

## System Administrator

---

**From:** Aycock, Gordon L <GAycock@usbr.gov>  
**Sent:** Tuesday, August 17, 2010 8:49 AM  
**To:** Ross, Scott  
**Attachments:** 2009-11-30\_Forecasting\_Republican\_Water\_Supply.pps; 2009-11-30\_Preliminary\_2009\_Results\_and\_2010\_Forecast.pps

### ***Gordon L. Aycock***

Technical Specialist  
Reservoir Operations & Water Rights  
Bureau of Reclamation  
Great Plains Regional Office  
P.O. Box 36900  
Billings, MT 59107-6900

Phone: 406-247-7756

# Forecasting Republican River Basin Water Supply

---



Jim Schneider

Nebraska Department of Natural  
Resources

# Overview

---

- A simplified approach to estimating the Basin Water Supply
- A proposed approach for predicting Nebraska's water supply and water use for an upcoming dry year
- Incorporating this forecast into the Compact Compliance flowcharts

# A Simplified Approach to Estimating the Basin Water Supply

---

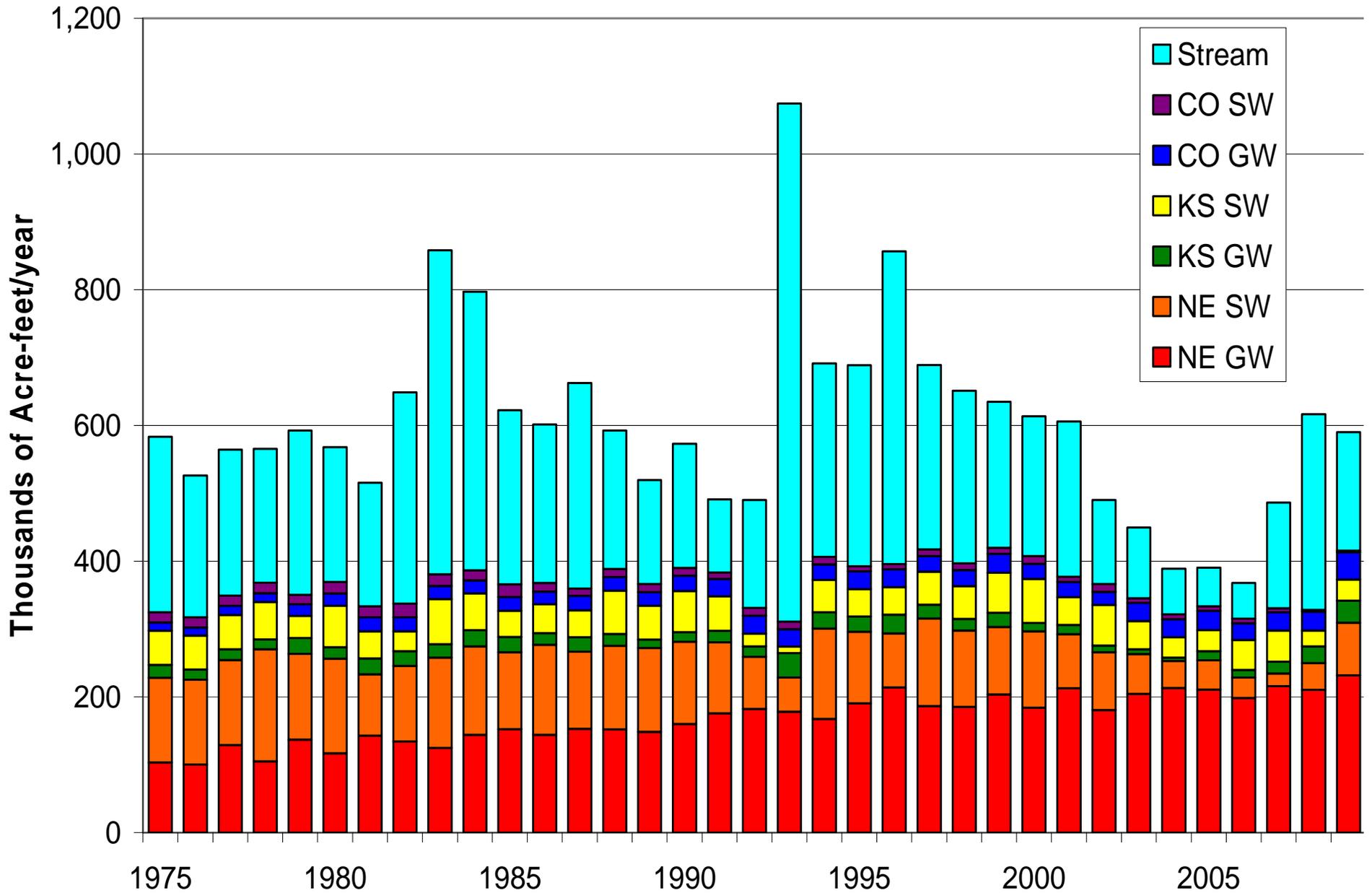
- RRCA Computed Water Supply (CWS) – Output from RRCA accounting procedures and spreadsheet, input data count is ~250
- Republican River Basin Water Supply (BWS) – An estimate of the total basin supply using consumptive use totals and total streamflow at the basin outlet

# Republican River BWS

---

- CO GW use
- KS GW use
- NE GW use
- CO SW use
- KS SW use
- NE SW use
- Streamflow: Hardy + Courtland Canal

