Ogallala-High Plains Fringe Area

2007 Field Analysis Summary

Subbasin Water Resource Management Program

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I. Introduction

The High Plains aquifer underlies about 174,000 square miles of the central United States in the Great Plains east of the Rocky Mountains. The aquifer underlies portions of eight states including South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, New Mexico and Texas (Figure 2). The High Plains aquifer is the most abundant source of water in the region, which leads the economy of the area to depend upon it for irrigated agriculture. The volume of water in the High Plains aquifer in 2000 was about 2,980 million acre-feet, which ranged from 40 million acre-feet in New Mexico to about 2,000 million acre-feet in Nebraska (McGuire et al., 2003; Figure 1).

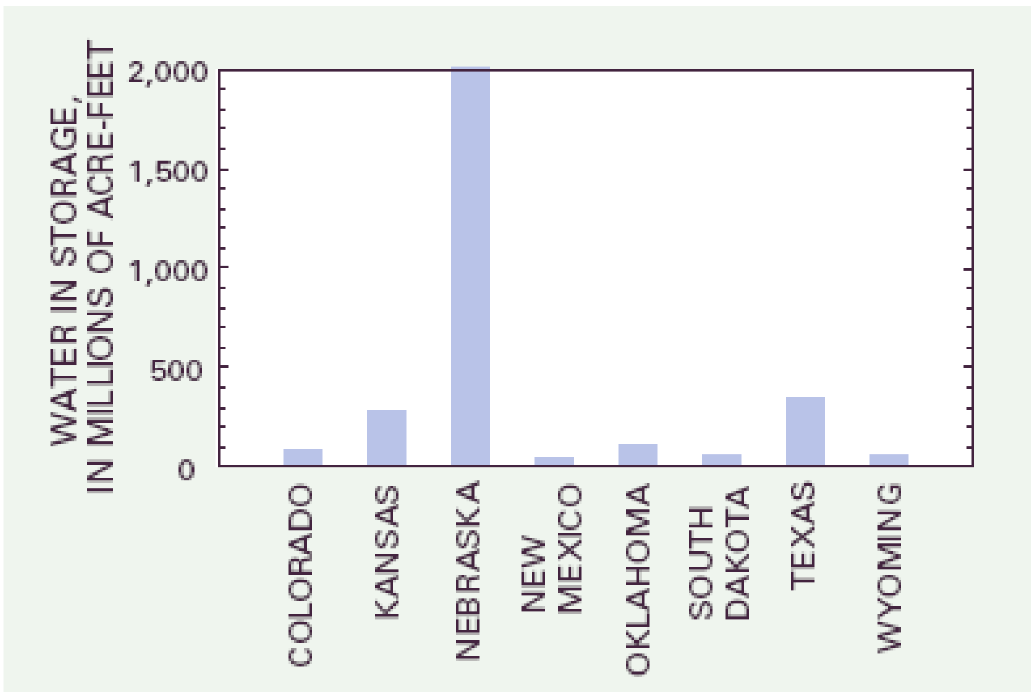

Figure 1: Water in storage in the Ogallala-High Plains aquifer, 2000, by state

The Ogallala Formation is the principal geologic unit in the High Plains aquifer, and it accounts for approximately 134,000 square miles of the High Plains aquifer. Groundwater flow is generally from west to east, at an average rate of approximately 1 foot per day, and discharges naturally to streams and springs and through atmospheric evapotranspiration. Estimated recharge rates vary from 0.024 inches per year in part of Texas to 6 inches per year in south-central Kansas.

The area is characterized as "between a semiarid to arid environment and a moist sub humid environment" (Lohman, 1953). Mean annual precipitation increases eastward across the area, from 14 inches in the west to about 30 inches in eastern Nebraska. Seventy-five percent of precipitation falls as rain during the growing season (April – September) as localized thunderstorms. Persistent winds and high summer temperatures cause high evaporation rates. The mean annual pan evaporation ranges from approximately 60 inches in northern Nebraska and southern South Dakota to about 105 inches in western Texas and southeastern New Mexico.

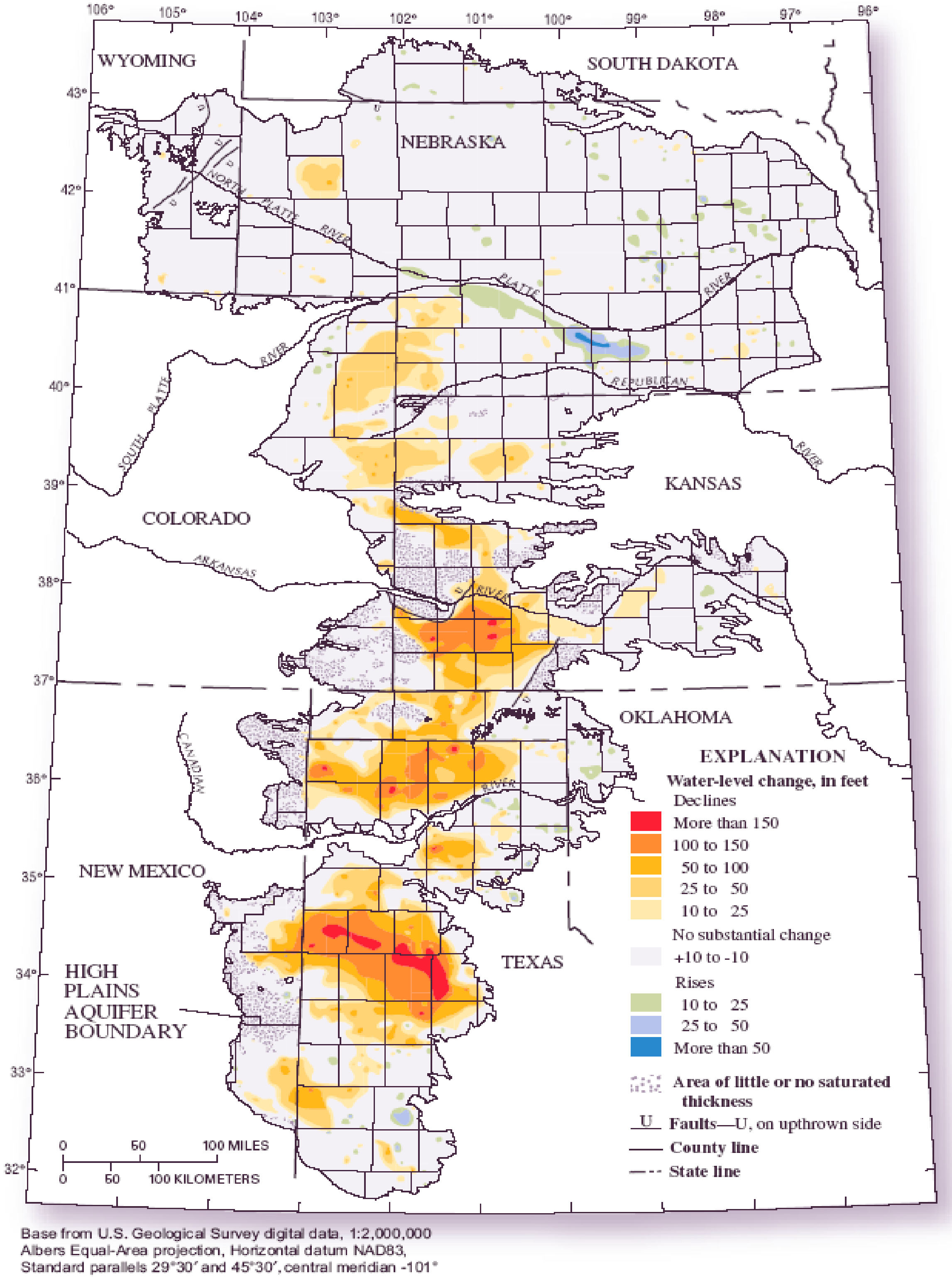

Figure 2: Water level changes in the Ogallala-High Plains aquifer, predevelopment to 2003 (Nebraska Conservation and Survey Division, 2004)

This report focuses on parts of the Ogallala-High Plains aquifer in western Kansas outside of Northwest Kansas Groundwater Management District No. 4 (GMD #4), Western Kansas Groundwater Management District No. 1 (GMD #1), and Southwestern Kansas Groundwater Management District No. 3 (GMD #3). These parts of the aquifer are known as “fringe areas” because they are generally located on the edge of the aquifer where there is marginal saturated thickness. Along the eastern edges of the fringe area, the aquifer tapers and in some locations terminates in outflow seeps to small streams. The most extensive fringe area is in northwest Kansas (Figures 5, 10).

II. Precipitation

Precipitation in northwest Kansas averages 20.17 inches (in.) per year based on 45 precipitation stations from 12 counties. Figure 3 shows the annual variation in precipitation. This chart was derived from National Climatic Data Center (NCDC) stations located in the following 12 counties: Cheyenne, Rawlins, Decatur, Norton, Sherman, Thomas, Sheridan, Graham, Wallace, Logan, Gove and Trego counties. The data is downloaded for each station and then averaged to create the following chart. The chart shows that there have been a number of years in which precipitation was below 15 in. per year. In contrast there are a number of years that precipitation has been greater than 25 in. per year. Annual precipitation data for these NCDC stations is currently available through 2006. Currently, only 32 precipitation stations are active and used for the 2007 chart. From January 2007 through October 2007, the average precipitation for northwest Kansas was 17.46 in., which suggests that the 2007 annual average was on track to be below the long-term annual average unless substantial precipitation was received in November and December (Figure 4).

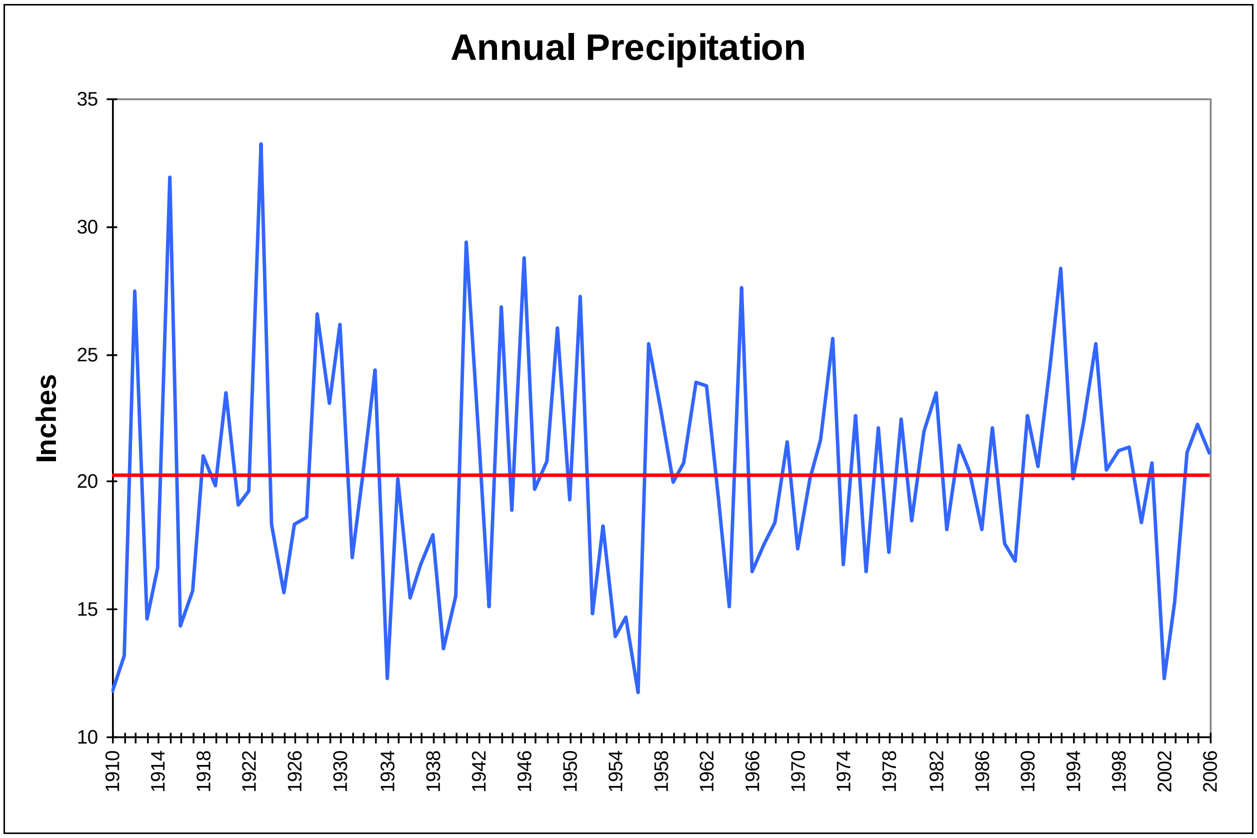

Figure 3: Annual Precipitation for Northwest Kansas, 1910-2006.

