Regional Water Planing Group - Area B

in cooperation with the Texas Water Development Board

August 22, 2012

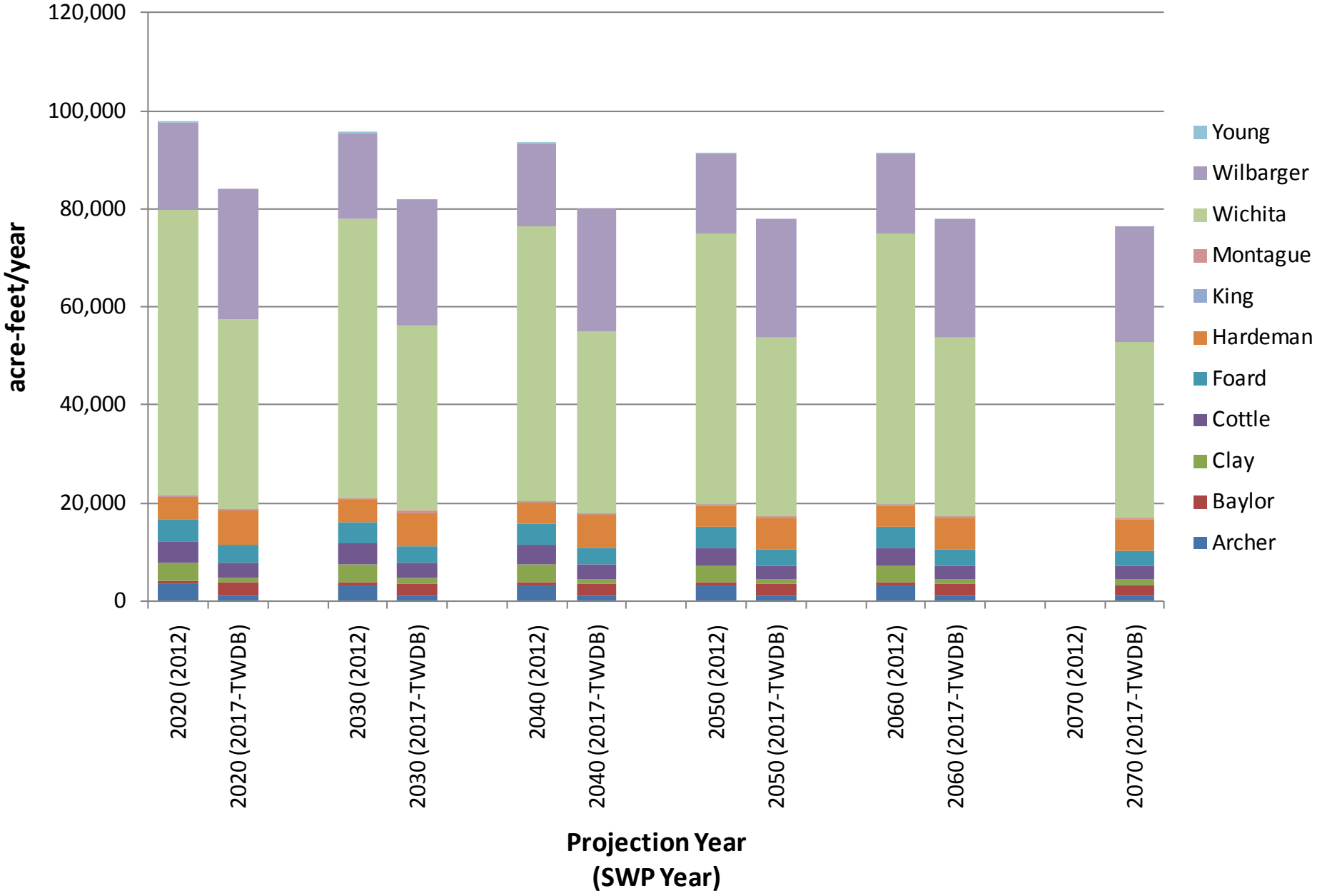
Region B
Regional Water Planning Group Meeting
August 22, 2012

Review of Nonmunicipal Demands

Overview

- Agricultural Irrigation Water Demands
- Agricultural Livestock Water Demands
- Manufacturing Demands
- Mining Demands
- Steam Electric Demands

Figure 1. TWDB-Proposed Irrigation Demands



Basis of Irrigation Demands

- Base year
  - FSA Crop acreage for 2005 – 2009
  - Evapotranspiration-based water demand (varies with weather conditions)
  - Acreage X ET = Total Demand
  - Adjusted based on TCEQ surface water release data or groundwater district data
- Projections – based on rate of change from the 2011 regional plans (2012 SWP)

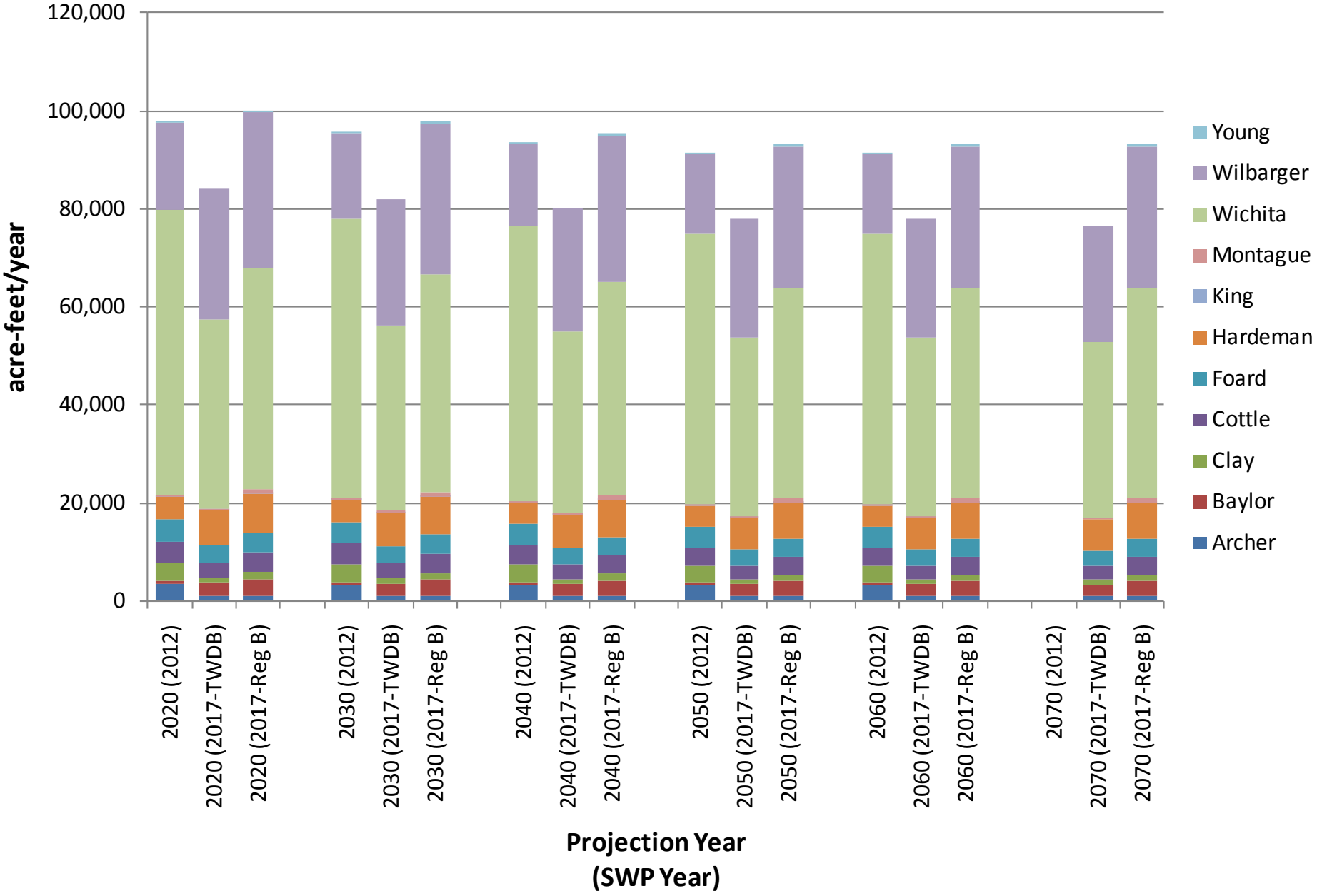
2005 – 2009 Irrigation Demands

County	Irrigation Demand (acre-feet/year)						
	2005	2006	2007	2008	2009	5-Yr. Average (TWDB-Proposed 2010 Base Year Demand)	Max Year Demand (Reg. B.-Proposed 2010 Base Demand)
Archer	750	**1,250**	1,188	1,100	1,000	1,058	1,250
Baylor	2,334	3,272	1,757	3,326	**3,404**	2,819	3,404
Clay	636	1,319	805	**1,476**	1,226	1,092	1,476
Cottle	**4,128**	3,998	2,394	2,699	2,491	3,142	4,128
Foard	3,875	**4,061**	3,268	3,634	3,745	3,717	4,061
Hardeman	7,678	7,286	5,785	7,656	**8,184**	7,318	8,184
King	25	**28**	26	0	0	16	28
Montague	171	398	91	130	**872**	332	872
Wichita	34,208	37,887	34,629	**46,047**	43,124	39,179	46,047
Wilbarger	28,636	30,020	16,613	28,855	**32,580**	27,341	32,580
Young	0	0	0	0	0	0	0
Total	**82,441**	**89,519**	**66,556**	**94,923**	**96,626**	**86,013**	**102,030**

Proposed Approach for Irrigation Demand Projections

- Base year – highest demand year for the 2005 – 2009 period.
- Projections – based on rate of change from the 2011 regional plans
- Adopt proportional changes in demand from 2012 SWP projections through 2050.
- Assume 2060 and 2070 demands equal to 2050 demands.

Figure 2. Region B-Proposed Irrigation Demands



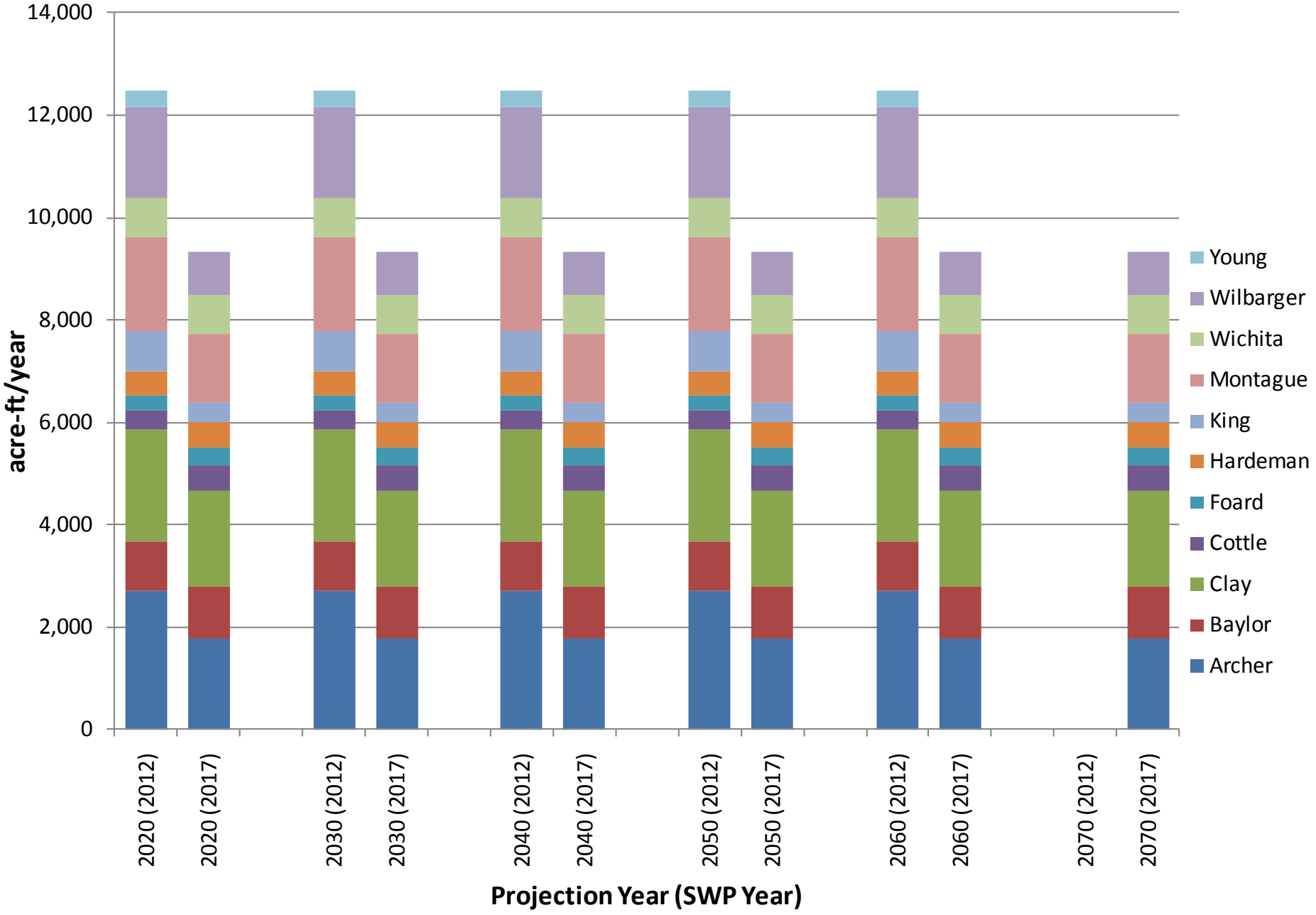
Region B-Proposed Irrigation Demands

County	Irrigation Demand by Decade (acre-feet/year)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Archer	1,214	1,178	1,142	1,106	1,106	1,106
Baylor	3,310	3,211	3,112	3,018	3,018	3,018
Clay	1,438	1,400	1,362	1,324	1,324	1,324
Cottle	4,004	3,884	3,767	3,655	3,655	3,655
Foard	3,939	3,820	3,706	3,595	3,595	3,595
Hardeman	7,939	7,701	7,470	7,246	7,246	7,246
King	28	28	28	28	28	28
Montague	872	872	872	872	872	872
Wichita	45,267	44,487	43,707	42,927	42,927	42,927
Wilbarger	31,603	30,655	29,736	28,843	28,843	28,843
Young	600	600	600	600	600	600
Total	**100,214**	**97,836**	**95,502**	**93,214**	**93,214**	**93,214**