# Republican River Basin Water Supply

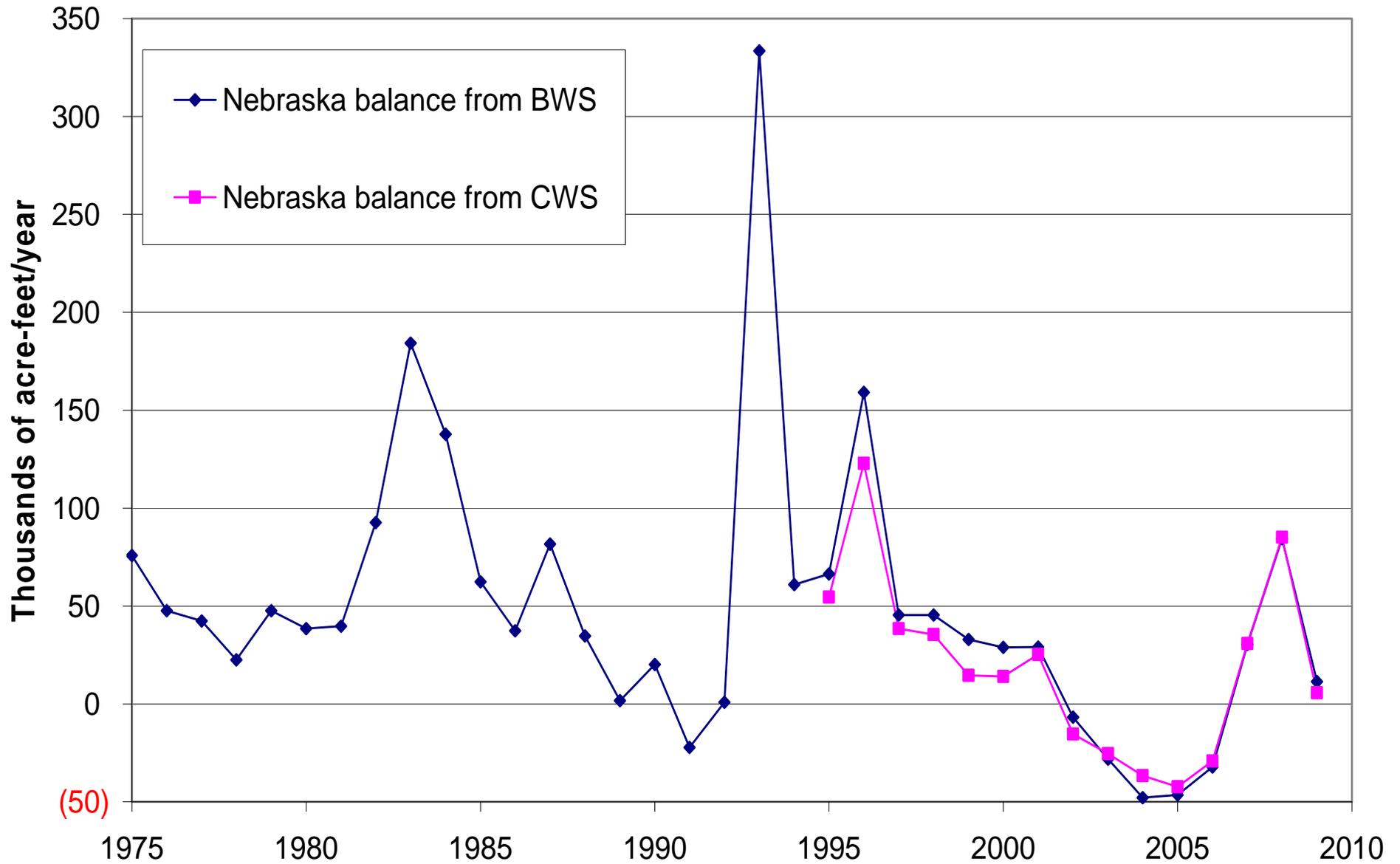


# Nebraska's Annual Balance

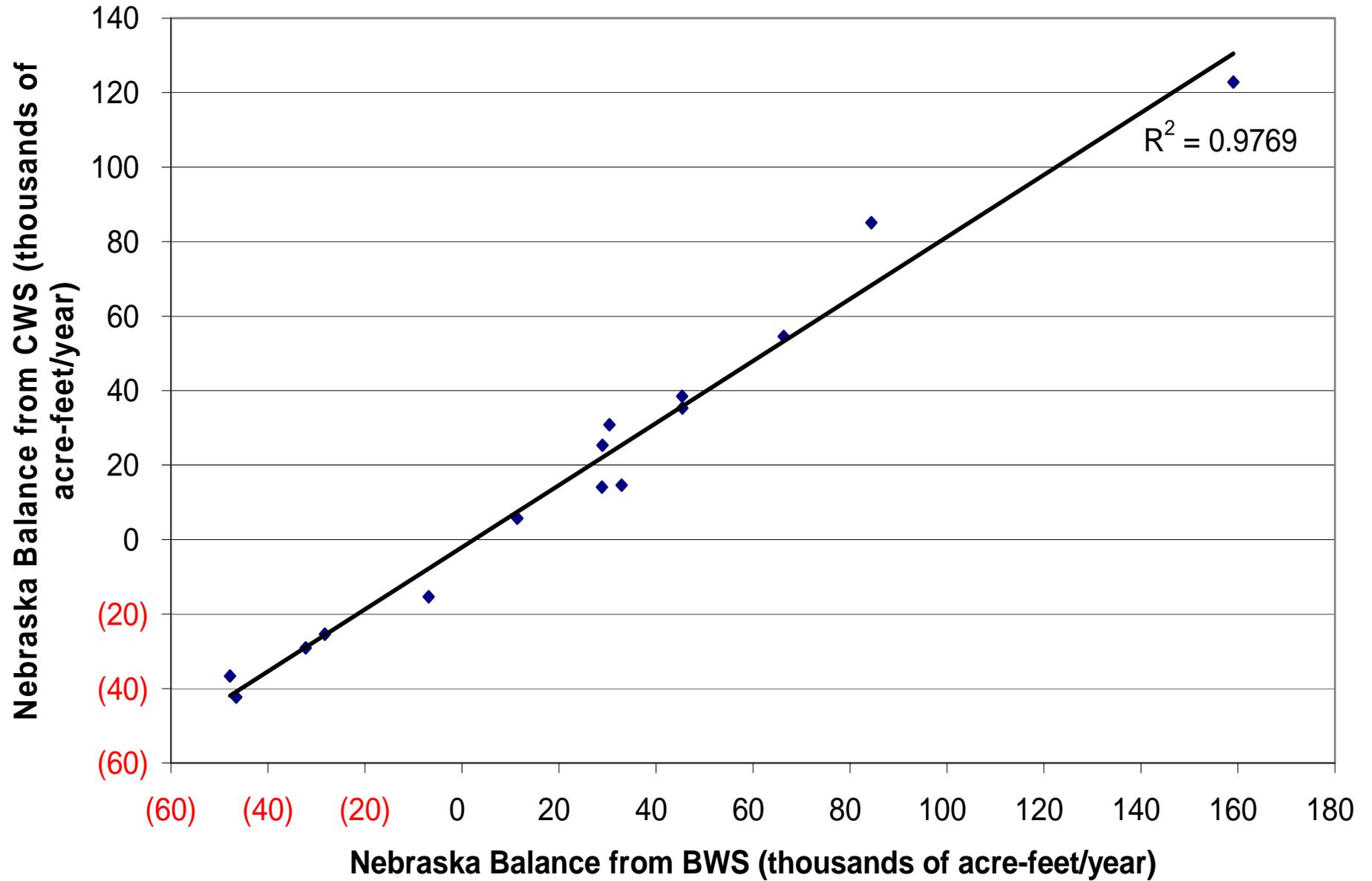
---

- Nebraska's Water Supply
  - The total BWS multiplied by 0.5
  - The IWS Credit
- Nebraska's Water Use
  - NE GW use
  - NE SW use

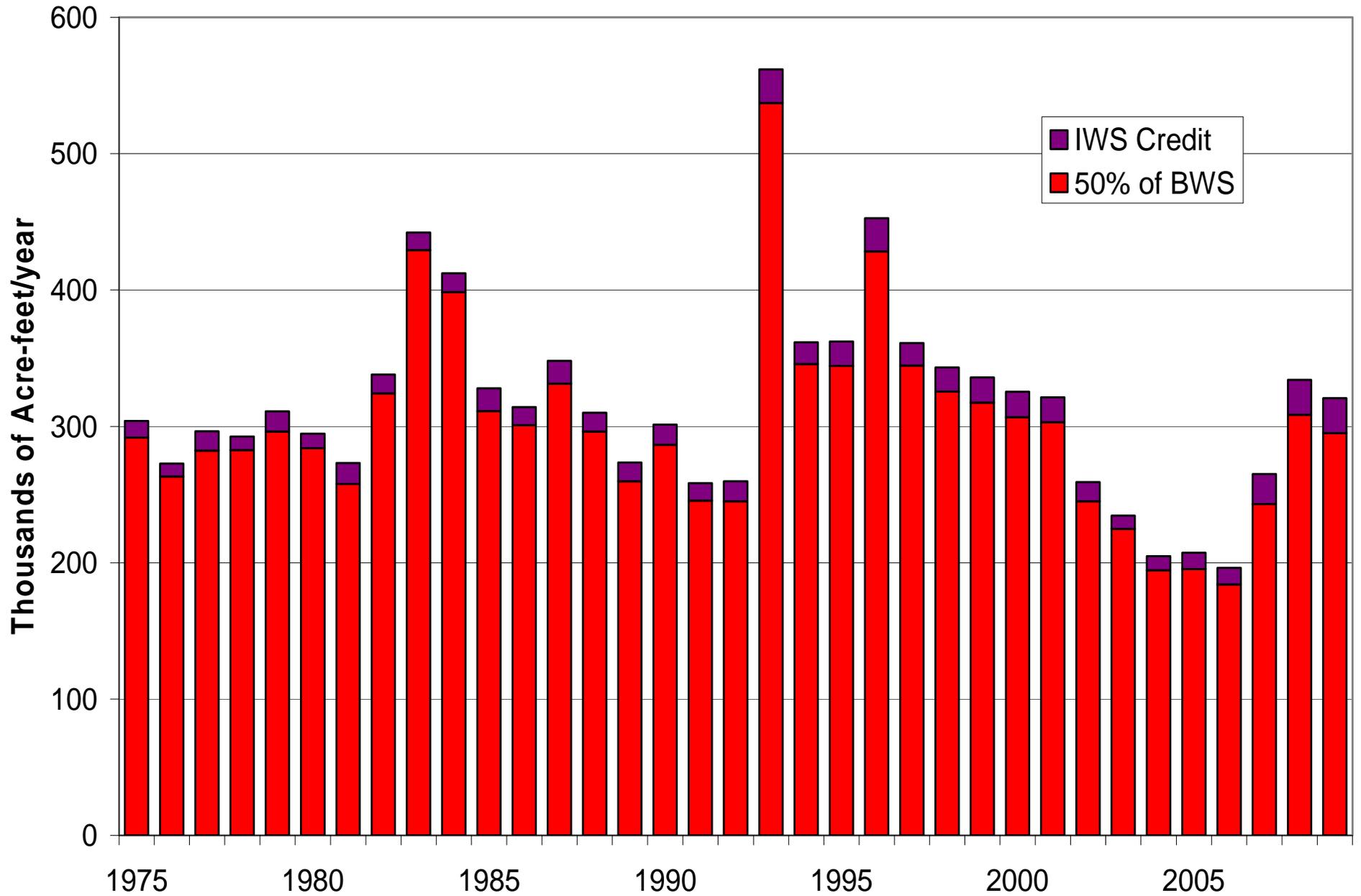
# Nebraska's annual balance of water use and water supply



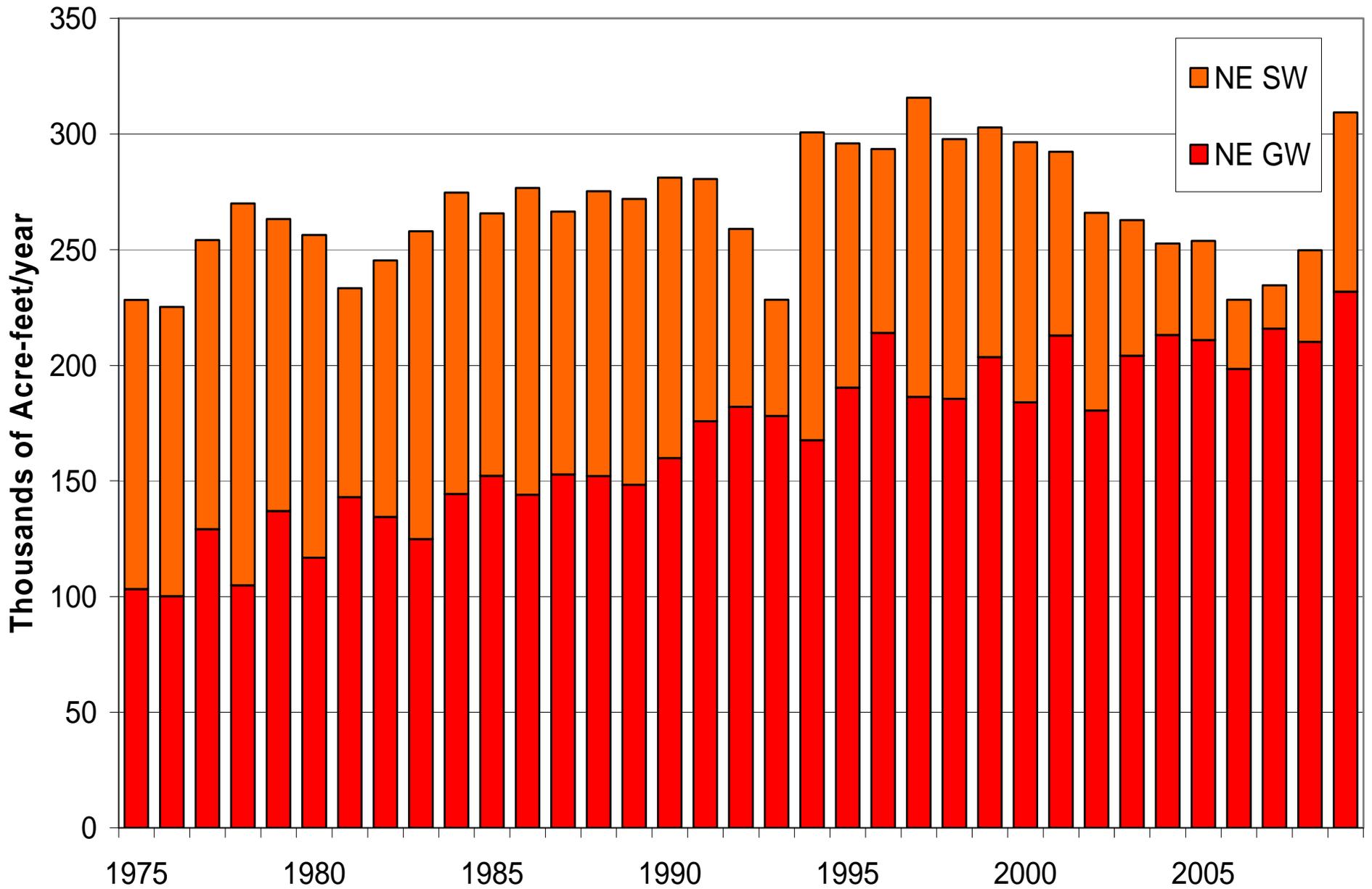
# Comparison of Nebraska Balance from BWS vs. CWS