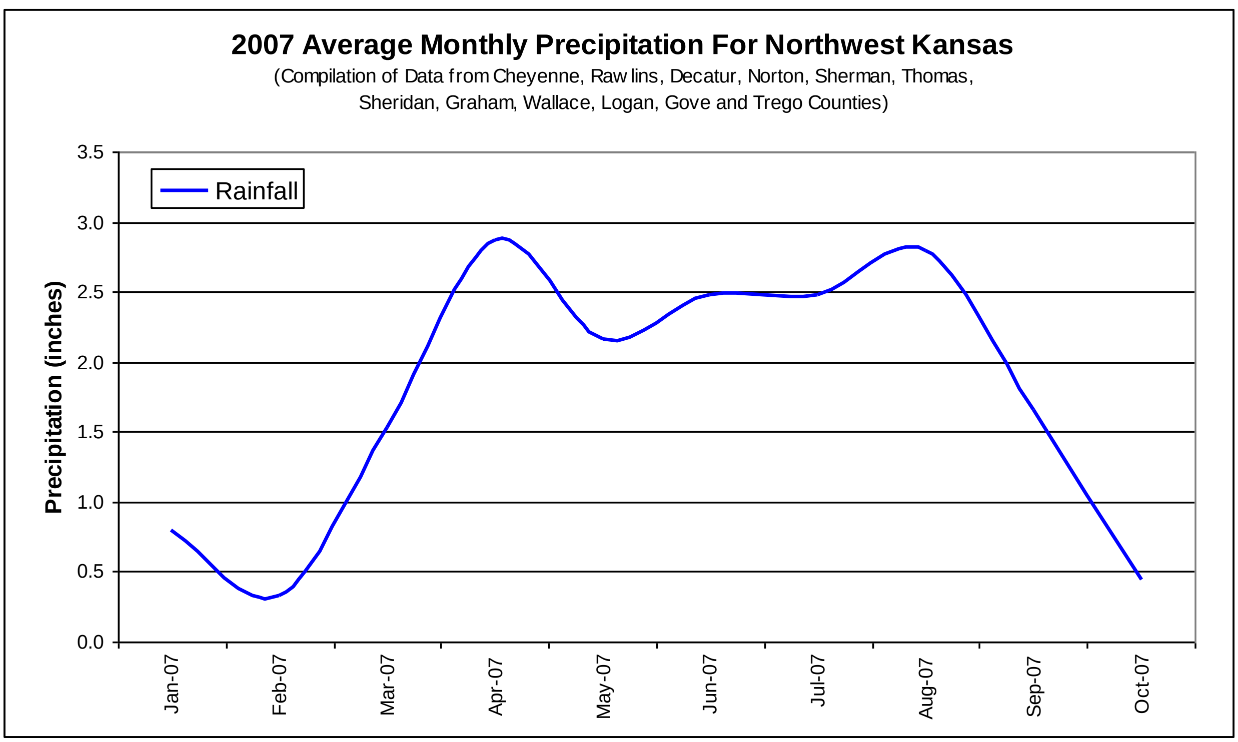

Figure 4: Average Monthly Precipitation, Jan 2007-Oct 2007.

III. Surface Water

There are four tributaries in the northwest Kansas Ogallala-High Plains fringe area (outside GMD #4) that have historical U.S. Geological Survey (USGS) gage data available: South Fork Republican River, Beaver Creek, Sappa Creek and Prairie Dog Creek (Figure 5). All four tributaries are located in portions of Cheyenne, Rawlins, Decatur, Norton and Phillips Counties.

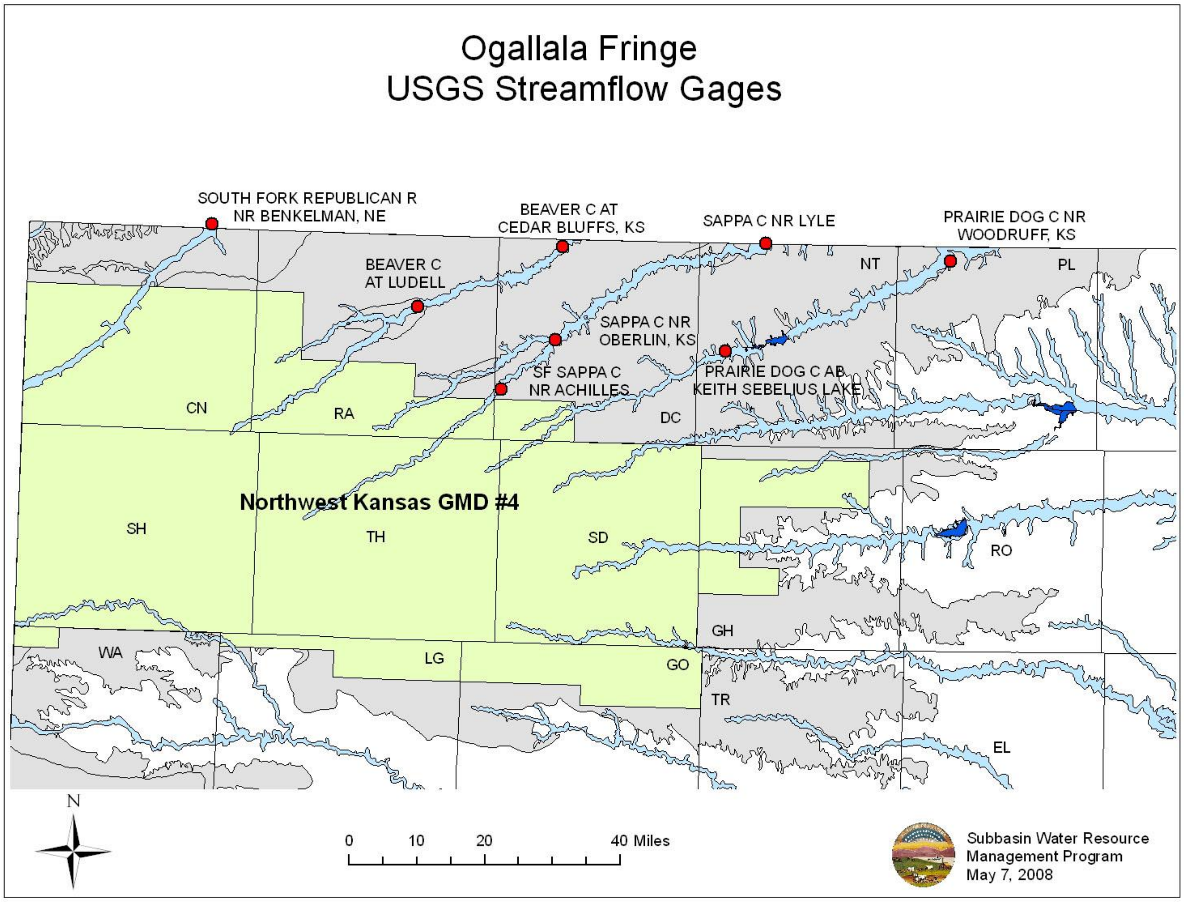

Figure 5: USGS Streamflow gages in the Northwest Kansas Ogallala-High Plains Fringe

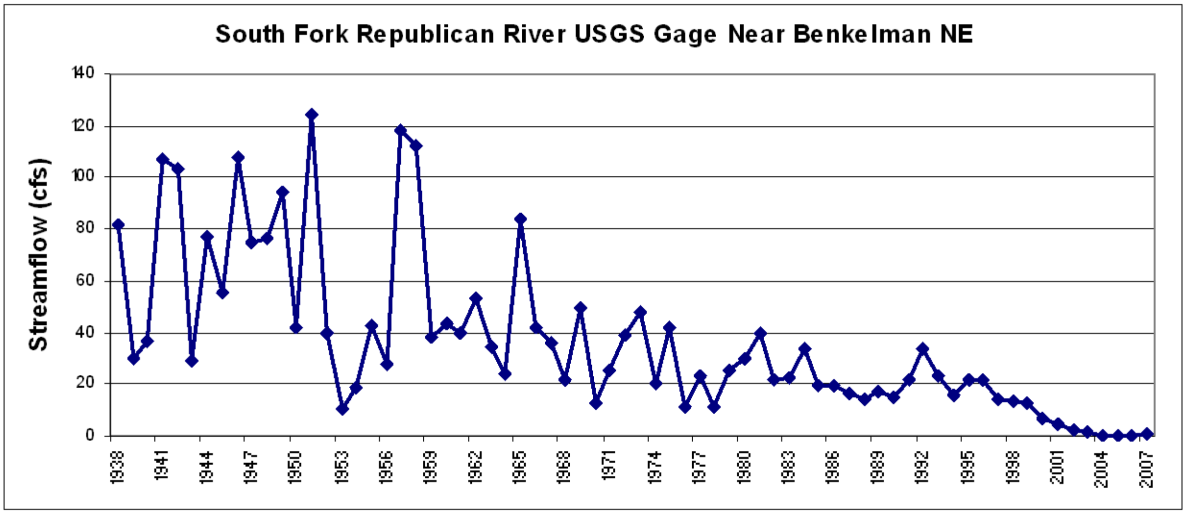

Figure 6: Streamflow for South Fork Republican River near Benkelman, NE 1938-2007

The section of the South Fork Republican River from the GMD #4 boundary to the Kansas-Nebraska state line south of Benkelman, Nebraska (Figure 5) is of interstate significance because this gage is used for Republican River Compact accounting. Due to its proximity, the USGS gage near Benkelman is also useful for examining discharge from the northwest Kansas Ogallala fringe. The 1938 to 2007 annual mean data at this gage displays a significant decrease in streamflow over time (Figure 6). The long-term average streamflow is 36.75 cfs. The last time the annual average streamflow was over 36.75 cfs was in 1981 when it averaged 39.8 cfs. The annual average streamflow at the Benkelman gage has been near zero for the past several years.

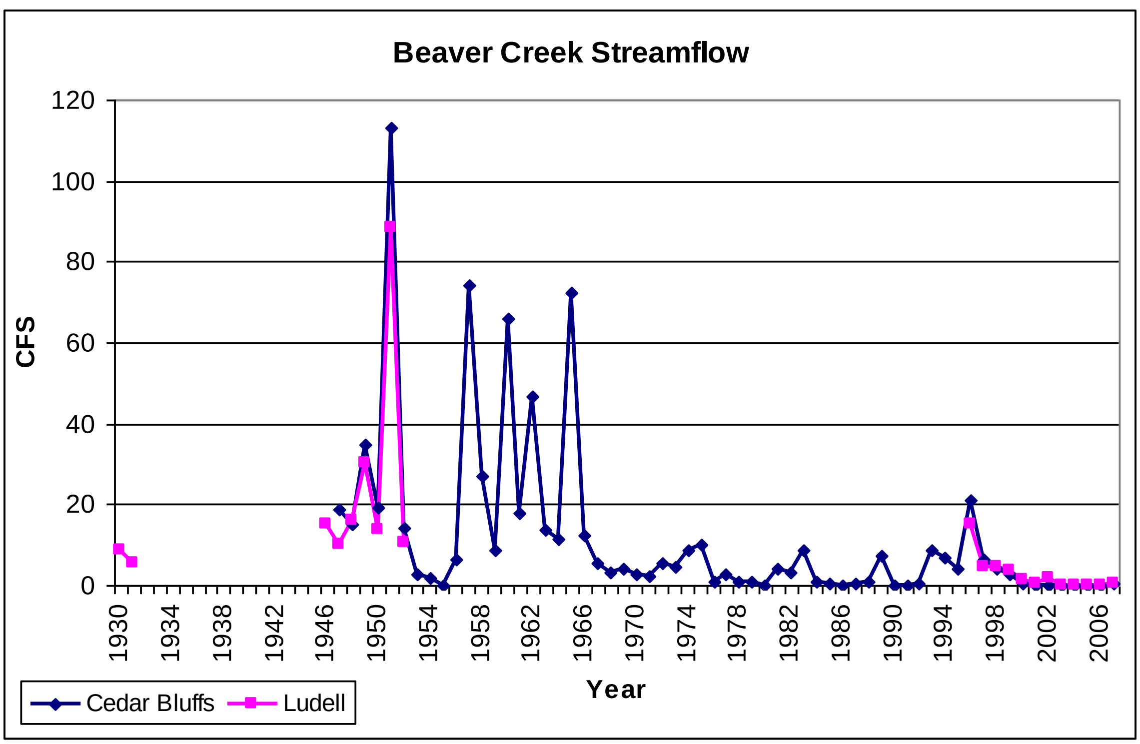

Figure 7: Streamflow for Beaver Creek at Ludell and Cedar Bluffs 1930-2007

The Ludell gage is located about 5 miles downstream of the confluence of the North and South Forks of Beaver Creek at Atwood and has a record dating back to 1930. Cedar Bluffs gage is located a little over one mile before the Beaver crosses over the state line to Nebraska. It has a record dating back to 1947. Over the period of record the average streamflow at Cedar Bluffs was 11.65 cfs and 11.02 cfs at Ludell. The highest average yearly streamflow on Beaver Creek was recorded at the Cedar Bluffs gage in 1951 at 113 cfs (Figure 7). Both streamflow gages had decreasing streamflows averaging 0.57 cfs at Ludell and 0.18 cfs at Cedar Bluffs from 2000-2007.

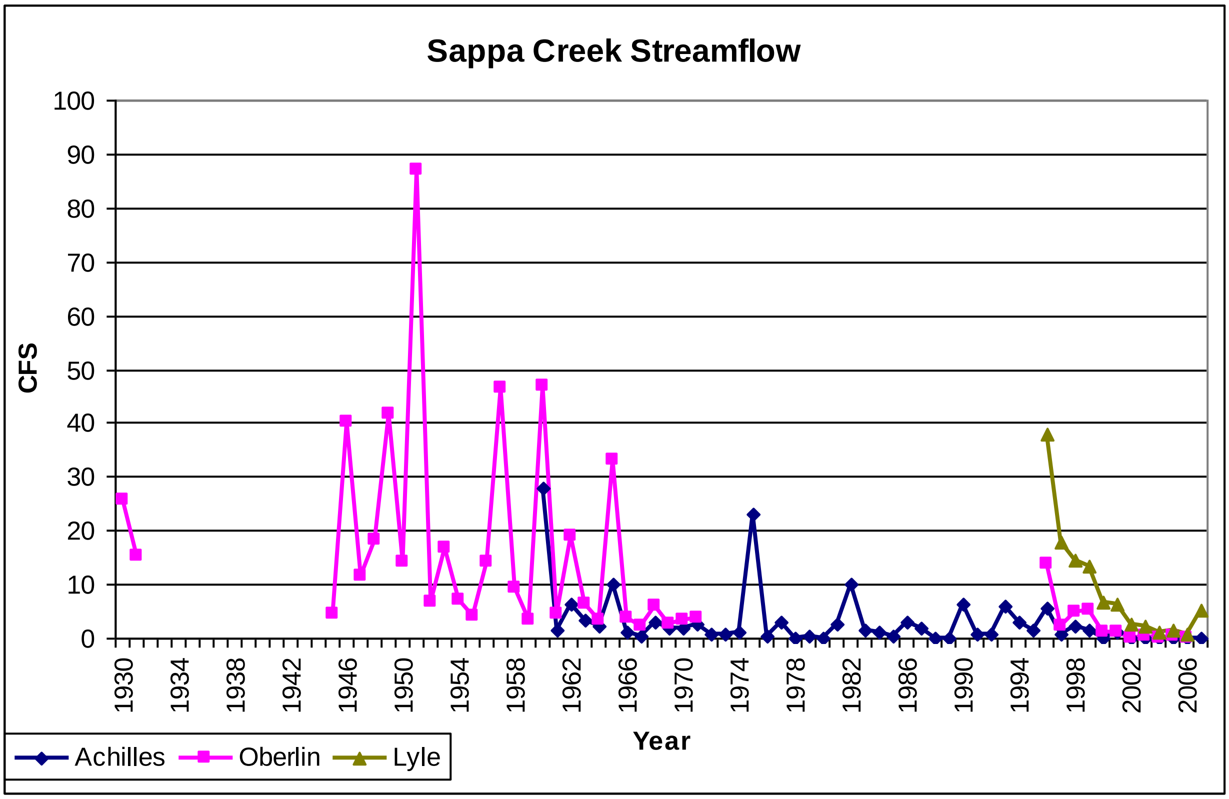

Figure 8: Streamflow for Sappa Creek at Lyle, Achilles and Oberlin 1930-2007

The Achilles gage is located on the South Fork Sappa near where baseflow typically begins and has a record dating back to 1960. The Oberlin gage was located a few miles downstream of the confluence of the North and South Forks of Sappa Creek. It has a measurement record from 1930-2007 as it was dropped off the USGS network in 2007. The Lyle gage is located on the KS-NE state line and has a record dating back to 1996. Over the period of record the average streamflow at Achilles was 2.95 cfs, 13.23 cfs at Oberlin, and 9.15 cfs at Lyle. The highest average yearly streamflow was recorded at the Oberlin gage in 1951 at 87 cfs (Figure 8). All three gages had decreasing streamflows averaging 0.16 cfs at Achilles, 0.44 cfs at Oberlin, and 3.22 cfs at Lyle from 2000-2007.

