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**REPUBLICAN RIVER COMPACT ADMINISTRATION
GROUND WATER MODEL**

June 30, 2003

EXECUTIVE SUMMARY

In accordance with the December 15, 2002 Final Settlement Stipulation in Kansas v. Nebraska and Colorado, No. 126 Original, the Republican River Ground Water Modeling Committee developed a comprehensive ground water model to represent the ground water flow system in the Republican River Basin. The primary purpose of the Republican River Compact Administration Ground Water Model (RRCA Model) is to determine the amount, location, and timing of streamflow depletions to the Republican River caused by well pumping and to determine streamflow accretions from recharge of water imported from the Platte River Basin into the Republican River Basin.

Representatives from the State of Colorado, State of Kansas, and State of Nebraska developed the RRCA Model, with participation from the United States Bureau of Reclamation and United States Geological Survey. The data and information used in construction and calibration of the RRCA Model were provided and shared by all three States and the United States in a collegial manner. In a similar vein, the RRCA Model was constructed and calibrated in a collaborative exercise by technical experts from all three States.

The RRCA Model is fully operational and calibrated to represent the physical and hydrogeological characteristics of the Republican River Basin to a reasonable degree. The RRCA Model matches the trend and magnitude of ground water level changes and stream baseflow targets distributed throughout the Republican River Basin, without significant bias in any region or hydrologic characteristic. The RRCA Model is calibrated to a sufficient degree that depletions from ground water pumping and accretions from imported water from the Platte River System to the Republican River may be quantified and assigned to prescribed streamflow reaches in accord with the RRCA Accounting Procedures.

INTRODUCTION

The Republican River rises in the high plains of northeastern Colorado and western Kansas and Nebraska. The river flows in a generally eastern direction and encompasses approximately 24,900 square miles within its watershed that is illustrated below. The States of Colorado, Kansas, and Nebraska, with the consent of the United States of America, entered into the Republican River Compact in 1942 in order to equitably divide the waters of the Republican River Basin. Ground water accretions and depletions are subject to administration within the Compact for the portion of the basin that contributes flow above the streamflow gaging station on the Republican River near Hardy, Nebraska which is in the eastern part of the Republican River Basin near the Kansas-Nebraska state line.

The Final Settlement Stipulation (FSS) in Kansas v. Nebraska and Colorado, No. 126 Original, which resolved that interstate dispute, provided for development of a comprehensive ground water model to represent the ground water flow system in the Republican River Basin. This document describes the content, construction, and calibration of the Republican River Compact Administration Ground Water Model (RRCA Model). Representatives from the State of Colorado, State of Kansas, and State of Nebraska developed the RRCA Model, with participation from the United States Bureau of Reclamation and United States Geological Survey (USGS).

Purpose and Scope

The primary purpose of the RRCA Model is to determine the amount, location, and timing of streamflow depletions to the Republican River caused by well pumping and to determine streamflow accretions from recharge of water imported from the Platte River Basin into the Republican River Basin above the streamflow gaging station near Hardy, Nebraska. The RRCA Model construction and calibration represent the physical and hydrogeological characteristics of the Republican River Basin to a reasonable degree for the period 1918 to 2000. The RRCA Model simulates historical and current physical conditions; it is not an optimization or operational model and does not assess the impact of land use and conservation practices, reservoir operations, or other water supply or water administration practices.

The RRCA Model will be used to determine ground water depletions and imported water supply accretions in formulas prescribed in the RRCA Accounting Procedures. Future input data to the RRCA Model will be developed in accordance with the requirements of the Accounting Procedures.

Document Context

This document is intended to provide a detailed description of all major facets in the RRCA Model structure, data and information, calibration, and results that were reached in its construction by the State of Colorado, State of Kansas, and State of Nebraska in consultation with the United States. Updated with annual streamflow, climatological, irrigated acreage, ground water pumping, and other information, the RRCA Model will be used to quantify said streamflow depletions caused by well pumping and imported water supply accretions for application within the formulas prescribed in the RRCA Accounting Procedures. The data and information used in construction and calibration of the RRCA Model were provided and shared by all three States and the United States in a collegial manner. In a similar vein, the RRCA Model was constructed and calibrated in a collaborative exercise by technical experts from all three States. This document reflects the RRCA Model architecture, the data sets used, and calibration agreed upon by the States as required by the FSS.

The RRCA Model, consisting of the computer code, input files, and pre-processing and post-processing programs, is provided in Appendix A on a DVD ROM. Members of the RRCA Engineering Committee are working on a RRCA Ground Water Model Users Manual that will provide details related to the use of the model in conjunction with the RRCA Accounting Procedures. The Users Manual will discuss data content and formatting, the use of pre-processing

programs, details on completing the various runs of the model, and application of the RRCA Model's outputs in the annual RRCA accounting.