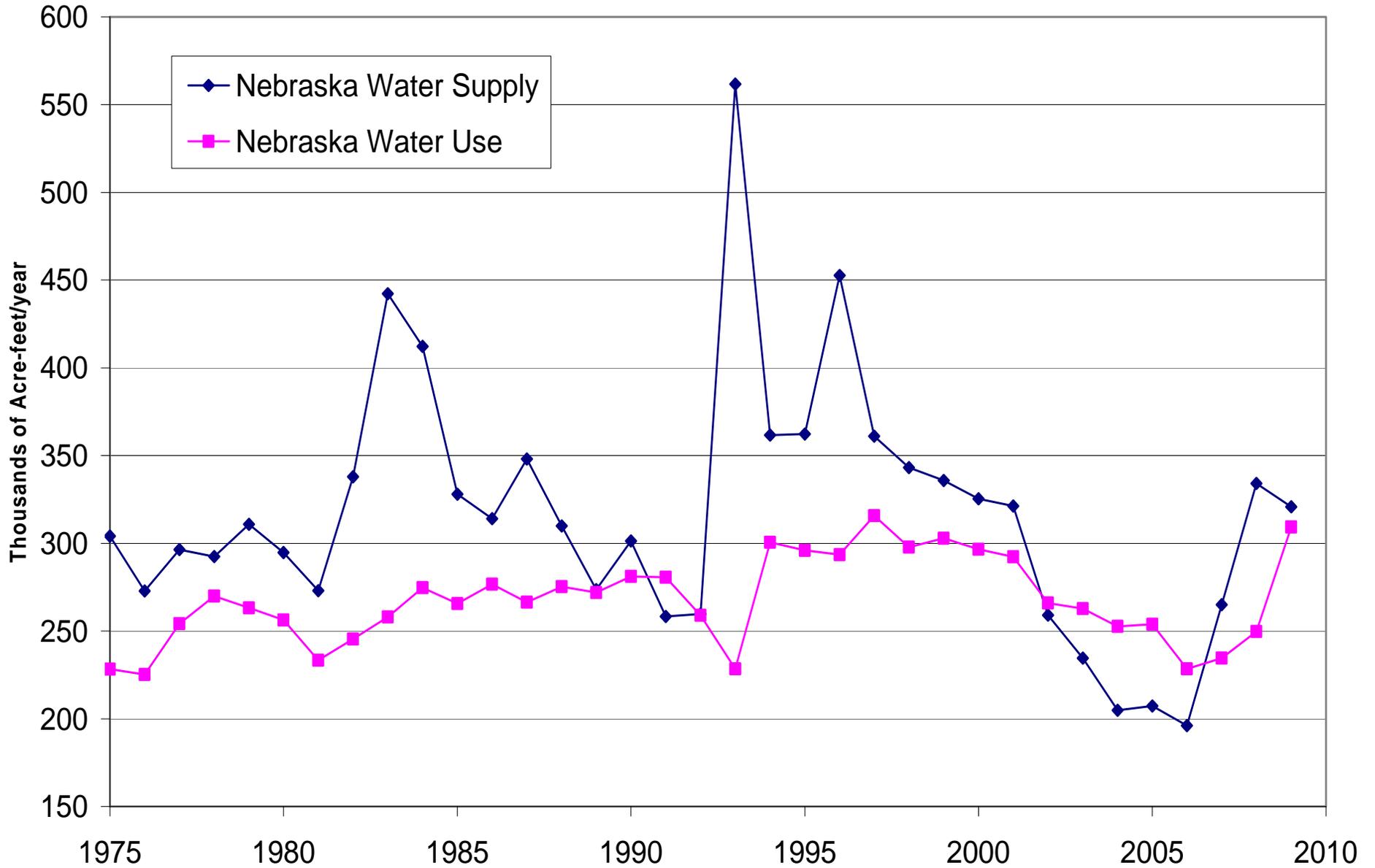
# Nebraska's Water Supply Above Hardy



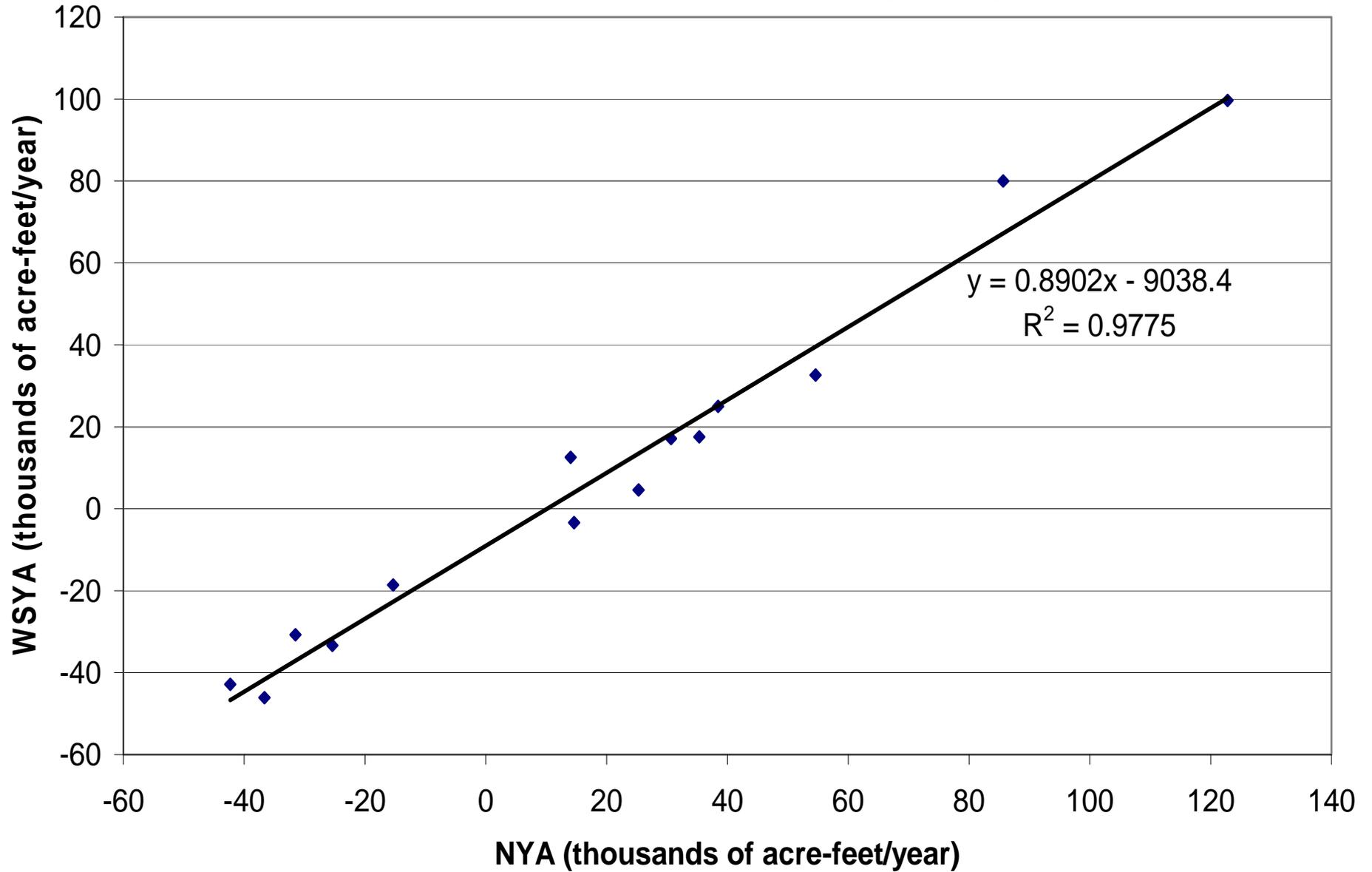
# Nebraska's Water Use Above Hardy



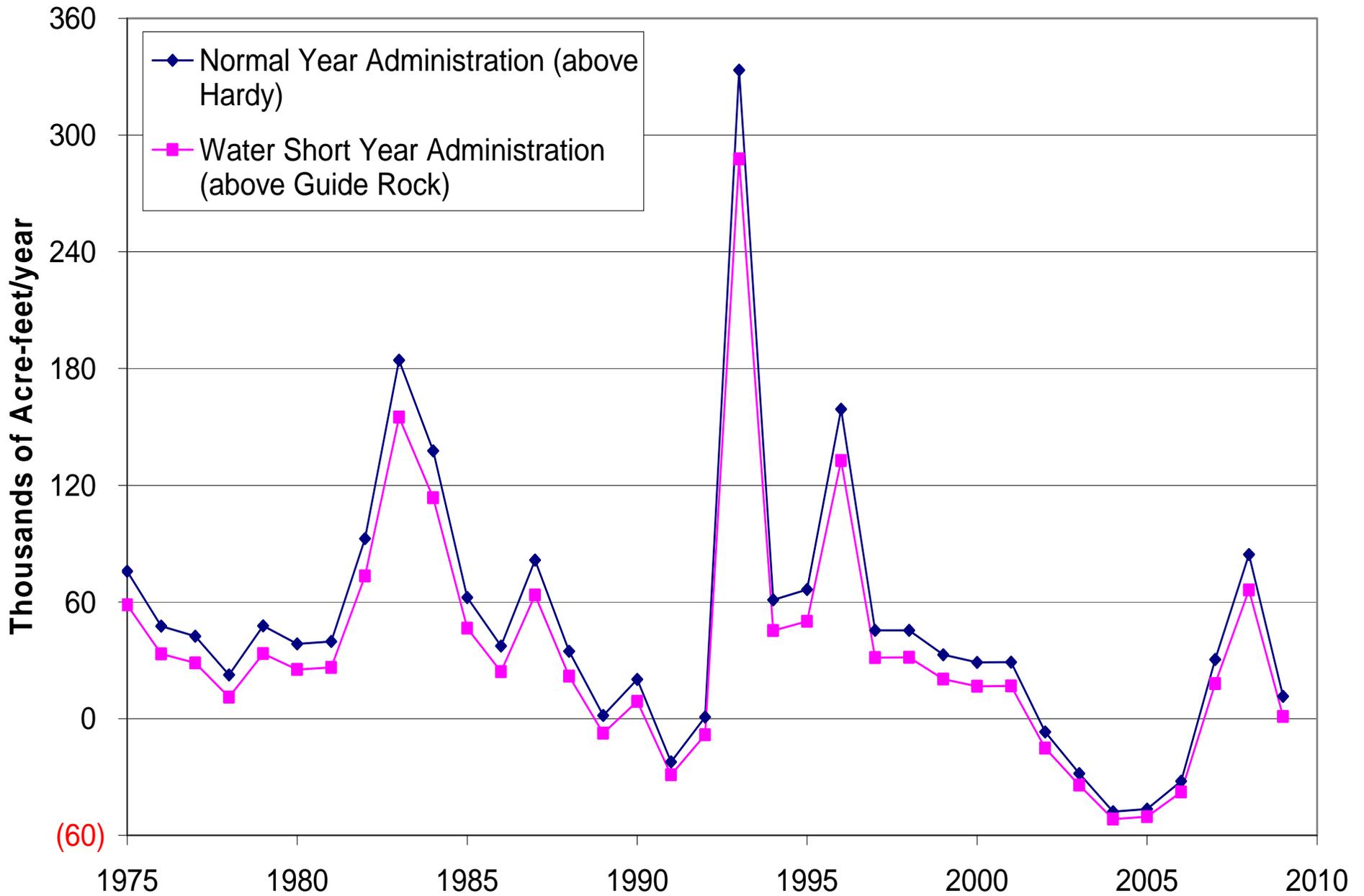
# Water Supply and Water Use above Hardy