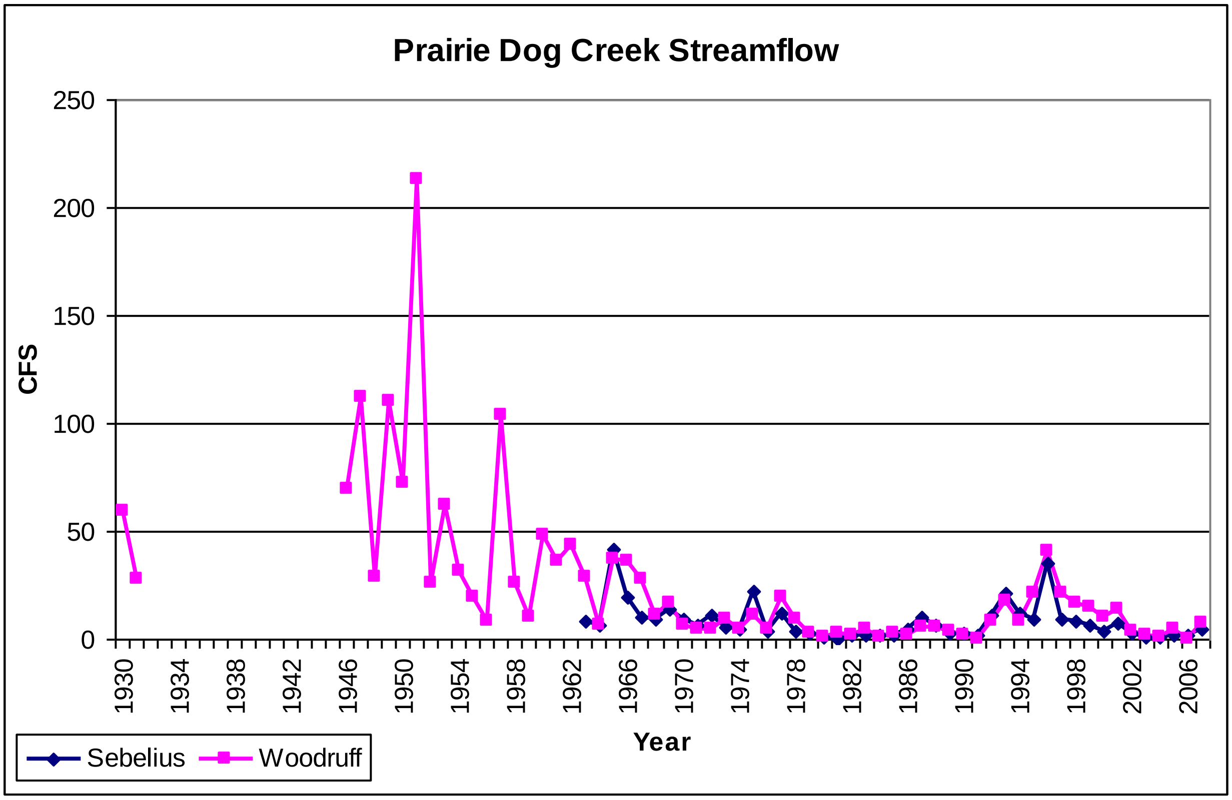

Figure 9: Streamflow for Prairie Dog Creek near Woodruff 1930-2007

The Sebelius gage is located approximately 5 miles upstream of the upper end of Keith Sebelius Reservoir and has a record dating back to 1963. The Woodruff gage is located near the KS-NE state line and has a record dating back to 1930. Over the period of record the average stream flow at Sebelius was 8.09 cfs and 24.61 cfs at Woodruff. The highest average yearly streamflow on Prairie Dog Creek was recorded at the Woodruff gage in 1951 at 213 cfs (Figure 9). Both streamflow gages had decreasing streamflows averaging 2.97 cfs at Sebelius and 5.28 cfs at Woodruff from 2000-2007.

IV. Groundwater

The Ogallala-High Plains fringe area has few monitoring wells with historical data. The historic fringe water level data is statistically inadequate to be applied to a section level approach, which is needed for adequate data to evaluate the hydrologic conditions. In an effort to improve the water level data coverage, the Subbasin Water Resource Management Program (SWRMP) added nearly 100 wells to the annual monitoring network in northwest Kansas in January 2004 (Figure 10). A few of these wells are in areas that have over 100 feet of saturated thickness, which is uncommon to this area.

The SWRMP measures water levels in the Ogallala-High Plains fringe areas throughout western Kansas. There are 92 wells measured annually. SWRMP collects additional water level measurements tri-annually, in the winter, spring and fall. Only winter (December, January and February) measurements are used for the monitoring well water level charts, since those measurements are considered to be the least influenced by groundwater pumping. Figure 11 to

Figure 24 chart groundwater levels in all fringe monitoring wells (legal descriptions are available in the appendix) and the five-year rolling averages. The y-axis is labeled depth below land surface (DBLS) with units in feet (ft).

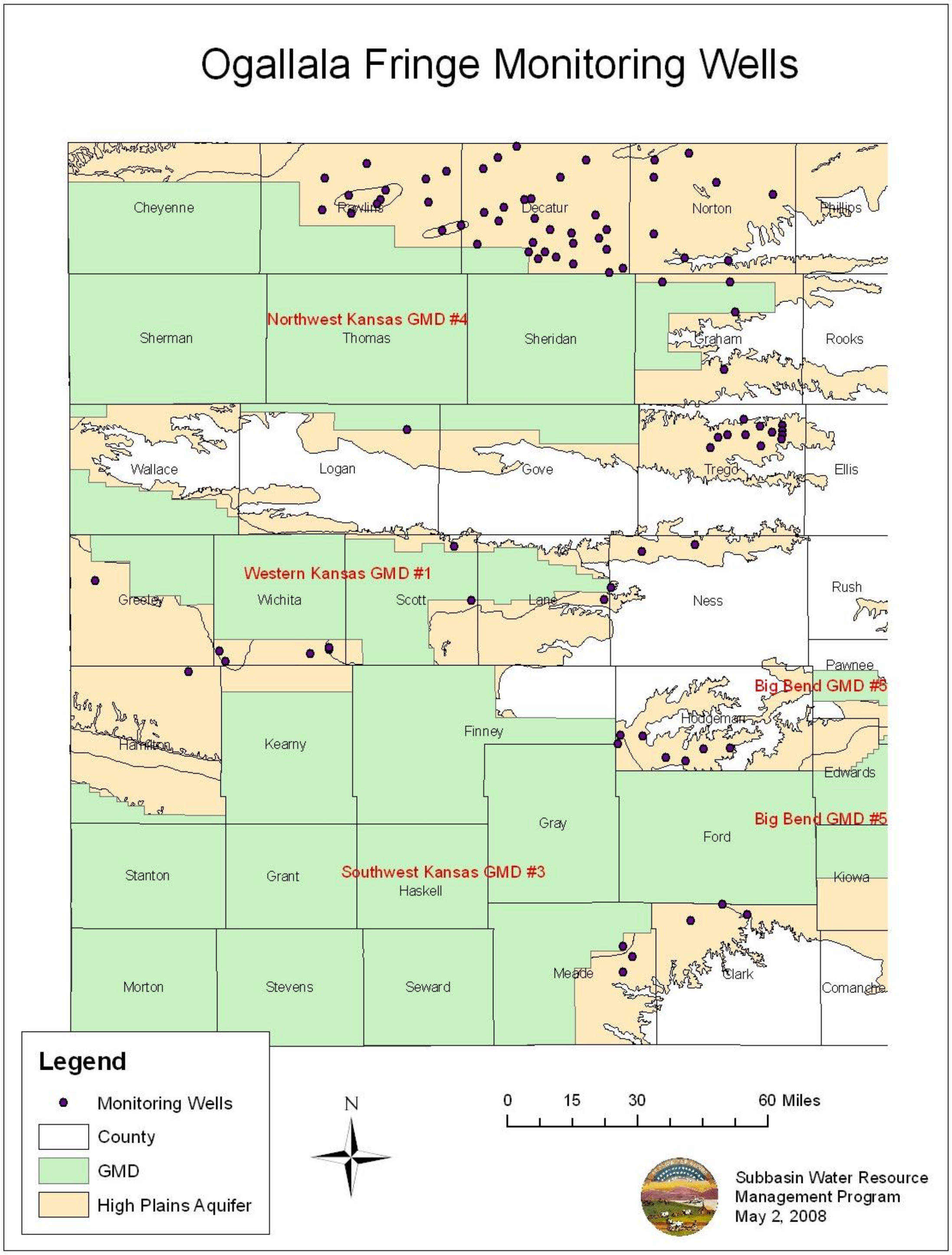

Figure 10: Monitoring wells in the fringe of the Ogallala-High Plains project area

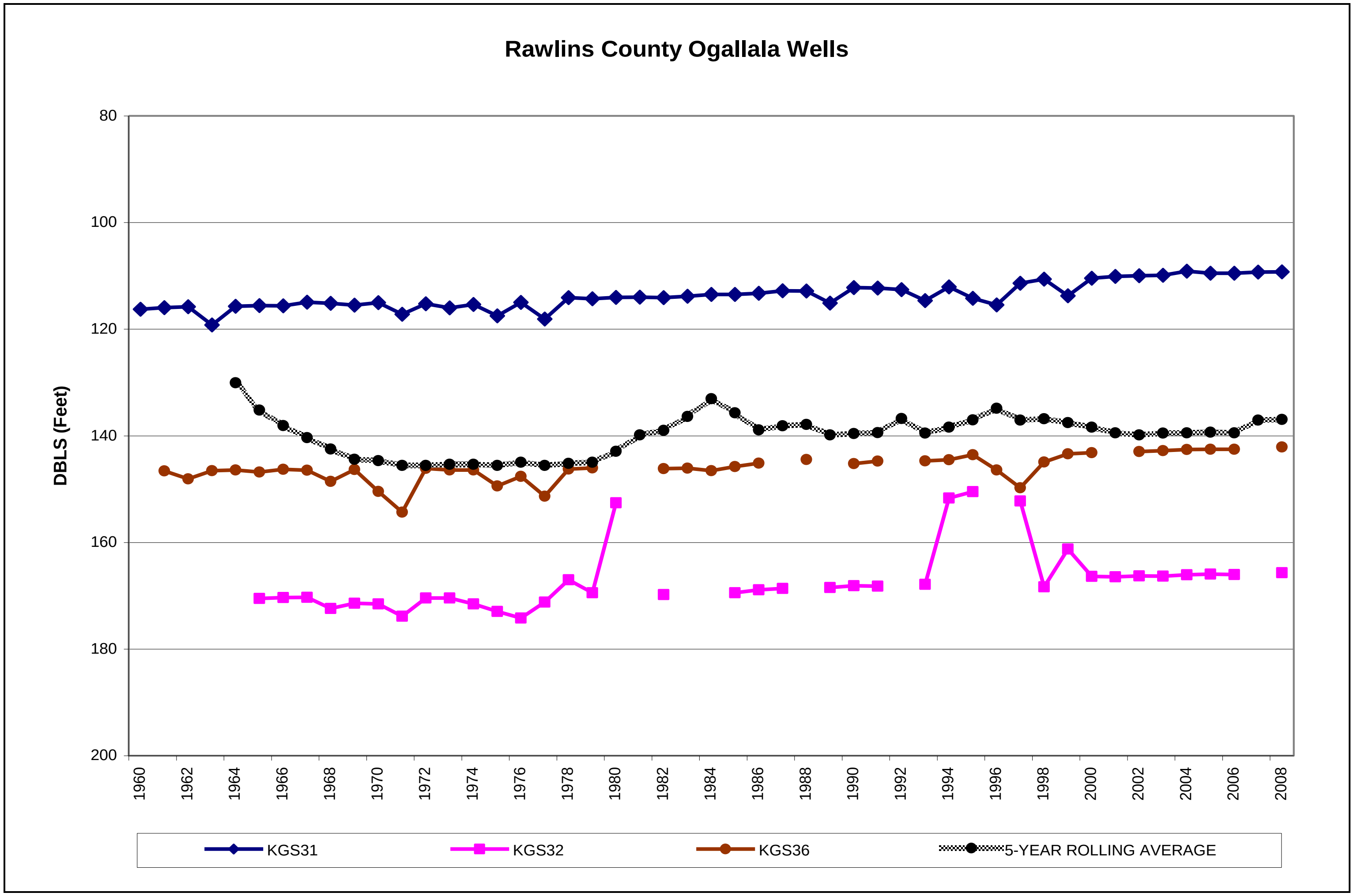

Figure 11: Annually Measured Ogallala-High Plains Wells in the Fringe Area of Rawlins County (1960-2008)

Rawlins County has both alluvial and Ogallala-High Plains monitoring wells. There are three monitoring wells in the Ogallala-High Plains. These wells have data beginning in the 1960s. The water levels exhibit an average net increase of 5.45 ft (Figure 11) over the period of record. Since 1960, KGS31 has a net increase of 7.04 ft. The five-year rolling average has been stable over the past decade with minor increases in 2007 and 2008.

