System Administrator

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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

KS000192

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

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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

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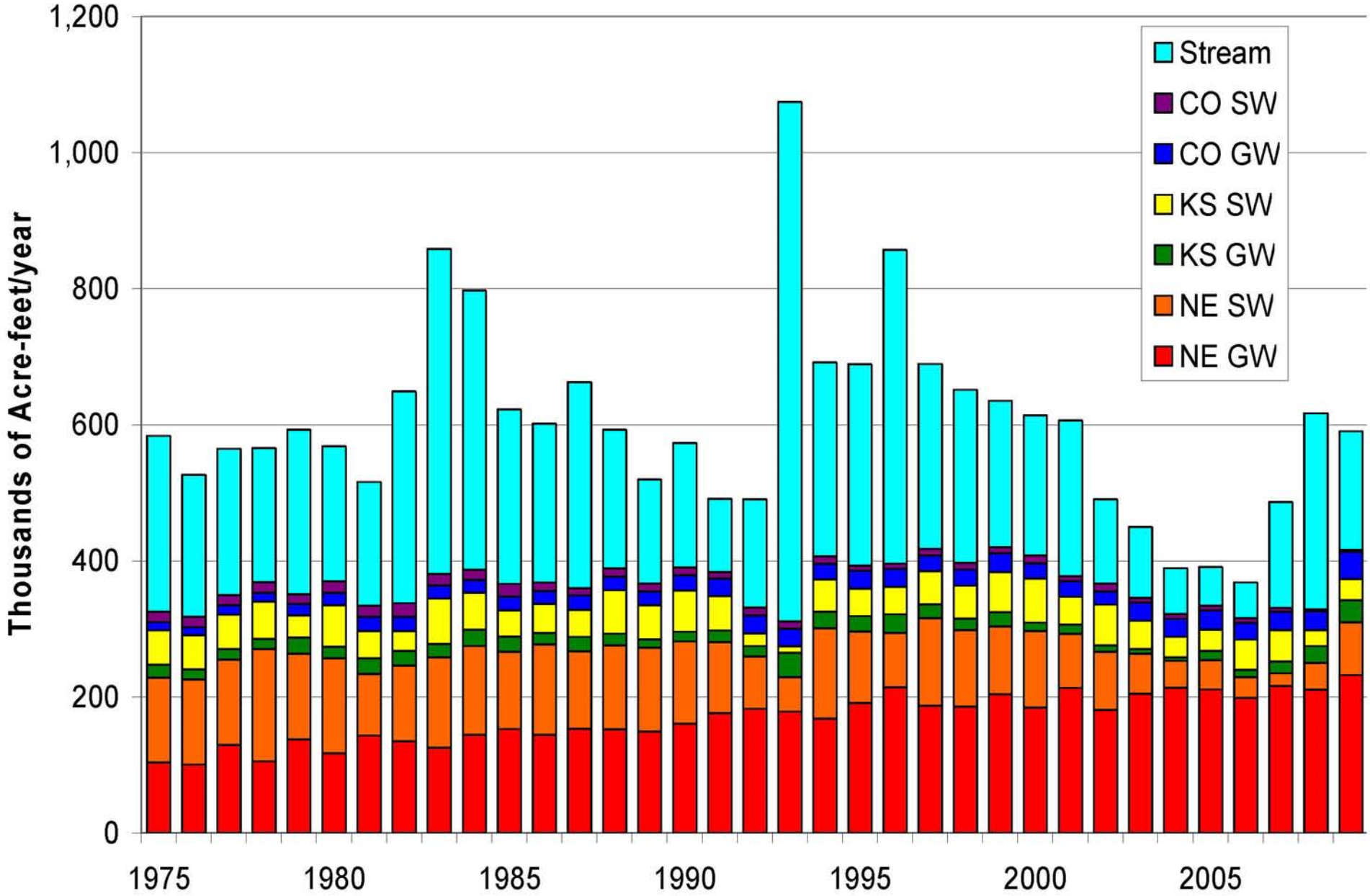
Republican River Basin Water Supply



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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

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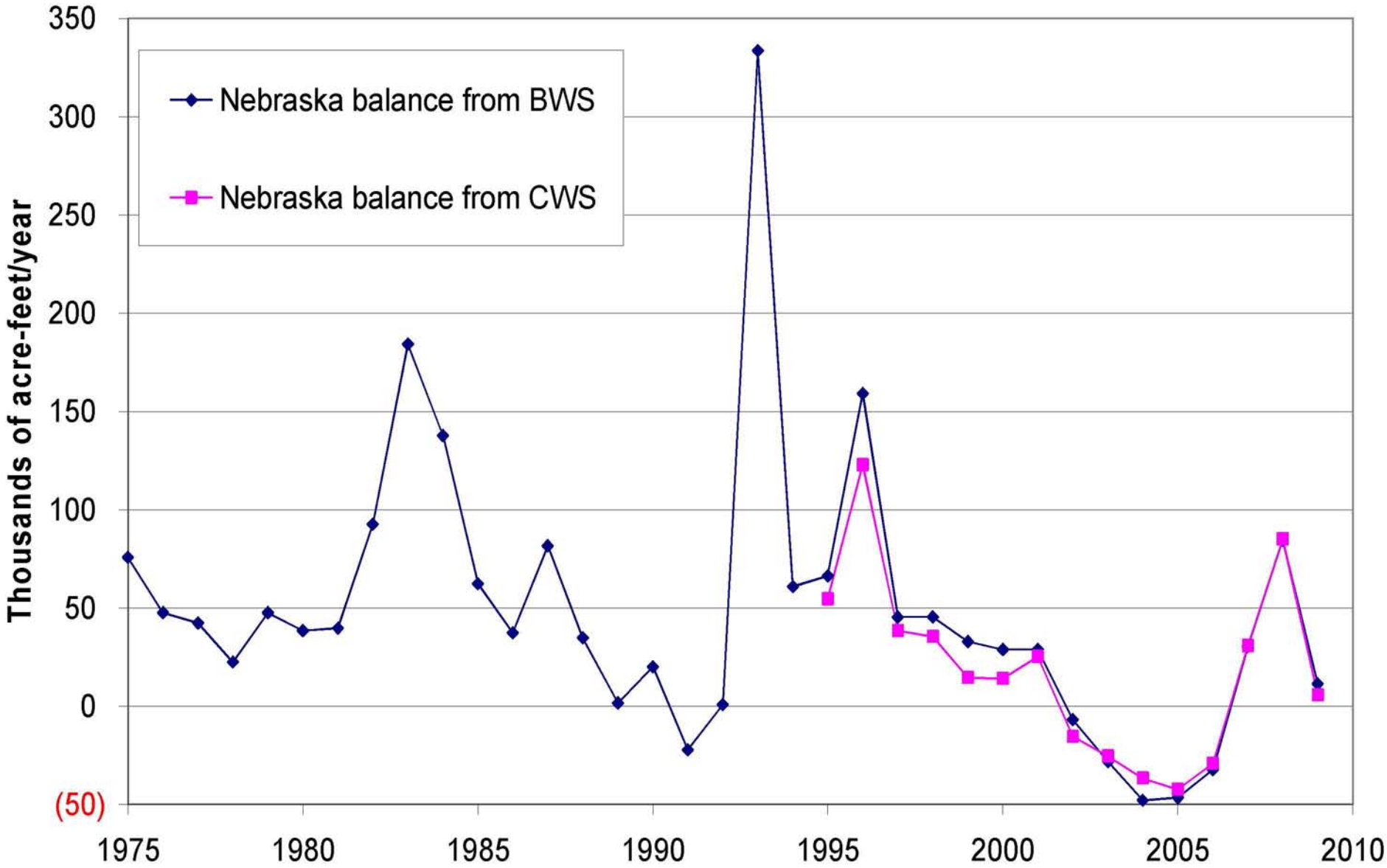
Nebraska's annual balance of water use and water supply



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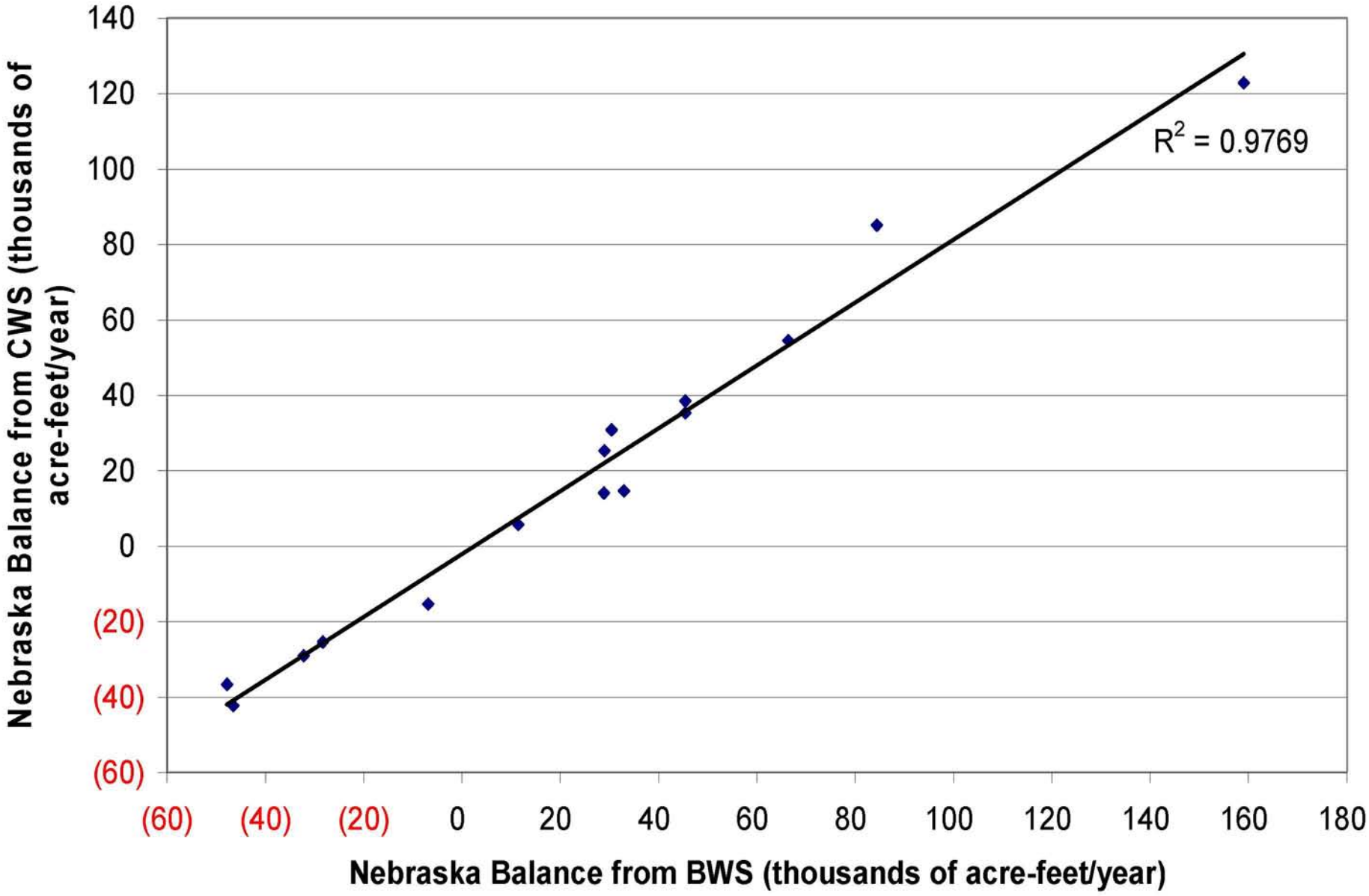
Comparison of Nebraska Balance from BWS vs. CWS