Basis for Livestock Demands

- Base year -- utilized an average of TWDB's 2005-2009 livestock water use estimates
  - County level inventory estimates from Texas Agricultural Statistics Service (TASS)
  - Water use for each type of livestock
- Projections – based on rate of change from the 2011 regional plans

Figure 3. TWDB-Proposed Livestock Demands



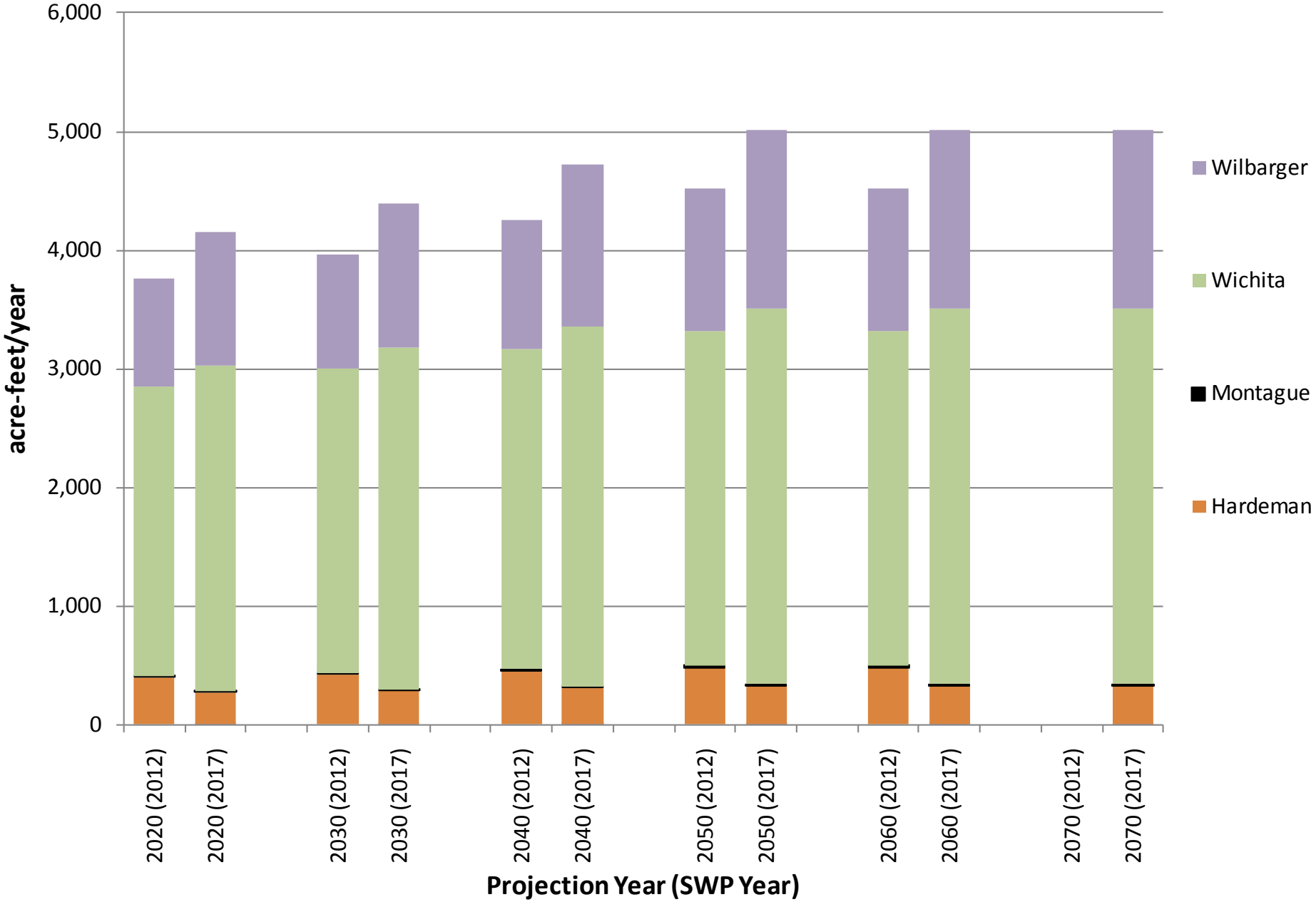
Region B-Proposed Livestock Demands (same as TWDB)

County	Livestock Demand by Decade (acre-feet/year)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Archer	1,781	1,781	1,781	1,781	1,781	1,781
Baylor	1,023	1,023	1,023	1,023	1,023	1,023
Clay	1,864	1,864	1,864	1,864	1,864	1,864
Cottle	494	494	494	494	494	494
Foard	353	353	353	353	353	353
Hardeman	495	495	495	495	495	495
King	363	363	363	363	363	363
Montague	1,365	1,365	1,365	1,365	1,365	1,365
Wichita	761	761	761	761	761	761
Wilbarger	820	820	820	820	820	820
Young	0	0	0	0	0	0
Total	**9,319**	**9,319**	**9,319**	**9,319**	**9,319**	**9,319**

Basis of Manufacturing Demands

- Base Year
  - 2004-2008 data from TWDB Water Use Survey
  - Adjusted based on Bureau of Economic Analysis (BEA) data
- Projections – based on rate of change from the 2011 regional plans
- Assume constant after2050

Figure 4. TWDB-Proposed Manufacturing Demands



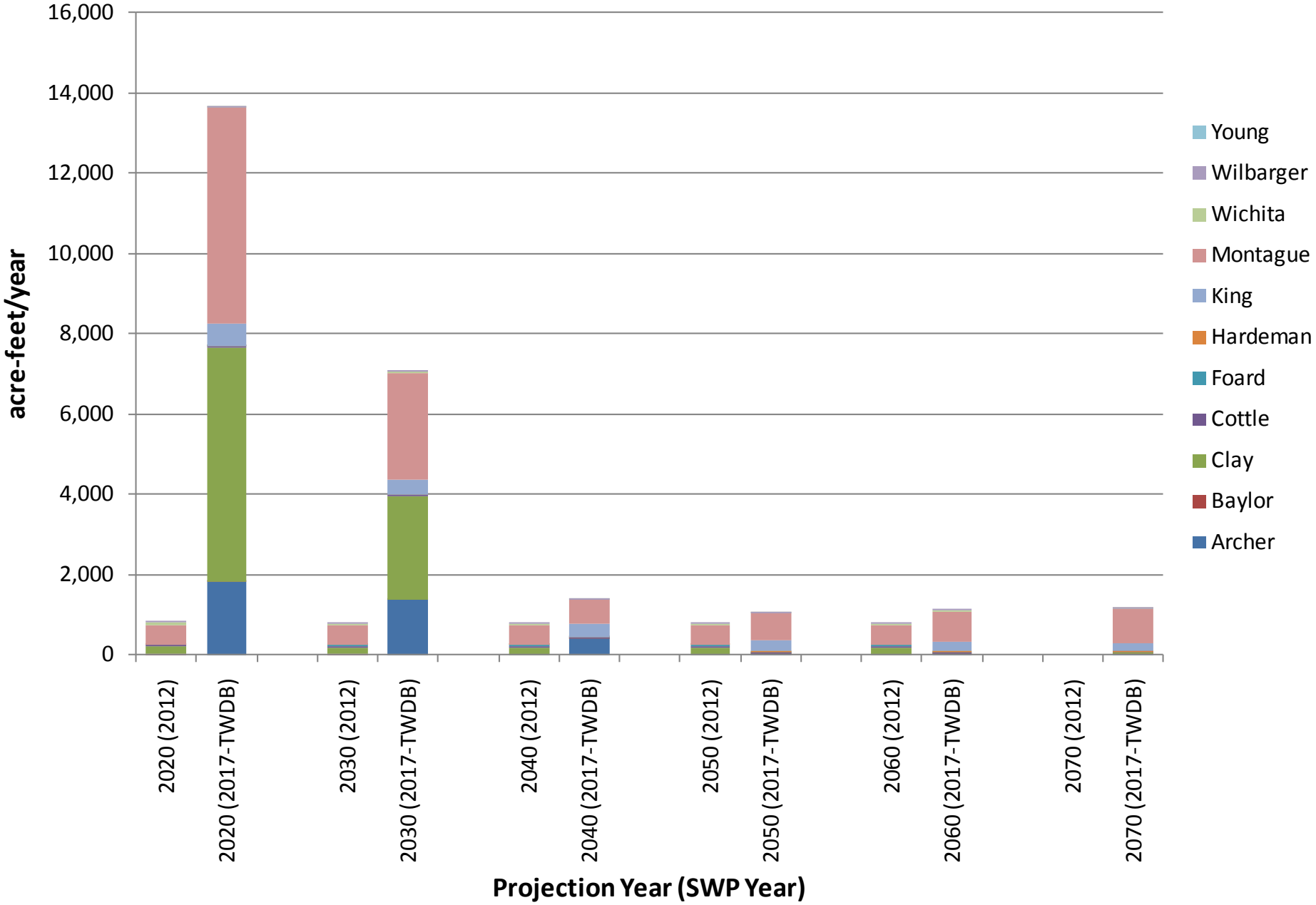
Region B-Proposed Manufacturing Demands (same as TWDB)

County	Manufacturing Demand by Decade (acre-feet/year)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Archer	1	1	1	1	1	1
Hardeman	276	294	313	332	332	332
Montague	5	6	8	10	10	10
Wichita	2,743	2,874	3,036	3,162	3,162	3,162
Wilbarger	1,133	1,217	1,362	1,511	1,511	1,511
Total	**4,158**	**4,392**	**4,720**	**5,016**	**5,016**	**5,016**

Basis of Mining Demands

- Based on the results of a study performed by the University of Texas Bureau of Economic Geology (BEG)
- Projections for sub-sector mining categories:
  - oil and gas (multiple purposes)
  - aggregates
  - coal and lignite
  - other (gypsum, clay, etc.)

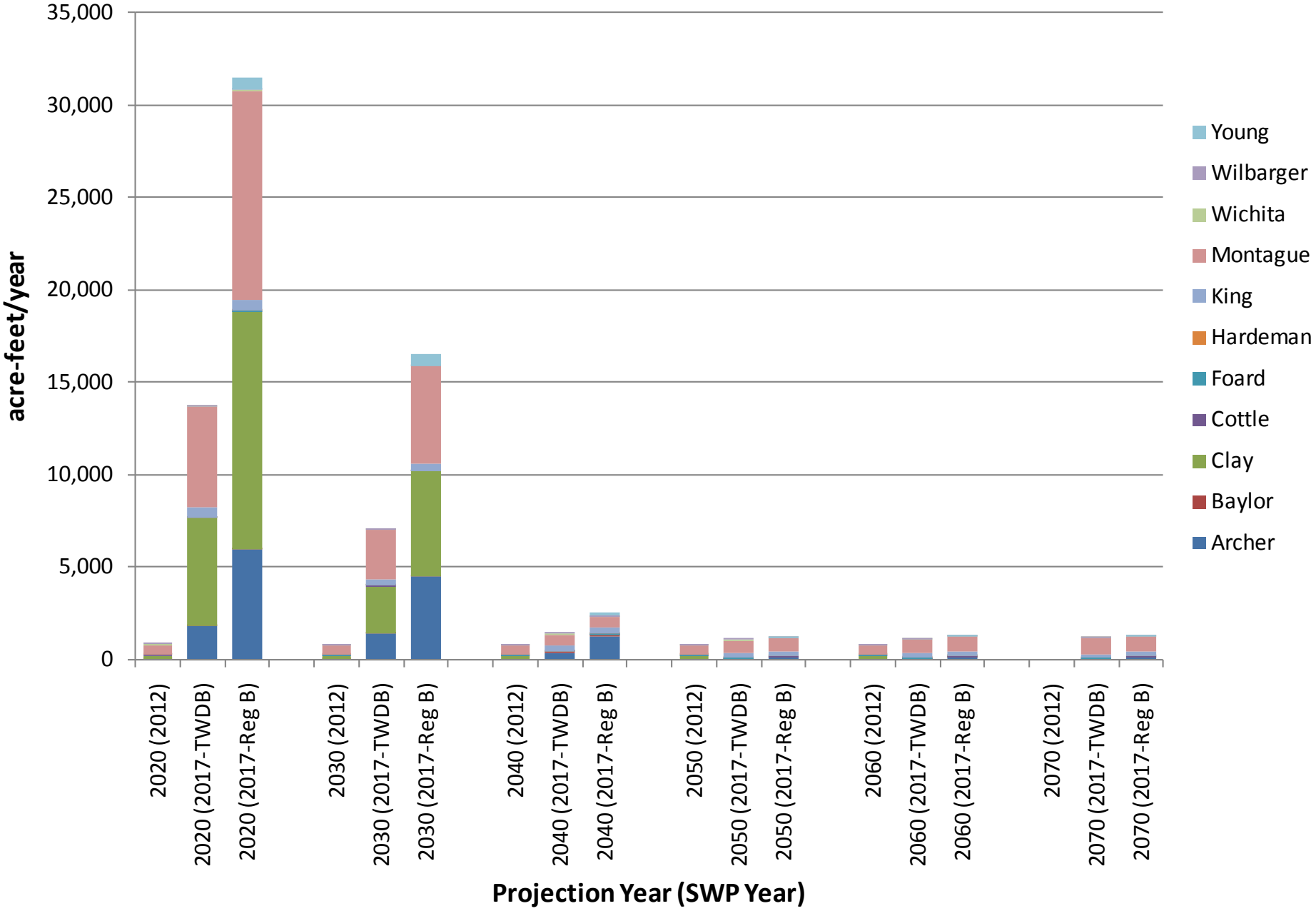
Figure 5. TWDB-Proposed Mining Demands



Proposed Approach for Mining Demand Projections

- BEG 2010 oil & gas water use estimate for Montague County was 648.5 ac-ft. UTGCD recorded use was 2,344.5 ac-ft. Produces a ratio of actual to estimated use of 3.62 for Barnett shale production.
- Adjust BEG estimates for oil & gas water use for Archer, Clay, and Montague by factor of 3.62.
- Adjust Young County to reflect BEG study.
- Assume 2070 demand = 2060 demand.