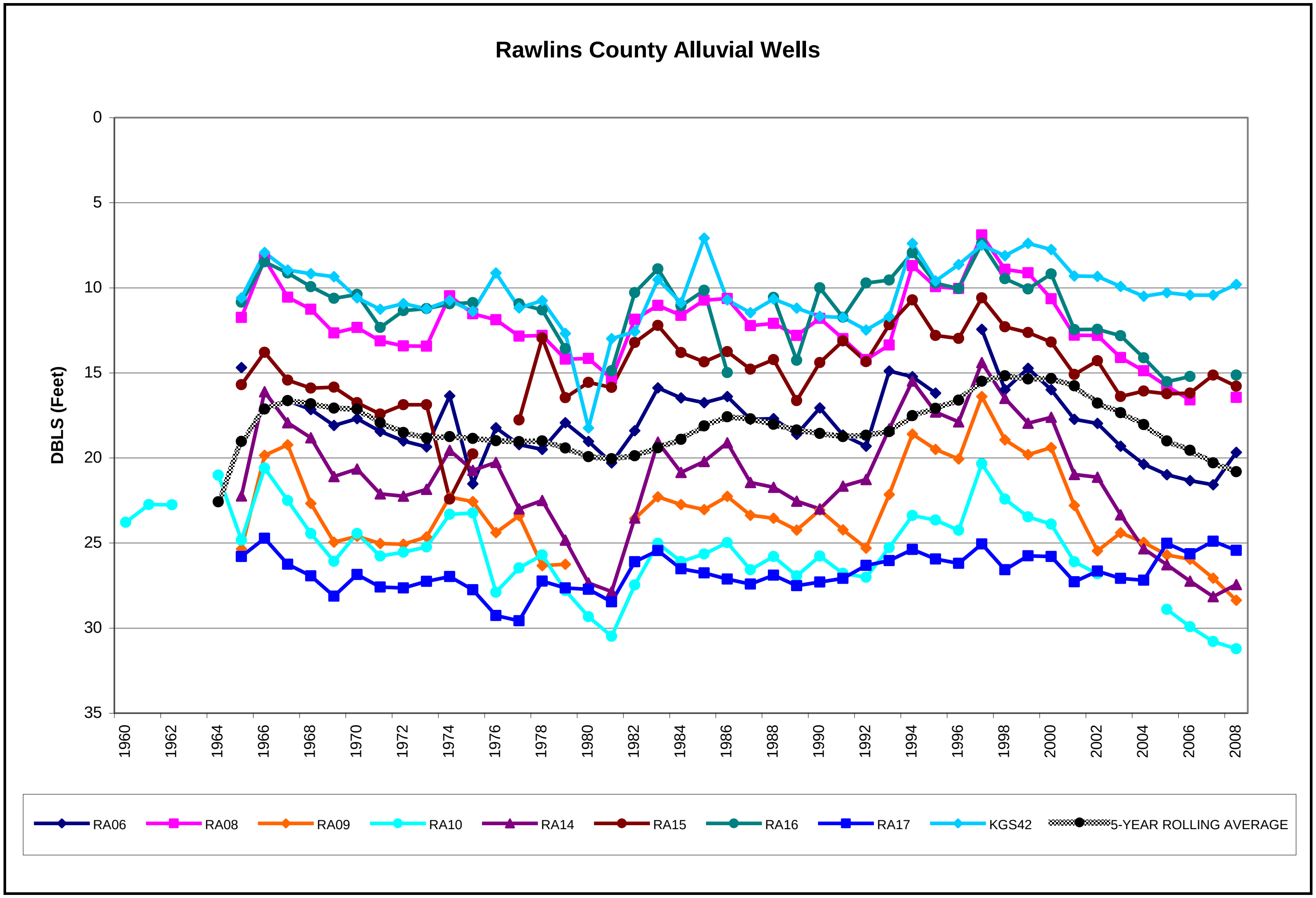

Figure 12: Annually Measured Alluvial Wells in the Fringe Area of Rawlins County (1960-2008)

Rawlins County has nine alluvial wells measured annually along Beaver and Sappa Creeks. Wells located in the alluvium along Beaver and Sappa Creek fluctuate over time and do not have a pronounced long term rising or declining trend (Figure 12). The five-year rolling average has steadily declined about 5 ft since 2000. RA10 has the longest record dating back to 1960. The water levels have increased and declined in that time period. RA10 exhibited a net decline of 7.43 ft since 1960.

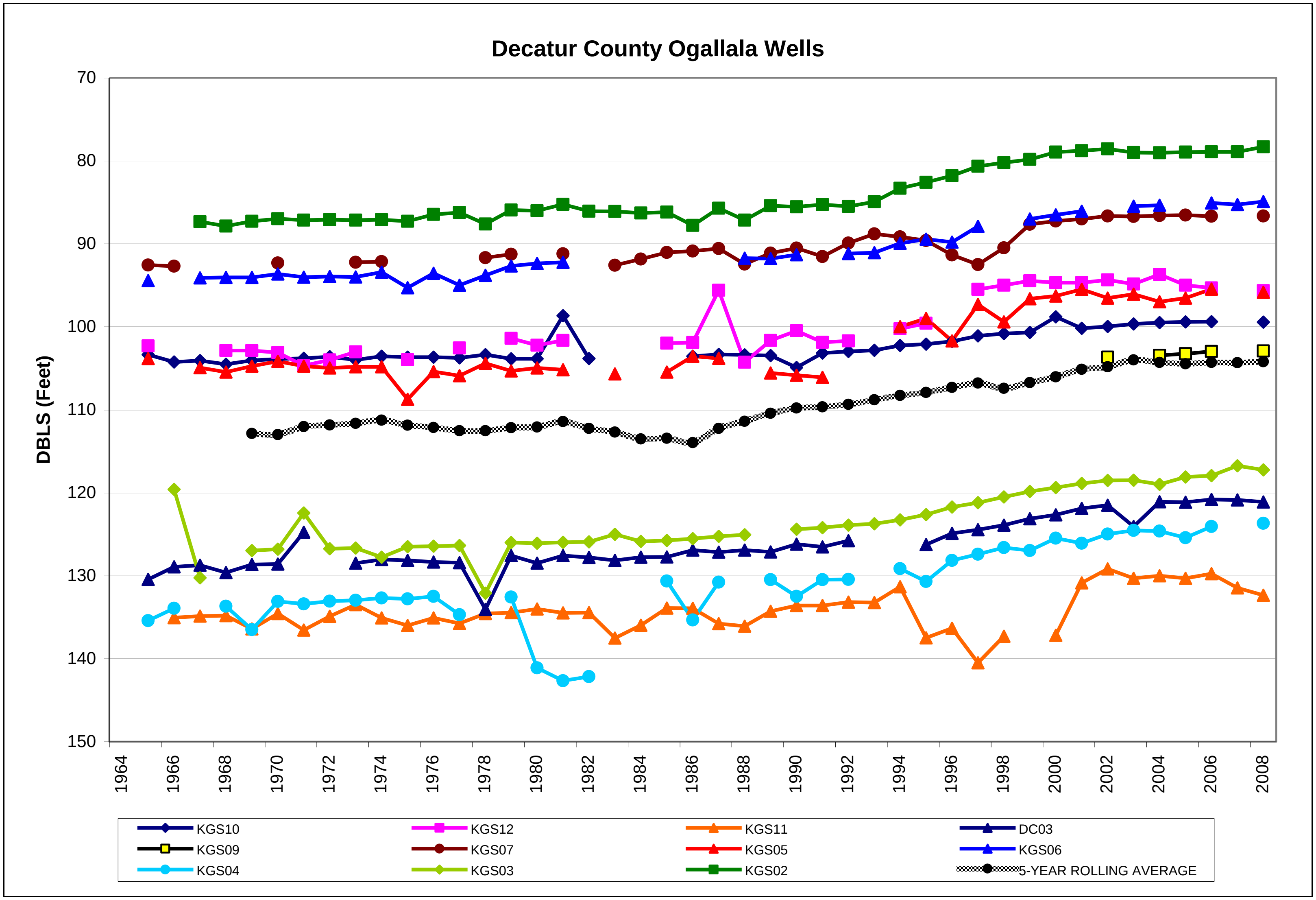

Figure 13: Annually Measured Ogallala-High Plains Wells in the Fringe Area of Decatur County (1965-2008)

Decatur County has a number of wells where measurements begin in 1965. Eleven monitoring wells have been charted in Figure 13. Ogallala wells in Decatur County show an average 6.35 ft net increase. The five-year rolling average shows a net increase (0.44 ft) in water levels since 1987.

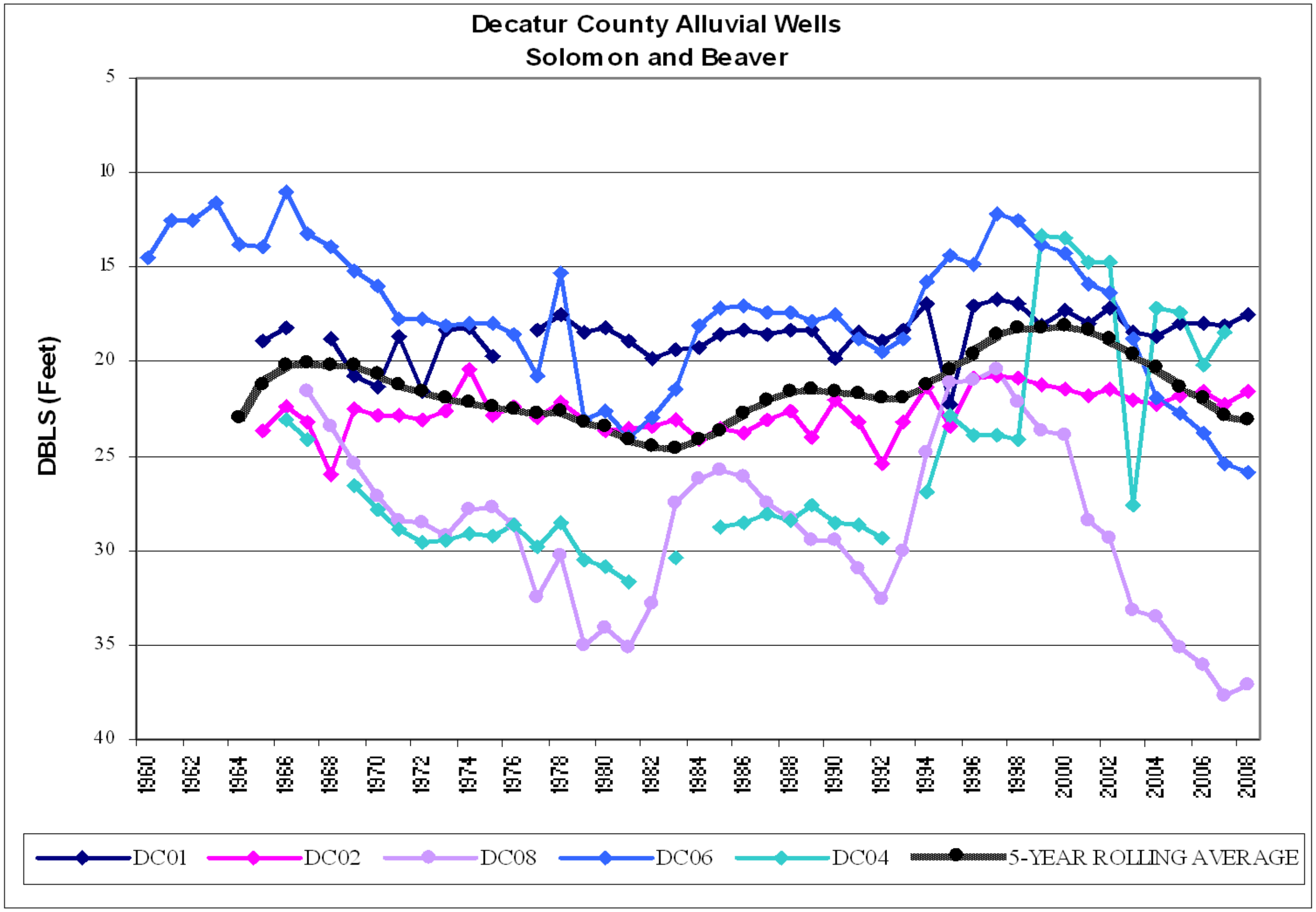

Figure 14: Annually Measured Alluvial Wells in the Fringe Area of Decatur County, Upper North Solomon and Beaver Creek (1960-2008)

NOTE: The 5-year rolling average is for all the alluvial wells in Decatur County

Decatur County has five alluvial monitoring wells. DC01 and DC02 are in the upper Solomon alluvium. Both wells are higher than their first measurement in 1965. The other three wells are in the Beaver Creek alluvium. Both DC06 and DC08 have net declines of 11.39 ft and 15.51 ft respectively. DC04 saw a net increase of 4.56 ft (Figure 14) since 1966.

