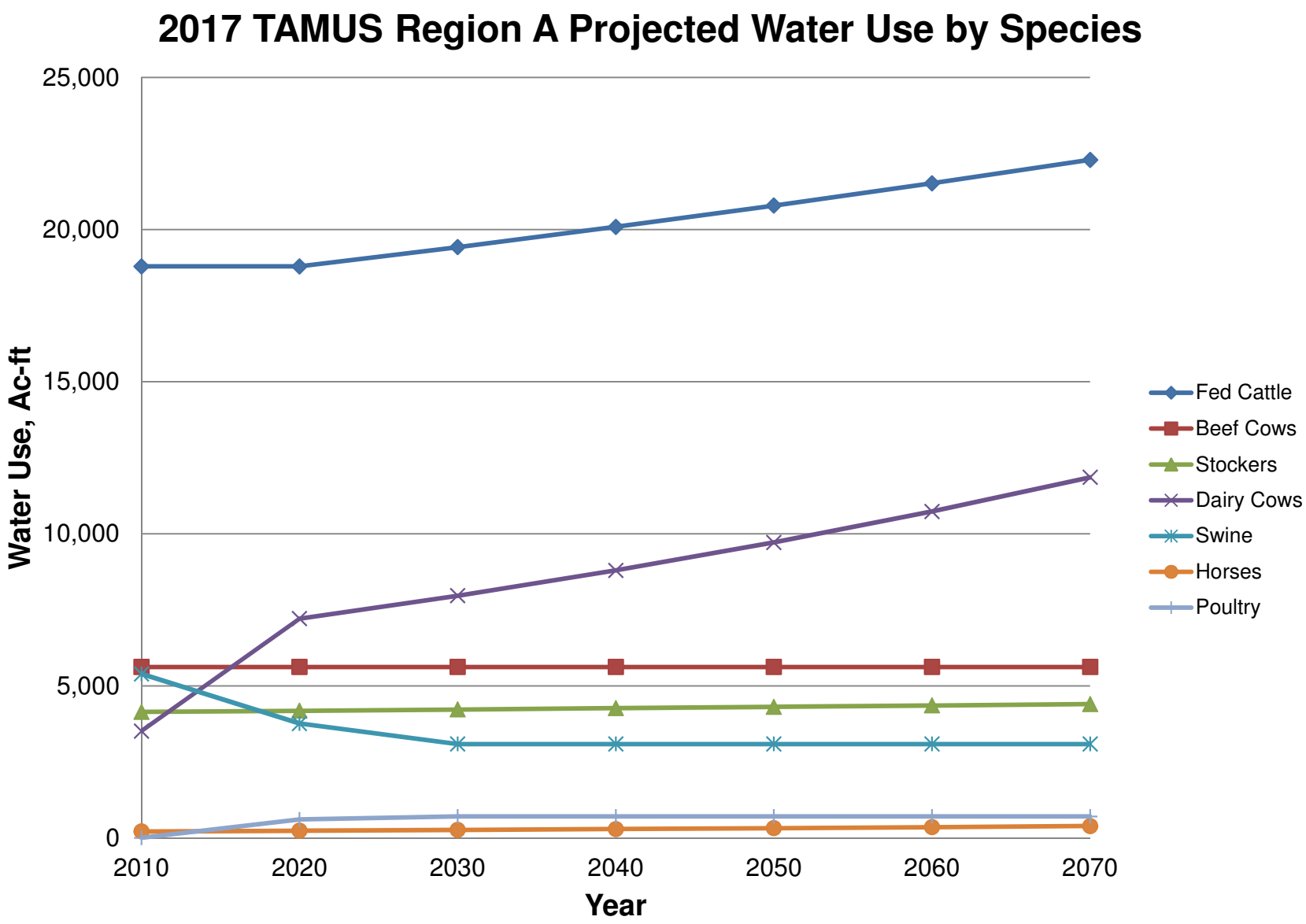
Livestock 2012 SWP Projections

County Name	2020	2030	2040	2050	2060
Armstrong	670	673	677	681	685
Carson	711	716	720	725	730
Childress	470	472	473	475	477
Collingsworth	564	566	569	571	574
Dallam	4,654	4,996	5,373	5,788	6,246
Donley	1,268	1,270	1,271	1,273	1,275
Gray	1,451	1,474	1,499	1,527	1,557
Hall	330	331	332	334	335
Hansford	3,956	4,256	4,586	4,948	5,346
Hartley	7,103	7,731	8,422	9,184	10,024
Hemphill	1,281	1,285	1,290	1,296	1,301
Hutchinson	689	698	708	720	732
Lipscomb	1,007	1,028	1,051	1,076	1,104
Moore	3,605	3,931	4,290	4,685	5,120
Ochiltree	3,463	3,605	3,761	3,932	4,119
Oldham	1,257	1,259	1,262	1,265	1,267
Potter	504	505	507	509	511
Randall	2,741	2,756	2,772	2,789	2,808
Roberts	385	386	387	388	388
Sherman	5,579	5,889	6,230	6,606	7,019
Wheeler	1,657	1,660	1,662	1,664	1,667
Total	43,345	45,487	47,842	50,436	53,285