Figure 6. Region B-Proposed Mining Demands



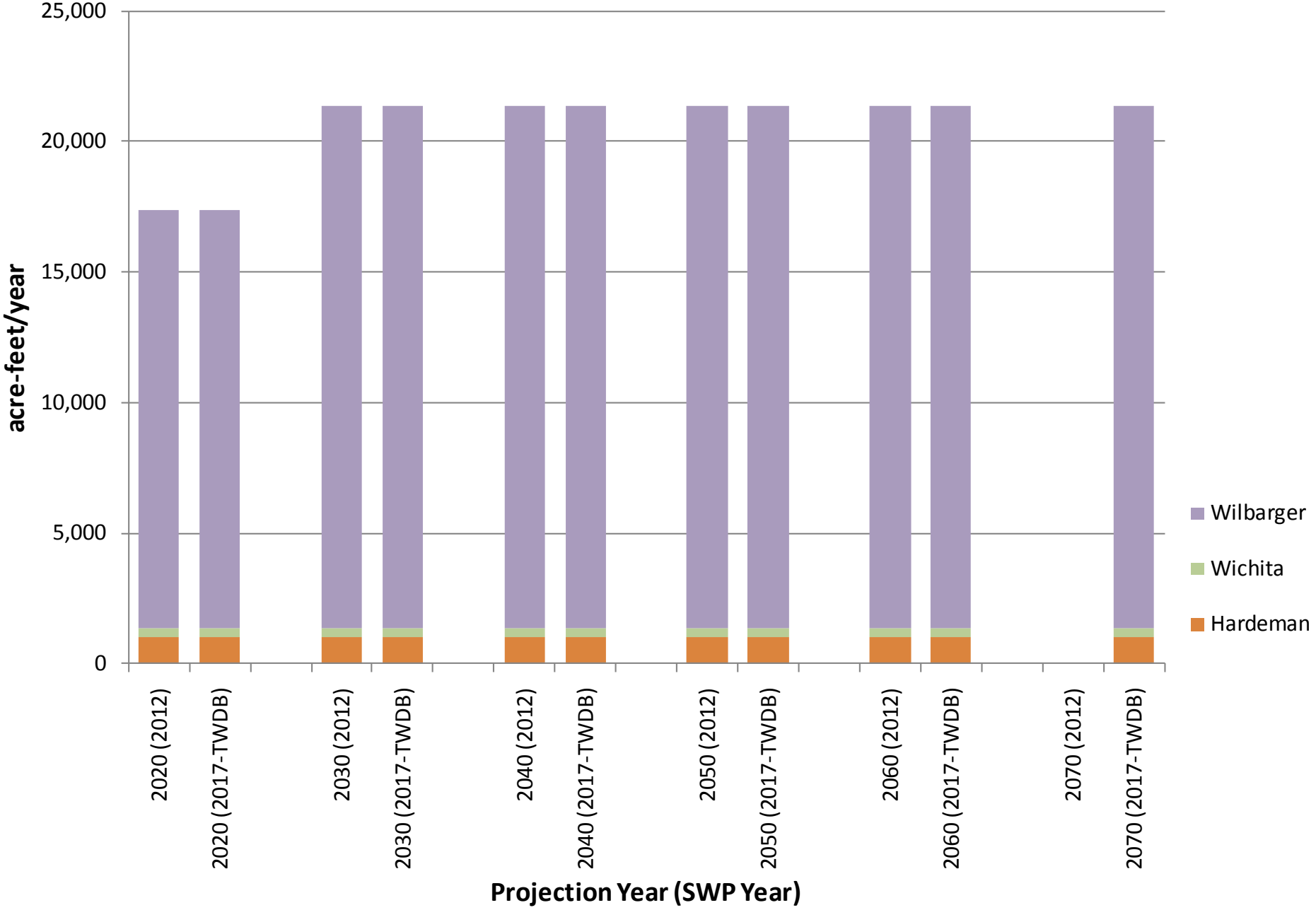
Region B-Proposed Mining Demands

County	Mining Demand by Decade (acre-feet/year)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Archer	5,931	4,468	1,271	71	65	65
Baylor	12	12	12	12	13	13
Clay	12,887	5,691	62	58	58	58
Cottle	14	13	13	13	13	13
Foard	10	10	10	10	10	10
Hardeman	17	17	18	18	18	18
King	565	357	311	271	236	236
Montague	11,365	5,310	625	711	795	795
Wichita	12	11	11	10	10	10
Wilbarger	14	14	14	14	14	14
Young	670	622	206	13	13	13
Total	**31,497**	**16,525**	**2,553**	**1,201**	**1,245**	**1,245**

Basis of Steam Electric Demands

- Based on projections from the 2011 Regional Water Plans and the 2008 TWDB report *Water Demand Projections for Power Generation in Texas*
- Recent data from the Public Utilities Commission of Texas on plant announcements, retirements, and capacity changes

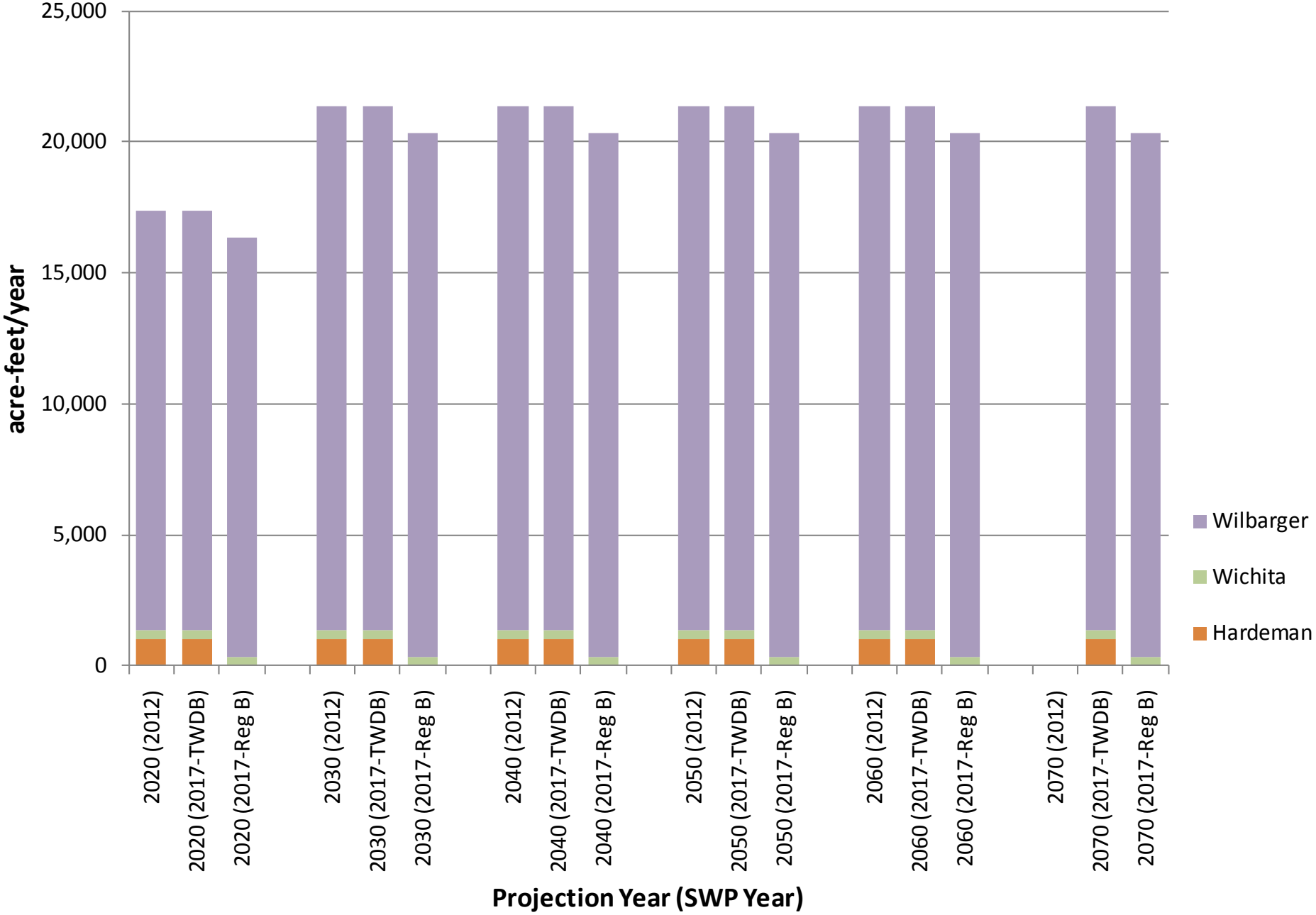
Figure 7. TWDB-Proposed Steam Electric Demands



Proposed Approach for Steam Electric Demand Projections

- Eliminate the 1,000 ac-ft/year demand in Hardeman County as the generating facility has been sold and not expected to resume power generation.

Figure 8. Region B-Proposed Steam Electric Demands



Region B-Proposed Steam Electric Demands

County	Steam Electric Demand by Decade (acre-feet/year)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Wichita	360	360	360	360	360	360
Wilbarger	16,000	20,000	20,000	20,000	20,000	20,000
Total	**16,360**	**20,360**	**20,360**	**20,360**	**20,360**	**20,360**

Region B
Regional Water Planning Group Meeting
August 22, 2012

Review of Nonmunicipal Demands

Methodology

Identifying Potentially Feasible Water Management Strategies

Region B

2016 Water Plan

Feasible Strategies

From TAC 357.5

"Before a regional water planning group begins the process of identifying potentially feasible water management strategies, it shall document the process by which it will list all possible water management strategies and identify the water management strategies that are potentially feasible for meeting a need in the region."

Identification Process

- Identify entities with needs
- Review recommended strategies in 2011 plan
- Determine if new or changed strategies are needed
- Contact entity for input
  - Contact RWPG representative for county-wide WUGs
- Verify recommendations

Feasible Strategies

- Considerations
  - A strategy must use proven technology
  - A strategy should be appropriate for regional planning
  - A strategy should have an identifiable sponsor
  - Must consider end use. Includes water quality, economics, geographic constraints, etc.
  - Must meet existing regulations

Feasible Strategies

- Water conservation
  - Review for applicability and consider for all WUGs with a need
  - Consider water conservation for all municipal WUGs with gpcd > 140
- Drought management
  - Emergency measures
  - Generally, not recommended for long-term

Feasible Strategies

- Expanded use of existing supplies
  - New groundwater wells
    - Consider groundwater availability
  - Conjunctive use of groundwater & surface water
  - New infrastructure
- Voluntary transfer
  - Contracts
  - Sales, leases and options
- New water supplies
  - Surface water (reservoirs and new diversions)
  - Groundwater (new well fields)

Feasible Strategies

- Wastewater reuse
  - Update based on current practices and planned implementation
    - Identify opportunity for expansion
  - Identify generators of wastewater and potential new recipients for reuse
- Desalination of brackish water
  - Includes both groundwater and surface water sources

Feasible Strategies

- Yield enhancement
  - Brush management
  - Recharge enhancement
- Water quality enhancements
  - Chloride Control Project

Evaluations

- Quantity, cost and reliability
- Environmental factors
- Impacts on water resources and other WMS
- Impacts on agriculture/ rural
- Impacts on natural resources
- Impacts on key water quality parameters
- Other relevant considerations