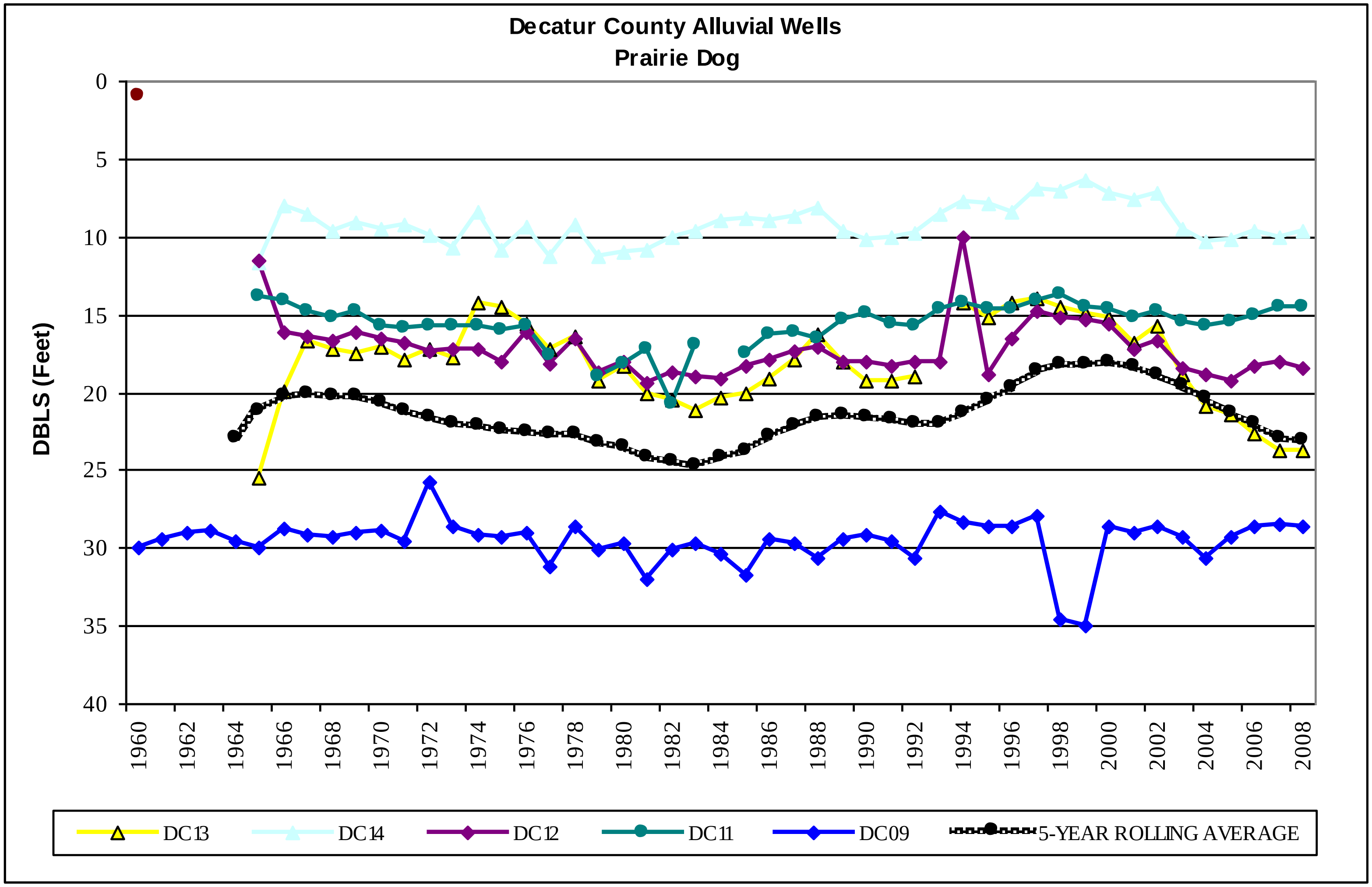

Figure 15: Annually Measured Alluvial Wells in the Fringe Area of Decatur County, Prairie Dog Creek (1960-2008)

NOTE: The 5-year rolling average is for all the alluvial wells in Decatur County

Decatur County has five alluvial monitoring wells in Prairie Dog Creek alluvium. Only DC12 has had a net decline (6.93 ft) since its inception. The other four wells have maintained water levels over time with short-term increases and decreases (Figure 15). The five-year rolling average was on a downward trend from 2001 to 2008.

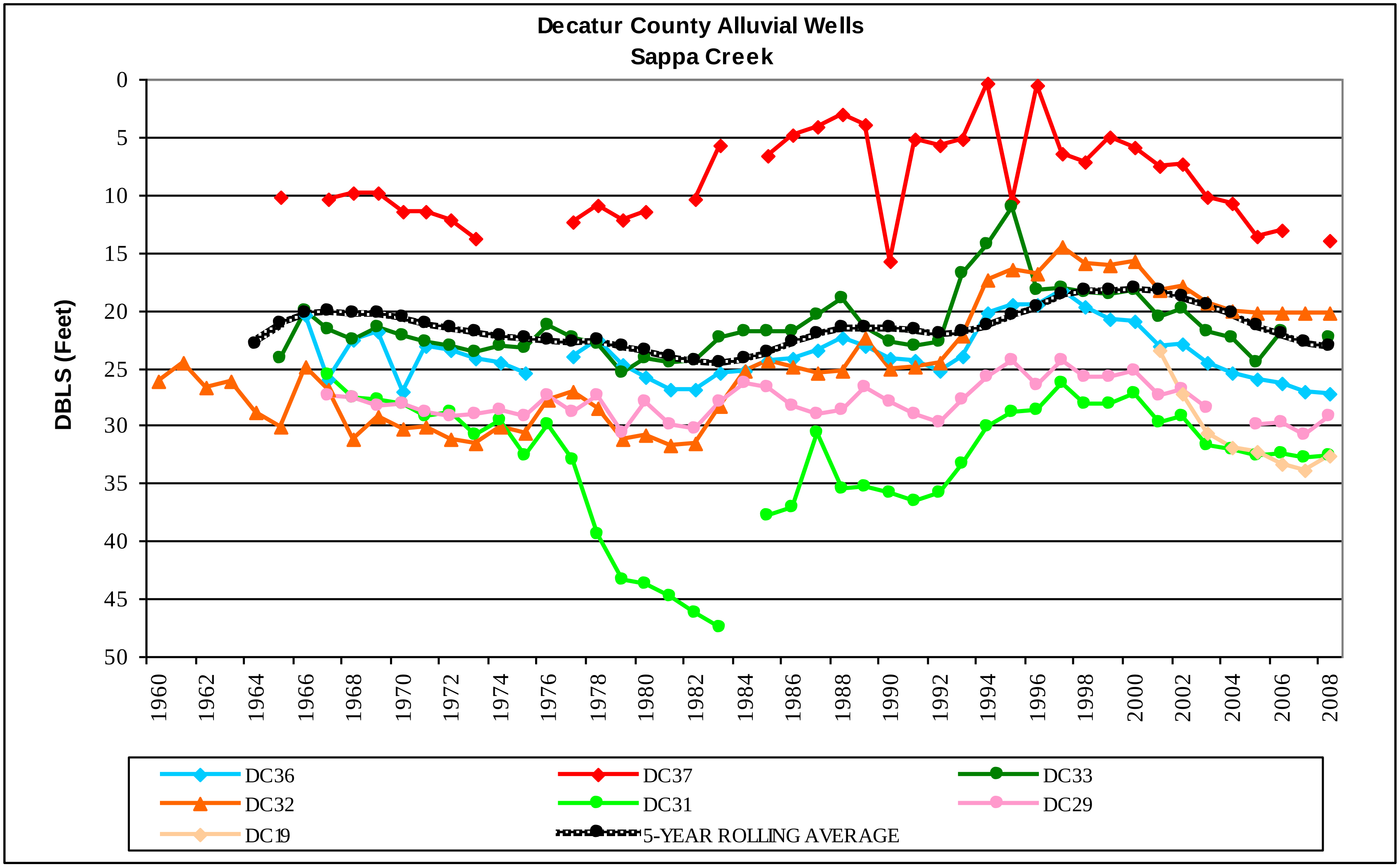

Figure 16: Annually Measured Alluvial Wells in the Fringe Area of Decatur County, Sappa Creek (1960-2008)

NOTE: The 5-year rolling average is for all the alluvial wells in Decatur County

Sappa Creek has seven monitoring wells in Decatur County. Five of the seven monitoring wells have had net declines over the period of record, with DC31 declining 6.93 ft and DC19 declining 9.23 ft. DC32 and DC33 had net increases of 5.81 ft and 1.78 ft respectively (Figure 18).

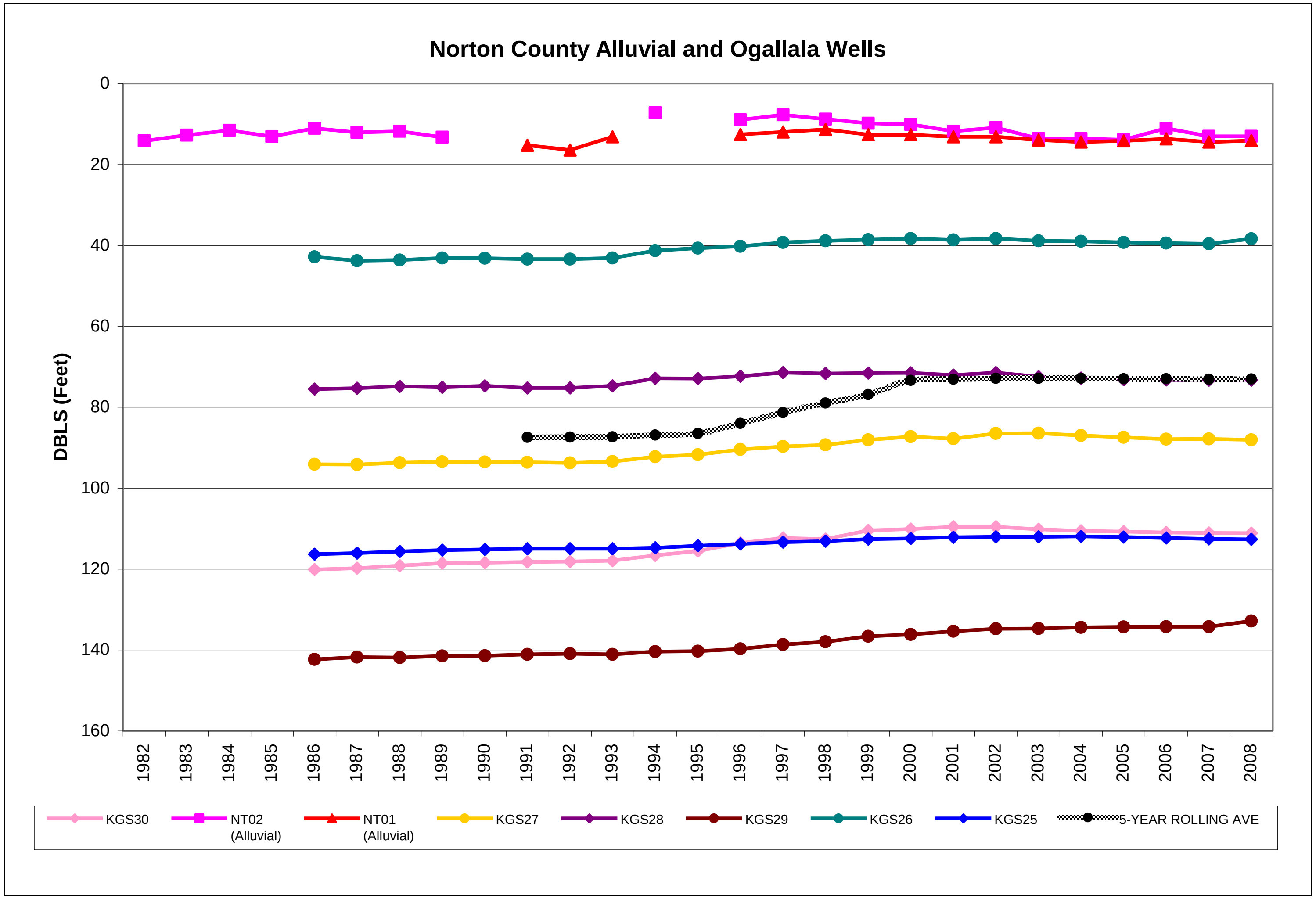

Figure 17: Annually Measured Wells in the Fringe Area of Norton County (1982-2008)

Norton County has a total of eight monitoring wells, two alluvial and six Ogallala. NT02 has the longest record beginning in 1982, while other wells were added to the network beginning in 1986. All wells show net increases over the period of record (Figure 17). The average net increase for the monitoring wells was 5.03 ft. The five-year rolling average had an increase in water levels during the late-1990s and has remained nearly constant since 2000.

