

Appendix F

Development of Groundwater Irrigated Acres per Well

Estimation of the number of acres irrigated per groundwater well was determined by evaluating three methodologies:

Method 1: Average Method

All active irrigation wells in the Nebraska Department of Natural Resources groundwater well database were queried and geographically located within the nine study basins. The average registered acres per well was computed for each basin. The groundwater well database acreage value is obtained from the applicant when the well is originally registered. An examination in the Republican River Basin showed that number was, on average, 25% to 33% higher than the actual measured number of irrigated acres. Therefore, three alternate variations for Method 1 have been produced, decreasing the acres per well by 25, 30, and 35%.

Method 2: 1995 Study Groundwater Irrigated Acres

Based on the number of groundwater irrigated acres for each county in the U.S. Geological Survey / Nebraska Natural Resources Commission 1995 Water Use Study Report and the number of active irrigation wells for each county in 1995 from the Nebraska Department of Natural Resources groundwater well database, the average number of acres per well for each county was computed. After attributing each irrigation well and its associated average number of irrigated acres into one of the nine study basins, the average irrigated acres per well for each basin were computed by dividing the total irrigated acres in the basin by the total number of irrigation wells in the basin.

Method 3: Combination of 1995 Report Results and 2002 Agriculture Census Data

The total number of irrigated acres and groundwater irrigated acres by county in the 1995 Water Use Study Report, total irrigated acres by county from the 2002 U.S. Agriculture Census, and the number of active irrigation wells in 2002 from Nebraska Department of

Natural Resources well database were used to estimate the number of irrigated acres per well in 2002.

By assuming that groundwater acres accounted for 95% of the increase in irrigated acres between 1995 and 2002, groundwater irrigated acres per county in 2002 were estimated as the 1995 groundwater irrigated acres plus 95% of the change in irrigated acres between 1995 and 2002. Then, using the estimated groundwater irrigated acres for each county in 2002 and the number of irrigation wells in 2002 from the DNR well database, an average number of acres per well for each county was computed.

All irrigation wells with their average acres per well by county were assigned to their corresponding basins using GIS analysis. Then the total number of acres and wells for each basin were totaled. An average number of acres per well by basin in 2002 was developed by dividing the total acres by the number of wells in each basin. The results obtained with the three methodologies are shown in table F-1.

Table F-1. Number of groundwater irrigated acres per well.

Basin	Method 1			Method 2	Method 3	
	Average	1A (75%)	1B (70%)			1C (65%)
Big Blue	120	90	84	78	91.7	89.7
Elkhorn	131	98.3	91.7	85.2	99.2	95.9
Little Blue	126	94.5	88.2	81.9	96.3	92.6
Loup	126	94.5	88.2	81.9	85.6	80.7
Lower Platte	106	79.5	74.2	68.9	85.7	84.4
Missouri Tributaries					116.2	103.9
Nemaha	138	103.5	96.6	89.7	54.6	63.8
Niobrara	130	97.5	91	84.5	83.7	78.4
Tri-Basin					100.1	99.6

Examination of the results produced by the three methods indicates that the estimated acres are fairly similar. Method 1 was eliminated because selection of the correct percentage reduction for each basin would be purely an educated guess until such time as actual data is collected to substantiate the numbers. Method 2 produces defensible numbers but is limited by its use of 1995 data. Method 3 is the procedure with the best available data.

Method 3 was selected as the preferred alternative. This process utilizes the information from a very detailed study done in 1995, and calibrates it to actual survey data collected in the 2002 Census of Agriculture. This procedure offers the additional advantage that it can be re-calibrated when the 2007 Census of Agriculture becomes available to see how the average number of acres per well in each basin has changed over time. Between census years, the number of acres irrigated can be estimated using the current number of registered wells in each basin times the number of acres per well.

There are a total of 89,695 active irrigation wells in Nebraska as of October 2005. Registration information shows that 37,519 of these are not in the area included in the nine basins evaluated. A breakdown of the location of the remaining 52,176 irrigation wells is shown in table F-2.

Table F-2. Number of irrigation wells by basin.

Basin	Number of Irrigation Wells
Big Blue	14,169
Elkhorn	8,350
Little Blue	6,720
Loup	9,953
Lower Platte	5,375
Missouri Tributaries	1,642
Nemaha	411
Niobrara	4,030
Tri-Basin	1,526
Nine Basin Total	52,176

There are an additional 3,539 high-capacity, non-irrigation wells registered in Nebraska. Of these, 1,220 are not in the nine basins evaluated. The remaining 2,319 wells are registered for a variety of uses: aquaculture, commercial/industrial, domestic, livestock, public water supplier, and other. The distribution of these wells in the nine basins is shown in table F-3.

Table F-3. Number of non-irrigation wells by use by basin.

	Aquaculture	Commercial/ Industrial	Domestic	Livestock	Public Water Supply	Other	Total
Big Blue	4	58	19	12	244	12	349
Elkhorn	2	88	18	79	230	31	448
Little Blue	1	21	15	9	114	10	170
Loup	10	40	25	63	166	7	311
Lower Platte	3	108	51	8	292	29	491
Missouri Tributaries	5	72	18	20	137	14	266
Nemaha		16	2	1	135	4	158
Niobrara	3	3	5	17	72	4	104
Tri-Basin		11	2	1	8		22

The U.S. Environmental Protection Agency reports that consumptive use of water varies by use category (EPA, 2005). They estimated that the rate of water consumption is highest for livestock at 67%, followed by irrigation at 56%. Domestic use consumes 23%, while industrial/ mining and commercial uses consume 16% and 11%, respectively. Thermoelectric use consumes only 3% while public uses and losses are not even quantified as consumptive use by the EPA.

Because these 2,319 wells are such a small portion of the total number of high-capacity wells in the state (2%), and no data exists in the registration database to indicate the annual pumpage of these wells, no additional efforts were made to identify the pumpage and calculate consumptive use at this time.