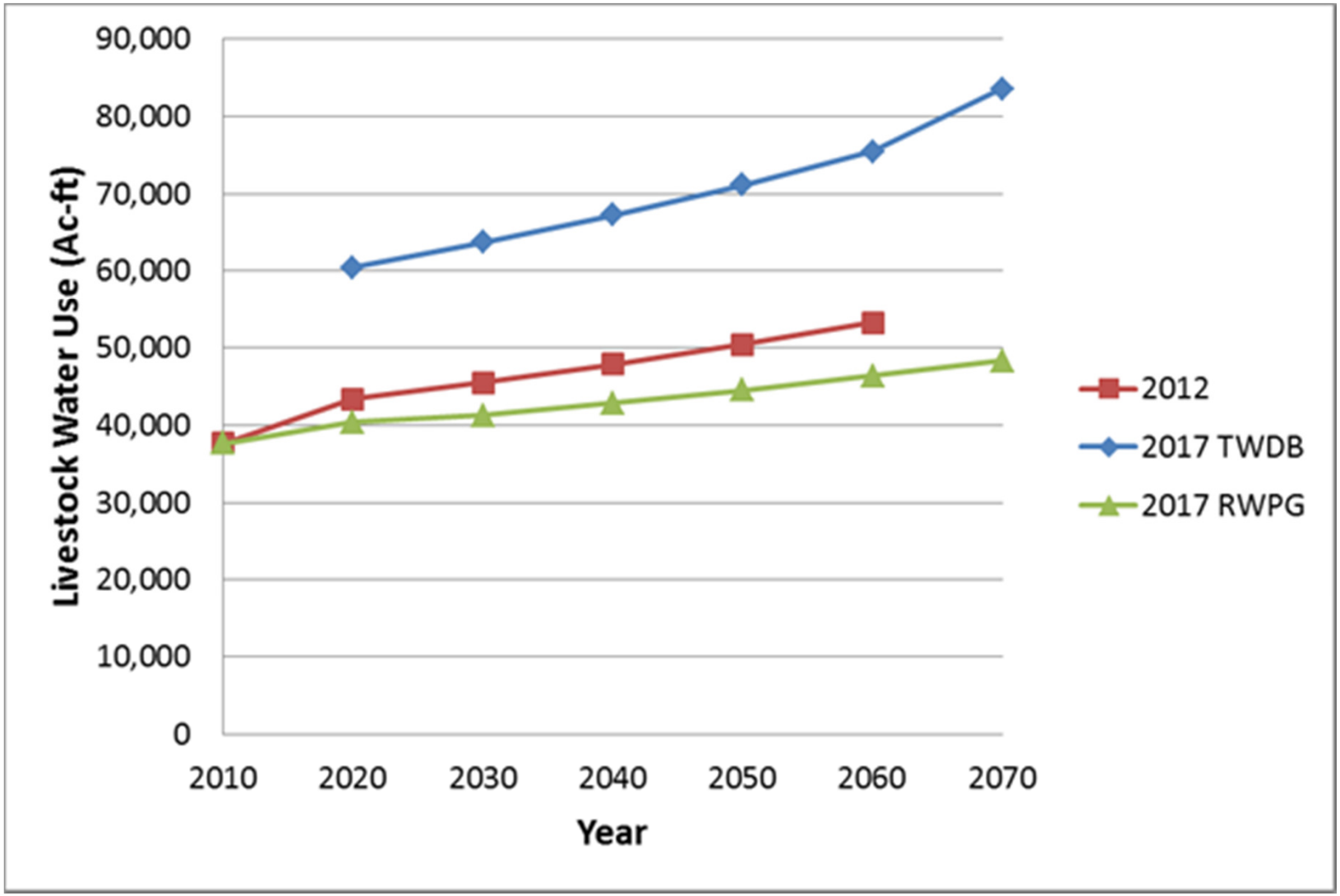
TAMUS 2017 Estimated Livestock Water Use by County in Region A, 2010 - 2070, Ac-ft