Alternative Strategies

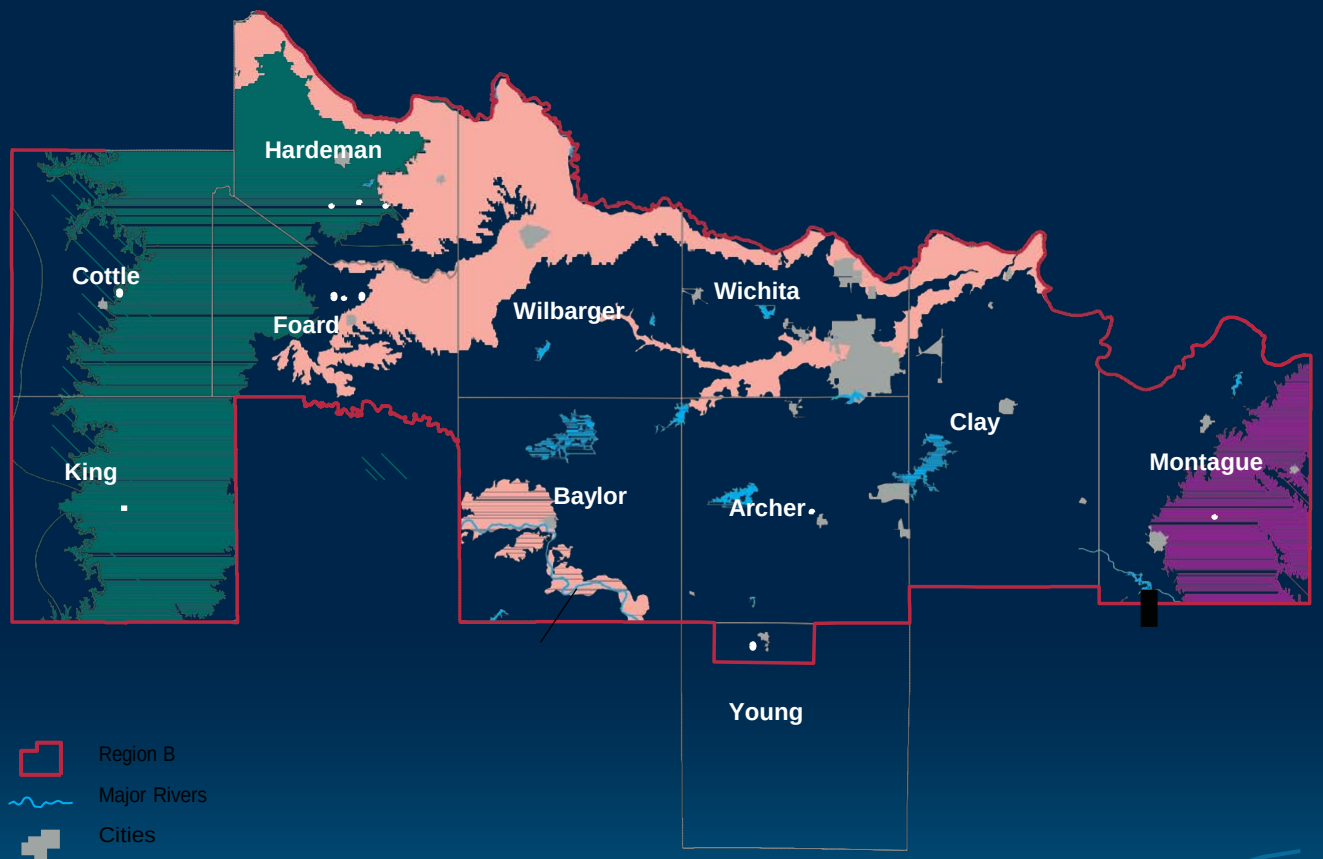
- Selected with entity input
- Evaluated using same considerations for selected strategies
- Included in 2016 Plan

Update
Supply Availability

Region B

2016 Water Plan

Region B



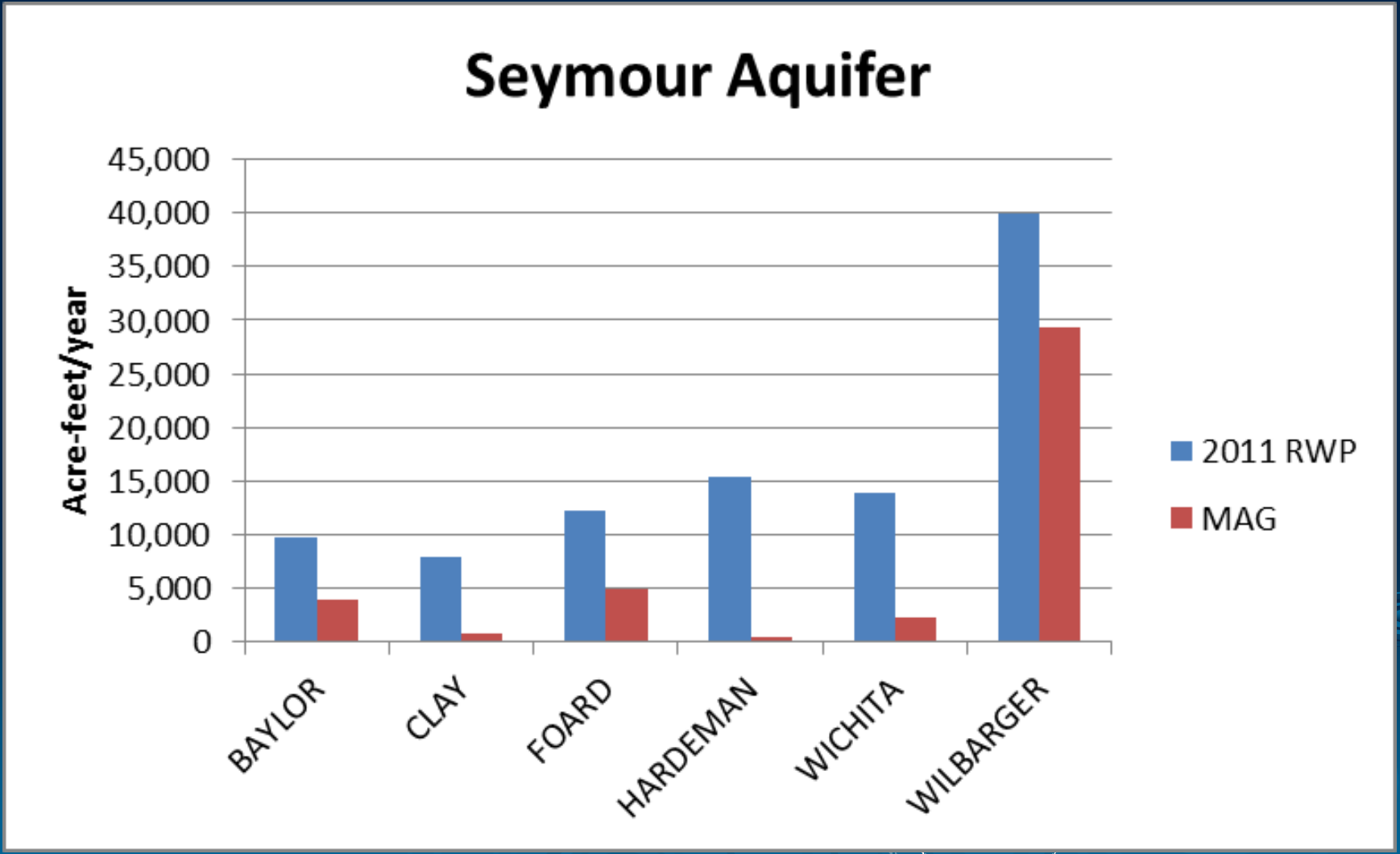
Region B
Major Rivers
Cities
Existing Reservoirs
Seymour Aquifer
Trinity Aquifer (outcrop)
Trinity Aquifer (subsurface)
Blaine Aquifer (outcrop)*
Blaine Aquifer (subsurface)*

* Minor aquifer (only shown where there is no major aquifer)

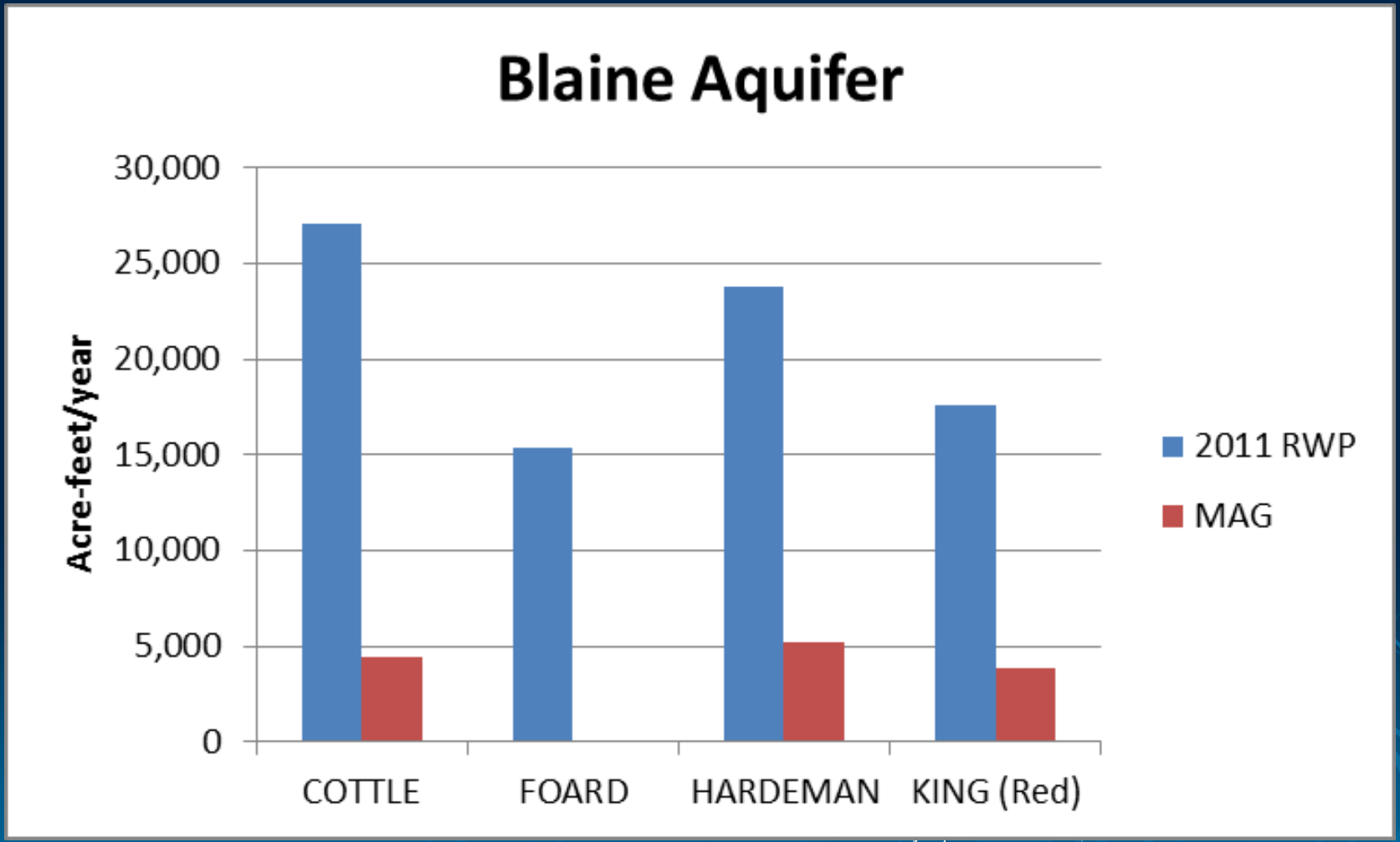
Groundwater Availability

- Previous Water Plans
  - Seymour and Blaine – effective recharge
  - Blaine – includes water with TDS <10,000 mg/l
  - Trinity – Modeled availability – GMA 8
- 2016 Water Plans
  - Modeled Available Groundwater
    - Based on Desired Future Conditions
    - GMA 8 (Trinity) and GMA 6 (Seymour, Blaine)