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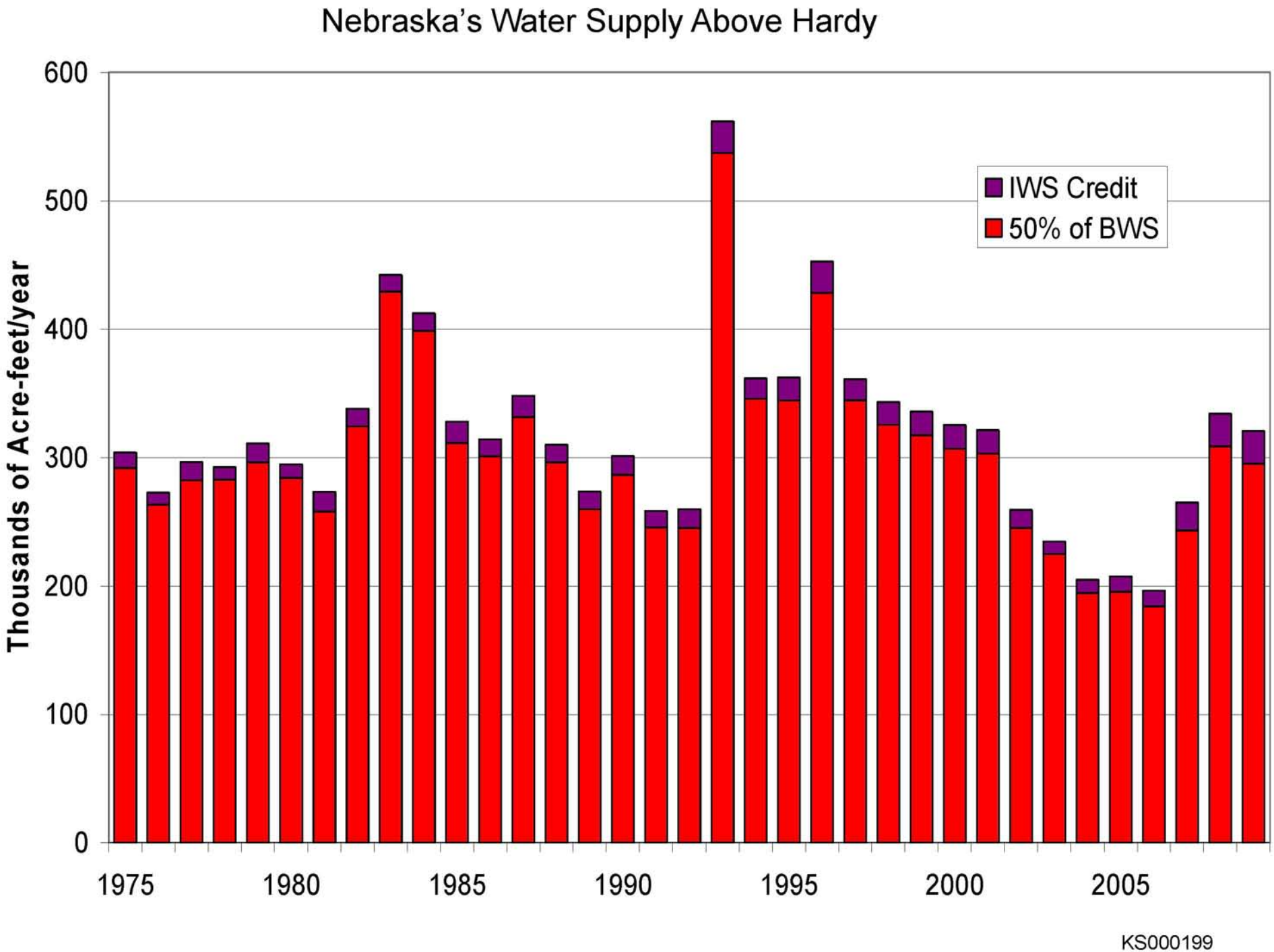
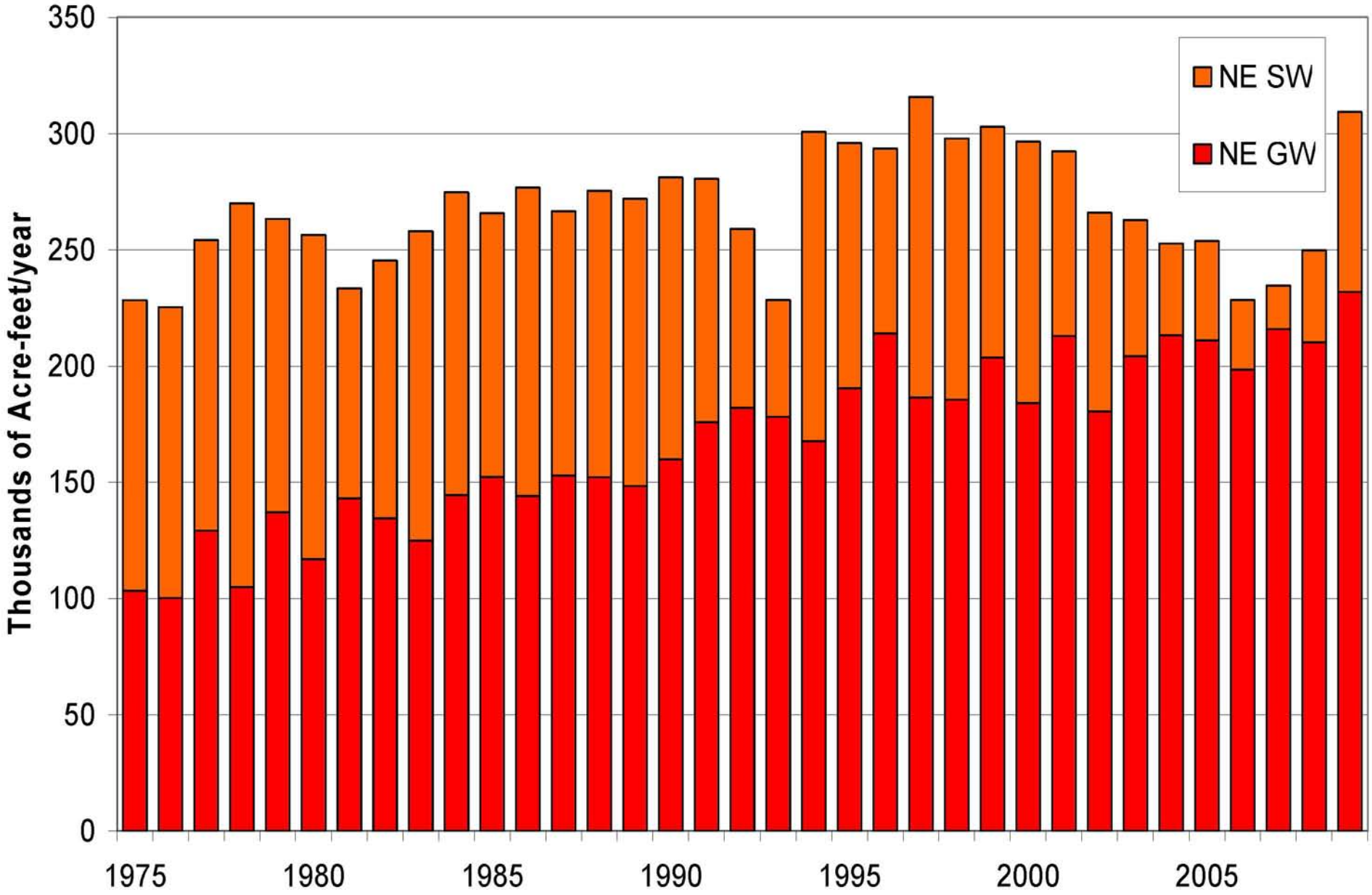

Nebraska's Water Supply Above Hardy
Thousands of Acre-feet/year
600
500
400
300
200
100
0
1975
1980
1985
1990
1995
2000
2005
IWS Credit
50% of BWS
KS000199