County	2010	2020	2030	2040	2050	2060	2070
Armstrong	541	645	648	651	655	659	663
Carson	587	692	696	700	704	708	713
Childress	387	490	492	495	497	500	502
Collingsworth	496	600	602	605	607	610	613
Dallam	4,739	4,437	4,669	4,919	5,191	5,484	5,802
Donley	1,328	1,330	1,331	1,333	1,335	1,337	1,339
Gray	1,248	1,352	1,378	1,406	1,438	1,472	1,511
Hall	335	336	337	338	340	341	342
Hansford	3,425	3,431	3,574	3,724	3,880	4,045	4,218
Hartley	4,675	6,498	6,976	7,498	8,065	8,684	9,358
Hemphill	1,270	1,274	1,279	1,283	1,289	1,295	1,301
Hutchinson	843	846	873	902	935	971	1,010
Lipscomb	815	817	825	835	846	857	870
Moore	3,021	3,675	3,905	4,154	4,424	4,715	5,031
Ochiltree	4,769	4,215	3,631	3,728	3,831	3,941	4,058
Oldham	1,125	1,228	1,231	1,233	1,236	1,239	1,242
Potter	479	480	482	484	486	488	490
Randall	2,646	2,654	2,665	2,677	2,690	2,704	2,719
Roberts	367	368	369	370	370	371	372
Sherman	2,989	3,449	3,630	3,825	4,033	4,257	4,497
Wheeler	1,575	1,577	1,680	1,682	1,684	1,686	1,689
Total	37,670	40,403	41,283	42,852	44,545	46,374	48,350


Water Use by County
Water Use, Ac-ft
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2070
Armstrong
Carson
Childress
Collingsworth
Dallam
Donley
Gray
Hall
Hansford
Hartley
Hemphill
Hutchinson
Lipscomb
Moore
Ochiltree
Oldham
Potter
Randall
Roberts
Sherman
Wheeler


2017 TAMUS Region A Projected Water Use by Species
Water Use, Ac-ft
25,000
20,000
15,000
10,000
5,000
0
2010
2020
2030
2040
2050
2060
2070
Year
Fed Cattle
Beef Cows
Stockers
Dairy Cows
Swine
Horses
Poultry

2012 RWP, 2017 TWDB and 2017 TAMUS Livestock Water Use Projections



Why the Differences??

Water use by species (TAMUS vs TWDB)

Inventory adjustments & calculation error

Changes in Fed Beef growth rates

Water Use by Species

Region A 2017TWDB and 2012 & 2017 TAMUS RWP livestock water use estimates per animal

Species	2017TWDB (gal/day)	2017RWP (gal/day)
Beef Cows	15	20
Fed Beef	15	12.5
Summer Stockers	15	10
Winter Stockers	15	8
Dairy Cattle	75	55
Equine	12	12
Poultry	0.09	0.09
Swine	11	2.5 – 8.2

Dallam County Swine Water Use Estimates (per head)

- Composite farrowing operation with a limited finishing operation
- Estimating procedure
  - Estimated total water use by sow by adding the known direct water consumption and est. indirect water use for cleaning, etc.
  - Used total water use est. from a county with only finishing operations
  - Constructed a weighted average
- Resulting estimate - - - - 8.2 gallons/day