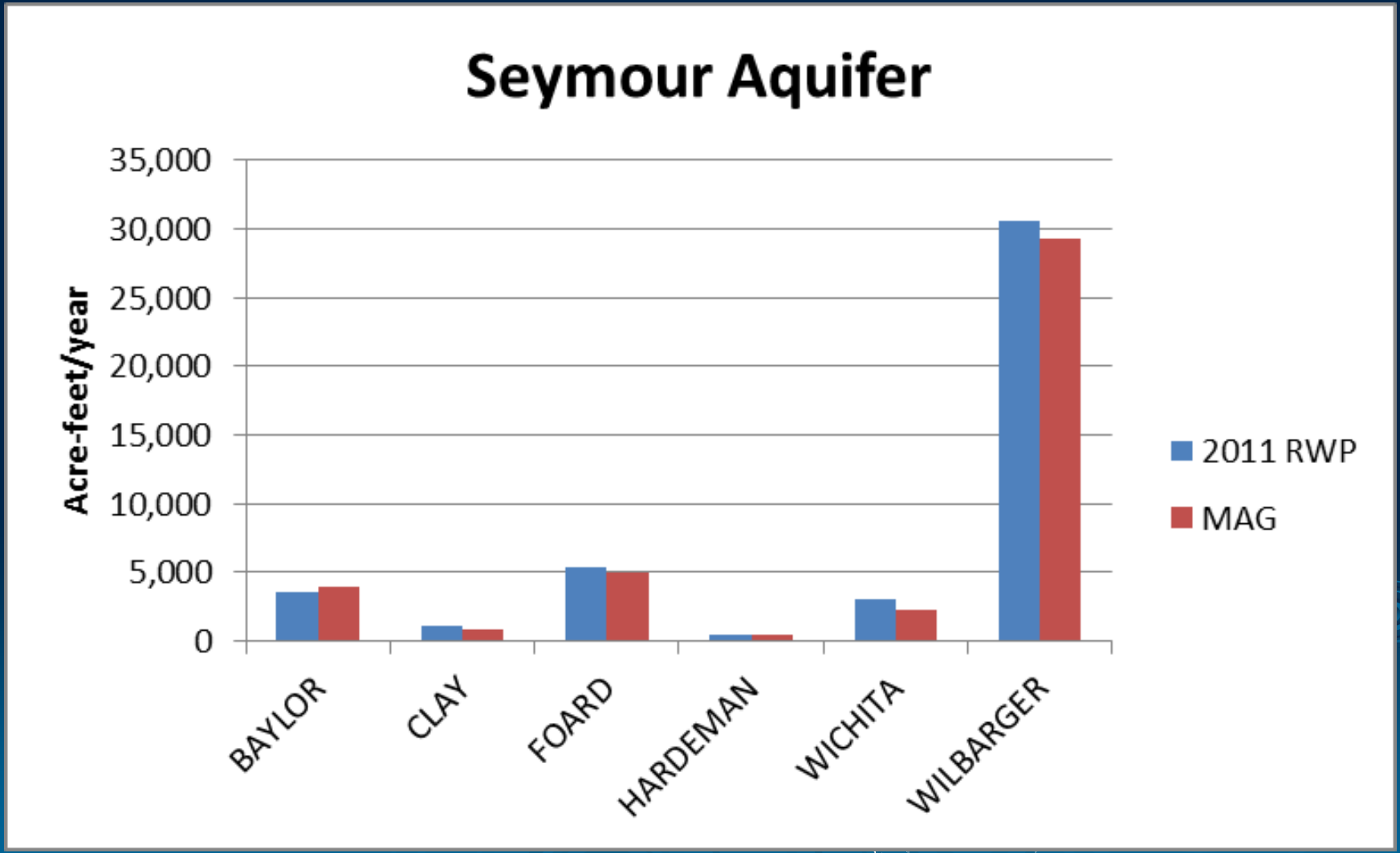
Seymour Availability



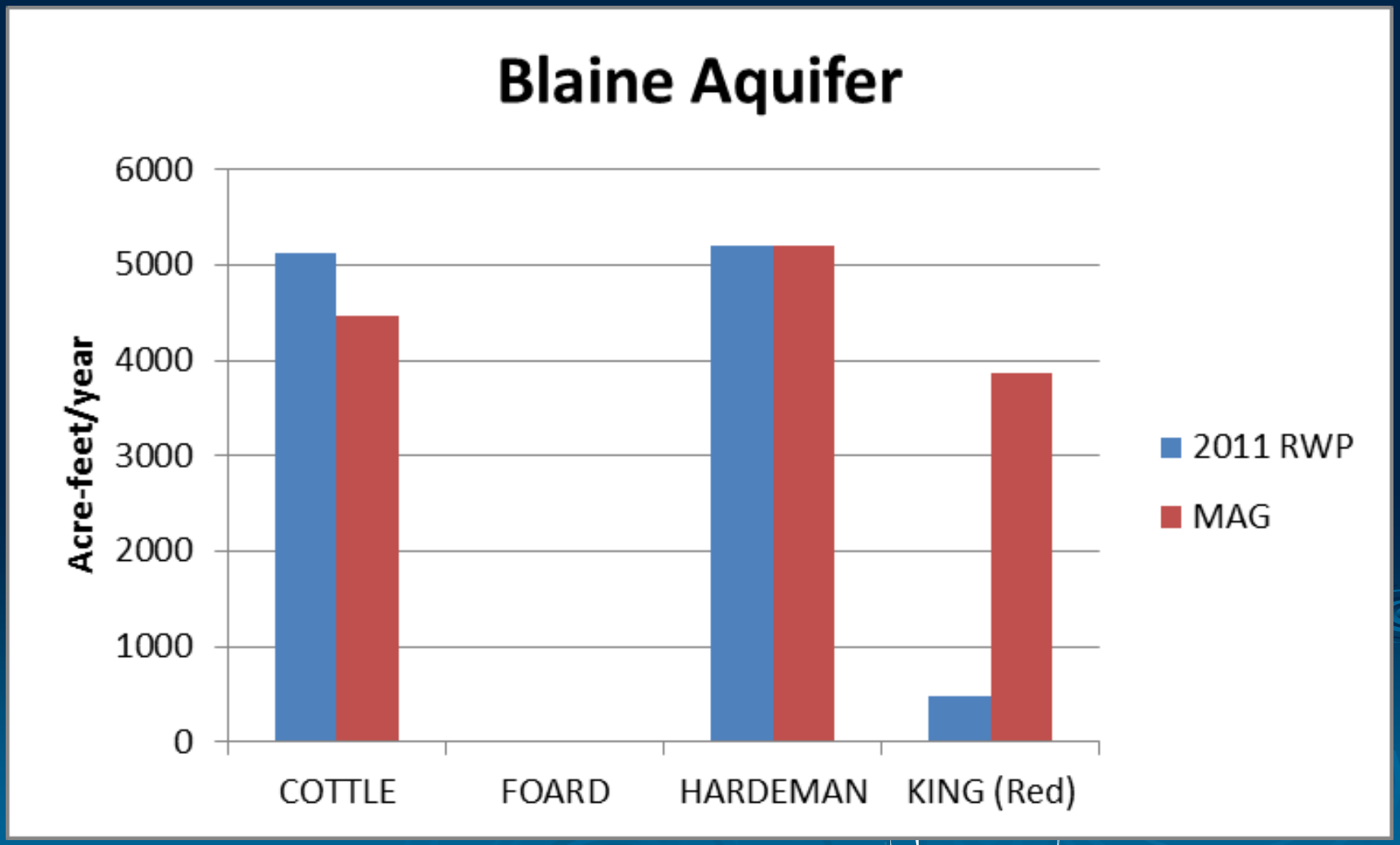
Blaine Availability



Seymour Allocated to Water Users



Blaine Allocated to Water Users



Groundwater Availability

- MAG values are significantly less than previous availability for Blaine and Seymour
- Allocated water – similar level to MAG
  - May have small shortages
  - May limit future development of groundwater
- MAG values are the same for Trinity
- Need to define supplies for “Other” Aquifer
  - Based on historical use

Surface Water Availability

Update

August 22, 2012

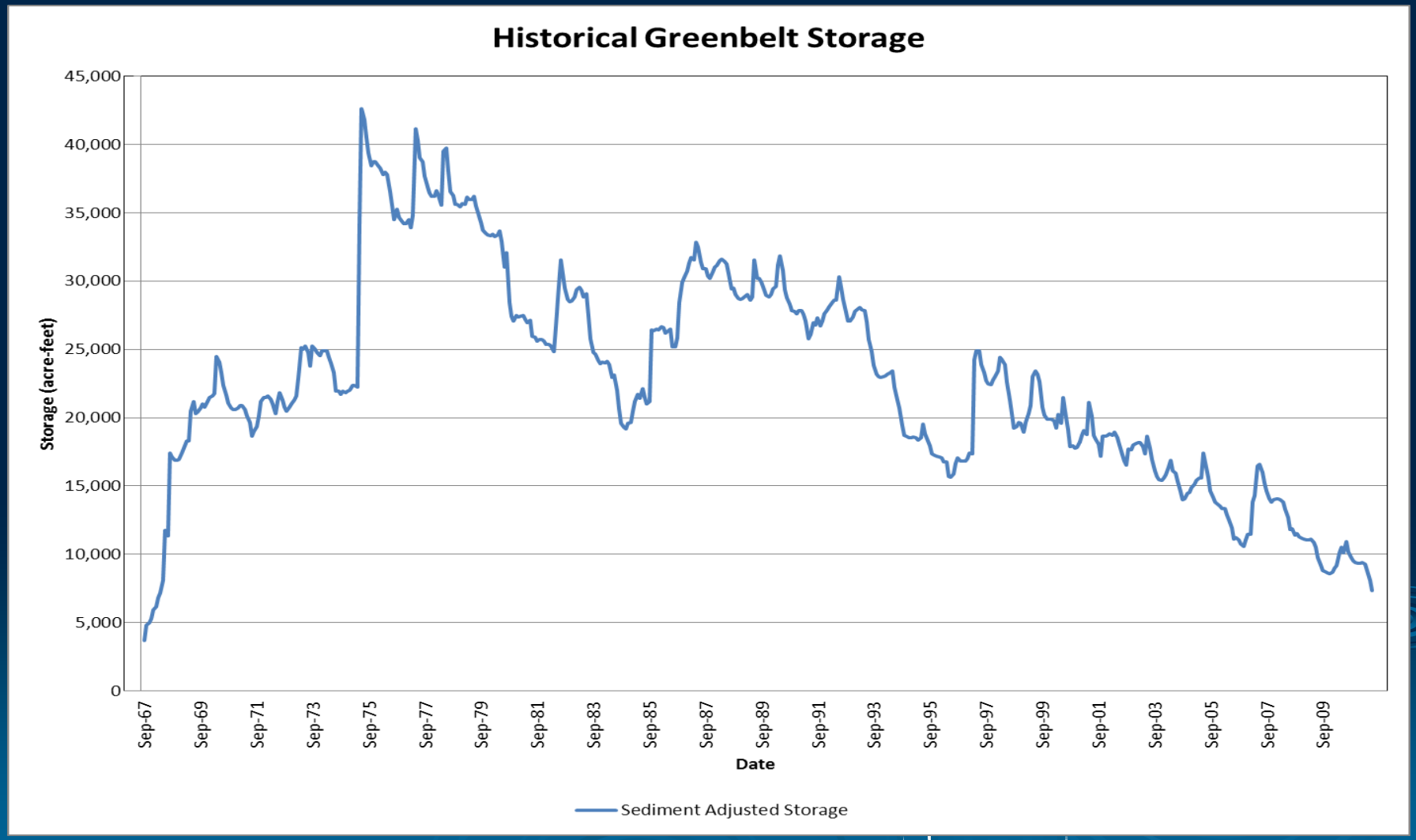
Reservoirs

- Firm and safe yields – WAMs
- Retaining availabilities from 2011 RWP
  - All reservoirs except Kemp-Diversion and Greenbelt (Region A)
  - Extending availabilities to 2070 by extrapolating from 2060

Kemp-Diversion

- TWDB-USACE Study on Lake Kemp
  - Differences in inflows between WAM and calculated inflows
  - Affected future yields under future sediment conditions
- Reviewing study and updating reliable supplies
  - Results at next meeting