Nebraska's Water Use Above Hardy



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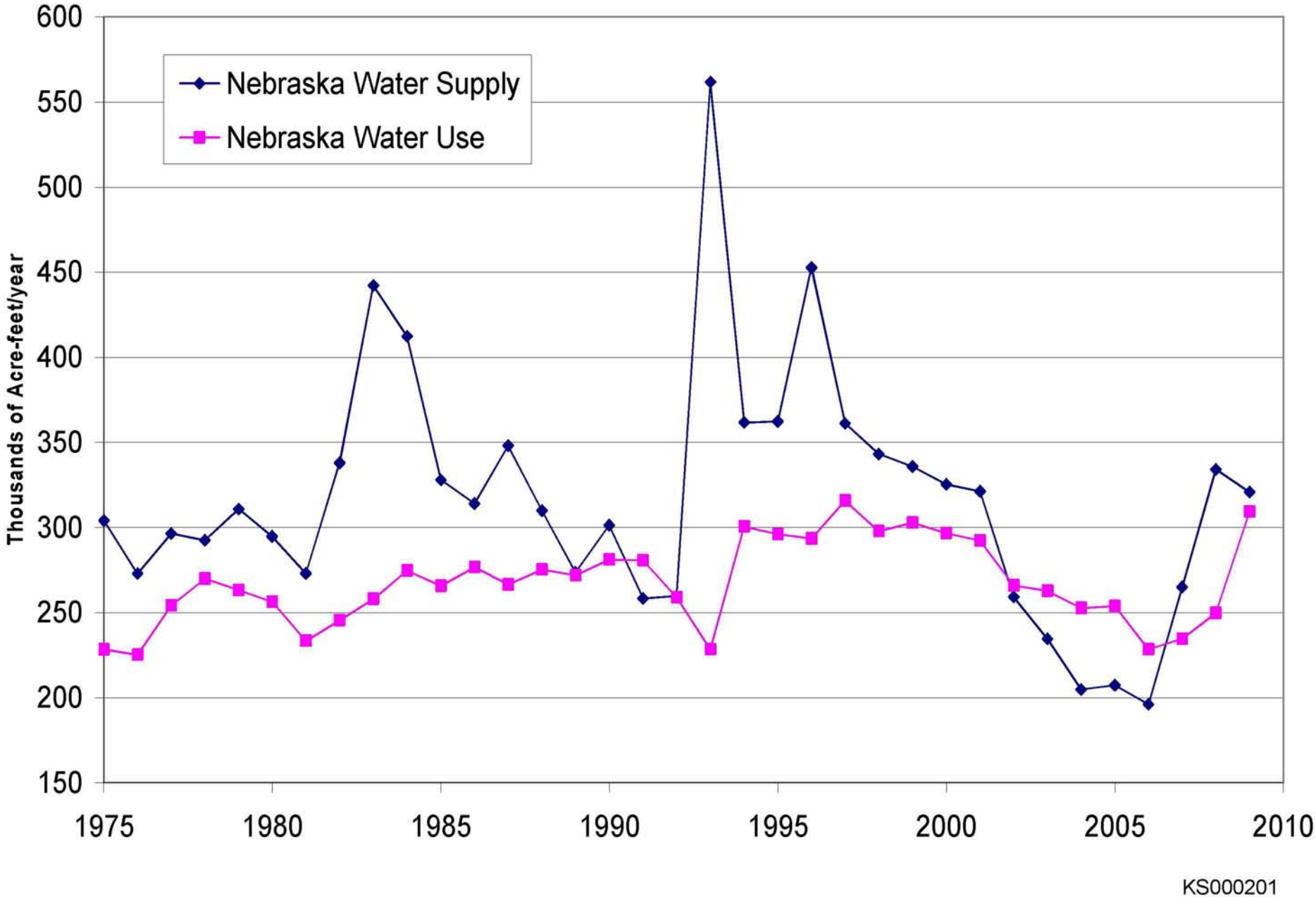
Water Supply and Water Use above Hardy



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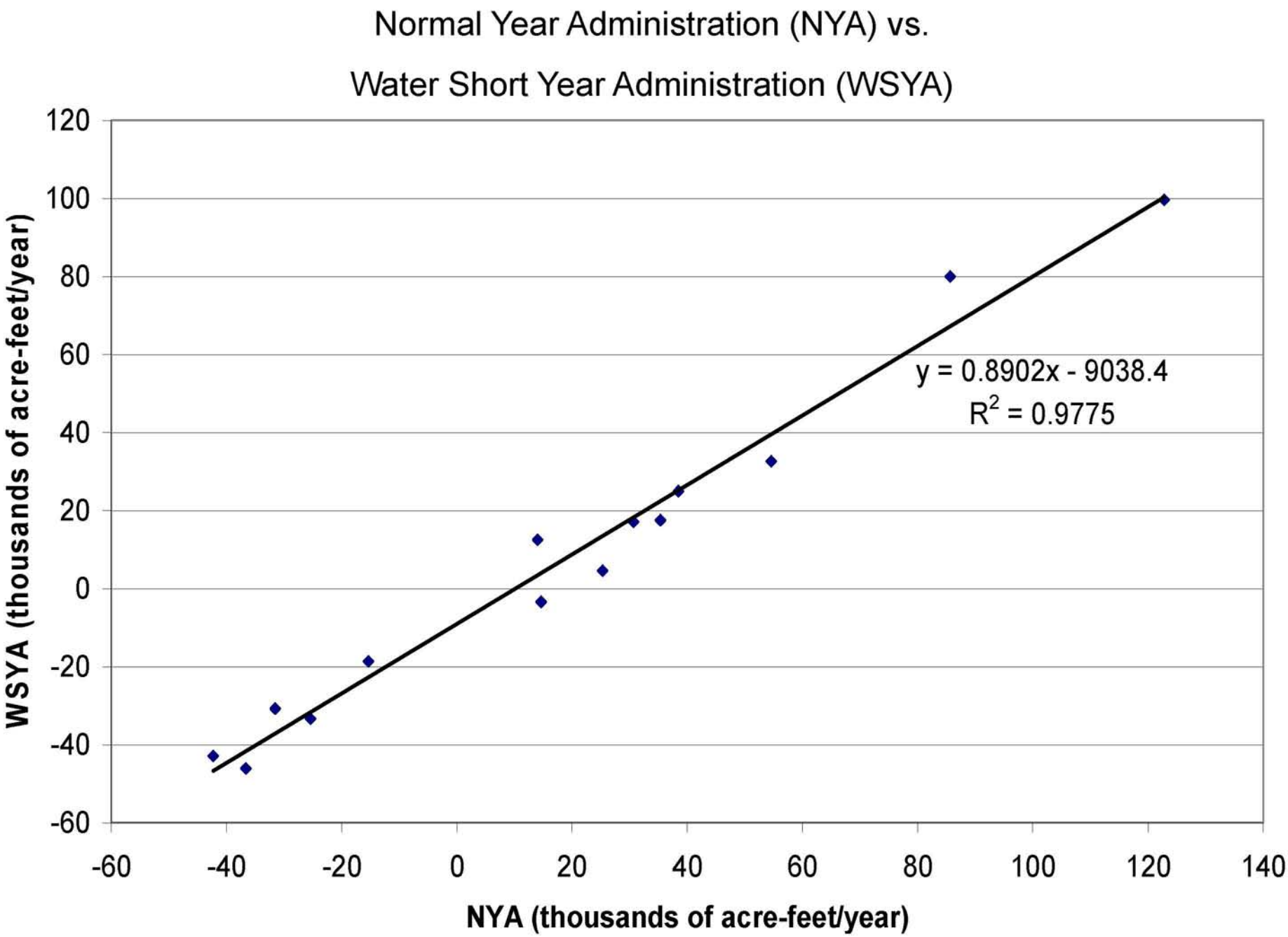
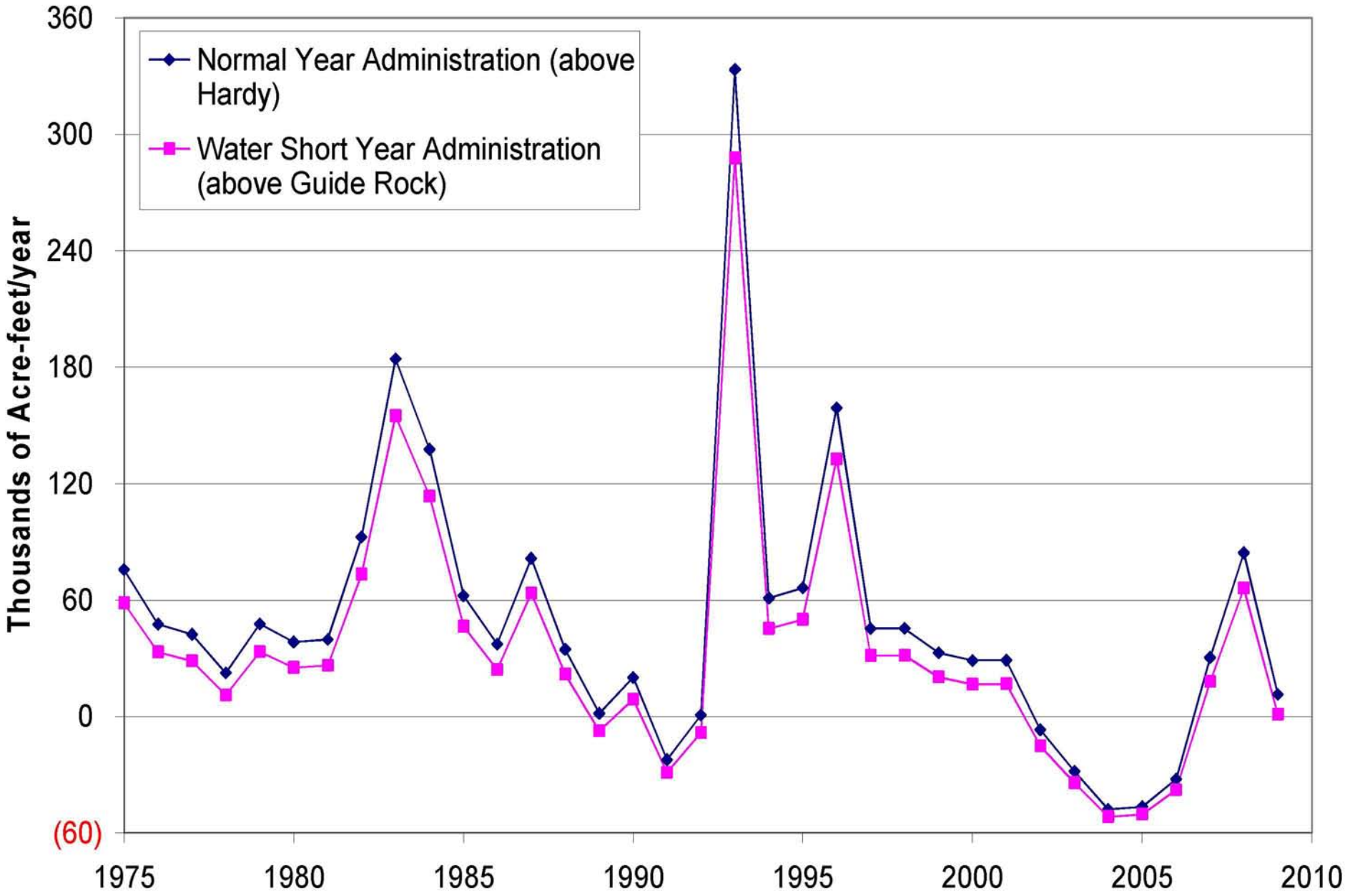