Normal Year Administration (NYA) vs.  
Water Short Year Administration (WSYA)



# Nebraska Annual Water Supply minus Water Use

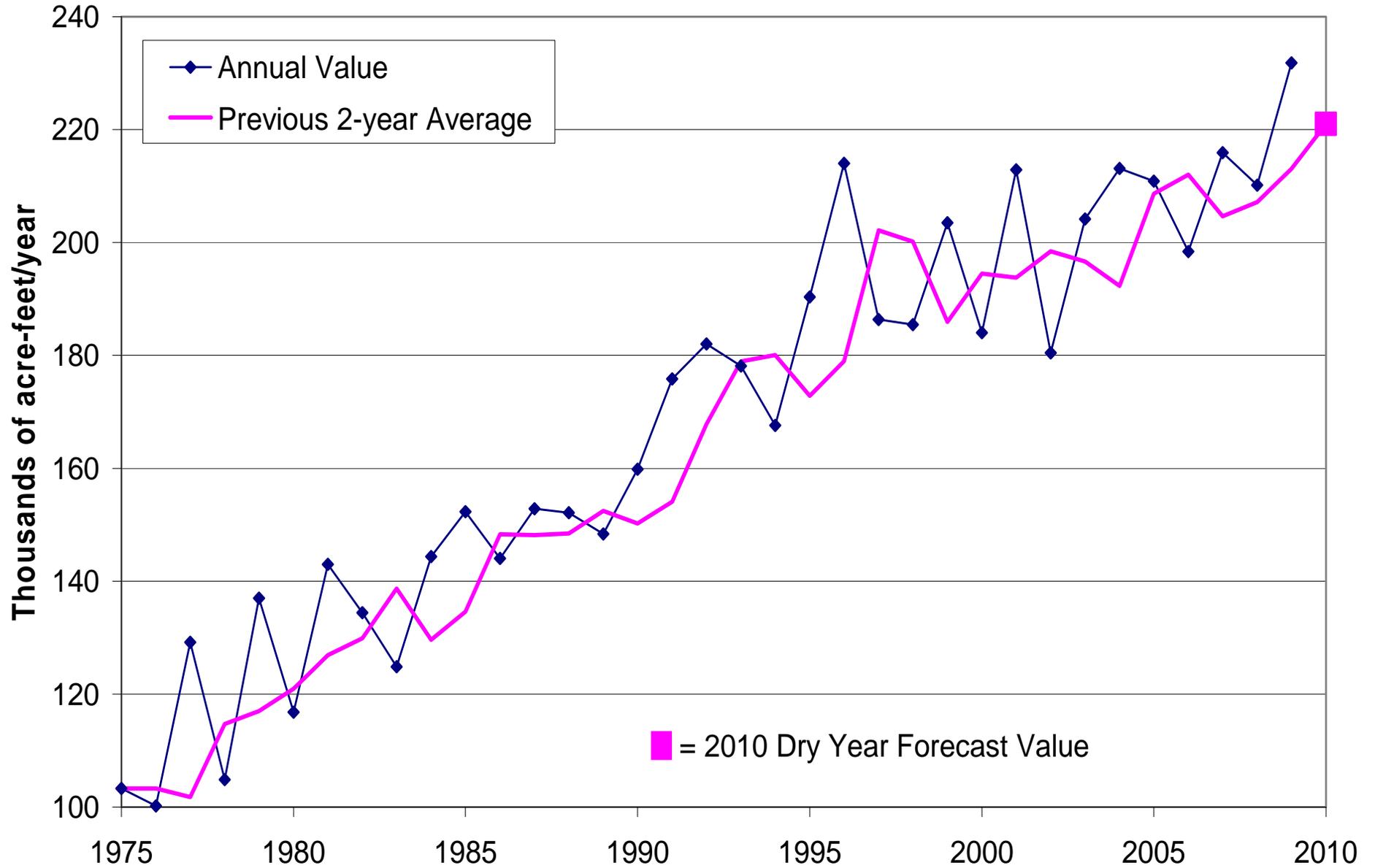


# A Proposed Approach for Predicting Nebraska's Water Supply and Water Use for an Upcoming Dry Year

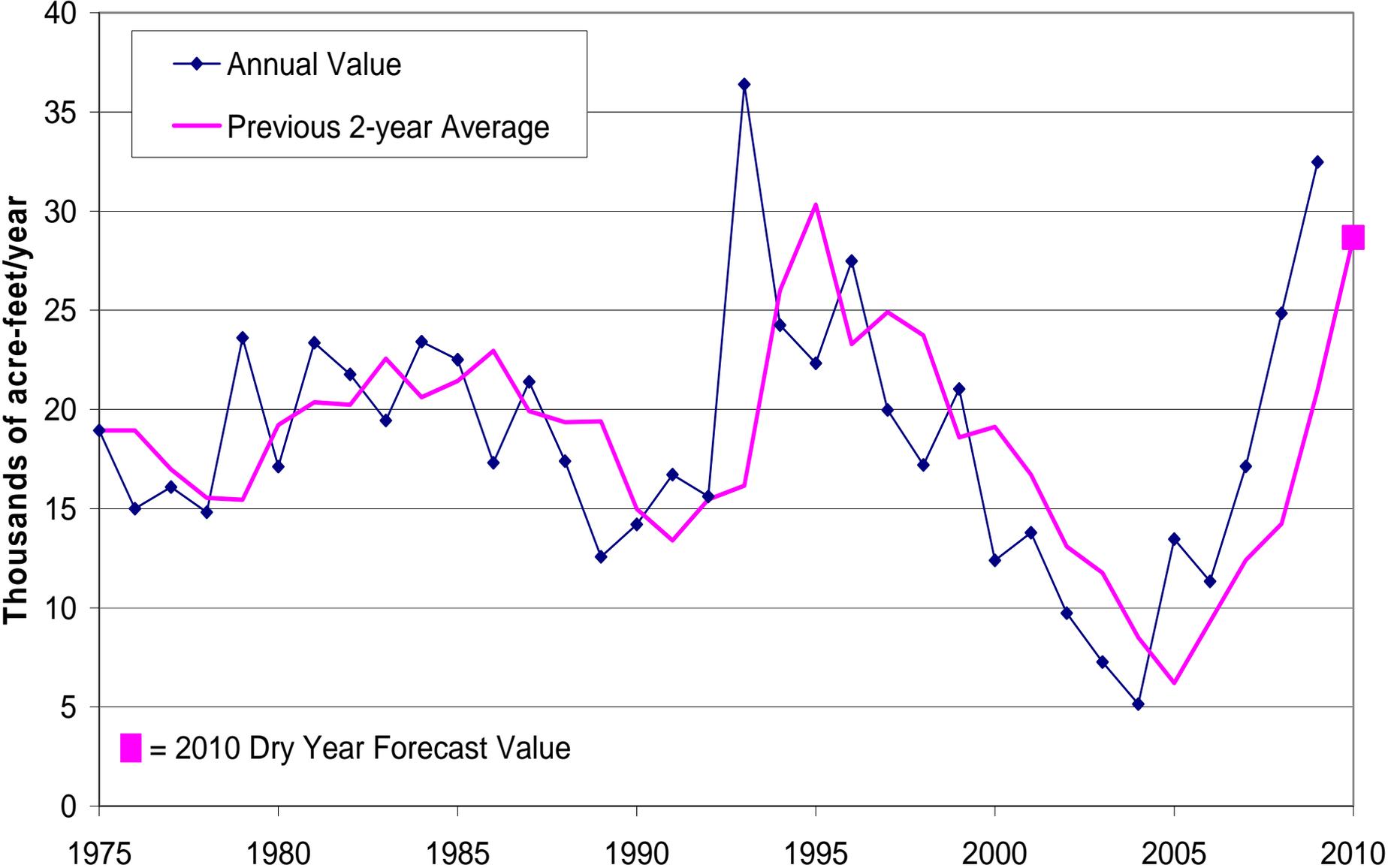
---

- The preceding approach to estimating Nebraska's Compact balance requires a total of eight values
- If we can estimate these values during the upcoming year, assuming that year will be dry, we can estimate Nebraska's annual balance for an upcoming dry year