Greenbelt Reservoir



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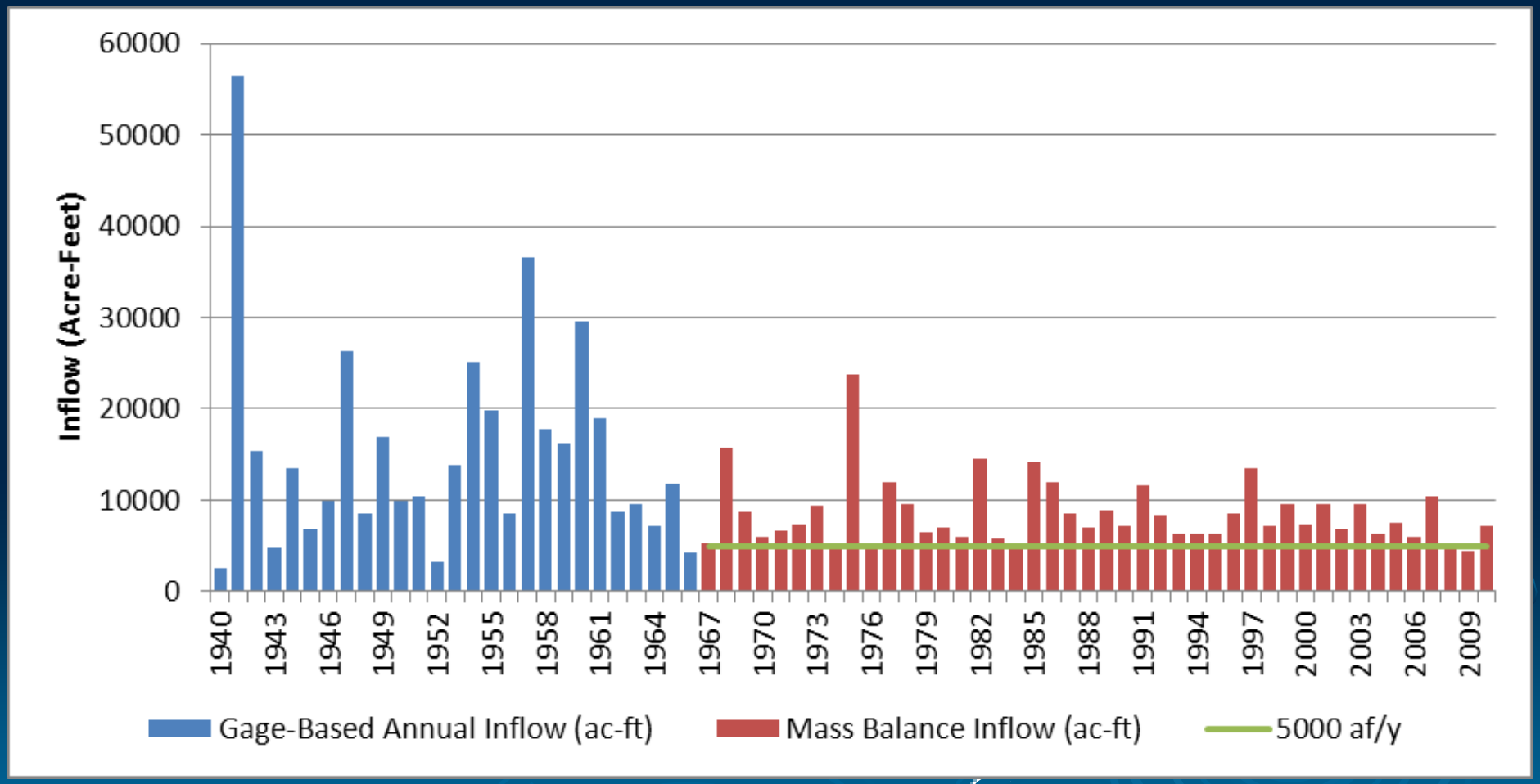
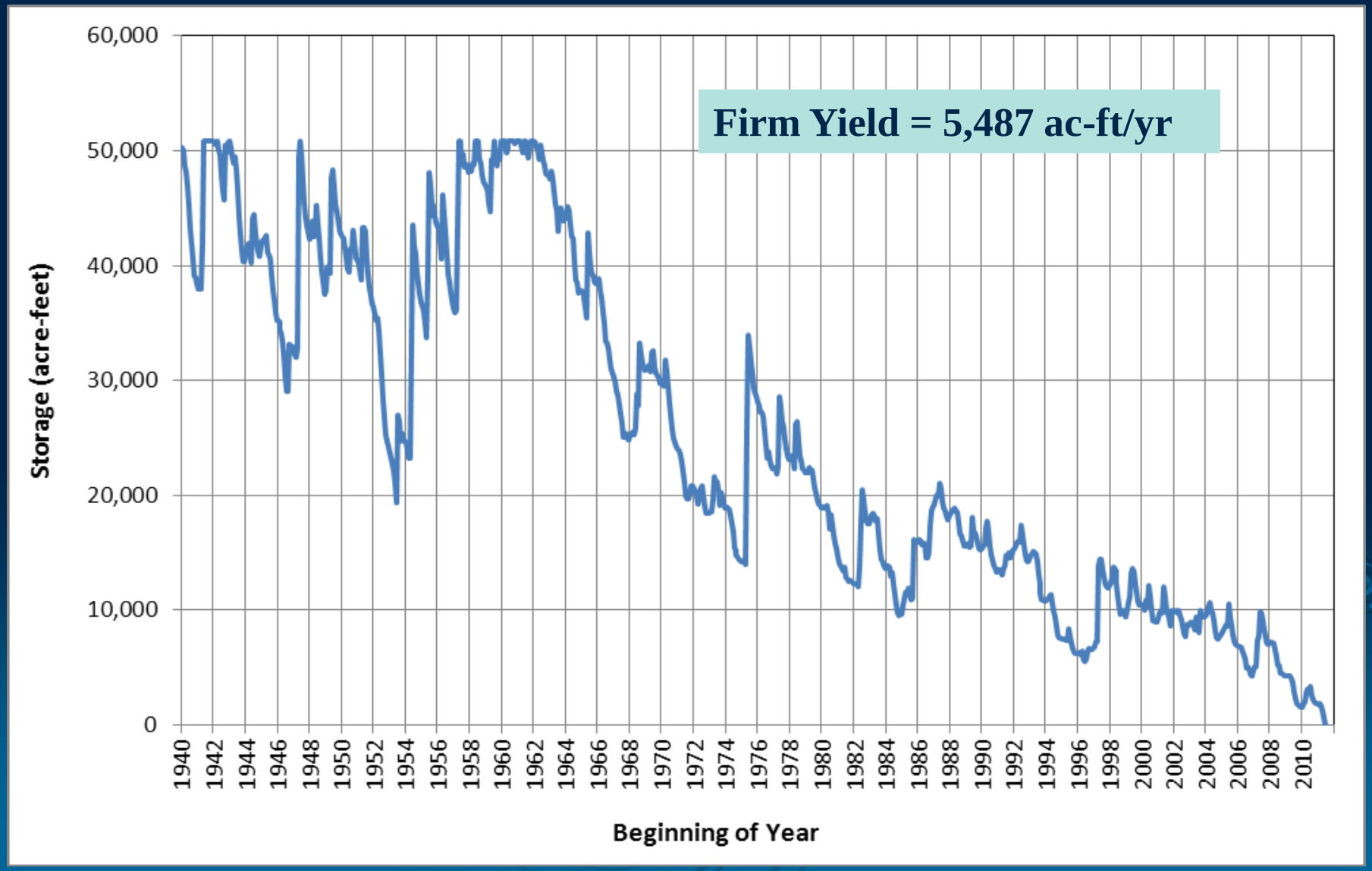
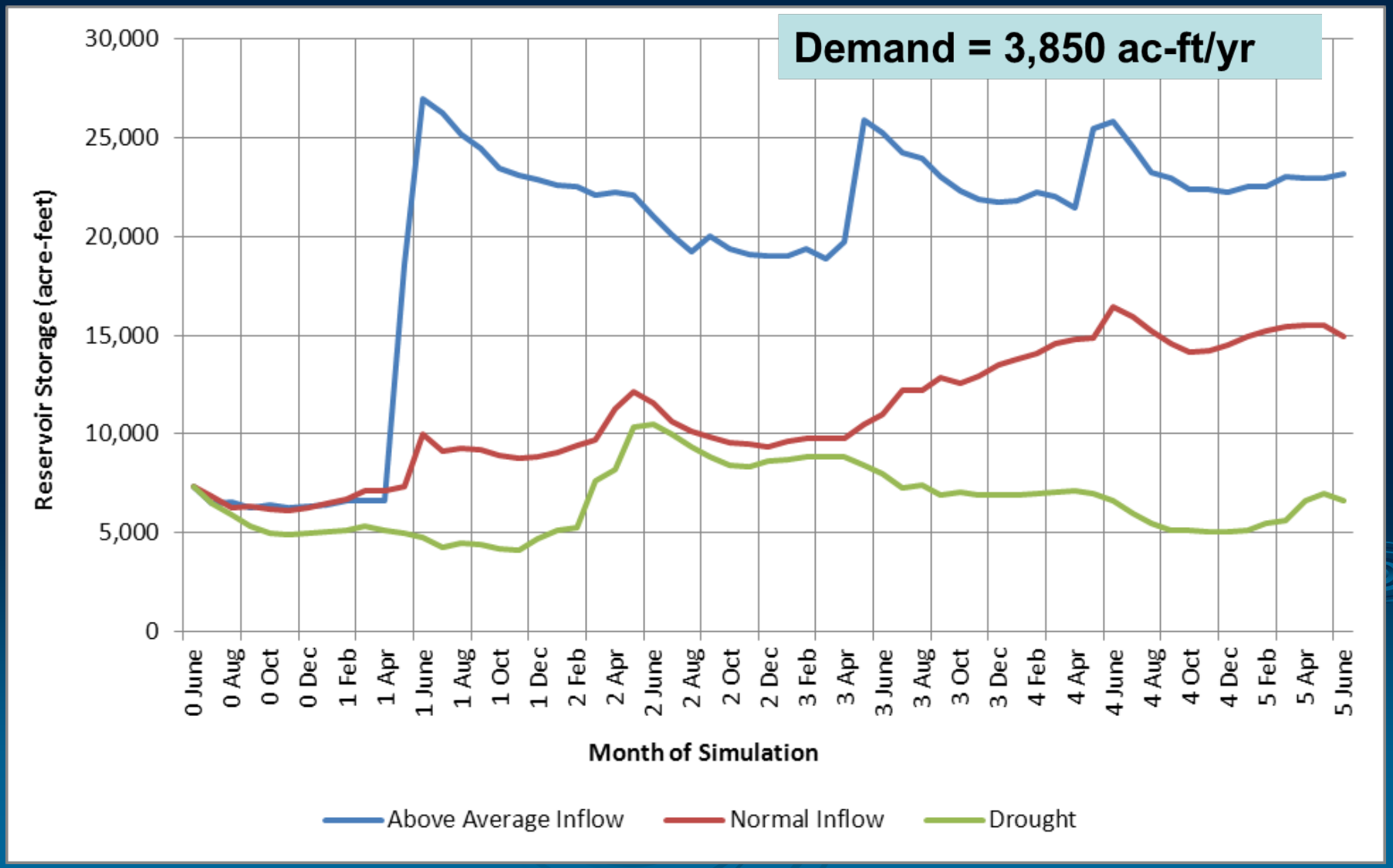


Reservoir Yield



Future Reservoir Storage



Surface Water Availability

- Assessment of availabilities is on-going
  - Safe yield for sources that supply municipal water
  - Firm yield for other sources
  - May assign reliable supply less than yield if reservoir is in critical drought
- Next steps:
  - Allocate surface water to users

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Good Earth Mechanics

www.goodearthmechanics.com

Truscott Brine Lake Solar Pond Project

Update to the Regional Water Planning Group

Wichita Falls, TX
22 August 2012

Good Earth Mechanics (GEM)
Salinity Gradient Solar Ponds (SGSP)

GEM is proposing to use the salt contaminating the Red River Basin to construct SGSP systems for the production of renewable energy.

- Cost effective, integratable renewable energy (solar *thermal* electricity)
- Unlike wind or other solar systems, SGSPs can deliver continuous power
- SGSP construction requires a **lot of salt** (typically 200,000 tons per MW)
- The Red River chloride control ***challenge*** provides an SGSP ***opportunity***

Transition the Red River Basin chloride control project into a renewable energy solution

Outline

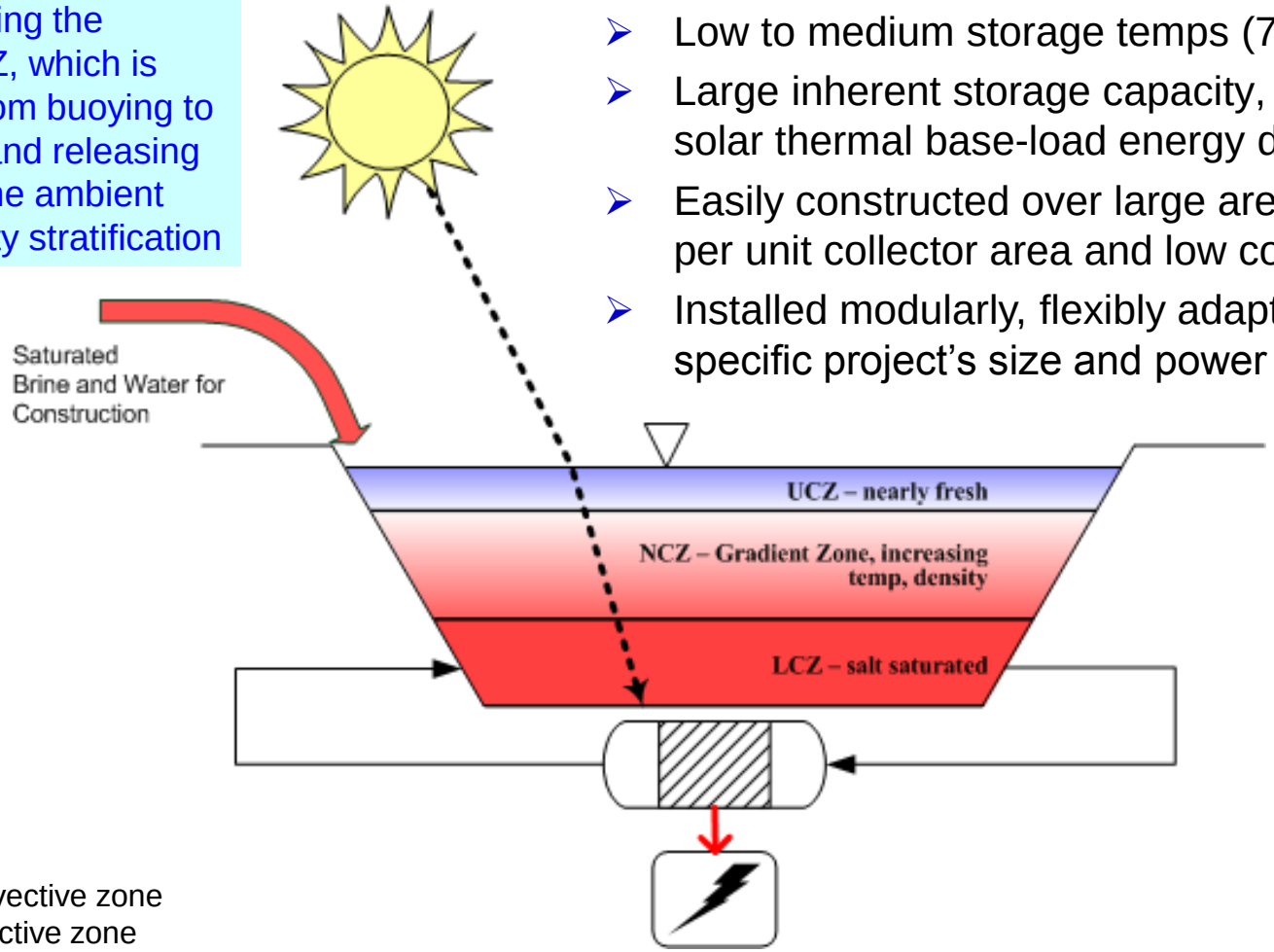
GEM SGSP Proposal

- Salinity Gradient Solar Pond technology
- SGSP project at the Truscott Brine Lake
- Status of the SGSP initiative

Salinity Gradient Solar Pond (SGSP)

~25% of the solar energy is absorbed at the pond bottom, heating the adjacent LCZ, which is prevented from buoying to the surface and releasing the heat to the ambient due to density stratification

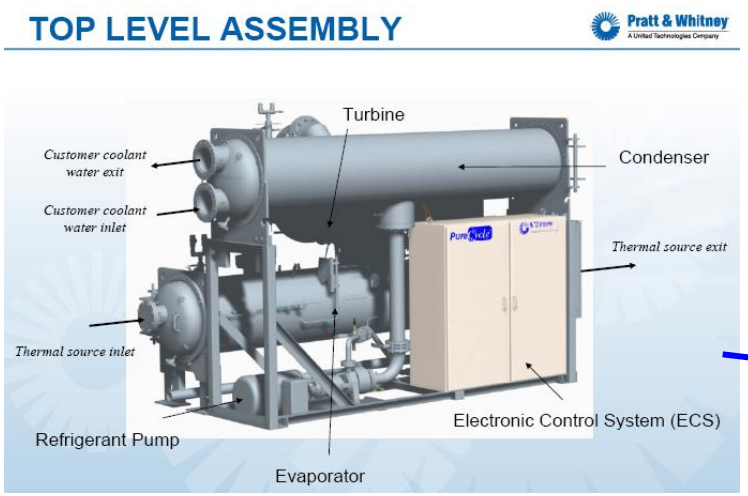
- Shallow, stratified body of water (9-12 ft deep) used to collect/store/recover solar energy
- Low to medium storage temps (70 ~ 90°C)
- Large inherent storage capacity, providing a solar thermal base-load energy delivery system
- Easily constructed over large area with low cost per unit collector area and low cost of operation
- Installed modularly, flexibly adaptable to a specific project's size and power requirements