Normal Year Administration (NYA) vs.
Water Short Year Administration (WSYA)
WSYA (thousands of acre-feet/year)
NYA (thousands of acre-feet/year)
y = 0.8902x - 9038.4
R2 = 0.9775
120
100
80
60
40
20
0
-20
-40
-60
-60
-40
-20
0
20
40
60
80
100
120
140

KS000202

Nebraska Annual Water Supply minus Water Use



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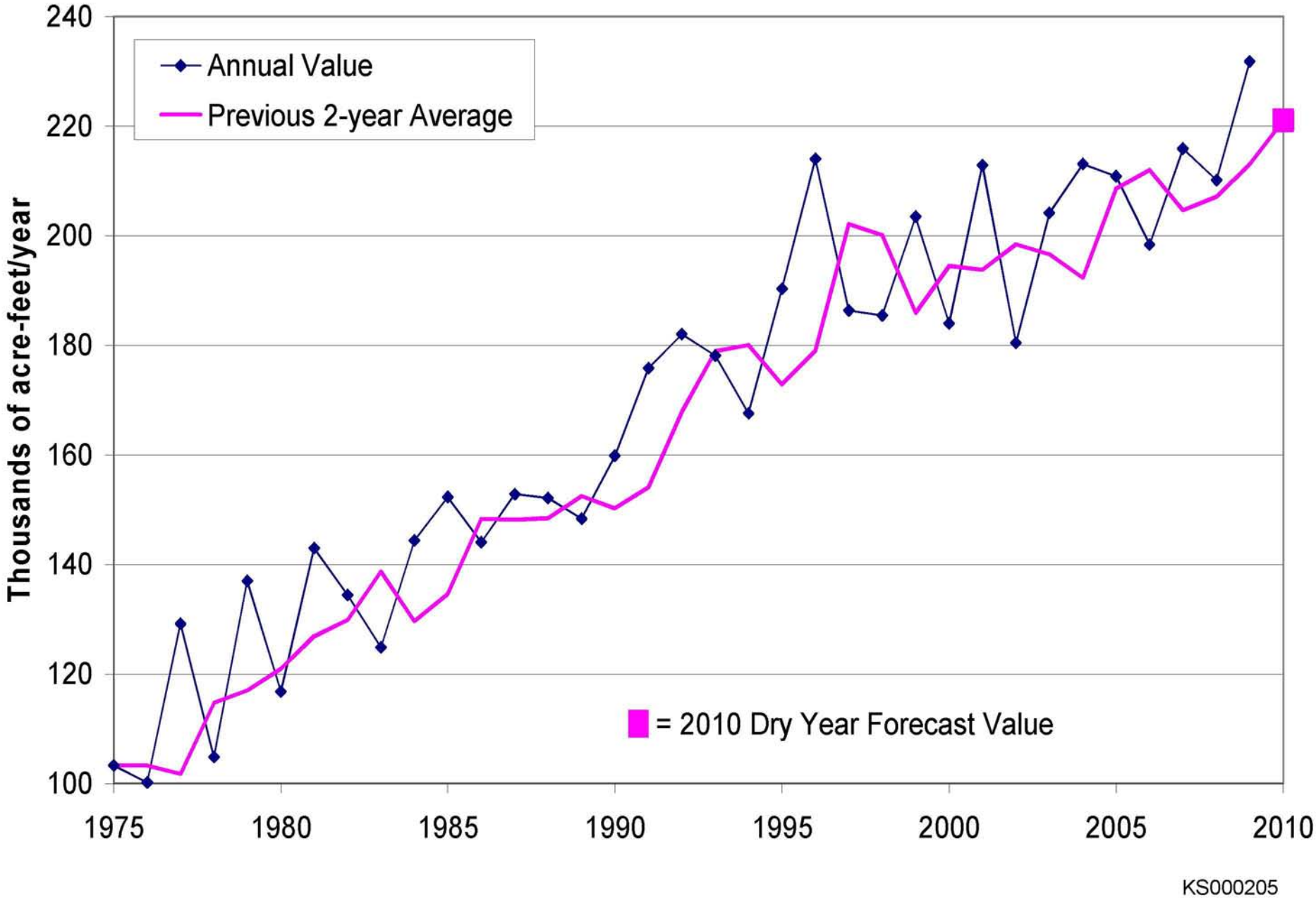
A Proposed Approach for Predicting Nebraska's Water Supply and Water Use for an Upcoming Dry Year

