

Exhibit 2006 Groundwater Pumping Estimates

Table 1 - Acres Irrigated by Groundwater in 2006

County (or portion of County in the Republican River Basin study area)									
Item	Cheyenne	Kit Carson	Lincoln	Logan	Phillips	Sedgwick	Washington	Yuma	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sprinkler	10,635	152,487	2,367	5,721	68,100	21,984	37,450	267,639	566,385
Flood	102	1,893	0	0	2,262	584	0	1,183	6,024
Total	10,737	154,380	2,367	5,721	70,362	22,568	37,450	268,822	572,409

Source: 2005 Aerial Photographs

Table 2 - Efficiency Factors for Estimating Pumping In Colorado

Year	Percent of CIR Met by Pumping (%)	Sprinkler Irrigation			Flood/Gated Pipe/Furrow Irrigation		
		Maximum Farm Efficiency (%)	Pumping Lost to Spray Loss (%)	Pumping to Deep Percolation (%)	Maximum Farm Efficiency (%)	Net Surface Water Runoff (%)	Pumping to Deep Percolation (%)
		(3)	(4)	(5)	(6)	(7)	(8)
2006	75%	80%	3%	17%	65%	5%	30%

Source:

- (2) Data from "150 Well Water Right Change Study" (See Table 5 of Helton & Williamsen memorandum entitled)
- (3) Estimated
- (4) Estimated
- (5) Calculated as 100% - Column(3) - Column(4)
- (6) Estimated
- (7) Initial surface water runoff is estimated to be 10%. Estimated that 5% deep percolates back into aquifer after it leaves the end of the field and 5% returns to the stream or is consumed.
- (8) Calculated as 100% - Column(6) - Column(7)

Table 3 - Crop Irrigation Requirement (units of inches)

County (or portion of County in the Republican River Basin study area)									Weighted Average Using Acres in Table 1
Year	Cheyenne	Kit Carson	Lincoln	Logan	Phillips	Sedgwick	Washington	Yuma	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2006	19.04	17.85	19.77	23.69	20.55	21.90	23.06	18.36	19.01

Sources:

- Potential consumptive use estimated using the Hargreaves equation calibrated to the Penman-Monteith equation.
- Effective rainfall estimated using procedure outlined in TR-21.
- Crop mix from NASS data was used to weight the CIR for each county.
- See memorandum by Helton & Williamsen entitled "Crop Consumptive Use Requirements - Republican River Basin in Colorado" dated November 19, 2002.

Table 4 - Gain in Soil Moisture from Winter and Spring Precipitation (units of inches)

County (or portion of County in the Republican River Basin study area)									Average
Year	Cheyenne	Kit Carson	Lincoln	Logan	Phillips	Sedgwick	Washington	Yuma	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2006	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Source:

- 1) "Republican River Basin Water Management Study - Working Paper - Farm Water Management", Steven J. Vandas, United States Bureau of Reclamation, March 1983
- 2) As a check on reasonableness
 - Average Monthly Precipitation for Yuma County in April and May = 4.8 inches
 - Average Monthly Consumptive Water Requirement for Corn Grain in Yuma County in April and May = 1.2 inches
 - Which results in 4.8" - 1.2" = 3.6" of precipitation that becomes surface water runoff, deep percolation, soil evaporation, or a gain to soil moisture storage.

Table 5 - Net Crop Irrigation Requirement (units in inches)

County (or portion of County in the Republican River Basin study area)									Weighted Average Using Acres in Table 3
Year	Cheyenne	Kit Carson	Lincoln	Logan	Phillips	Sedgwick	Washington	Yuma	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2006	17.04	15.85	17.77	21.69	18.55	19.90	21.06	16.36	17.01

Calculated as Table3 minus Table 4

Table 6 - Irrigation Groundwater Pumping (acre-feet)

County (or portion of County in the Republican River Basin study area)									
Year	Cheyenne	Kit Carson	Lincoln	Logan	Phillips	Sedgwick	Washington	Yuma	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sprinkler	14,161	188,786	3,286	9,693	98,696	34,171	61,622	342,084	752,499
Flood	167	2,885	0	0	4,035	1,117	0	1,861	10,065
Total	14,328	191,671	3,286	9,693	102,731	35,287	61,622	343,945	762,564

For each county pumping is calculated as

- Sprinkler Pump = Sprinkler Irrig Acres (Table 1) x % CIR (Table 2, column2) x Net CIR/12 (Table 5) / Sprinkler Efficiency (Table2, column3)
- Flood Pump = Flood Irrig Acres (Table 1) x % CIR (Table 2, column2) x Net CIR/12 (Table 5) / Flood Efficiency (Table2, column6)

Table 7 - Recharge From Groundwater Pumping in Colorado (acre-feet)

County (or portion of County in the Republican River Basin study area)									Total
Year	Cheyenne	Kit Carson	Lincoln	Logan	Phillips	Sedgwick	Washington	Yuma	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sprinkler	2,407	32,094	559	1,648	16,778	5,809	10,476	58,154	127,925
Flood	50	865	0	0	1,210	335	0	558	3,019
Total	2,458	32,959	559	1,648	17,989	6,144	10,476	58,713	130,944

For each county recharge is calculated as

- Sprinkler Recharge = Sprinkler Pump (Table 6) x Sprinkler Pump to Deep Percolation (Table2, column5)
- Flood Recharge = Flood Pump (Table 6) x Flood Pump to Deep Percolation (Table2, column8)