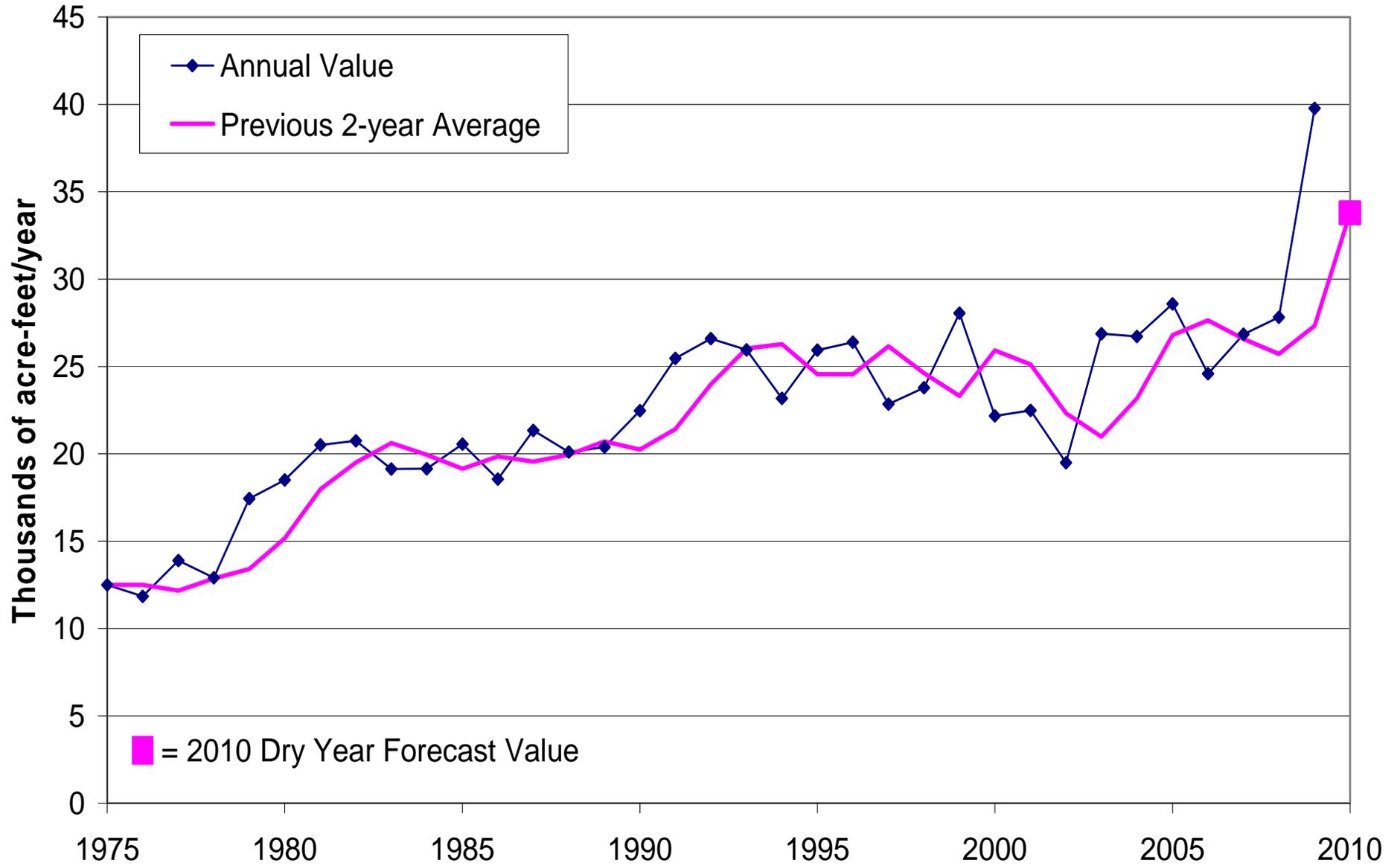
# Nebraska groundwater CBCU



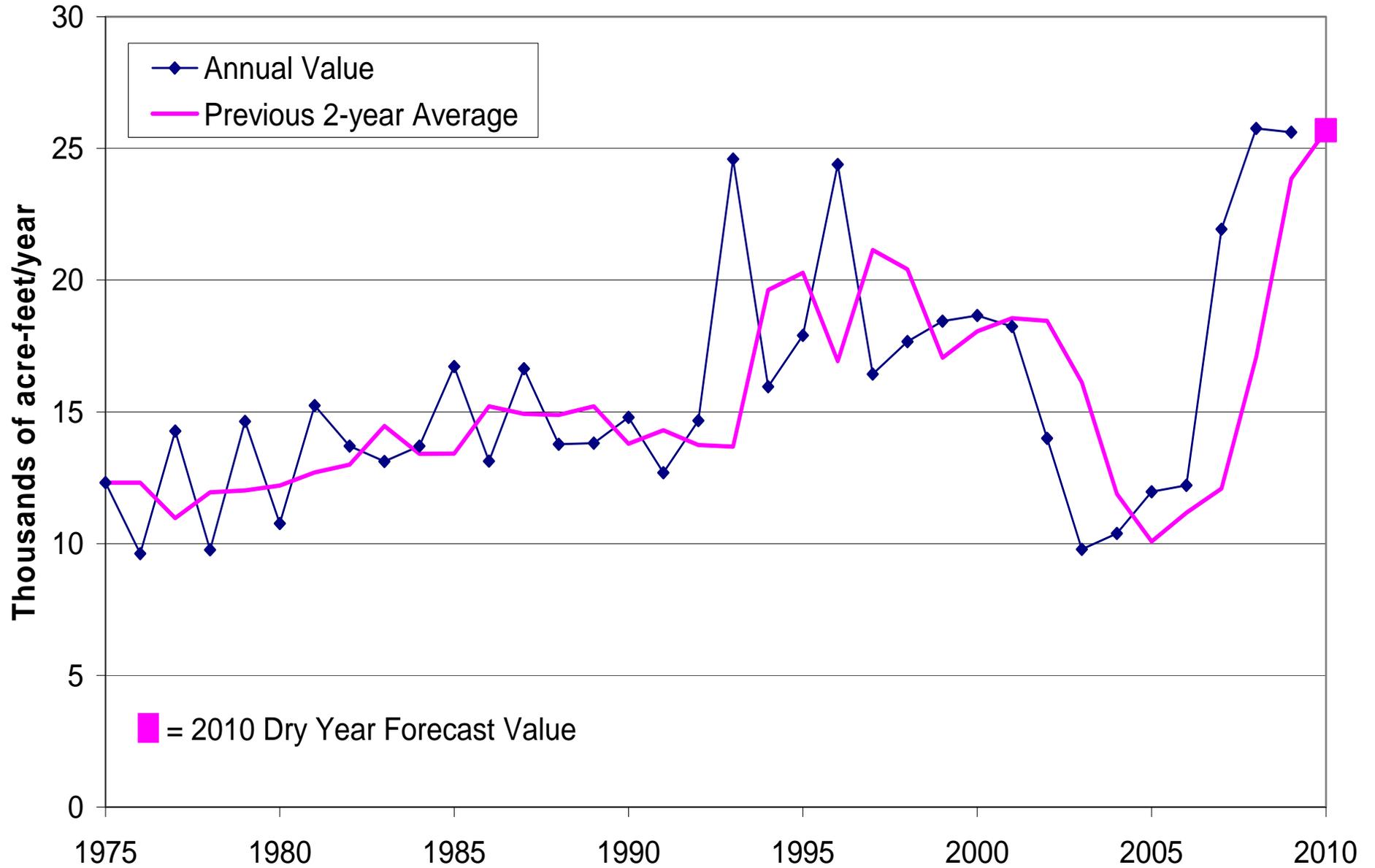
# Kansas groundwater CBCU



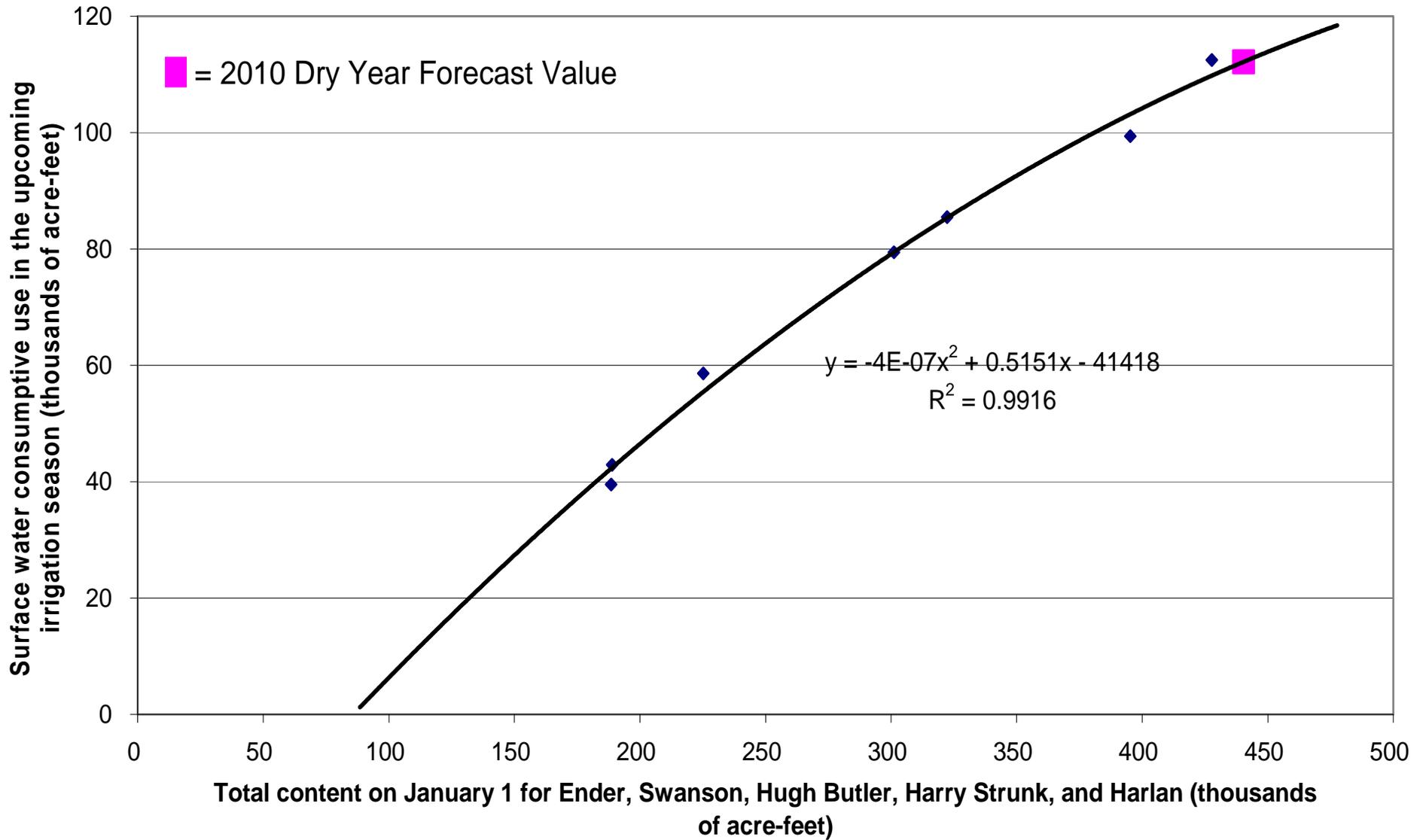