- 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

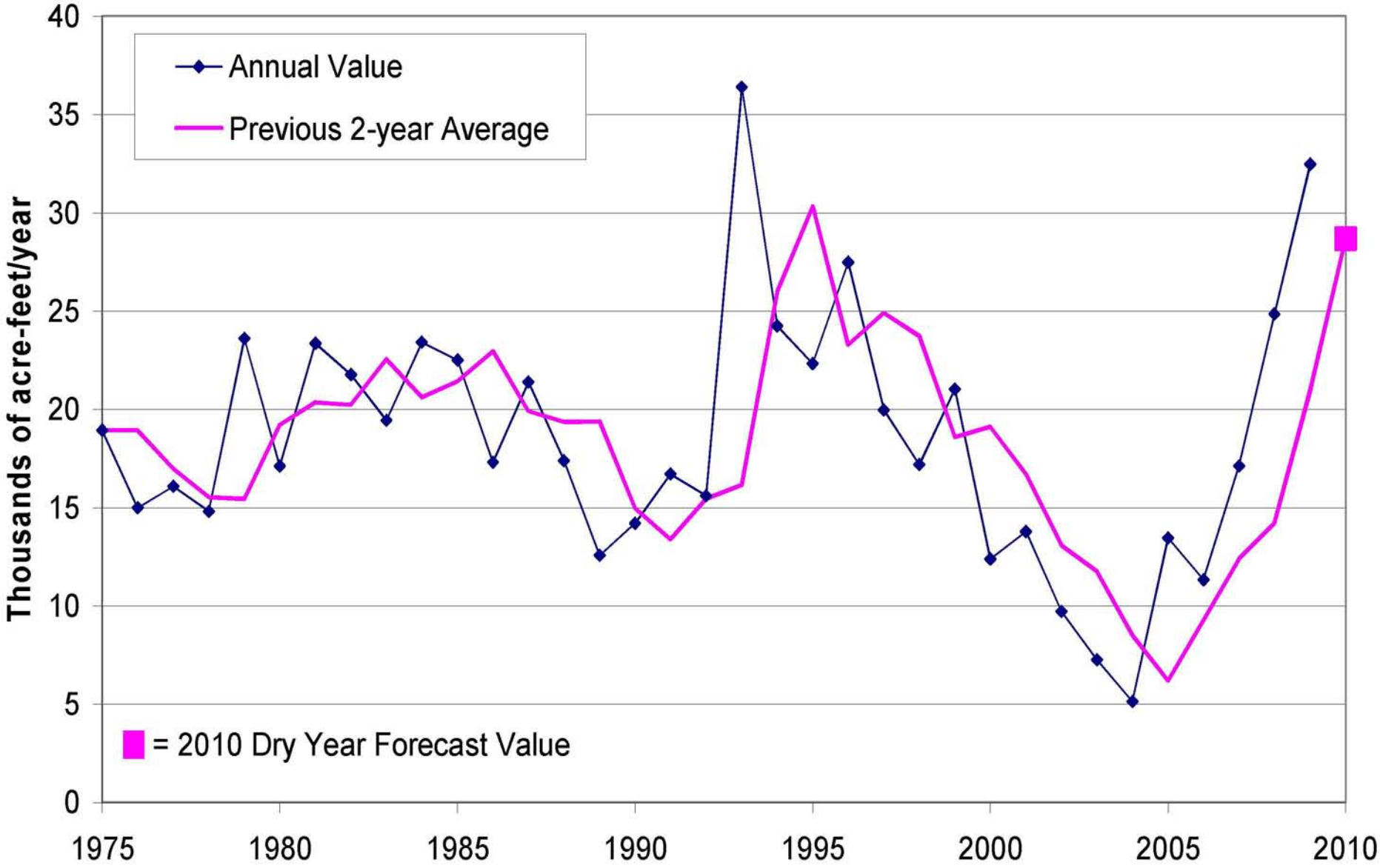
KS000204

Nebraska groundwater CBCU



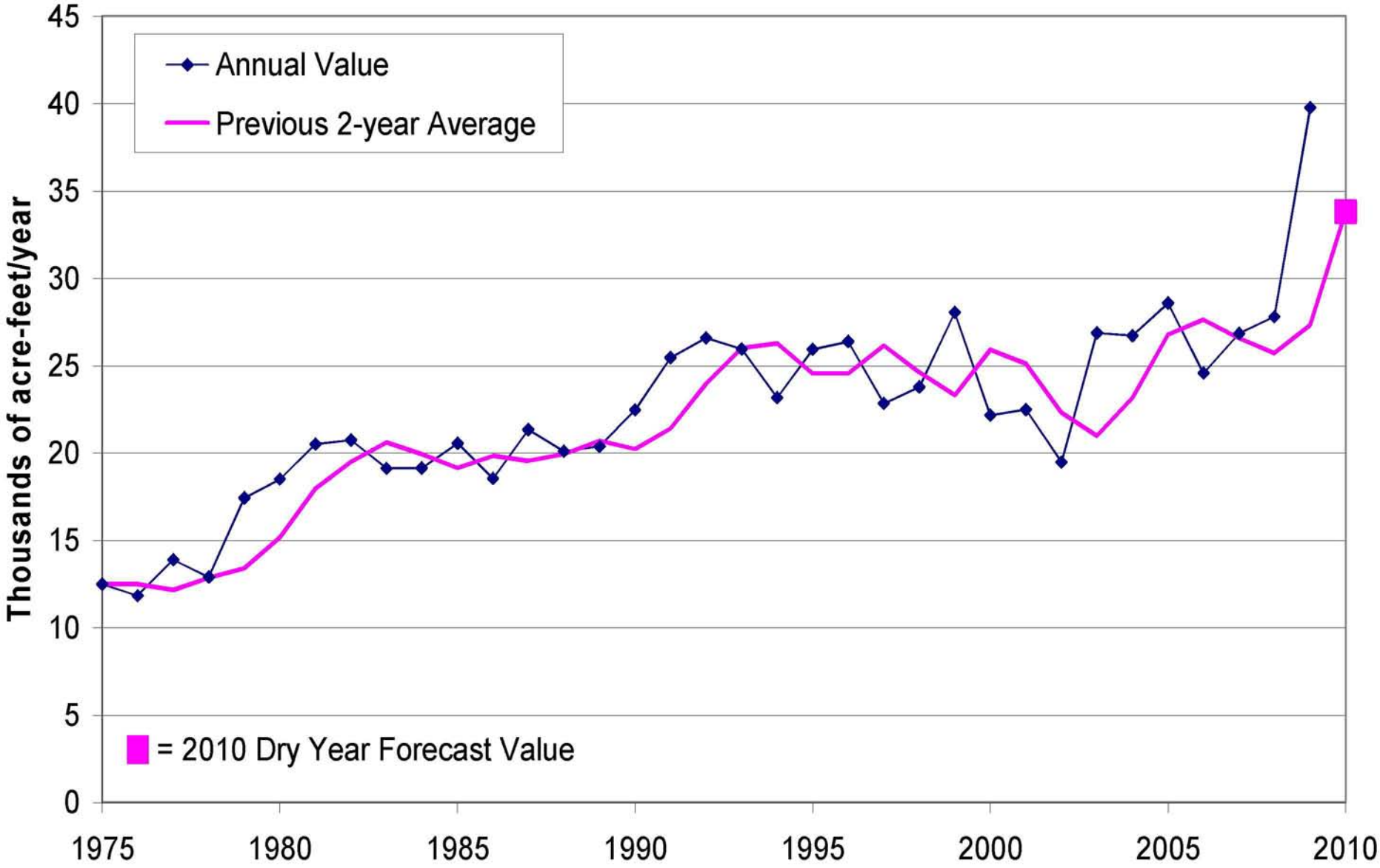
KS000205

Kansas groundwater CBCU



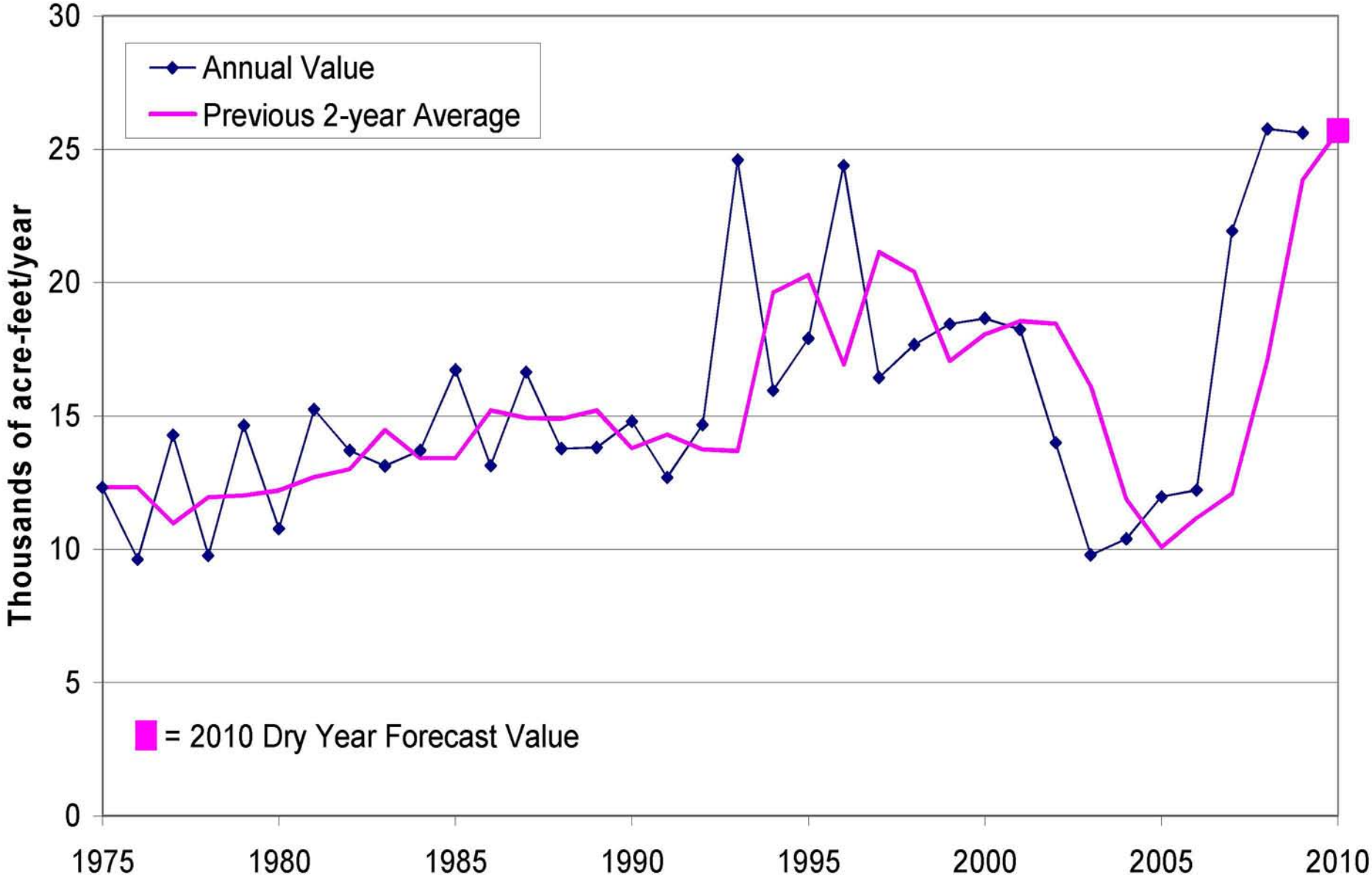
KS000206

Colorado groundwater CBCU



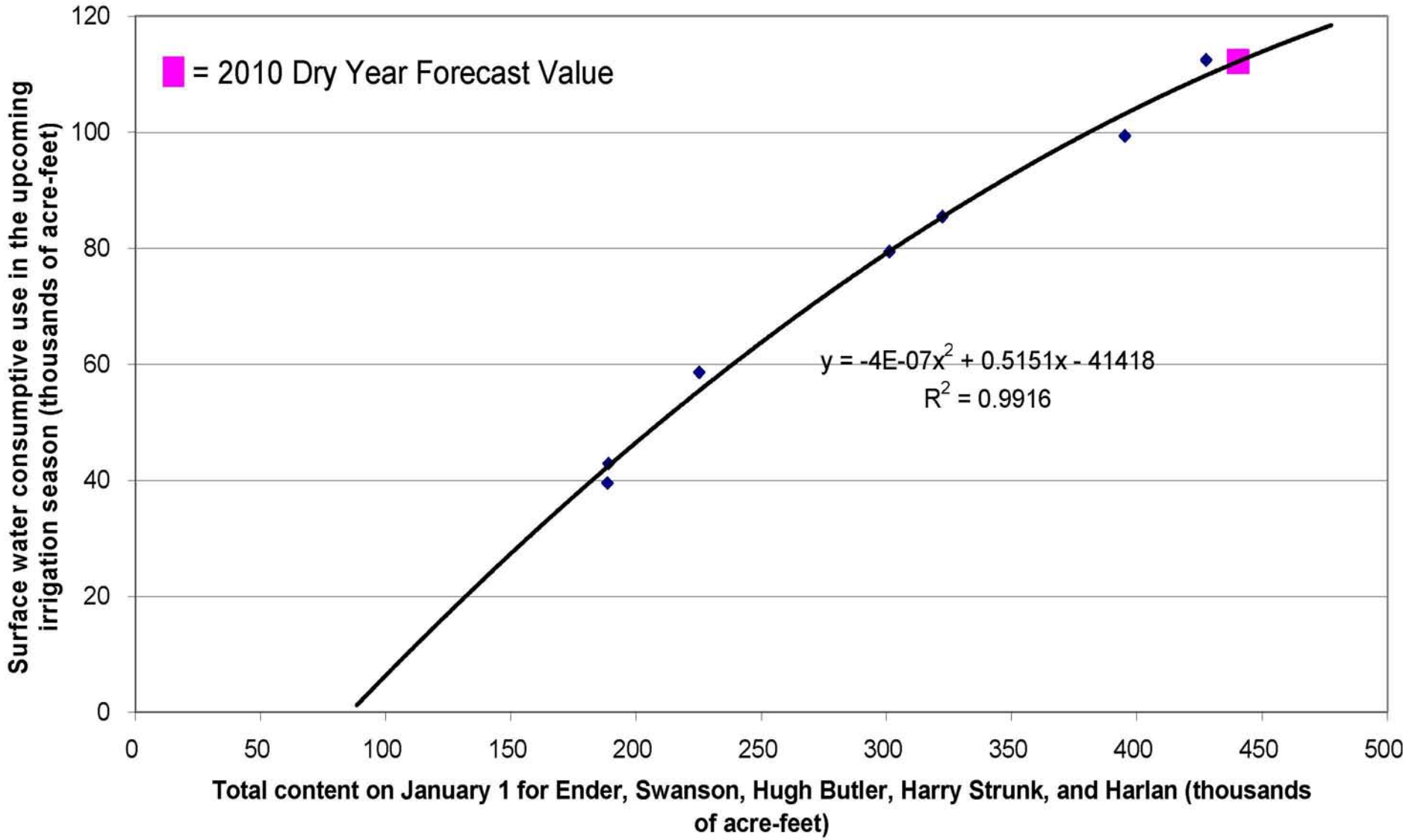
KS000207