Model Findings and Summary

The RRCA Model is fully operational and calibrated to represent the physical and hydrogeological characteristics of the Republican River Basin to a reasonable degree. The RRCA Model reasonably matches the trend and magnitude of ground water levels and stream baseflow targets distributed throughout the Republican River Basin, without significant bias in any region or hydrologic characteristic. The RRCA Model is calibrated to a sufficient degree that depletions from ground water pumping and accretions from imported water from the Platte River System to the Republican River may be quantified and assigned to prescribed streamflow reaches in accord with the RRCA Accounting Procedures.

CONCEPTUAL MODEL OF GROUND WATER FLOW SYSTEM

Background and Physical Setting

The tributaries at the headwaters of the Republican River rise on the high plains of northeastern Colorado and western Kansas and Nebraska. The mainstem of the Republican River is formed by the junction of the North Fork of the Republican River and the Arikaree River near Haigler, Nebraska. The river flows in a generally eastern direction for approximately 445 miles before it joins the Smoky Hill River to form the Kansas River at Junction City, Kansas. The Republican River Basin encompasses approximately 24,900 square miles within its watershed that is illustrated below.

In order to include all ground water resources that affect stream flows within the Republican River Basin, the RRCA Model domain was extended beyond the Republican River watershed. The model domain boundaries extend from the Platte River in the north to the Ogallala aquifer outcrops on the southern, eastern, and western boundaries. The model domain coincides with that described in USGS Open File Report 02-175 except in the eastern portion of the Basin where it was extended eastward to the eastern edge of Kearney County, Nebraska and into Adams County, Nebraska to reflect increased water table elevations caused by imported water supplies from the Platte River. The model domain encompasses approximately 30,000 square miles. A map of the model domain, including model cell designations and boundary conditions, is provided in Appendix B.

MATHEMATICAL REPRESENTATION OF GROUND WATER FLOW MODEL

Model Program

The RRCA Model applies a modified version of the United States Geological Survey modular ground water model MODFLOW 2000 (Harbaugh and others, 2000) version 1.10 to numerically calculate stream depletions from ground water pumping and accretions from imported water supplies. MODFLOW is a simulation program that uses a finite-difference method to solve the ground water flow equation.

In addition to its robust numerical solver capabilities, MODFLOW also offers two significant attributes. First, it is relatively easily understood, which promotes confidence in its application by those intending to use the computer model to simulate physical and hydrological conditions. Second, it is easily enhanced to accommodate the continuing need for additional capabilities to address a variety of physical and hydrogeological conditions.

The MODFLOW program promotes simulation accuracy and computational flexibility by segmenting various hydrologic attributes such as recharge, leakage from the aquifer to the rivers, or evapotranspiration from ground water as separate or distinct packages. For application within the RRCA Model, the following enhancement modules or packages were used:

- ◆ Basic (BAS6)
- ◆ Layer Property Flow (LPF1)
- ◆ Recharge (RCH6)
- ◆ Well (WEL6)
- ◆ Stream (STR6)
- ◆ Evapotranspiration (EVT6)
- ◆ Drains (DRN6)
- ◆ Preconditioned Conjugate Gradient (PCG2)
- ◆ Hydrograph (HYMOD1)