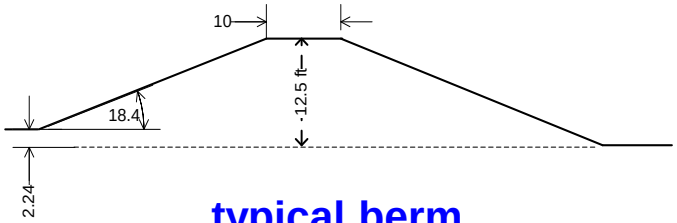


UCZ: upper convective zone
NCZ: non-convective zone
LCZ: lower convective zone

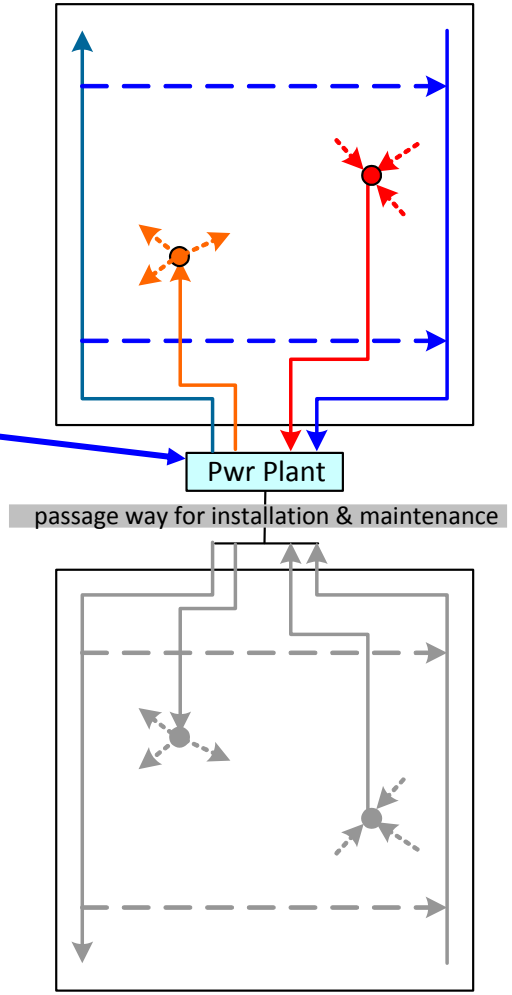
EL PASO SOLAR POND

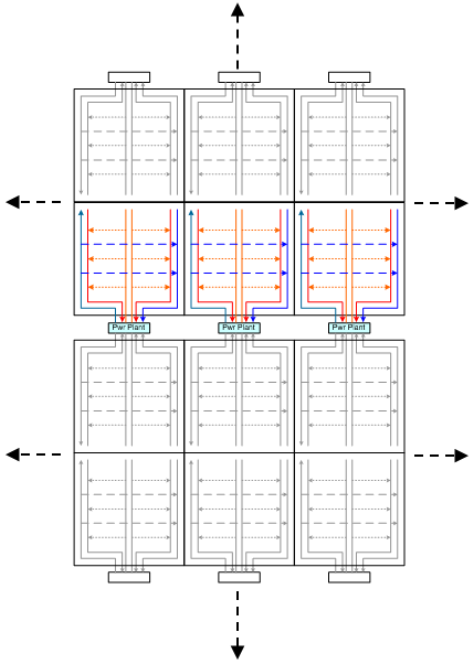
The GEM SGSP Module Design





typical berm





modularly extensible

Comparison: Renewable Electricity

	Wind	Photovoltaic	Concentrating Systems	SGSP [4]
Footprint kWh/yr/acre	34,000 [1]	152,000 [2]	248,000 [3]	149,000
Installed Costs $/kWh/yr	$0.64 [5]	$2.07 [6]	$1.86 [8]	$0.62 (w/o salt)
O&M Costs $/kWh	$0.015	$0.005 [7]	$0.007 [8]	$0.015 (large scale)
Baseload?	No	No	No	Yes [9]

[1] Example: Navitas Energy; 87 1.5-MW turbines on 10,000 acres; 13 kW (peak)/acre; at 30% capacity factor, avg 3.9 kW/acre; note that "fetch acreage" for wind power is still available for other uses, e.g., cattle, farming
[2] Example: Nellis Solar Pwr Plant , 25E06 kWh/y, 140 acres (178,571 kWh/y/acre) 85% adjust f/ Corpus Christi, 20% capacity factor
[3] Example: 500 MW (peak, Mojave) In-Development Solar 1; 4500 acres at 30% capacity factor w/ 85% adjust for Corpus Christi
[4] GEM estimate for SGSP in Texas at 20 kWe/acre using low-temp ORC with 0.92 duty factor
[5] DOE Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends: 2007 (for Texas region)
[6] $3.63/W installed system costs, Industrial Scale, 20% capacity factor (http://solarbuzz.com/, updated 07 January 2012)
[7] PV panel cleaning, inverter replacement; no consideration for PV panel replacement (material degradation, marred glazing, etc.)
[8] Solar Energy Technologies Program 2008-2012 MYPP (DOE Office of Energy Efficiency and Renewable Energy)
[9] SGSPs are both collector and storage, providing baseload power; other methods have storage costs, inefficiencies, etc.

Note: This chart is for comparison only and not recommended for direct project pricing. The comparisons are made using representative data as provided in the cited references. Direct project pricing requires detailed site-specific analysis.

Introductions: *GEM Team*

World Recognized SGSP Leadership

Dr. Huanmin Lu
Solar Ponds
Lecturer, Mechanical Engineering, UTEP
Good Earth Mechanics, LLC

Mr. Herbert D. Hein, Jr.
Solar Pond Project Management, UTEP
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Dr. Andrew H.P. Swift, P.E.
Solar Ponds, Wind Energy;
Professor, Civil Engineering
Texas Tech University

Dr. John C. Walton, P.E.
Solar Ponds, Environmental
Professor, Environmental Engineering, UTEP
Good Earth Mechanics, LLC

Dr. George S. Nitschke, P.E.
Surface Systems, Drilling, Renewable Energy
Technology Director,
Good Earth Mechanics, LLC

Mr. Peter Gross
Business Development
Good Earth Mechanics, LLC
Chief Executive Officer,
GEM Solar Development, LLC

Mr. Bill Watts
Business Development
President & Owner
Watts Development, LLC

Mr. Mike Moore
Business Development
Good Earth Mechanics, LLC

Outline

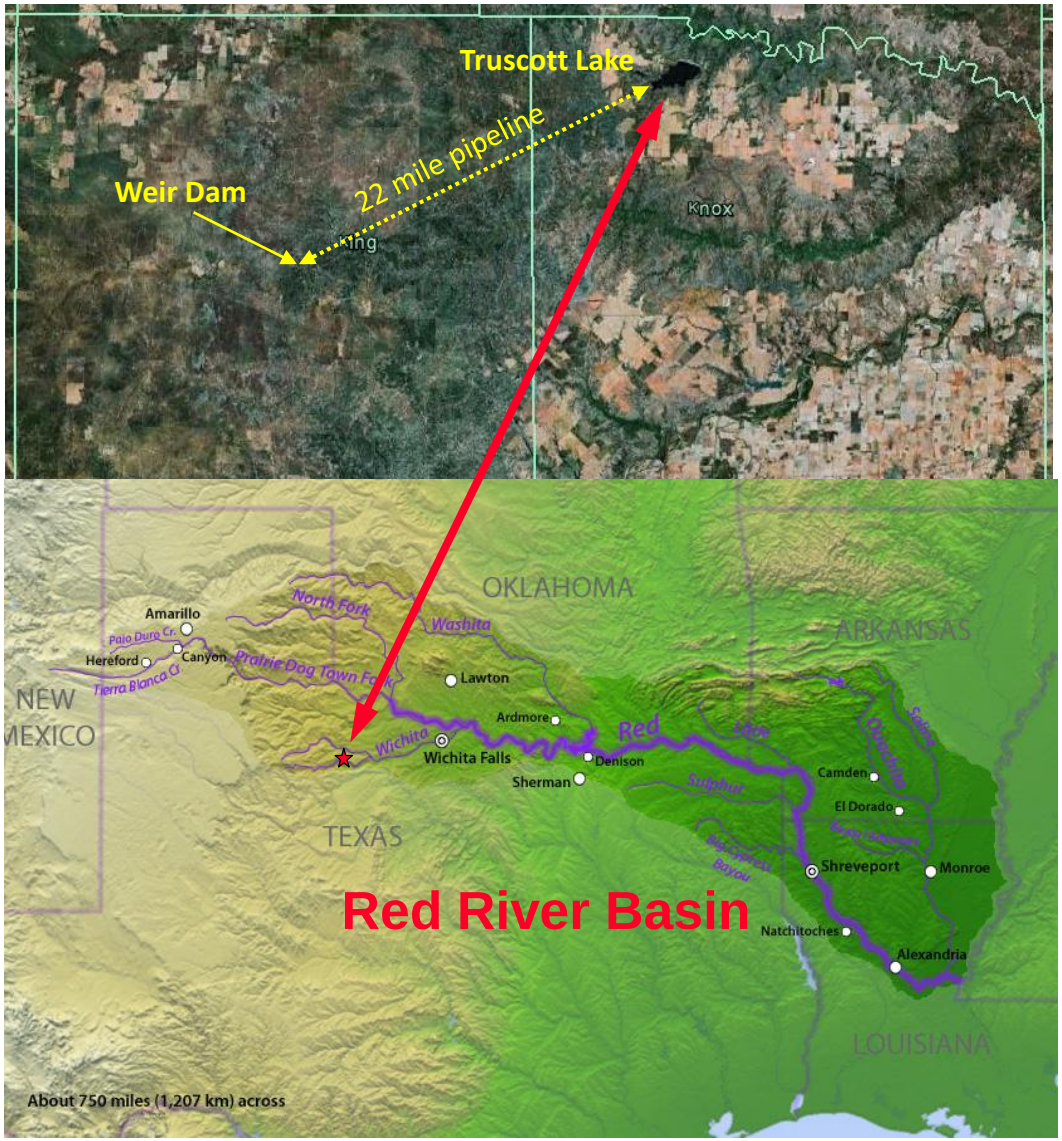
GEM SGSP Proposal

Salinity Gradient Solar Pond technology

→ SGSP project at the Truscott Brine Lake

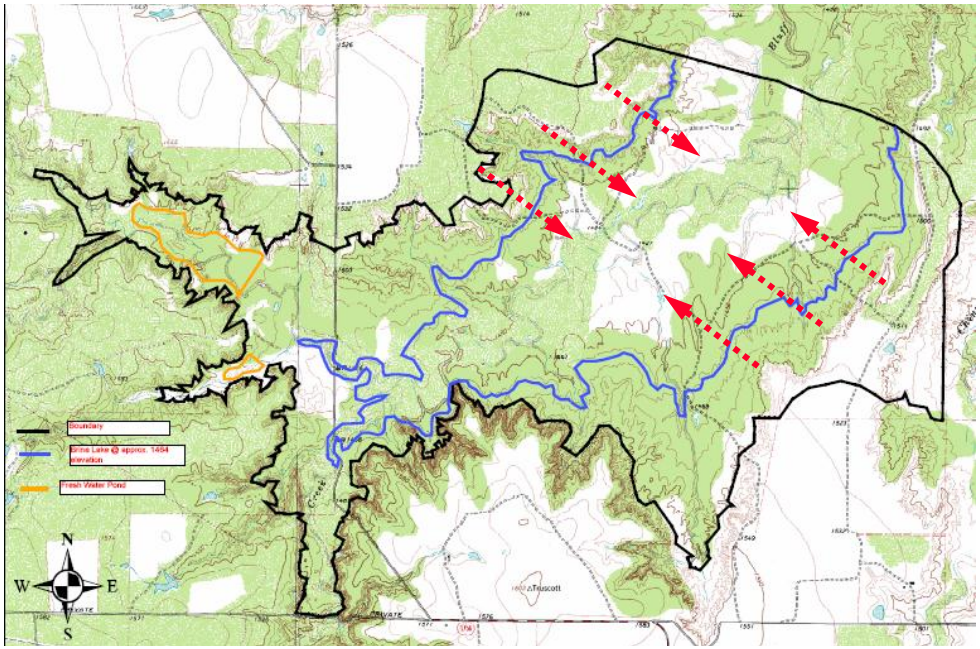
Status of the SGSP initiative

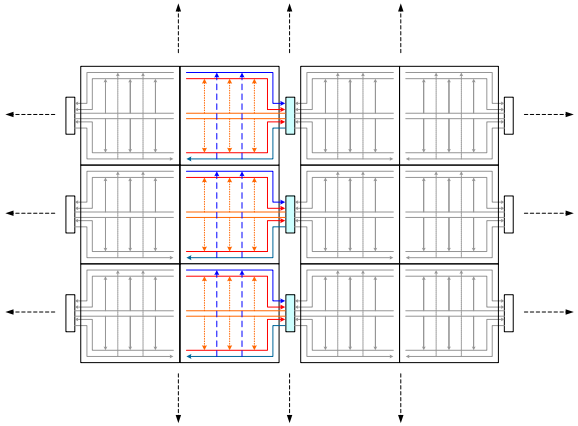
Truscott Lake Salt Impoundment



- U.S. Army Corps of Engineers collects saline river flow from the south fork, Wichita River, with an inflatable weir dam and pumps it to the Truscott Lake
- The system has been flowing an average of 200 tons/day dissolved salt to the reservoir since 1986 from one of three identified collection sites (Area VIII)
- Completing the other two collection sites (Areas VII, X) would increase the salt capture to 500 tons/day, further reducing the salinity in Lake Kemp
- USACE has determined the Truscott dam is in need of refurbishment to mitigate diminishing freeboard; completing the other two sites would make this worse
- *Using the salt and lake bed for SGSP systems would negate the need to upgrade the lake dam while enabling salt collection from all three sites*