Imported Water Supply Credit



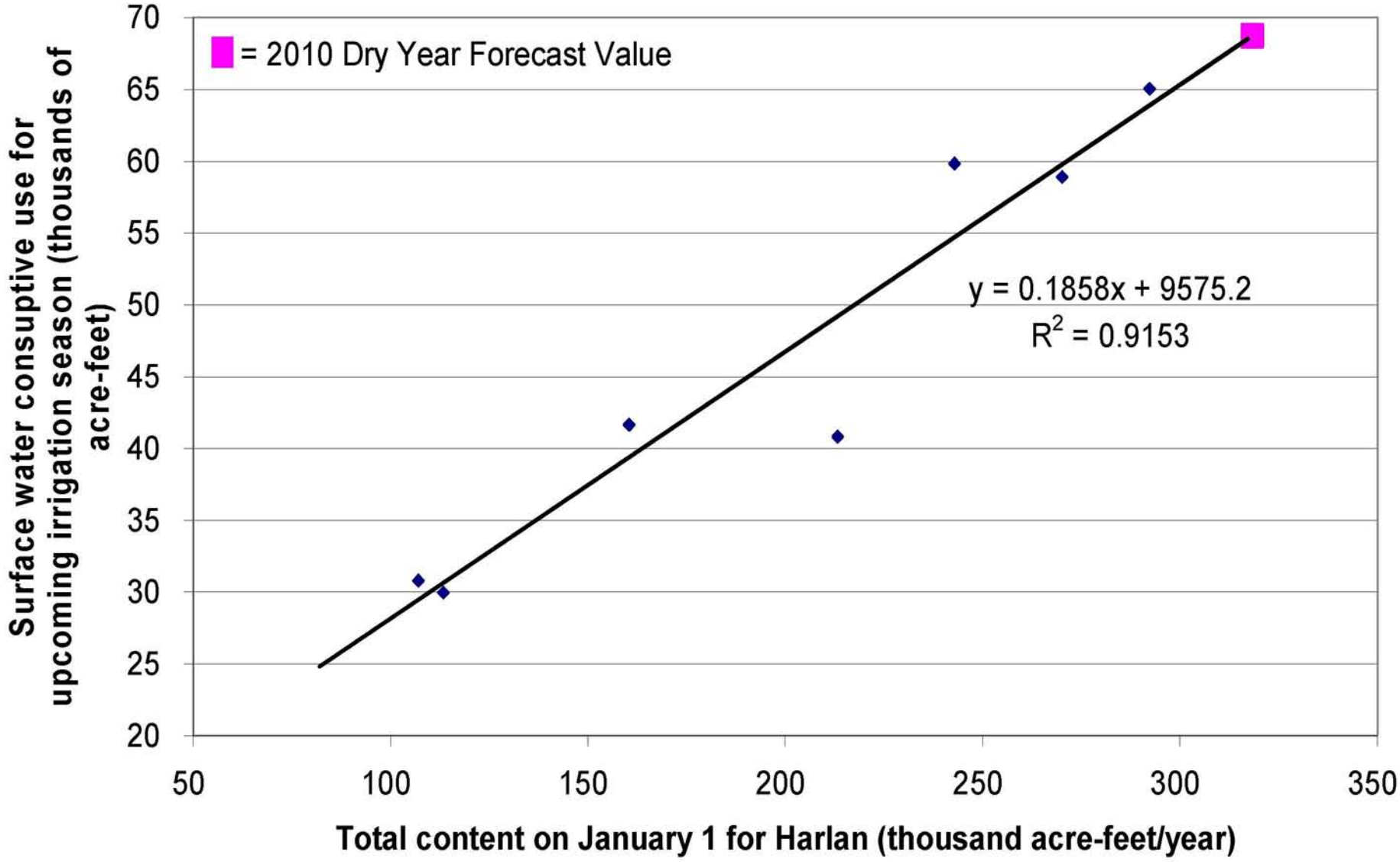
KS000208

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



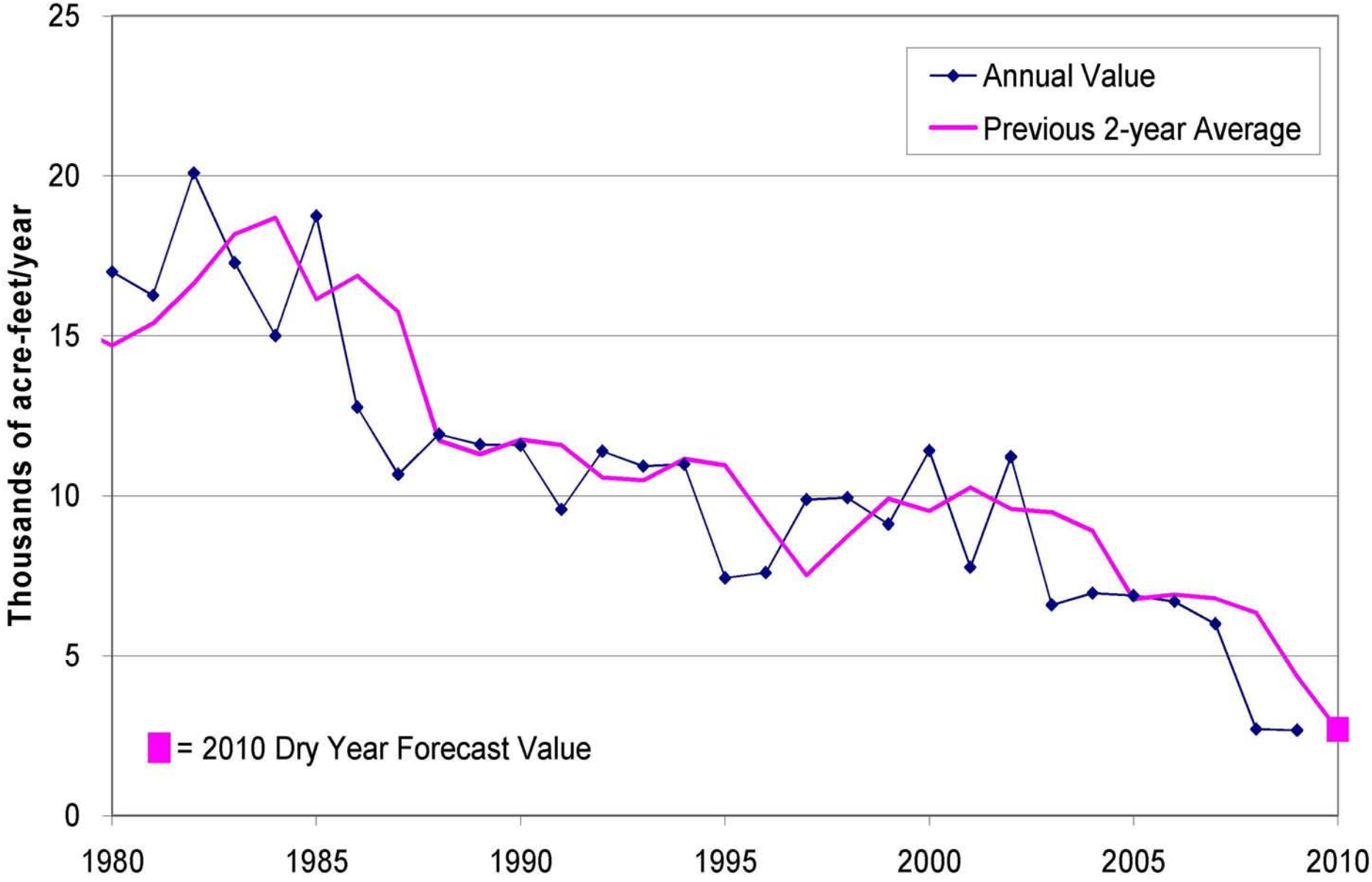
KS000209

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



KS000210

Colorado SW Consumptive Use



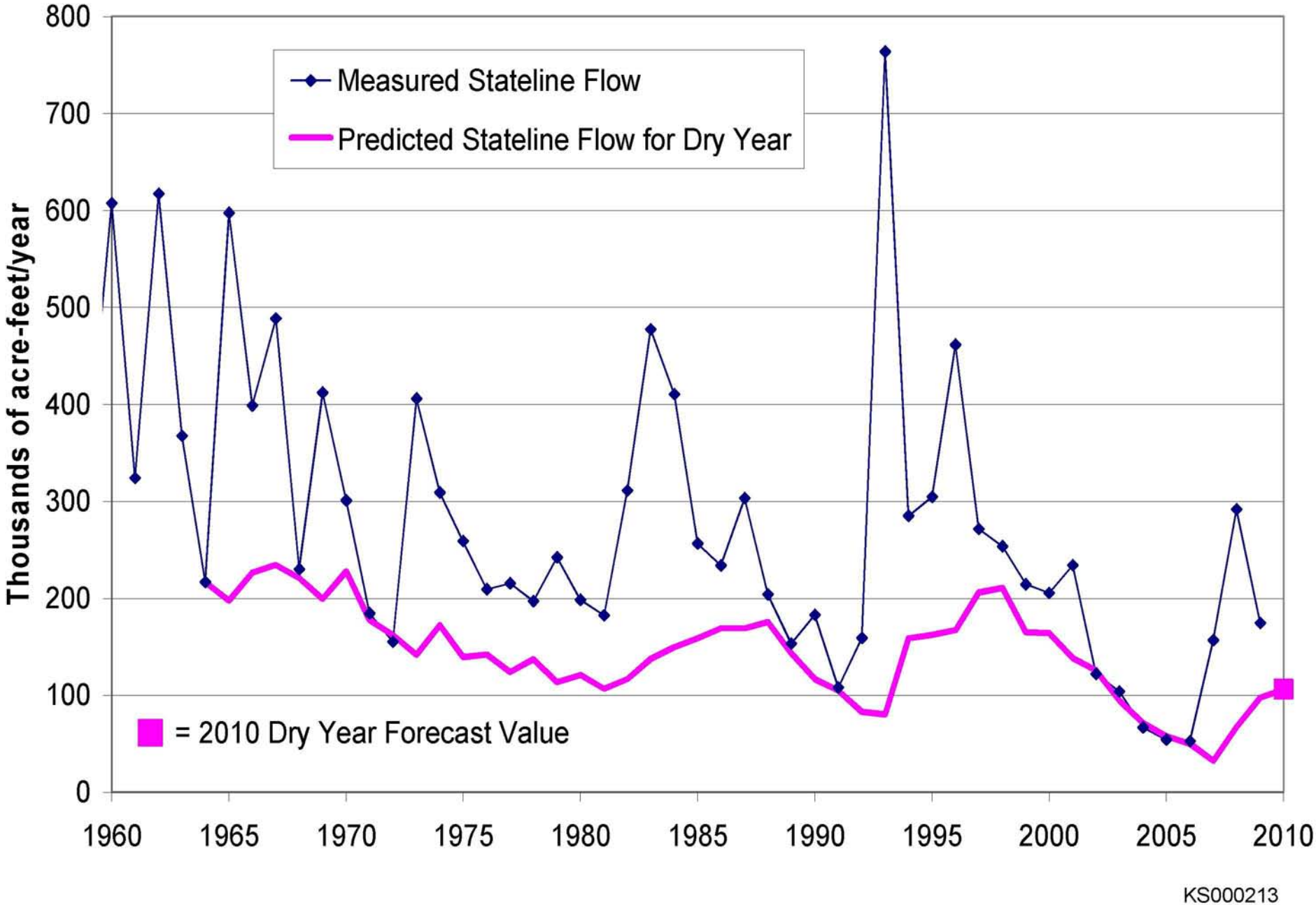
KS000211

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