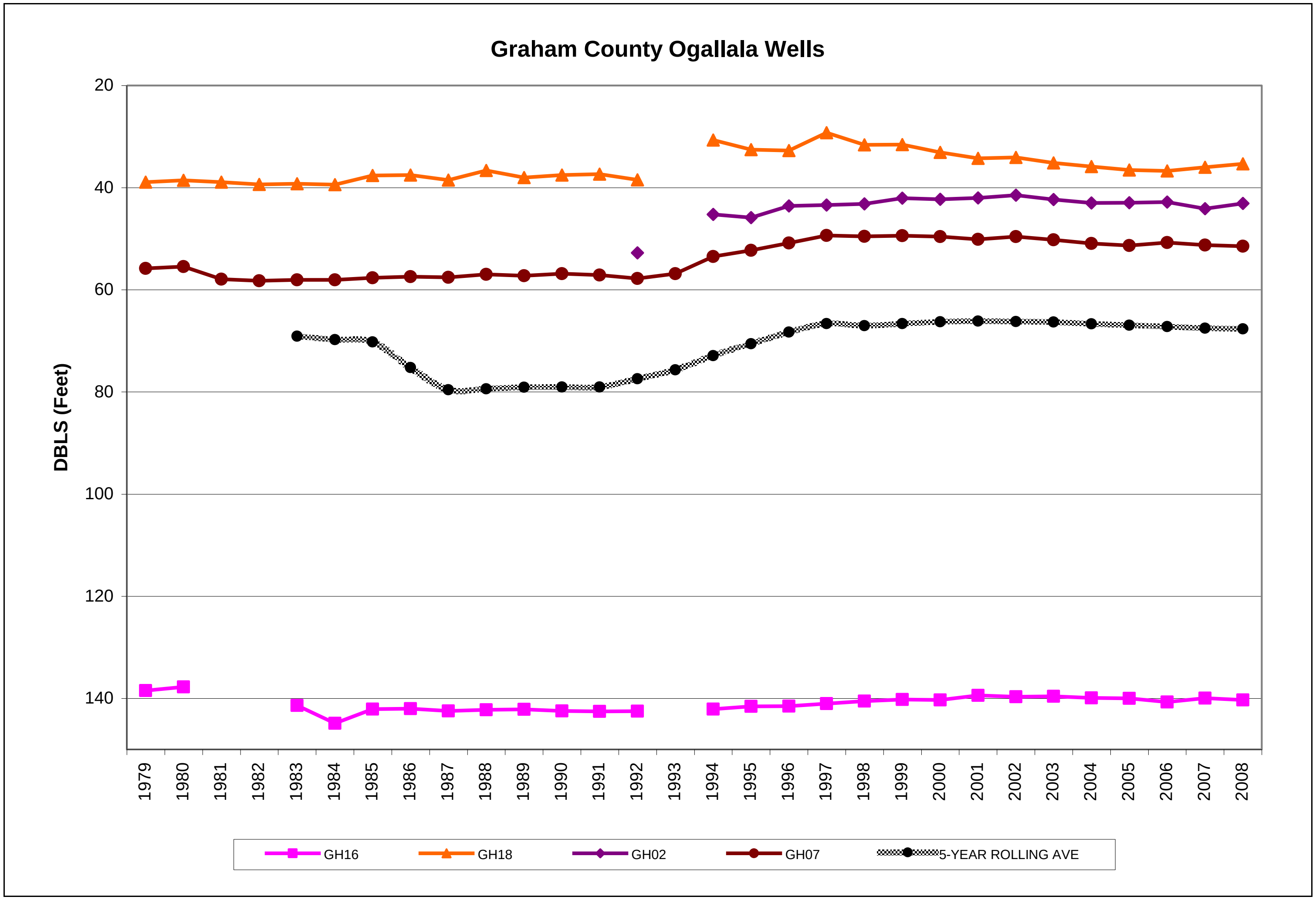

Figure 18: Annually Measured Wells in the Fringe Area of Graham County (1953-2008)

Graham County has four Ogallala monitoring wells. Measurements begin for three of the wells in 1979. GH 02 was added to the network in 1992. GH16 had a net decline of 1.51 ft. The other three wells have net increases (GH18 at 3.56 ft, GH02 at 9.68 ft and GH07 at 4.54 ft) (Figure 18). The five-year rolling average has remained fairly consistent since 1996.

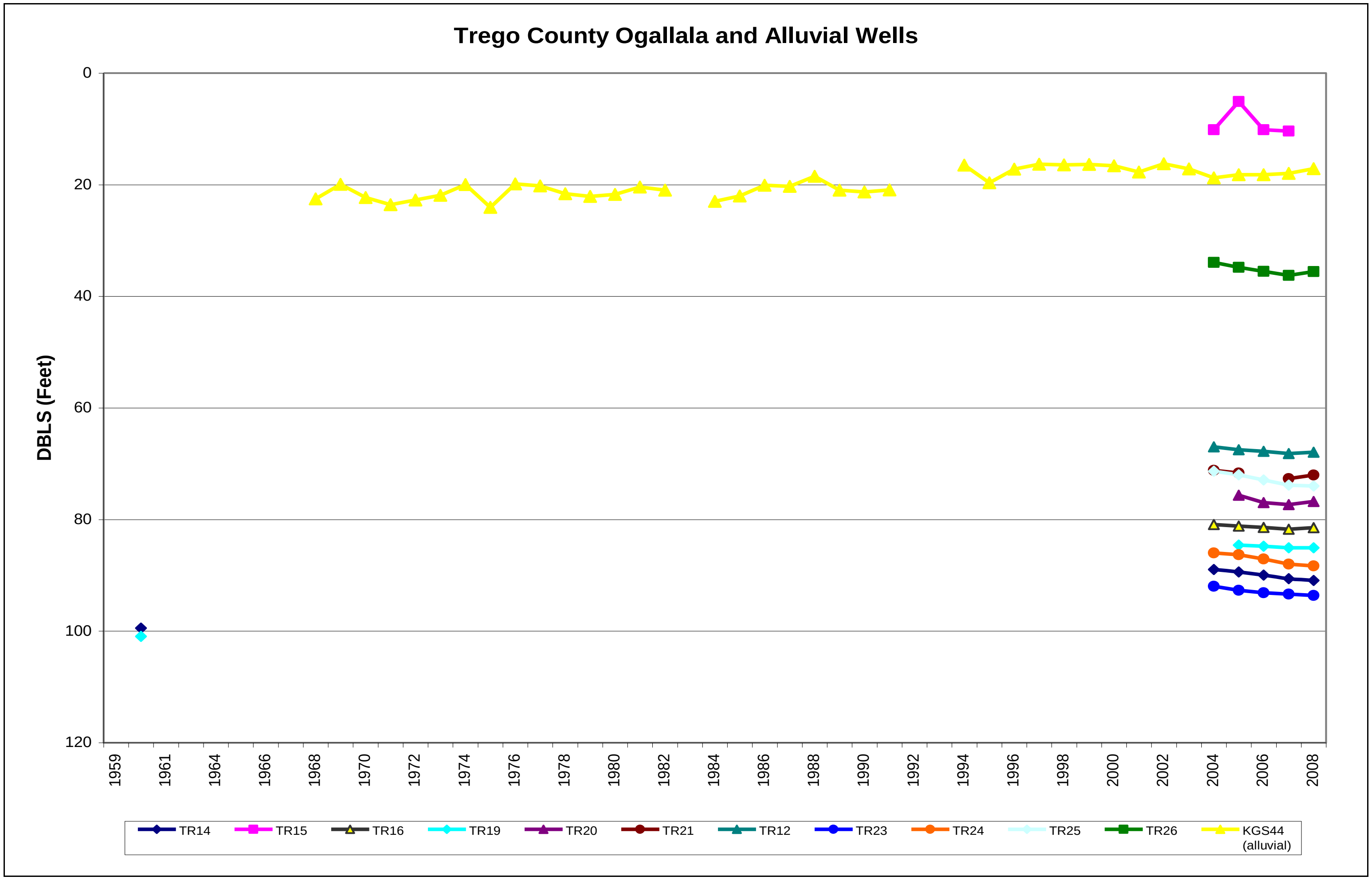

Figure 19: Stockton Field Office Wells and an Annually Measured Well with Historical Data for the Fringe Area of Trego County (1959-2008)

Trego County has a total of twelve monitoring wells. KGS44 has a record dating back to 1968 and is located in the alluvium of Big Creek. TR14 and TR19, Ogallala wells, were first measured in 1960, but were not measured again until 2004 and 2005, respectively. The rest of the wells were not added to the network until 2004 and are located in the Ogallala. KGS44 showed a net increase of 5.42 ft while the Ogallala wells show a net average increase of 1.13 feet. Since 2004, all Ogallala wells have decreased 1.31 ft in water levels (Figure 19).

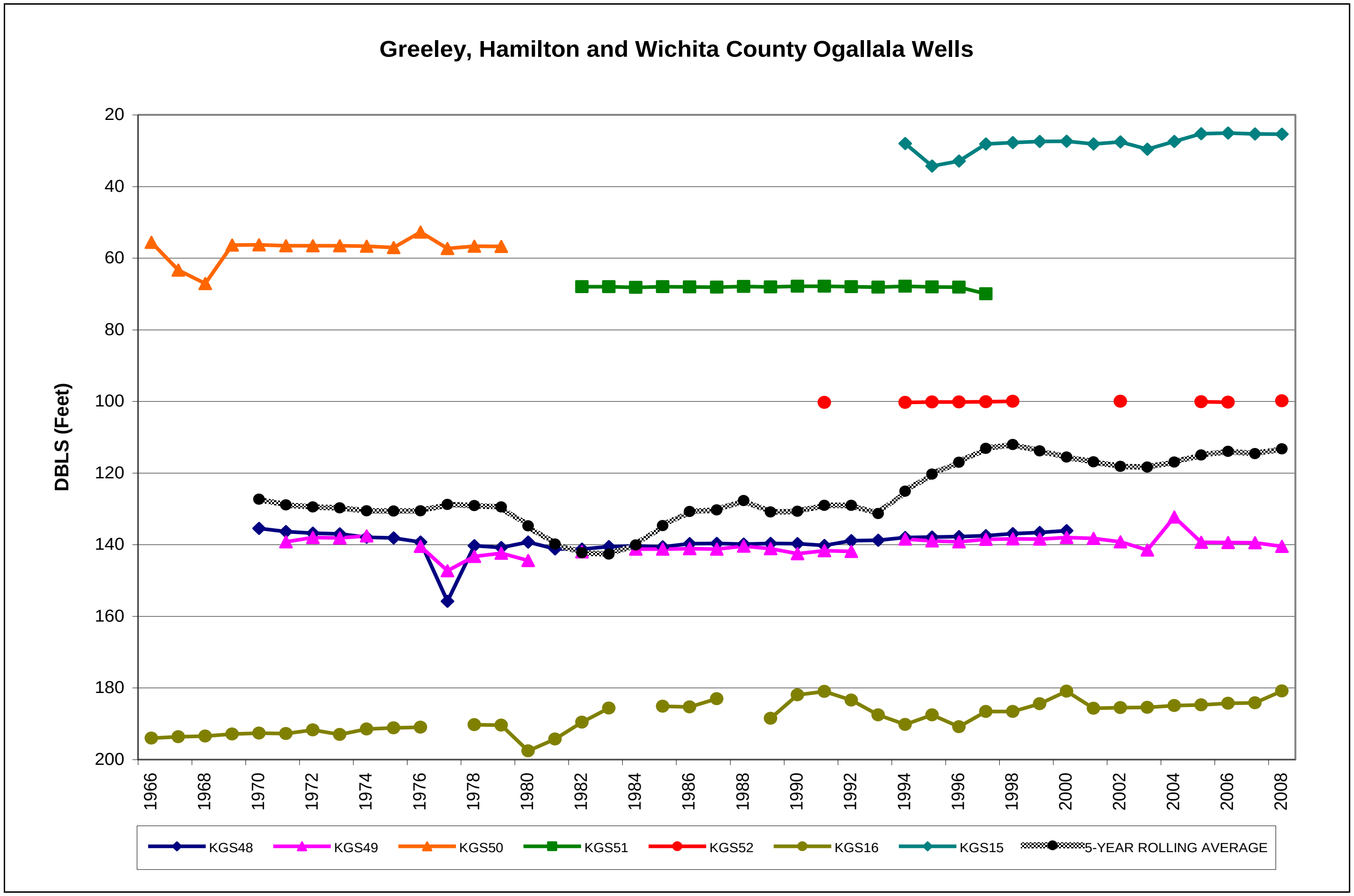

Figure 20: Annually Measured Wells in the Fringe Area of Greeley, Hamilton and Wichita Counties (1966-2008)

Hamilton County has one monitoring well, Greeley County has one monitoring well and Wichita County has five monitoring wells. There were two annually measured wells in the fringe area outside GMD #1 in Wichita County with historical data for 1966 to 2008. They showed an average net decline of 0.41 ft. KGS52 showed a net increase of 0.46 ft (Figure 20). The Hamilton County well KGS16 located outside GMD #3 and had a net increase of 13.16 ft for 1966-2008. The Greeley County well KGS15 located outside GMD #1 had a net increase of 2.57 ft for 1994-2008 (Figure 20). The rise on the five-year rolling average is likely due to the addition of KGS15.

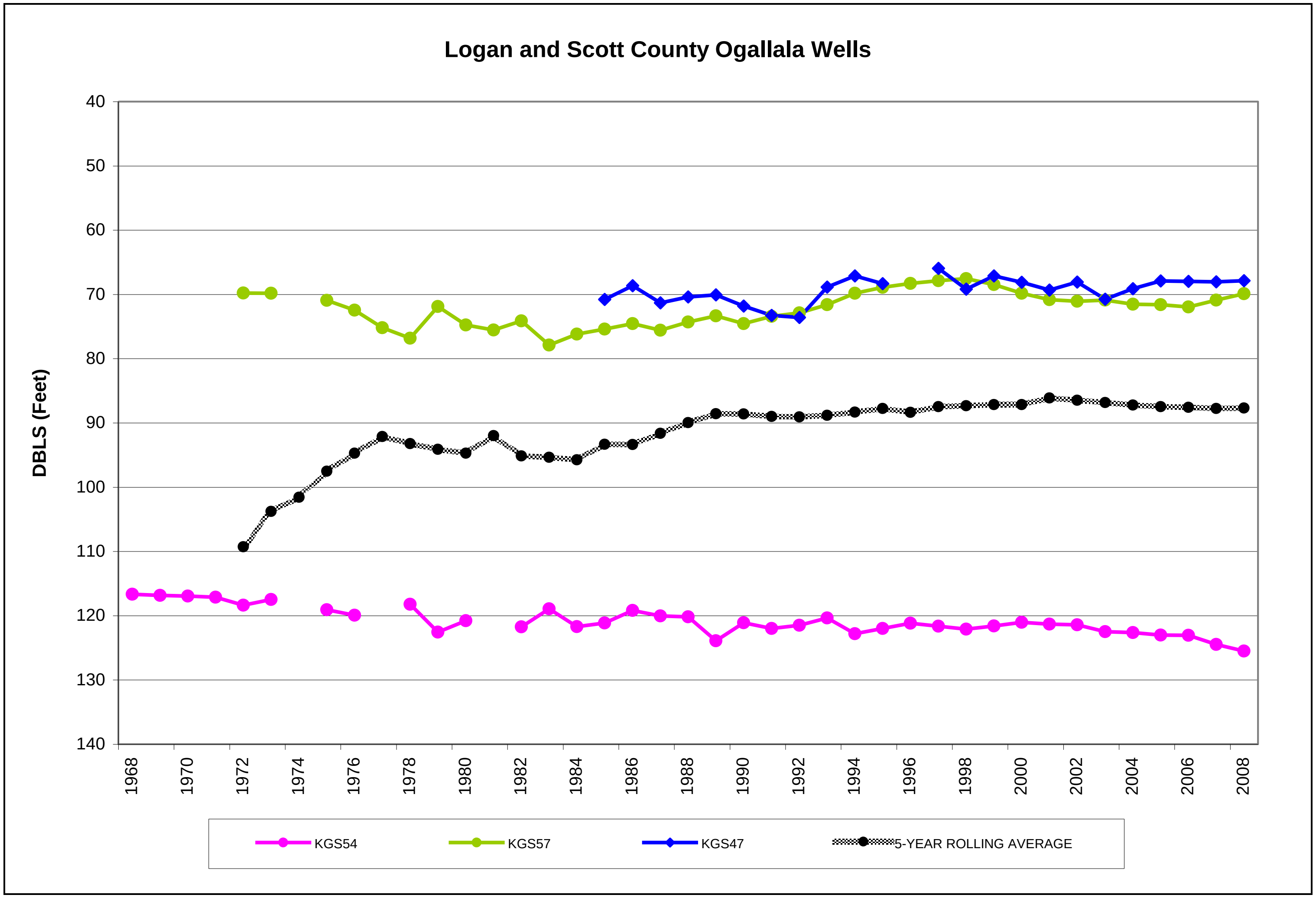

Figure 21: Annually Measured Wells in the Fringe Area of Logan and Scott Counties (1965-2008)

Logan and Scott County have a total of three monitoring wells located outside of the GMD #1. Water level measurements date back to 1968 for KGS54, 1972 for KGS57 and 1984 for KGS47. KGS57 and KGS54 (Scott County) show a net decline. The groundwater levels average net decline was 3.28 ft, ranging from a decline of 0.09 ft to a decline of 8.82 ft (Figure 21). The five-year rolling average exhibits a net increase.