# Colorado groundwater CBCU



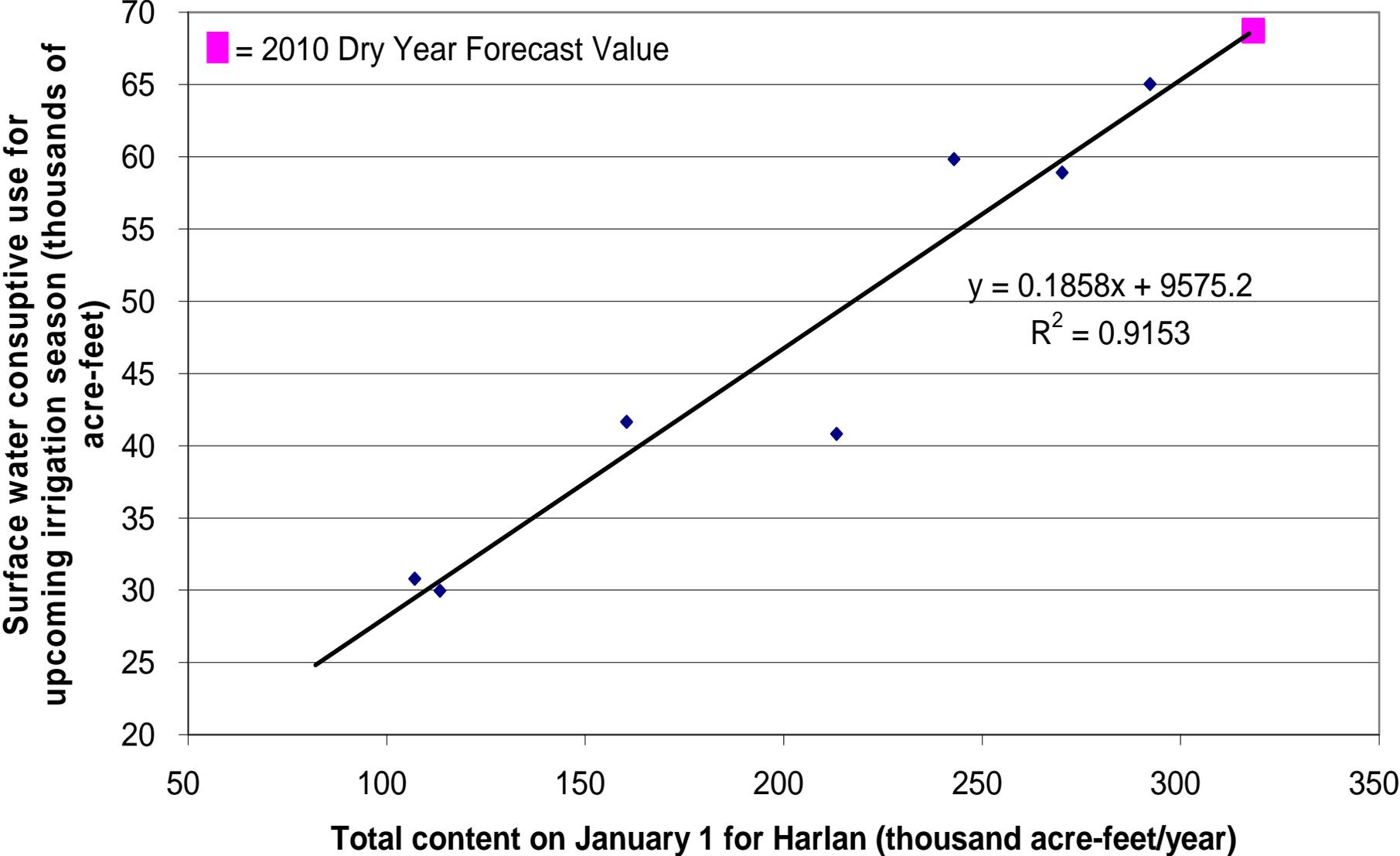
# Imported Water Supply Credit



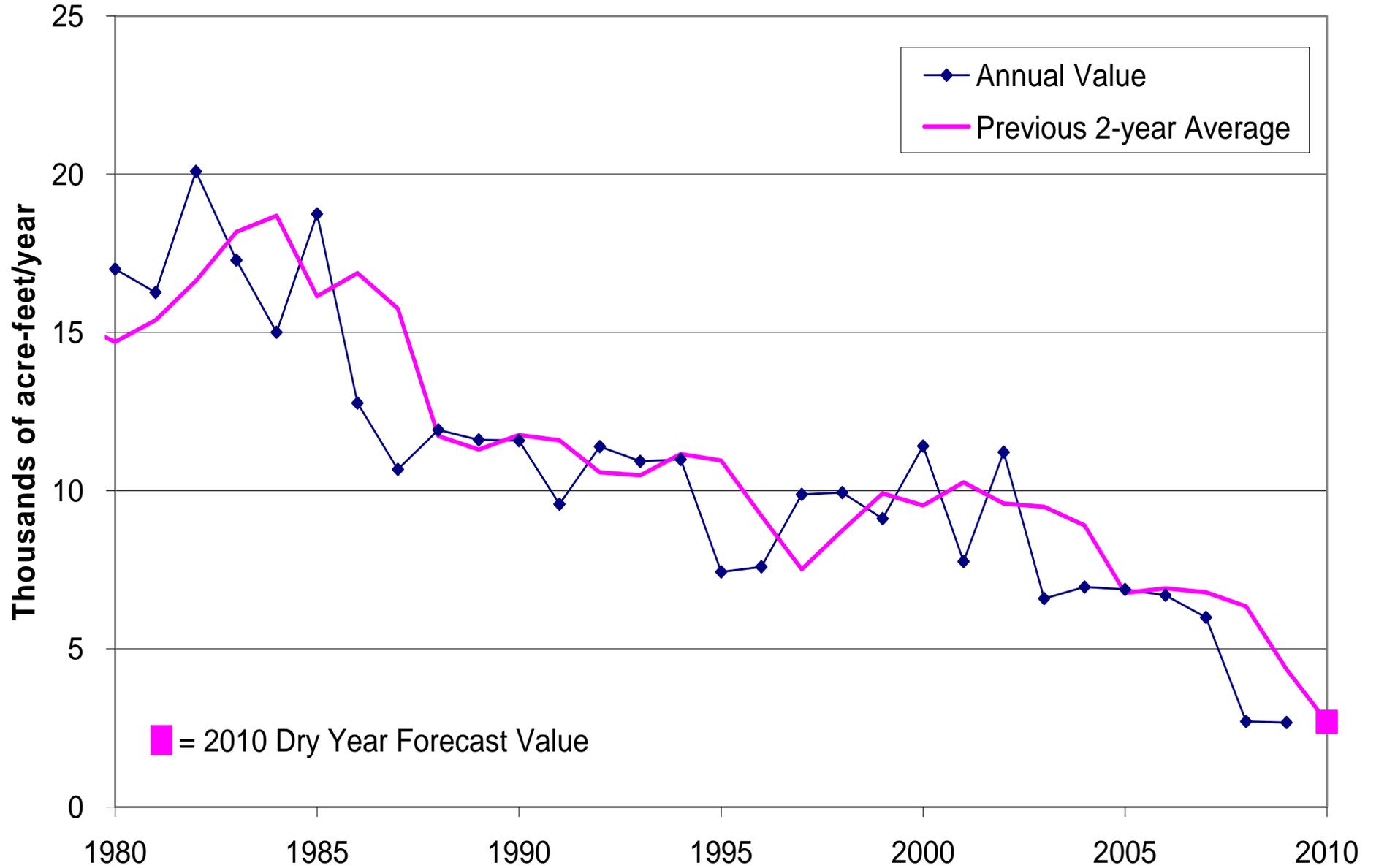
# Comparison of Nebraska SW use vs. Nebraska reservoir content, 1999-2005