GEM Proposed SGSP Initiative

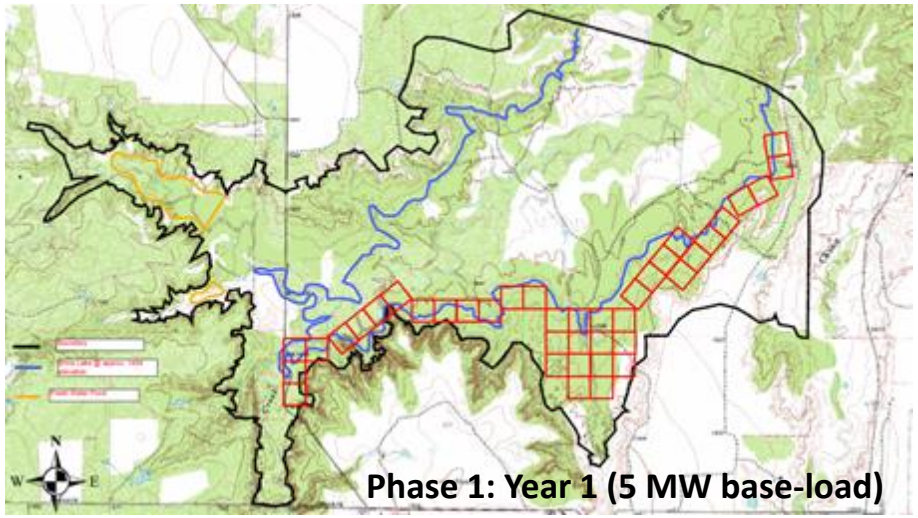


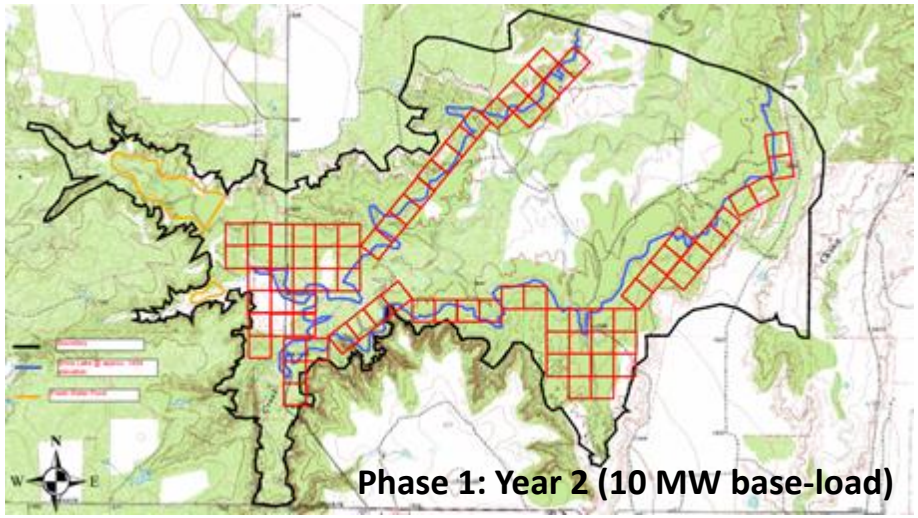


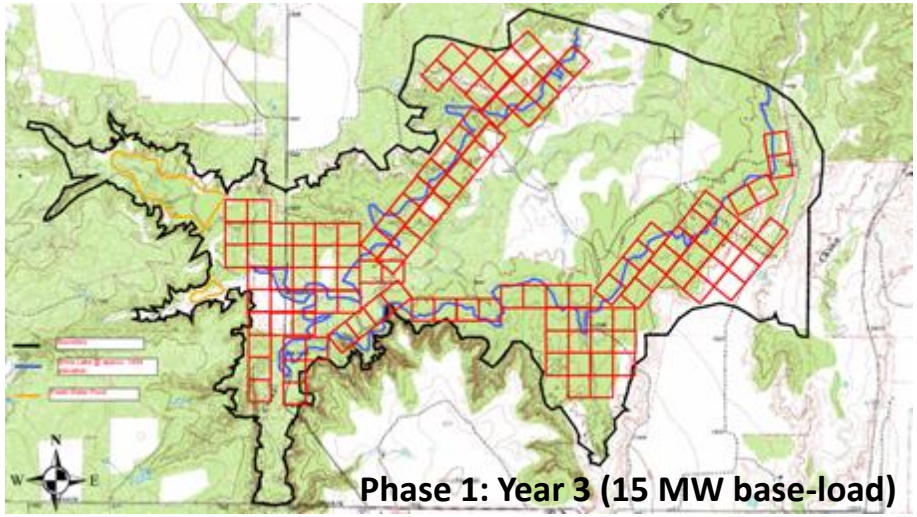
- **Modular extensible**
- **Landscape conformable**
- **Tier-step to follow topo**

- Using the salt currently impounded in Truscott Lake, initially build 10-15 MW SGSP systems (at 5 MW per year)
- Tie-in to local power line, sell power
- 10-15 MW SGSPs will use most of the brine currently in the lake, using 750-1125 acres footprint (approx. half the area under water)
- Install the SGSPs within the lake bed area as the lake water is withdrawn for SGSP construction; optimize modularity
- Complete the other collection sites (Area X has dam & pump house, needs pumps & pipeline; Area VII is undeveloped)
- Flow 500 tons/day to the lake from all three sites and add 1 MW/year SGSP systems (75 acres per year)
- Truscott site large enough for 50 MW SGSP systems: a 35-40 year solution, *or develop quicker per availability of salt*

PRELIMINARY Phase 1 Land Use







- Phase 1: install 5 MW per year for 3 years to install a total of 15 MW base-load SGSP systems
- Build out the lake perimeter, keeping the center of the lake open as risk mitigation

Note: *Later phases would continue installing SGSP systems on and around the Truscott site*

Truscott SGSP Not a New Idea

THE TECHNICAL AND ECONOMIC FEASIBILITY OF SALT-GRADIENT SOLAR PONDS AT THE TRUSCOTT BRINE LAKE OF THE RED RIVER CHLORIDE CONTROL PROJECT

A Report to the House-Senate Committee on Appropriations of the Ninety-Seventh Congress

September 1982

A Joint Publication of
Tulsa District, US Army Corps of Engineers
and Pacific Northwest Laboratory
for the U.S. Department of Energy

Conceptual Design of a 20-Acre Salt Gradient Solar Pond System for Electric Power Production at Truscott, Texas

E. Kenneth May
Cécile M. Leboeuf
David Waddington

ANALYZED

July 1983

Prepared under Task No. 1209.00
WPA No. 332

Solar Energy Research Institute
A Division of Midwest Research Institute

1617 Cole Boulevard
Golden, Colorado 80401

Prepared for the
U.S. Department of Energy
Contract No. EG-77-C-01-4042

- Testing determined that the Truscott brine is suitable for SGSPs
- Testing of clay showed potentially low enough permeability to allow use of linerless ponds

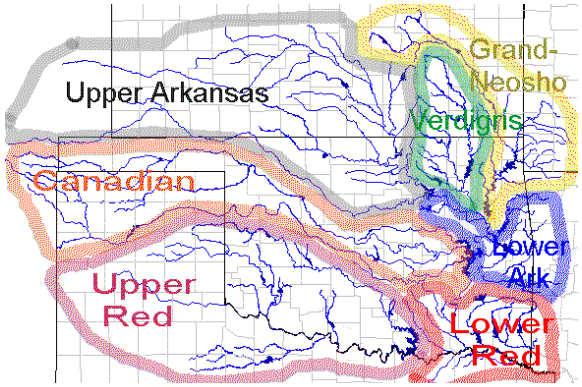
  E-08 – E-09 cm/sec
- Clays did not interact negatively with brine, i.e., for clarity, algae
- Truscott brine and site well-suited for SGSPs

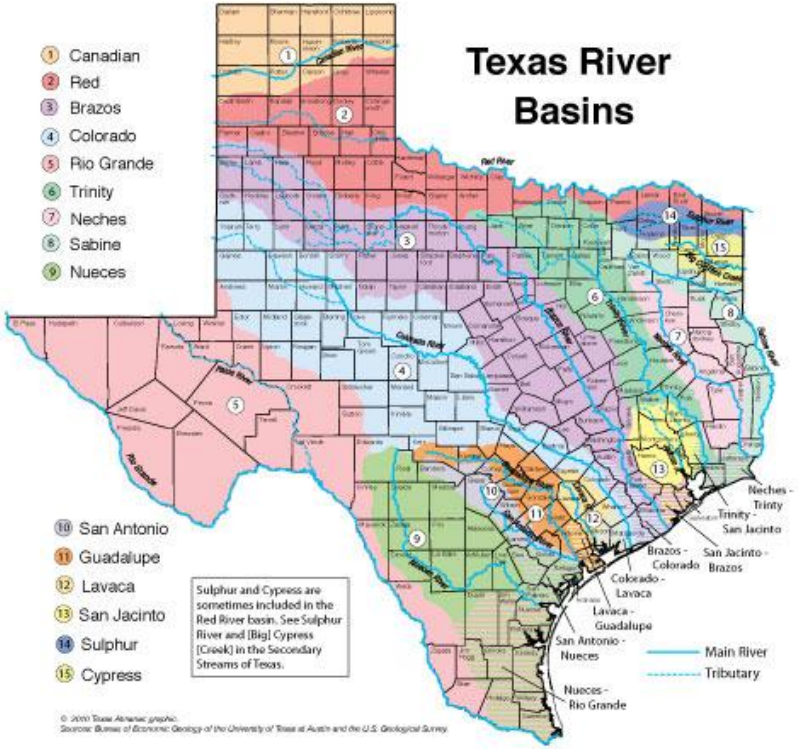
Benefits & Synergy

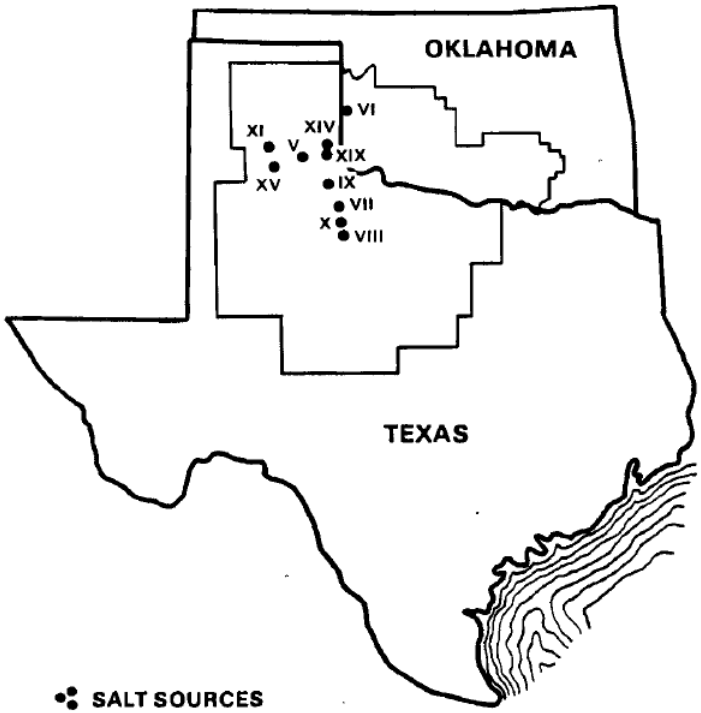
1. The SGSP development has the potential to completely mitigate the salt contamination in the Red River region, helping USACE/RRA achieve the chloride control objective by transitioning to a commercial operation
2. Establish cost-effective, integratable renewable energy in the area
3. Cost avoidance:
   a. USACE facilities: new & refurbished (reservoir rehab, spray-evap fields)
   b. USACE ongoing O&M expenses
   c. Lake Kemp desalination costs
   d. Other regional impacts from salt contamination
4. Jobs / income / tax revenue to local economy
5. The Truscott project could be the leader for a regional commercialization of the ***salt-contamination/SGSP-solution*** approach
   a. USACE estimates 1.6M tons/year natural salt flows to the Red River Basin
   b. Studies estimate 2.4M tons/year natural salt flows to the Brazos River Basin

Salt Collection Sites / River Basins

Regional Salt-Contamination/SGSP-Solution







- Regionally deploy SGSP systems to utilize the salt for profitable renewable power production
- Install ~20 MW per year (Red & Brazos River Basins) to match natural inflows, or faster if desired
- *Use extraction wells to sequester the salt before it gets into the rivers for regional remediation*

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Truscott SGSP Project Status

- Key activities to date:
  1. Initial teleconference briefing to USACE (Dennis Duke): 24 June 2011
  2. GEM meeting at USACE Tulsa District Office: 04 October 2011
  3. GEM meeting at RRA of TX: 03 November 2011
  4. Execute GEM-RRA provisional letter of intent: 30 January 2012
  5. Red River Valley Association conference (Shreveport, LA): 23 February 2012
  6. USACE SW Division Commander BGen Kula site visit: 09 May 2012
  7. Steering Committee meetings: April 9 & June 5, 2012
  8. Table Top Exercise with USACE, RRA, RRVA and GEM: 09-11 July 2012
  9. GEM-RRA Initial Agreement signed: 18 July 2012
  10. RRA application submittal to USACE for Truscott easement in-work
- Status / Next steps (in-work)
  1. Working to find customer for the power: 25 year, fixed-rate contract
     - *Must have power agreement before going forward*, challenge for long-term contract in today's pwr market
  2. After securing agreement for power, fund the USACE-RRA easement application process
     - USACE & RRA have provided cost estimates, process, and schedule
  3. Process USACE-RRA easement application – approximately 4 mth process
  4. Secure project financing in-parallel with application process (pending power agreement)
  5. Start project after application approval; begin first power delivery 8-10 mths after project start