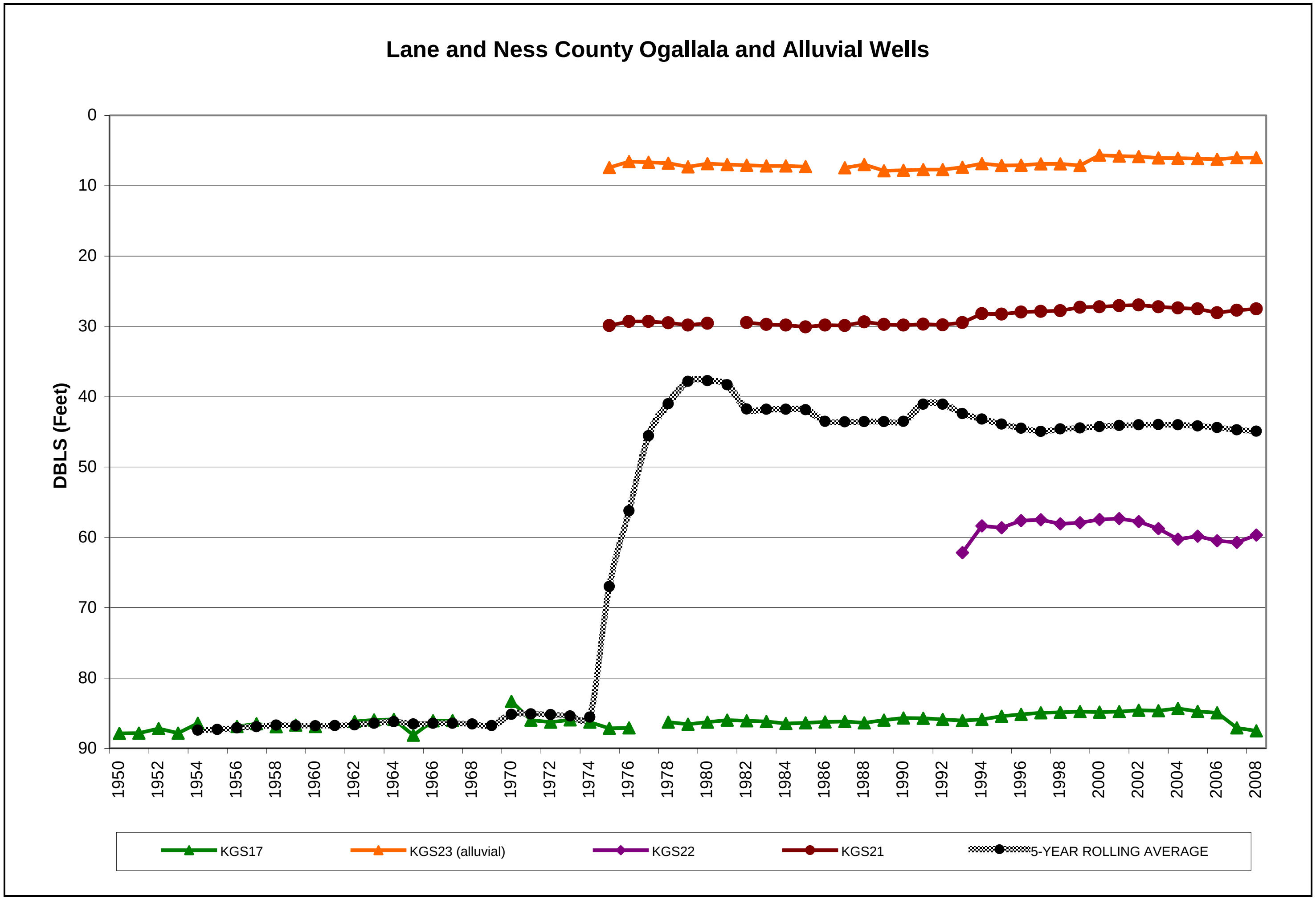

Figure 22: Annually Measured Wells in the Fringe Area of Wallace, Lane and Ness Counties (1950-2008)

Lane County has one monitoring well outside GMD #1 in the Ogallala. Ness County has three monitoring wells, one in the alluvial aquifer and two in the Ogallala (Figure 22). The one well in Lane County (KGS17) with measurements dating back to 1950 had a net increase of 0.34 ft. The three wells in Ness County, two dating back to 1974 (KGS23 and KGS21) had net increases of 1.37 ft and 2.38 ft, respectively. KGS22 had a net increase of 2.49 ft. The five-year rolling average is showing a slight decline (0.19 ft) in water levels since 2004.

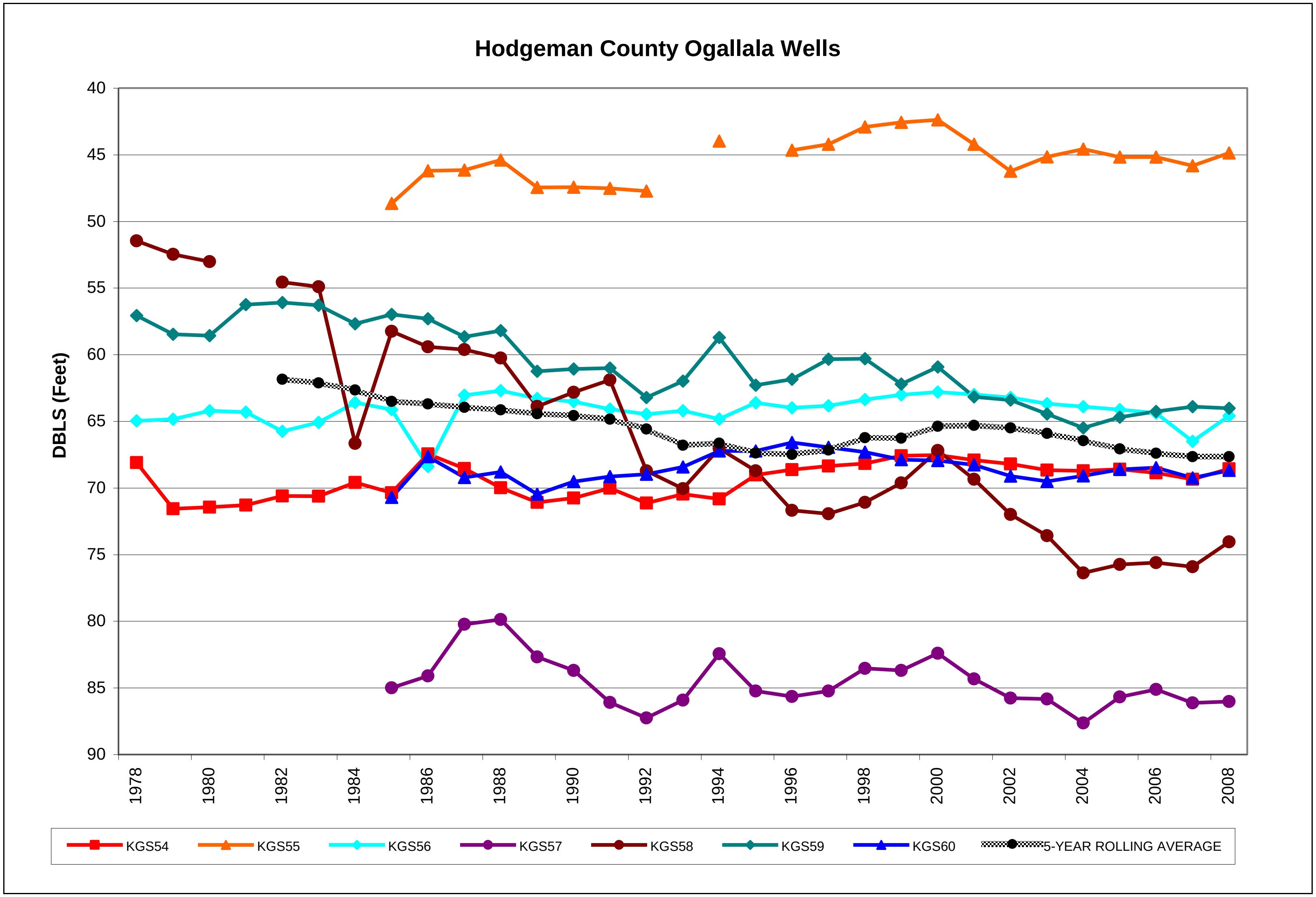

Figure 23: Annually Measured Wells in the Fringe Area of Hodgeman County (1954-2008)

In Hodgeman County there are seven monitoring wells in the fringe area outside GMD #3. Four of the wells showed an average net decline of 7.76 ft. Well KGS56 has a net decline 22.57 ft. The other four wells show an average net increase of 3.52 ft (Figure 23). The five-year rolling average has a net decline of 3.05 ft.

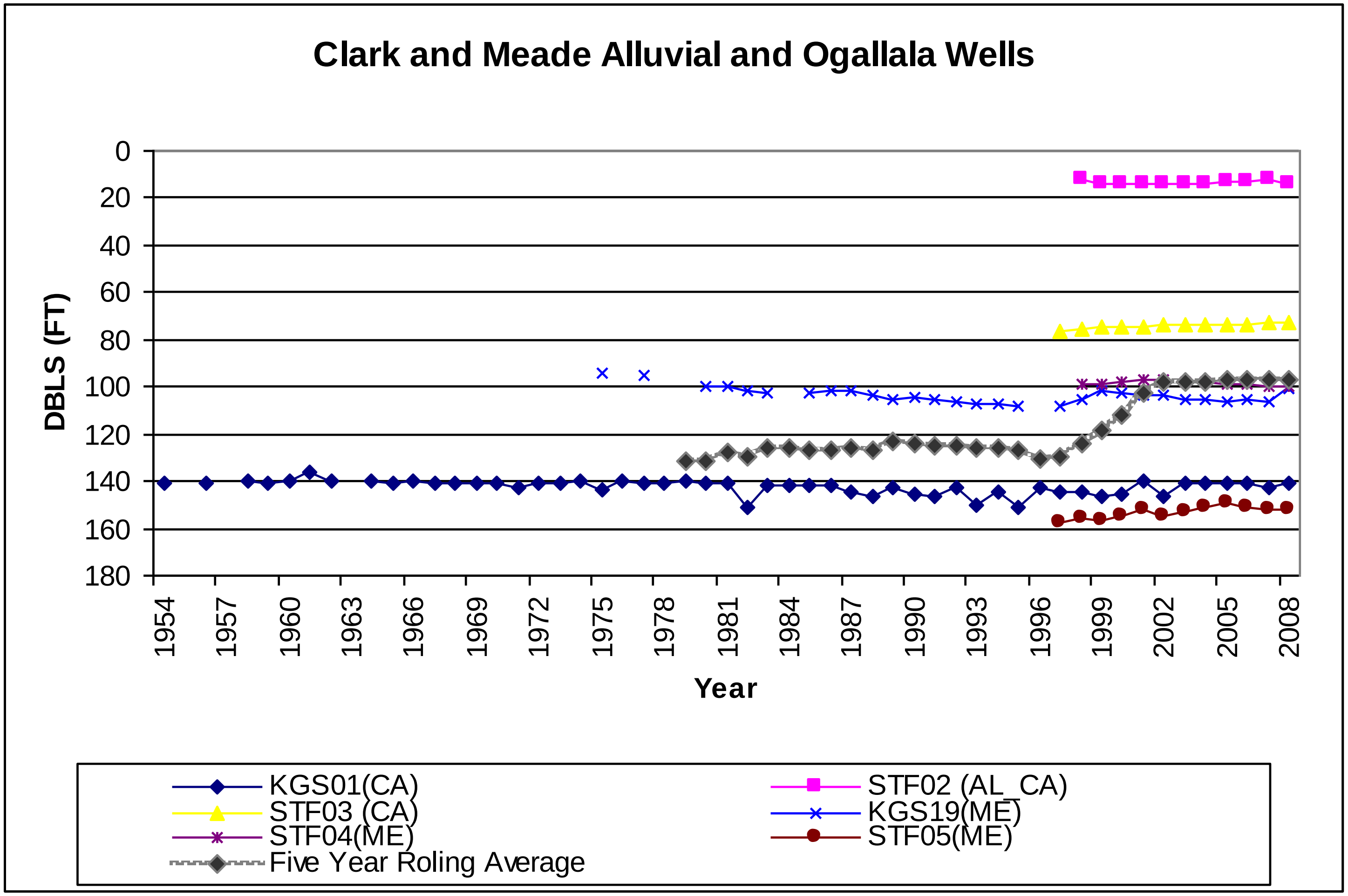

Figure 24: Annually Measured Wells in the Fringe Area of Clark and Meade Counties (1954-2007)

Clark County has three monitoring wells located in the fringe area of GMD #3. STF02 is an alluvial well where as KGS01 and STF03 are Ogallala wells. STF02 has had a net decline of 1.48 ft for the period of record. KGS01 and STF03 increased from 2007-2008 by 2.16 ft and 0.13 ft, respectively (Figure 24). Meade County has three monitoring wells that are all Ogallala wells. KGS19 had a net decline of 6.69 ft since 1975. The other two wells, STF04 and STF05, had a net decrease of 0.19 ft and net increased 6.33 ft, respectively. The five-year rolling average for all the wells in Meade and Clark counties shows a net increase of 1.19 ft since 1980. Four wells were added to the network in 1997 likely explains the change in the five-year rolling average.