Inventory Adjustments and Calculation Error

Inventory Adjustments and Calculation Error

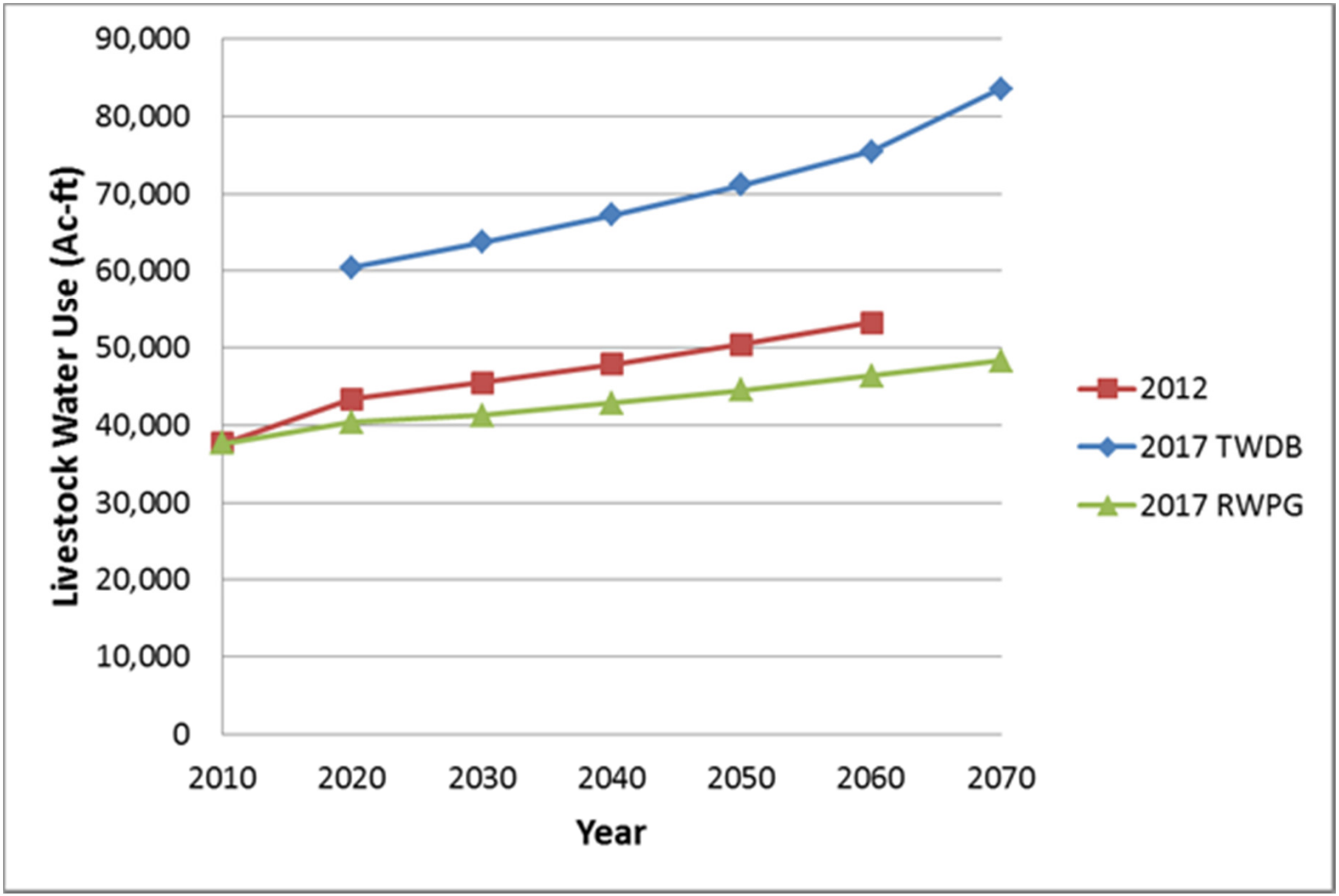
- Inventory estimates between TWDB and TAMUS are generally not comparable because of differences in categorization
- All 2010 inventories except hogs (down 482,000 head) were within +- 10% comparing 2012RWP to TAMUS est. 2017RWP
- Changing condition in 2017 est.: Dallam county hog inventory was decreased an additional 116,000 in 2020.
- TWDB estimates double counted fed beef and dairy water use.

2020 – 2070 Livestock Water Use Projections

Region A 2006RWP and 2012RWP 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%

2012 RWP, 2017 TWDB and 2017 TAMUS Livestock Water Use Projections



Changing Conditions

- In the 2012 RWP, fed beef was projected to grow 10% per decade starting in 2020 in Dallam, Hansford, Hartley, Moore, Ochiltree and Sherman counties with the remaining counties in the region having no growth.

- ***TCFA in the 2017 RWP based on changing conditions has revised the decadal growth rate down to 5% in the 6 counties with growth starting in 2030.***

2012 RWP 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**

2017RWP TAMUS Projected Livestock Water Use by Species

Species	2010	2020	2030	2040	2050	2060	2070
Fed Cattle	18,787	18,787	19,421	20,087	20,786	21,520	22,290
Beef Cows	5,620	5,620	5,620	5,620	5,620	5,620	5,620
Stockers	4,140	4,181	4,222	4,265	4,309	4,354	4,400
Dairy Cows	3,511	7,208	7,962	8,795	9,715	10,732	11,855
Swine	5,393	3,761	3,086	3,086	3,086	3,086	3,086
Horses	215	238	263	290	320	354	391
Poultry	1	605	706	706	706	706	706
Total	37,670	40,403	41,283	42,852	44,545	46,374	48,350

Summary & Conclusions

- Comparable (2012RWP, 2017TWDB, 2017 TAMUS) livestock water use estimates for 2060 were:
  - 53,287 ac-ft (2012RWP)
  - 75,459 ac-ft (2017TWDB)
  - 46,374 ac-ft. (2017TAMUS)

- TWDB estimates appear excessive because of differences in: water use by species, beginning inventories, changing conditions and a calculation error

Summary & Conclusions – cont.

- Differences between the 2017 TAMUS estimates and the 2012RWP can be attributed to inventory changes and changing conditions since the 2012 plan was completed.
- In our estimation, the 2017TAMUS projections represent the best estimates for use in the 2017RWP