# Comparison of Kansas SW use vs. Harlan County Lake content, 1999-2005



# Colorado SW Consumptive Use

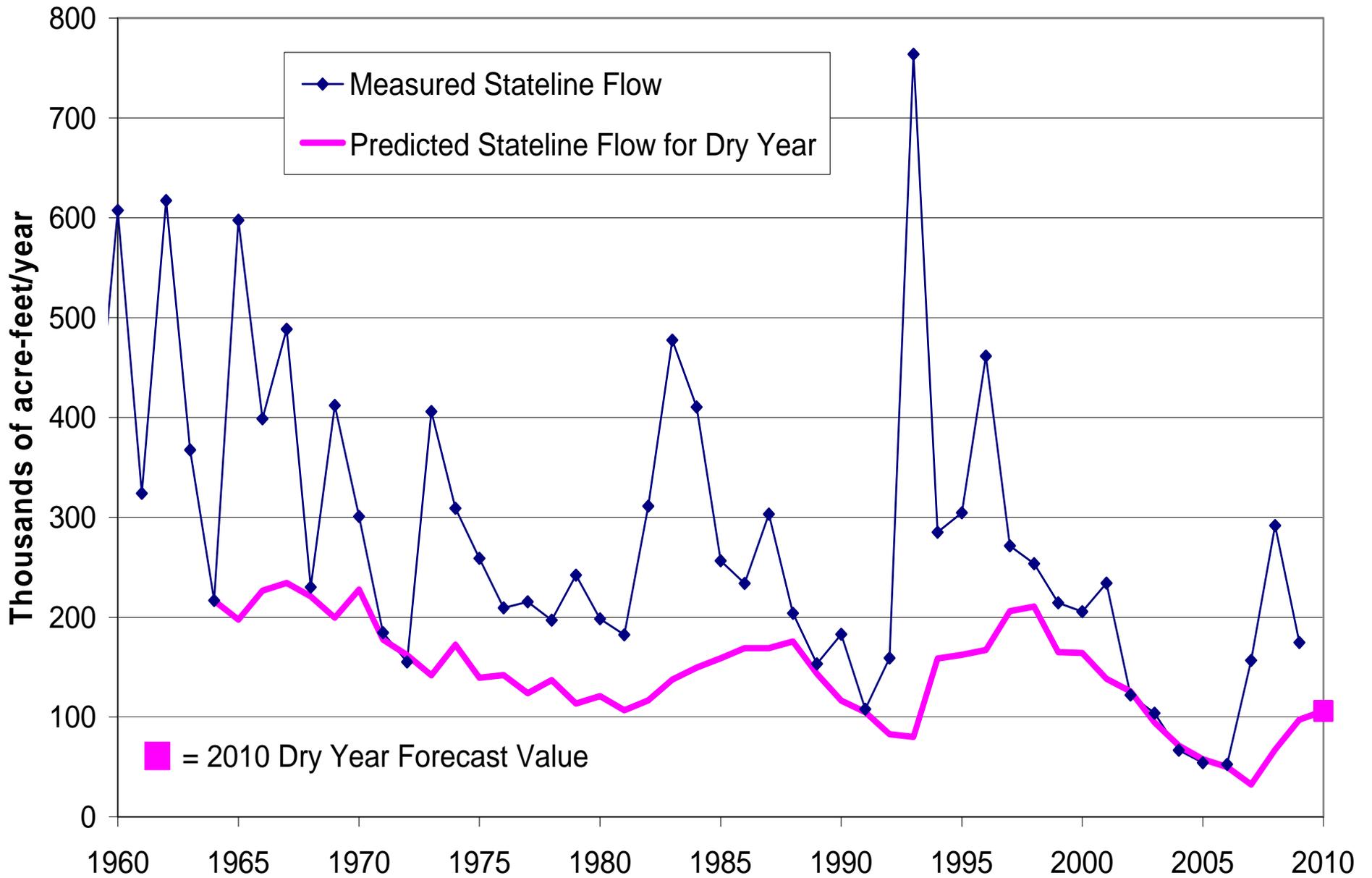


# Streamflow

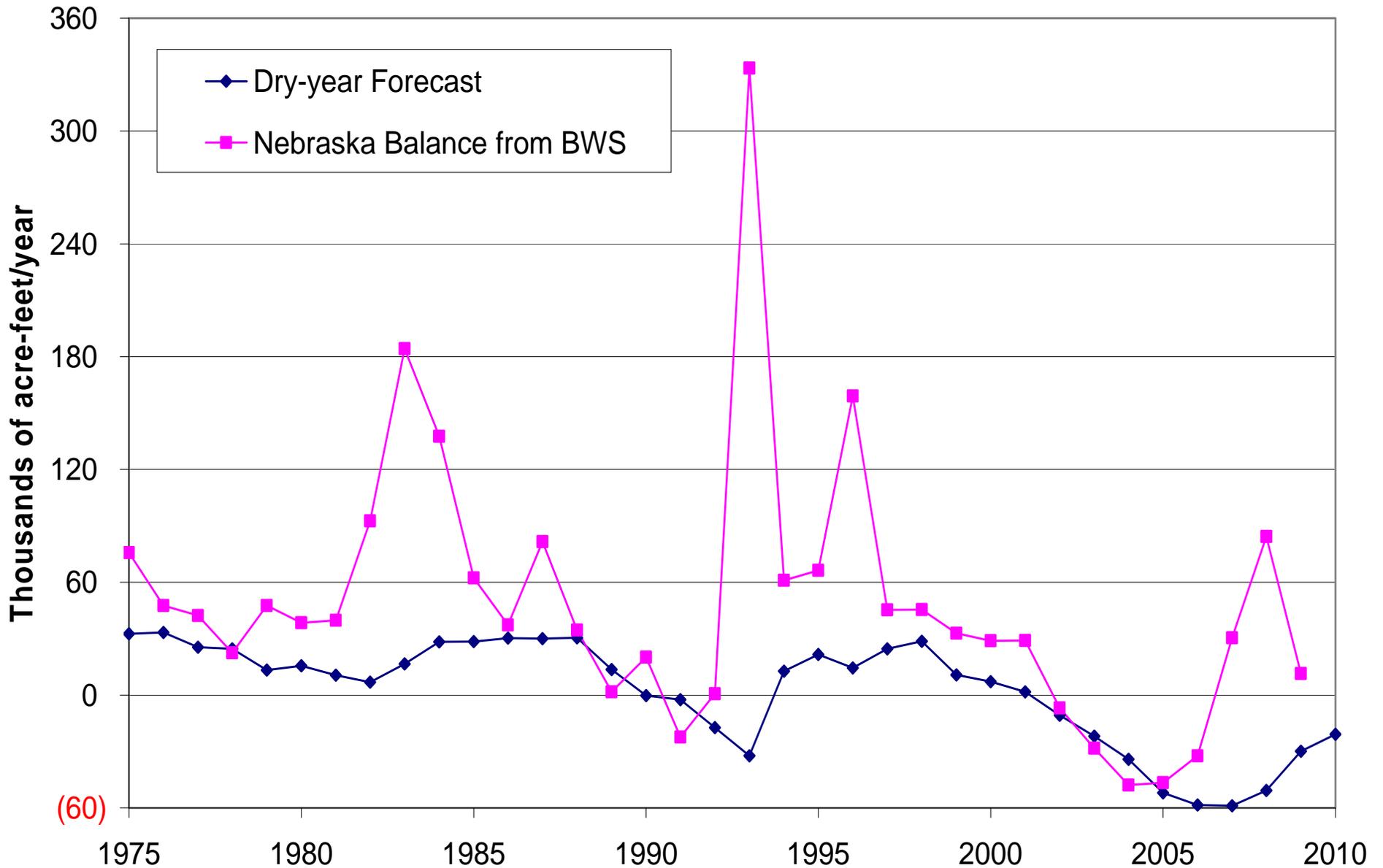
---

- Need to be able to predict a dry-year streamflow value for the state line from existing data
- Used multiple linear regression with two variables:
  - Previous 5-year average state line flows (0.41)
  - January 1 Harlan County Lake content (0.23)
  - Constant = -27450