Note, not all the Ogallala-High Plains fringe area had historical annual well measurement data. Therefore, some counties are not included in the analysis: Cheyenne, Phillips, Rooks, Gove and Finney counties. SWRMP staff has added nearly 100 additional wells to this monitoring network; however, these wells only have measurements for January 2004 to 2008, so they are not included in this summary. After an additional year of data collection the measurements from these additional wells will be included in the field summary analysis.

V. Water Use

The Ogallala-High Plains fringe area has a total of 994 water rights with an authorized quantity of 107,619 acre-feet (Table 1). The majority of the water rights are appropriated groundwater rights.

Table 1: Water Rights in Ogallala - Fringe

Type	Source	No. of Rights	Authorized Quantity
Vested	Surface	18	788.13
Appropriated	Surface	51	14,928.30
Vested	Ground	66	4,224.94
Appropriated	Ground	859	87,677.80
	Totals	**994**	**107,619.17**

The water use ranges from 23,666 acre-feet in 1993 to 64,068 acre-feet in 1989. The average water use over the twenty-year span was 48,492 acre-feet (Table 1). Water use in 2006 (the most recent year for complete records are available) was 45,356 acre-feet. This was up from 2005 and below the average for the area (Figure 25).

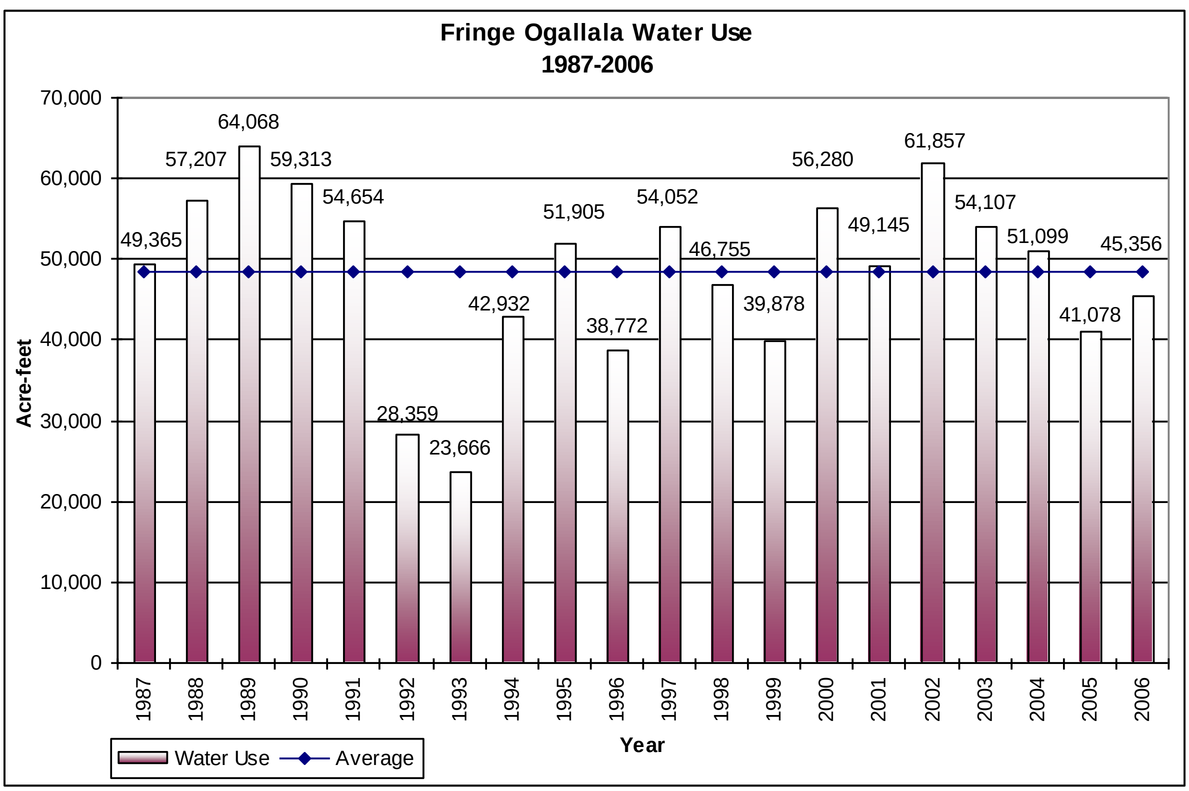

Figure 25: Groundwater Use in the Ogallala-High Plains by Year.

VI. Conclusions

The year 2007 appears to have been an above average year for precipitation. After two years of above average precipitation, average annual streamflow at the USGS gages experienced minor increases at all locations except the South Fork Sappa Creek near Achilles, which experienced a minor decrease. Groundwater levels in most areas of the fringe continued to remain relatively consistent. Water use increased in 2006 but remained below average. Continued monitoring of hydrologic conditions and their response to climate variations is important for evaluating the long-term effects of water usage on this subbasin and protection of property rights. It is equally important to understand how fast the system recovers after recharge events as it is to understand the impacts of pumping and other factors on the hydrologic system

VII. References

Lohman, S.W. 1953. High Plains of west-central United States, general aspects, Chapter 4 of subsurface facilities of water management and patterns of supply-type area studies, v. four of the physical and economic foundation of natural resources: U.S. 83d Congress, House Committee of Interior and Insular Affairs, p. 70-78.

McGuire, V.L., 2003, Water-level changes in the High Plains aquifer, predevelopment to 2001, 1999 to 2000, and 2000 to 2001: U.S. Geological Survey Fact Sheet FS-078-03, 4 p.

McGuire, V.L., 2004, Water-Level Changes in the High Plains Aquifer, Predevelopment to 2003 and 2002 to 2003: U.S. Geological Survey Fact Sheet FS-2004-3097, 6 p.

VIII. Appendix

Monitoring Well ID	USGS ID	Legal Description	County
STF01	Stafford F.O.	30S 23W 06 NENENE	Clark
STF02	Stafford F.O.	30S 23W 13 NWSENW	Clark
STF03	Stafford F.O.	30S 24W 20 SWSWSE	Clark
DC01	393407100143101	05S 26W 33 SESWSW 01	Decatur
DC02	393505100115901	05S 26W 26 SESENE 01	Decatur
DC03	393853100150901	05S 26W 05 NESESE 01	Decatur
DC04	395925100331901	01S 29W 03 SESENW 01	Decatur
DC06	395708100370701	01S 29W 19 NWSESE 01	Decatur
DC08	395458100395501	01S 30W 34 SESESE 01	Decatur
DC09	394248100150801	04S 26W 08 SESESE 01	Decatur
DC11	394110100163301	04S 26W 19 SESWNE 01	Decatur
DC12	394005100215501	04S 27W 33 NWNWNW 01	Decatur
DC13	393814100305401	05S 28W 07 NWNWSW 01	Decatur
DC14	393820100273201	05S 28W 10 NWNWNW 01	Decatur
DC19	395636100192601	01S 27W 26 NWNWNE 01	Decatur
DC29	395307100243001	02S 28W 13 NENWNE 01	Decatur
DC31	394859100301701	03S 28W 06 SESWNW 01	Decatur
DC32	394846100314901	03S 29W 12 NWNWNE 01	Decatur
DC33	394715100355501	03S 29W 17 SESWNW 01	Decatur
DC36	394432100370401	03S 29W 31 SESWSW 01	Decatur
DC37	394610100395001	03S 30W 26 NWNWNW 01	Decatur

KGS02	395358100124001	02S 26W 11NWNWNE 01	Decatur
KGS03	394544100172202	03S 26W 30 SWNWNW 02	Decatur
KGS04	394504100293601	03S 28W 32 NWSWNE 01	Decatur
KGS05	394208100221101	04S 27W 17 SENESW 01	Decatur
KGS06	394241100263201	04S 28W 15 NENENE 01	Decatur
KGS07	394011100295401	04S 28W 30 SESESE 01	Decatur
KGS09	393954100405901	04S 30W 34 NWSWNW 02	Decatur
KGS10	393557100214701	05S 27W 21 SWSWNE 01	Decatur
KGS11	393709100252601	05S 28W 14 NESESE 01	Decatur
KGS12	393656100285601	05S 28W 17 SENESW 01	Decatur
GH02	391451099512701	09 23W 26 NWNENE	Graham
GH07	393216099503801	06S 23W 13 NWNWNW	Graham
GH16	393223100040801	06 25W 12 SWSWSW	Graham
GH18	392611099493301	07 22W 19 NWNWNW	Graham
KGS15	383247101573601	17S 42W 28 SENENW 01	Greeley
KGS16	381422101385501	21S 39W 07 SWNWNE 01	Hamilton
KGS54	380005100130401	23S 26W 31 SWSESE 01	Hodgeman
KGS55	380149100122201	23S 26W 20 SWSWSW 01	Hodgeman
KGS56	375636099592101	24S 24W 20 SWSWSW 01	Hodgeman
KGS57	375719100033001	24S 25W 22 NWNENW 01	Hodgeman
KGS58	375911099560301	24S 24W 02 SWSWSW 01	Hodgeman
KGS59	375912099503201	24S 23W 03 SWSWSW 01	Hodgeman
KGS60	380135100081001	23S 26W 26 NENESE 01	Hodgeman
KGS17	382857100154501	18S 27W 13 SWSWSW 01	Lane
KGS47	390252100551301	11S 32W 31 SWSWSE 01	Logan
KGS19	371931100115501	31S 26W 30 NWNWNW 01	Meade
STF04	Stafford F.O.	32S 26W 05 NESWNE	Meade
STF05	Stafford F.O.	32S 26W 30 NWNWNW	Meade
STF06	Stafford F.O.	33S 27W 17 SESESE	Meade
KGS21	384006099574601	16S 24W 15 NENWNW 01	Ness
KGS22	383839100081701	16S 26W 24 SESENE 01	Ness
KGS23	383129100142402	18S 26W 06 NWNENW 02	Ness
KGS25	395806099584801	01S 24W 13 NWSWNW 01	Norton
KGS26	395634100053201	01S 25W 25 NWNWNW 01	Norton
KGS27	394945099420101	02S 21W 33 SWSWSW 01	Norton
KGS28	395214099532101	02S 23W 22 NENENE 01	Norton
KGS29	395306100054301	02S 25W 14 NENENE 01	Norton
KGS30	394156100054101	04 25W 13 SWSWSW 01	Norton
NT01	393709099594501	05S 24W 14 NWSESW 01	Norton
NT02	393643099505401	05S 22W 18 SWSWSE 01	Norton
KGS31	395551101031601	01S 33W 29 SWSWSW	Rawlins
KGS32	395308101114301	02S 35W 13 NENWNW	Rawlins
KGS36	394814100505201	03S 31W 07 SWNWSE	Rawlins
KGS42	394236100480601	04S 31W 16 NENWSE	Rawlins
RA05	395256100512301	02S 32W 13 NESWNENE	Rawlins
RA06	395419100471001	02S 31W 03 SWNESE	Rawlins
RA09	395038100592301	02S 33W 26 SESWSW	Rawlins
RA10	394854101003101	03S 33W 03 SESWSW	Rawlins

RA14	394802101030301	03S 33W 08 SWSESW	Rawlins
RA15	394940101071501	03S 34W 03 NENWNW	Rawlins
RA16	394605101062601	03S 34W 26 NWNESW	Rawlins
RA17	394637101122001	03S 35W 24 SWNWNW	Rawlins
KGS54	383928100453301	16S 31W 17 SESESE	Scott
KGS57	382841100420601	18S 31W 24 NWSWNW	Scott
KGS44	385919099542601	12S 23W 20 SWSWSW	Trego
TR12	390119099531901	12S 23W 09 SWNWNW	Trego
TR14	390341099400601	11S 21W 29 SESESE	Trego
TR15	390458099475001	11S 22W 19 NESESE	Trego
TR16	390334099443101	11S 22W 34 NENENE	Trego
TR19	390149099472801	12S 22W 08 NWNENW	Trego
TR20	385951099435201	12S 22W 23 NENWSW	Trego
TR21	390149099510401	12S 23W 11 NWNWNW	Trego
TR23	390213099421101	12S 21W 06 SWNWNW	Trego
TR24	390238099400701	12S 21W 05 NENENE	Trego
TR25	390156099400802	12S 21W 05 SESESE	Trego
TR26	390060099400801	12S 21W 08 SESESE	Trego
KGS48	381635101313701	20S 38W 33 NWNWNE 01	Wichita
KGS49	381840101324401	20S 38W 17 SWNWSE 01	Wichita
KGS50	381900101104901	20S 35W 15 NWSWSW 01	Wichita
KGS51	381920101104901	20S 35W 15 NWNWNW 01	Wichita
KGS52	381804101144001	20S 36W 24 NESWSW 01	Wichita