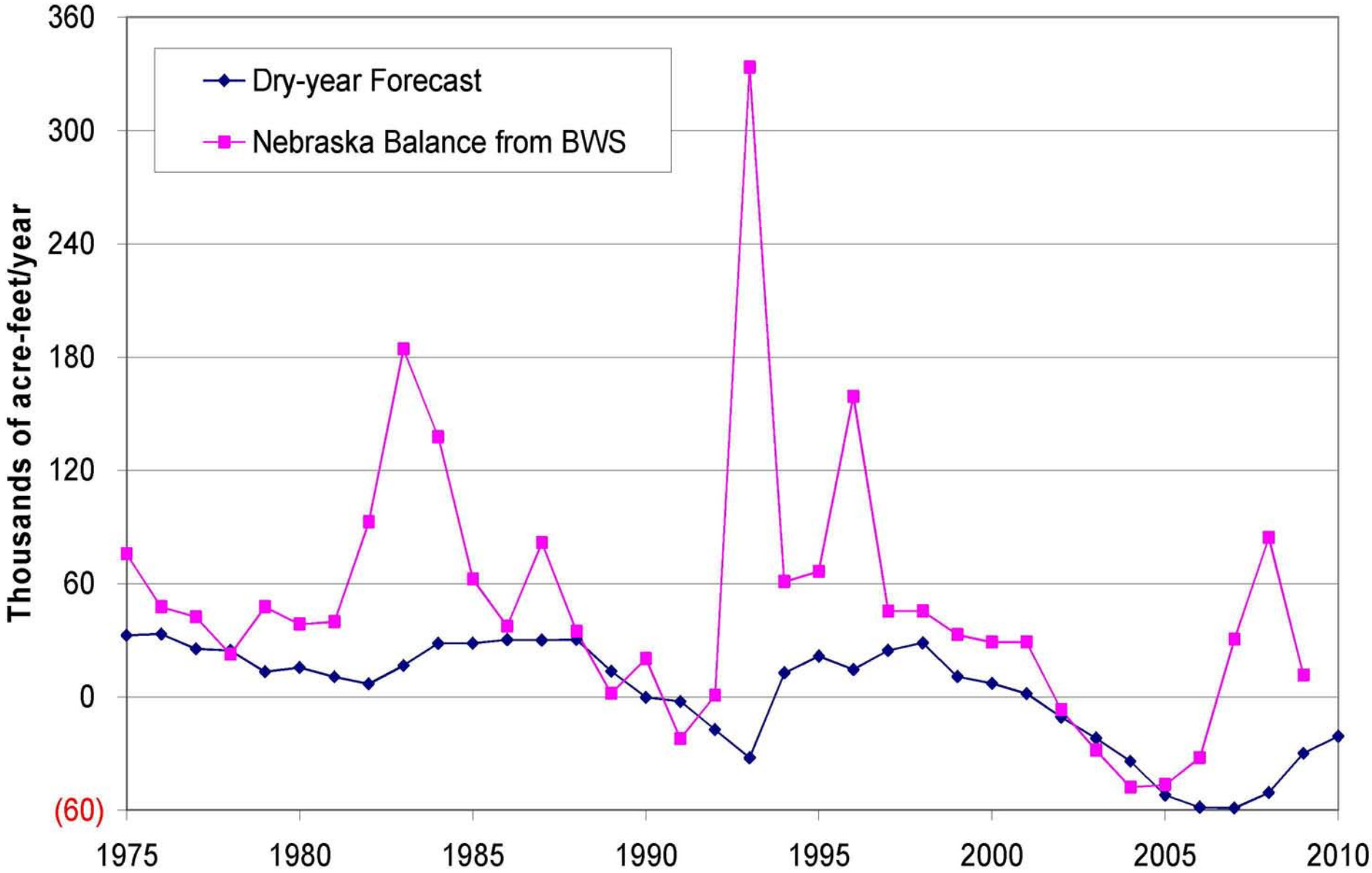
KS000212

Comparison of Actual Stateline Flows vs. Dry Year Predictions



KS000213

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



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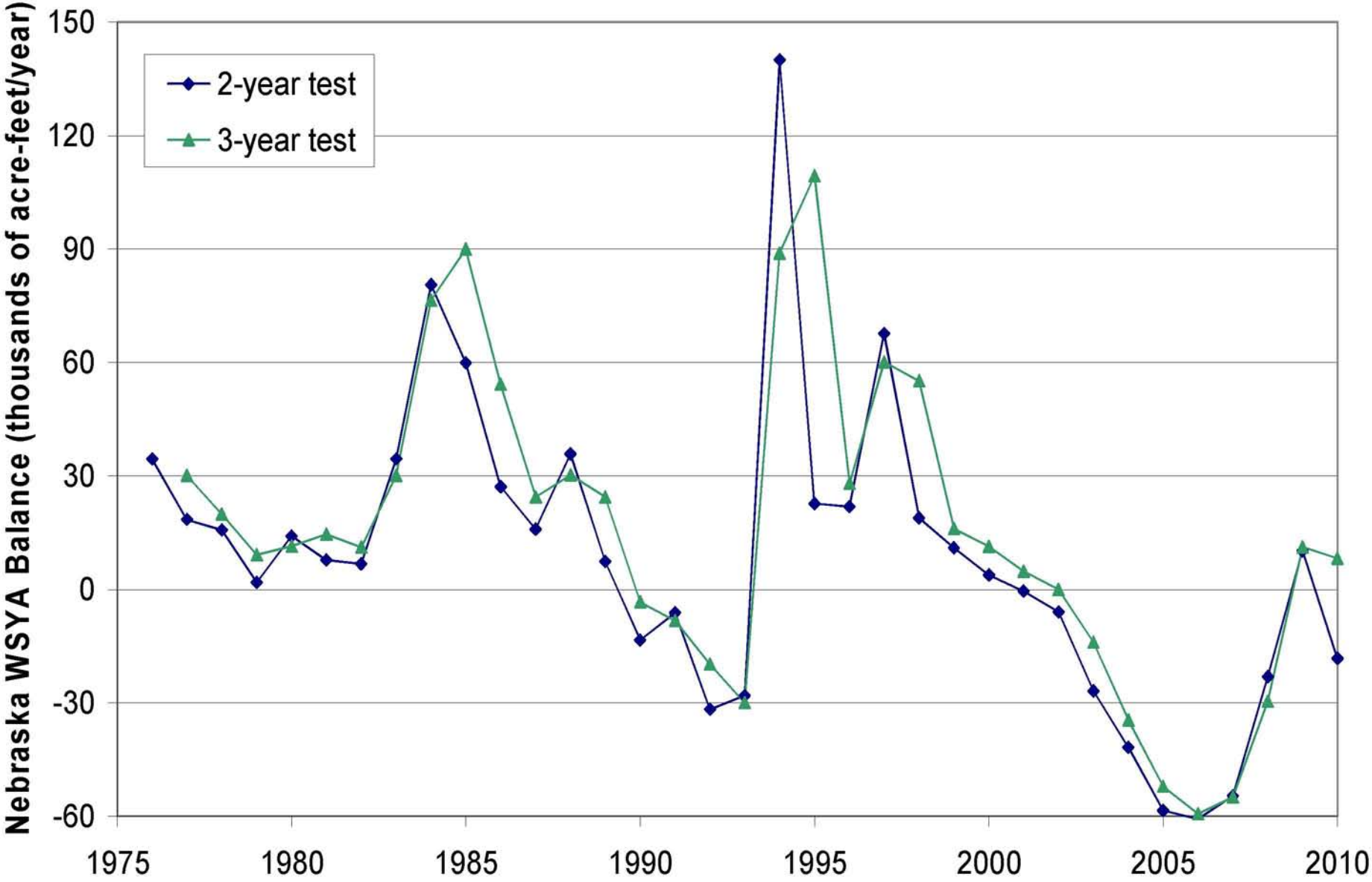
Incorporating this Forecast into the Compact Compliance Flowcharts