Comparison of Actual Stateline Flows vs. Dry Year Predictions



# Comparison of Nebraska balance from BWS vs. dry-year forecast

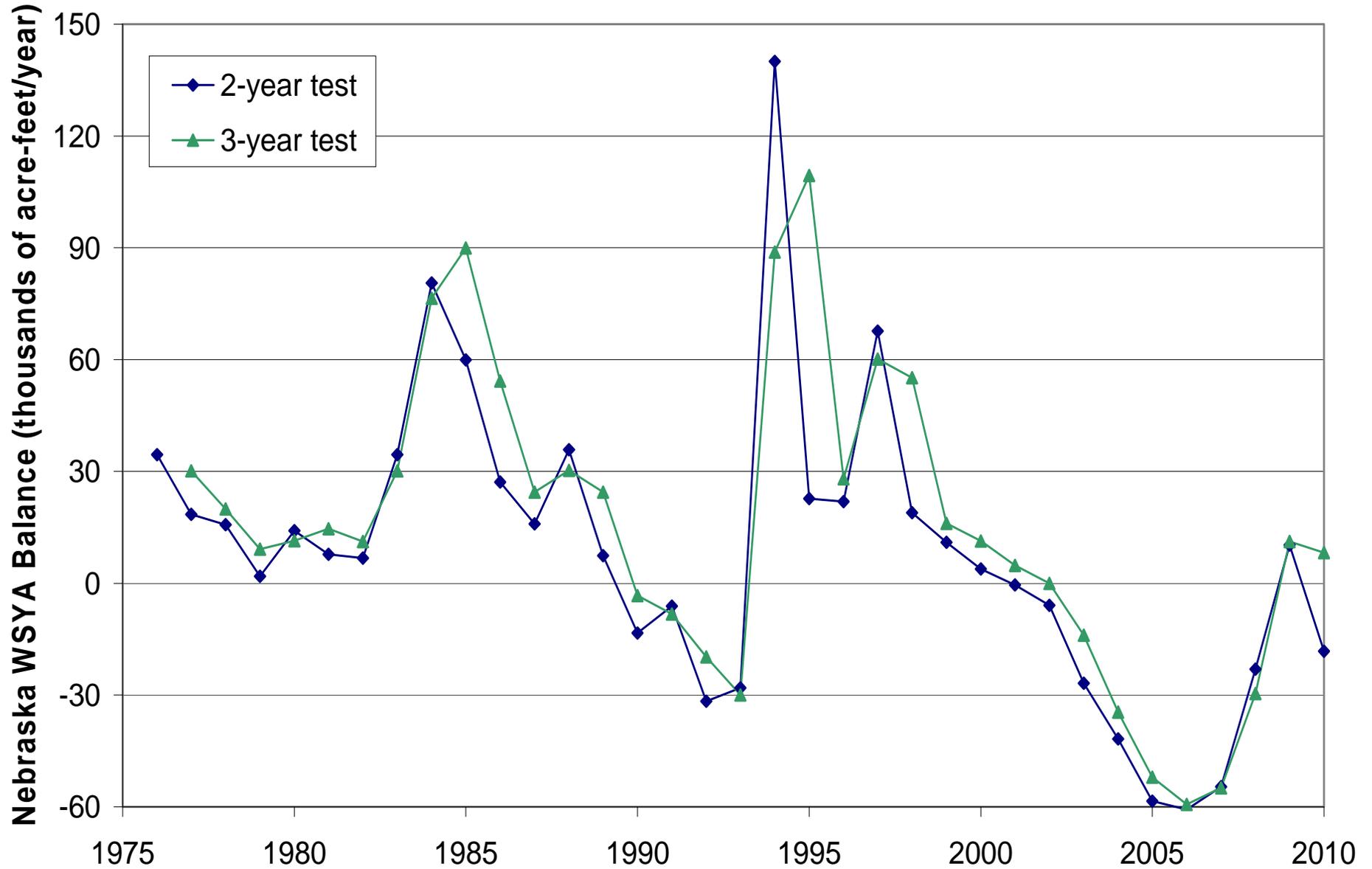


# Incorporating this Forecast into the Compact Compliance Flowcharts

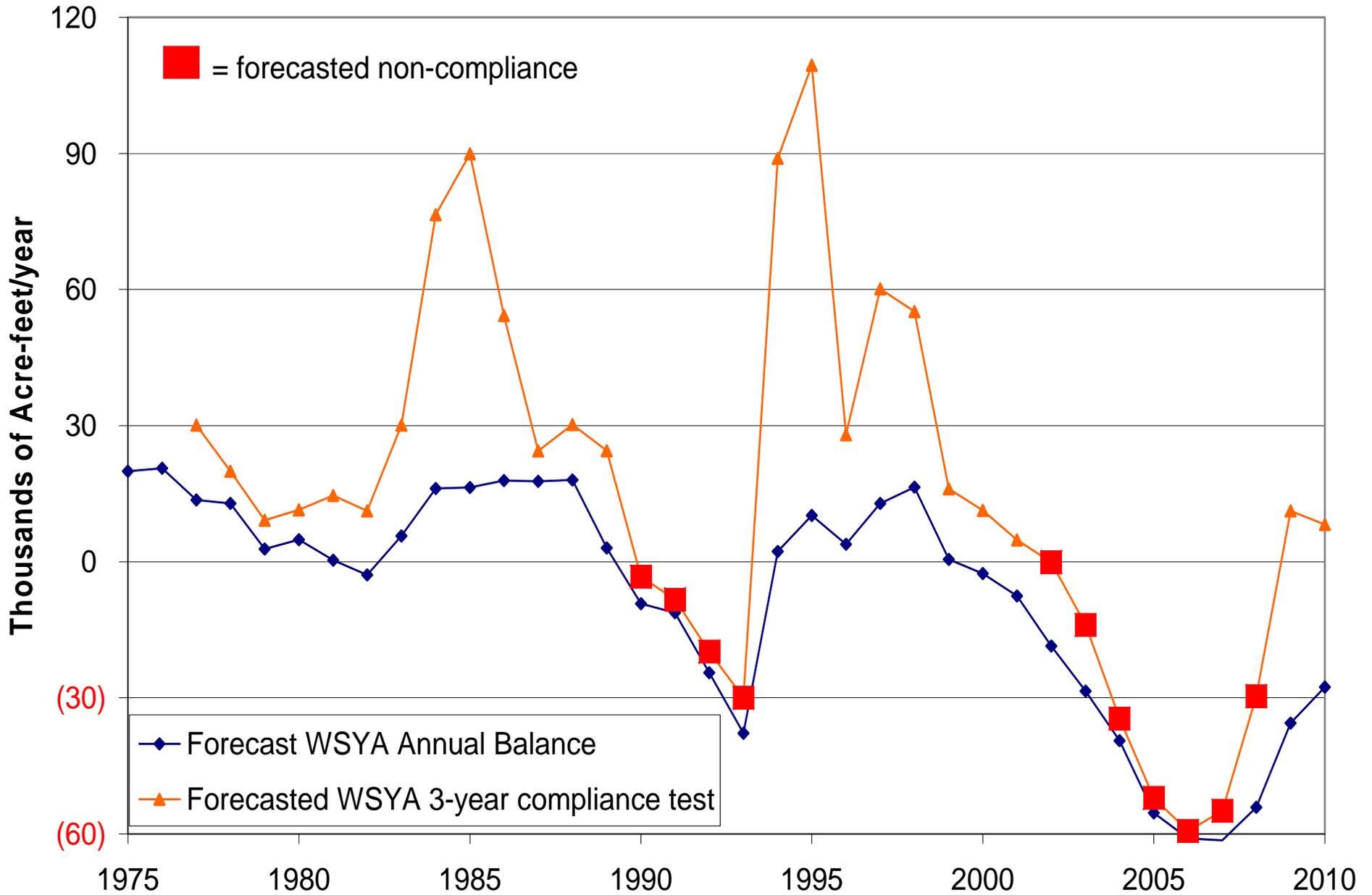
---

- Compliance flowcharts utilize the forecast along with recent accounting results
- Computes a 2-year or 3-year average with the forecast value for the most current year (t-0) and the actual accounting results for the previous years (t-1 and t-2)
- Also builds in a cushion of 5,000 acre-feet per year

# Results of dry-year forecast incorporated into WSYA compliance tests



# Forecast of WSYA Compact Compliance



# Questions?

---

# Preliminary 2009 Republican River Compact Accounting Results and 2010 Forecast

---

Curtis, Nebraska



# Overview

---

- Background-purpose of forecast
- Data sources
- Preliminary results
- Forecast for 2010
- Summary

# Background—Purpose

---

- 46-715 (6): “...the department, in consultation with the affected districts, shall forecast on an annual basis the maximum amount of water that may be available from streamflow for beneficial use in the short term and long term...”

# Background—(cont.)

---

- The short-term forecast has been defined as pertaining to the upcoming year
- The long-term forecast refers to the next decade
- The maximum amount of water available from streamflow has been defined as referring to a dry year

# Preliminary 2009 Results

---

# Data sources for early 2009

---

- Groundwater model: power records, NRD estimates
- Streamflow and SW use: data through November 24 with estimates through the end of the year
  - Hardy + Courtland Canal are critical
- Evaporation: based on prior years

# Preliminary Results: 1-Year Balance above Guide Rock

Year	Balance
2005	(42,856)
2006	(28,345)
2007	17,300
2008	79,500
2009	(600)

# Preliminary Results: 2-Year Average above Guide Rock (2009 not WSYA)

Year	Balance
2005-2006 Ave	(35,600)
2006-2007 Ave	(5,500)
2007-2008 Ave	48,400
2008-2009 Ave	39,440

# Preliminary Results above Hardy (Approximate – Numbers Rounded)

Year	Balance
2005	(42,300)
2006	(29,100)
2007	30,800
2008	85,100
2009	5,700
Average	10,000

# Looking Forward to 2010 and 2011

---

# Water Short Year Administration

---

- Occurs when <119,000 AF available for irrigation in Harlan County Lake
- 2010 will not be a Water-Short Year
- When HCL volume decreases, the decrease averages 16%
- It is not likely that 2011 will be Water Short

# Forecast: If 2010 is Dry, Then:

---

- One-year balance above Guide Rock – (-27,600) AF
- Two-year average above Guide Rock (with 10,000 AF cushion) – (-19,100) AF
- Three-year average above Guide Rock (with 15,000 AF cushion) – 15,400 AF
- Averages do not apply if 2010 not WS

# Forecast: If 2010 is Dry, Then:

---

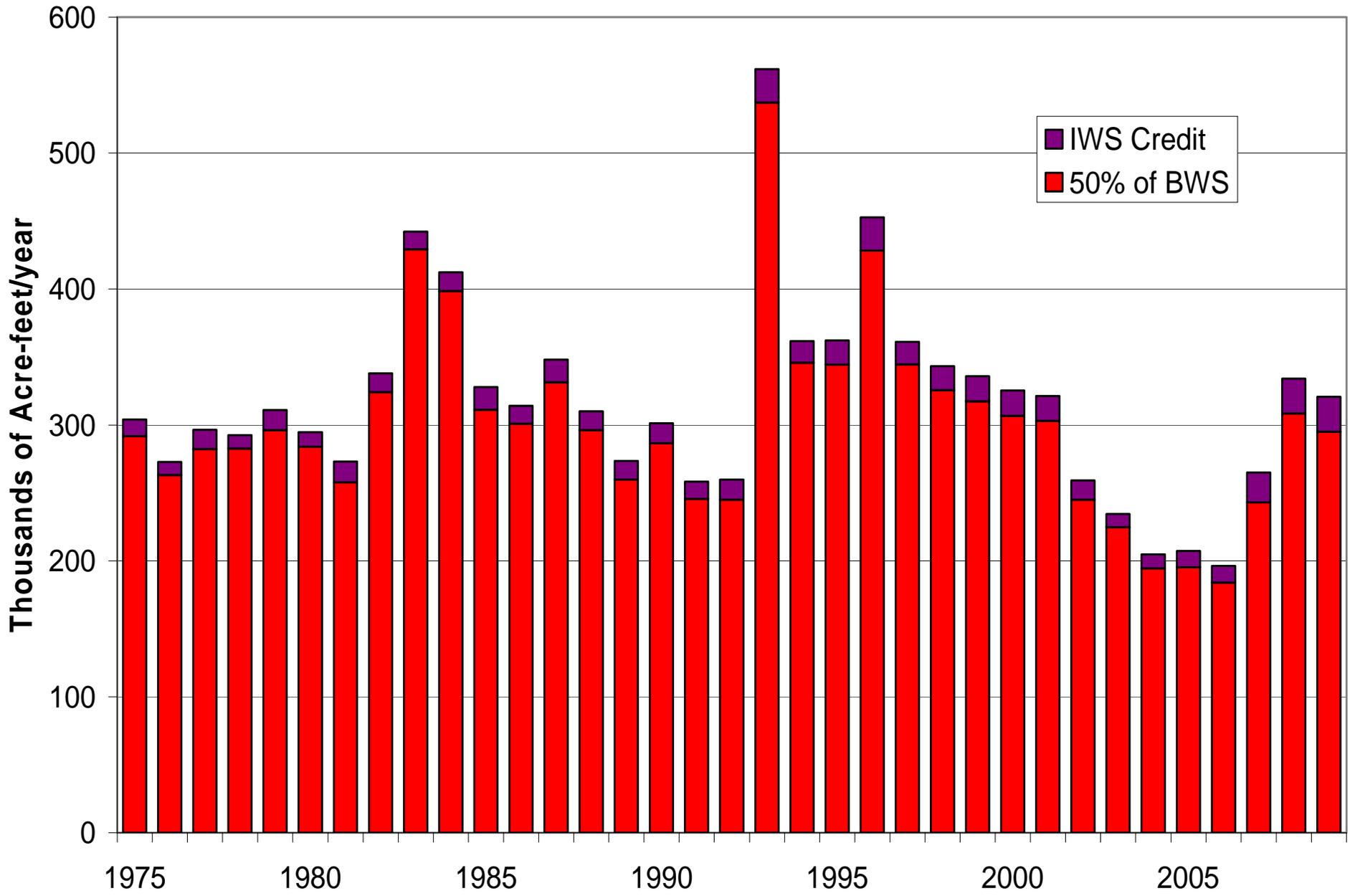
- One-year balance above Hardy –  
(-20,900) AF
- Five-year average above Hardy –  
14,300 AF (greater than 10,000 AF/yr)
- Five-year average compliance test  
always applies

# Long-term Forecast

---

- Look at the historical record as an indication of the future water supplies.
- Impossible to know if the next ten years will be wet, dry, or average.
- In ten years, if it is dry, the water supply may be as low as ~200k AF
- Maximum depletions will depend on recent Compact balances and whether or not it is a WSY

# Nebraska's Water Supply Above Hardy



# Summary

---

- The 2009 balance above Guide Rock will be neutral or slightly negative
- The 2009 balance above Hardy will probably be positive
- 2010 will not be water short
- Taking into account a dry year forecast above Hardy, the 2006-2010 5-year average will be positive (probably greater than 10,000 AF/yr)

# Questions?

---