- 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

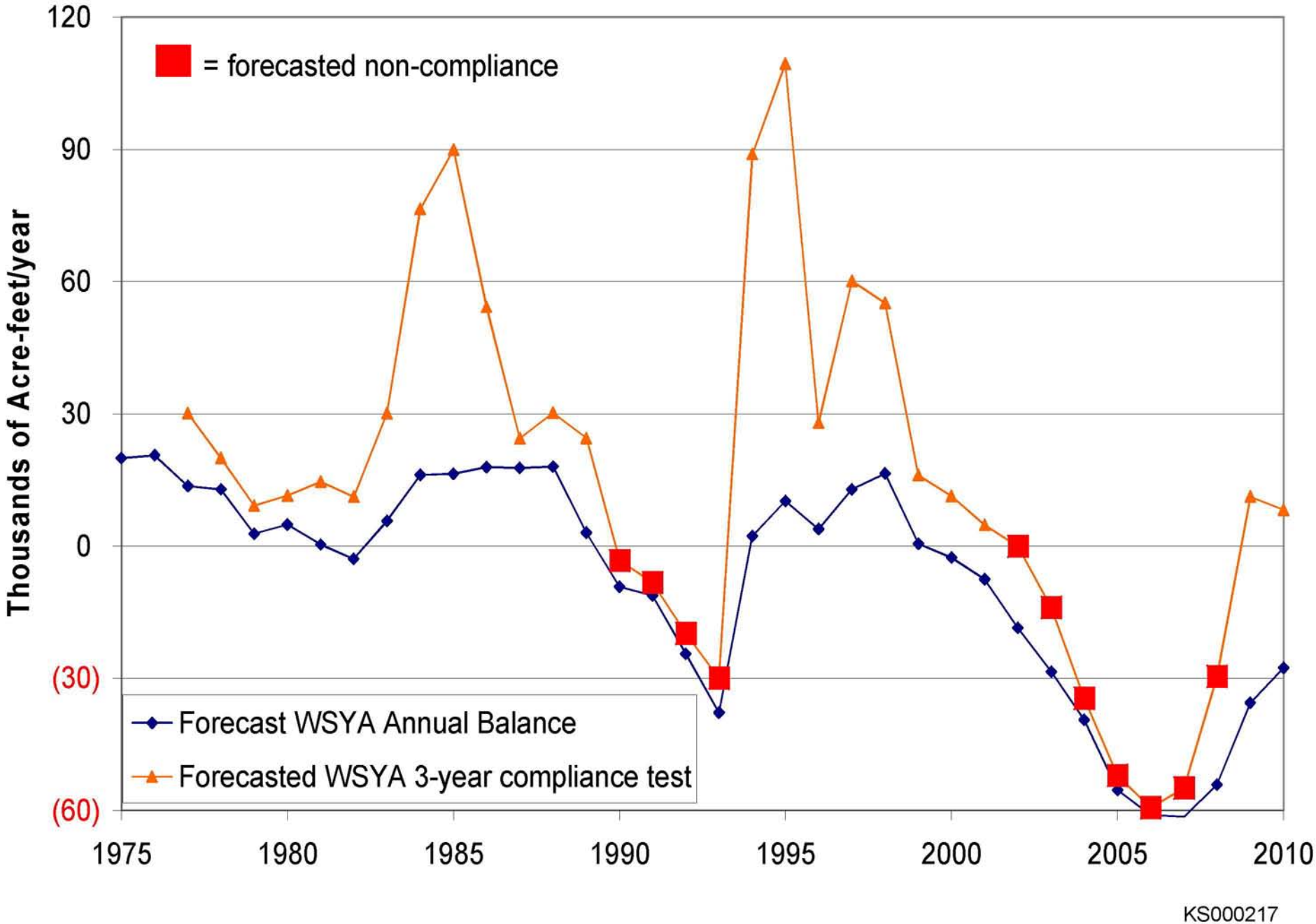
KS000215

Results of dry-year forecast incorporated into WSYA compliance tests



KS000216

Forecast of WSYA Compact Compliance



KS000217

Questions?

Preliminary 2009 Republican River Compact Accounting Results and 2010 Forecast

Curtis, Nebraska

KS000219

Overview

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

KS000220

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…"

KS000221

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

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Preliminary 2009 Results

KS000223

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

reliminary Results: 1-Year Balance bove Guide Rock

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

KS000225

reliminary Results: 2-Year Average bove 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

KS000226

reliminary 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

KS000227

Looking Forward to 2010 and 2011

KS000228

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

KS000229

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

KS000230

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

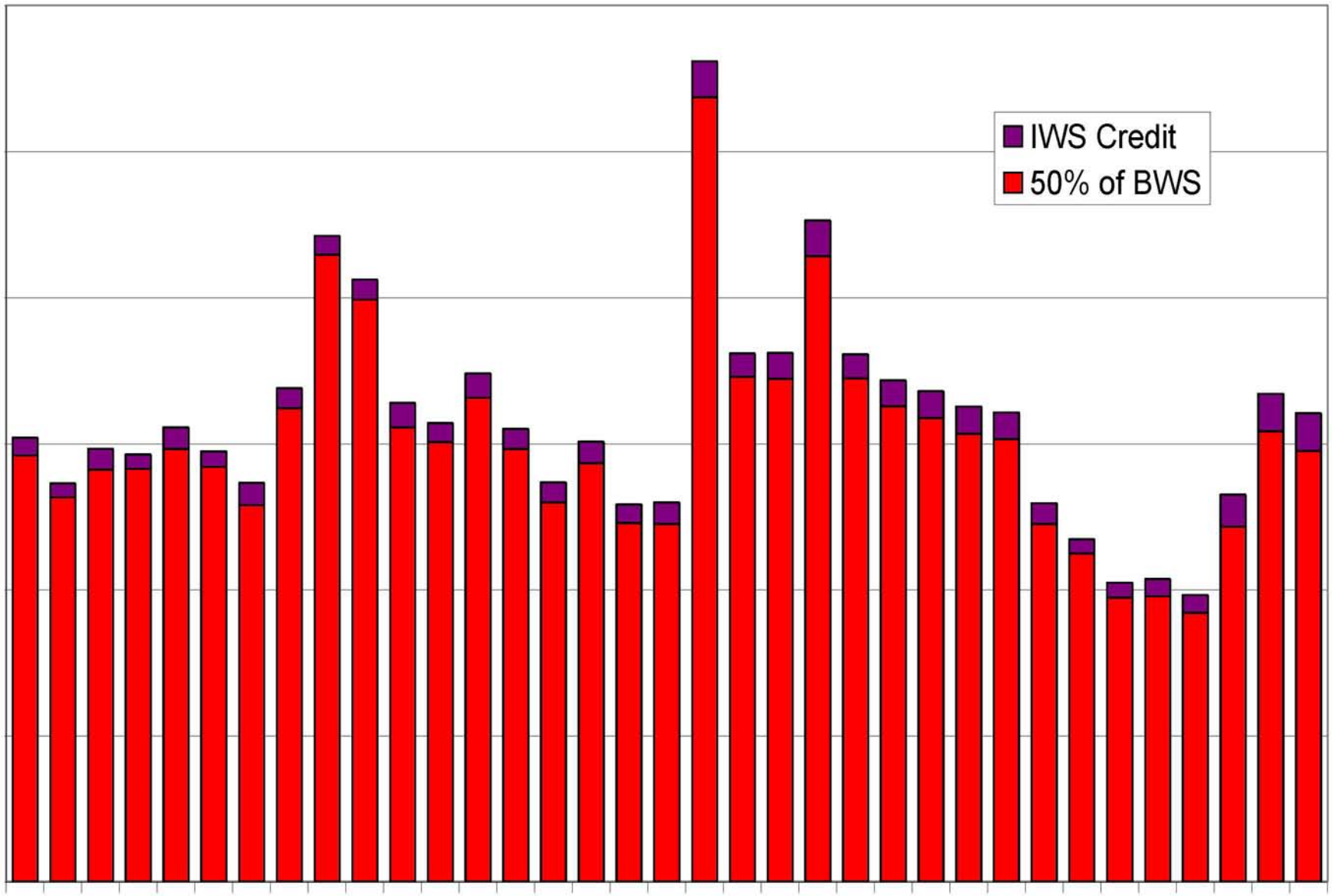
KS000231

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

KS000232

Nebraska's Water Suply Above Hardy



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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)

KS000234

Questions?

KS000235