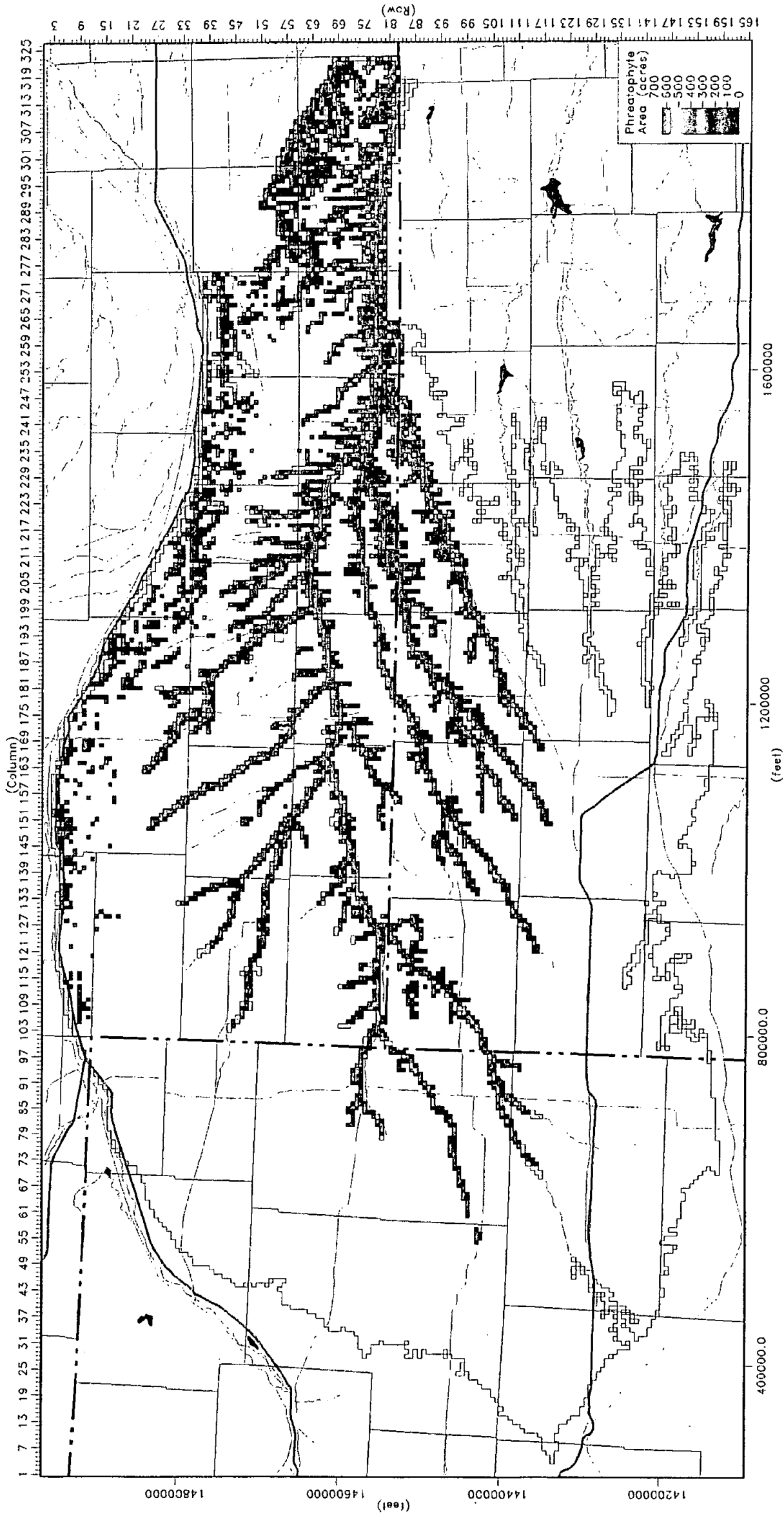
Model Architecture

The following items are the major components in the RRCA Model architecture:

- ? The model is a single layer bounded on the bottom by the impermeable Pierre Shale.
- ? The initial Stream Network was taken from USGS Open File Report 02-175.
- ? The interim aquifer base was taken from USGS Open File Report 02-175, and was adjusted to reflect elevation variances near streams and data available from Nebraska.
- ? Land surface elevations were obtained from the National Elevation Dataset (NED) one arc second Digital Elevation Model (DEM). The land surface elevations along stream channels were modified in order to provide strictly decreasing elevations along stream channels.
- ? The ground water flow system was simulated as if there were a constant transmissivity in order to preserve numerical stability.

Phreatophyte Area

Republican River Settlement Model Version 12p



irrigated lands. The Y-axis for each curve is inches of recharge from precipitation and the X-axis depicts the total amount of precipitation each year.

Lesser calibration parameters that are used to further refine the ground water model include:

Spatial Multipliers – the Spatial Multiplier has a value of 1.0 throughout the model domain except in the mound area in Nebraska where the value is 1.5. A map of spatial multipliers with associated values is provided in Appendix Q.

Steady-State Multiplier – for the period of 1918 to 1940, the long-term average recharge is not fully indicative of all conditions in the model domain, primarily in the western area. A steady-state multiplier of 0.75 was applied to the average of the 1918-1940 recharge period throughout the Republican River Basin.

Phreatophyte potential evapotranspiration rate – the rate is indexed to the McCook and Red Cloud, Nebraska and Akron, Colorado climate stations. The annual potential evapotranspiration rates were linearly interpolated from west to east across the model domain. To improve the ability of the model to match baseflows, all phreatophyte evapotranspiration rates were adjusted by a factor of 2.0. For specific sub-basins, a second factor ranging between 0.03 and 1.12 was applied. The location of the phreatophyte areas and distribution of potential evapotranspiration are provided in Appendix R.

Saturated Thickness – Applied within the RRCA Model to improve the model performance, the saturated thickness in any given model cell was adjusted to a minimum of 10 feet. The saturated thickness is based upon average values for the period 1940-2000 and was kriged across the model domain between known data points. The distribution of saturated thickness is provided in Appendix S.

Transmissivity – The adjustments to hydraulic conductivity and saturated thickness described above were made during the calibration procedures and resulted in a distribution of transmissivity that is provided in Appendix T.

Model Output

The RRCA Model is fully operational and calibrated to represent the physical and hydrogeological characteristics of the Republican River Basin to a reasonable degree. The RRCA Model reasonably matches the trend and magnitude of ground water levels and stream baseflow targets distributed throughout the Republican River Basin, without significant bias in any region or hydrologic characteristic. The RRCA Model is calibrated to a sufficient degree that depletions from ground water pumping and accretions from imported water from the Platte River System to the Republican River are quantified and assigned to prescribed streamflow reaches that are in accord with the RRCA Accounting Procedures.

The RRCA Model calculates the amount of ground water depletions from well pumping as the difference in streamflows using two simulation runs of the model. The “base” run is the simulation with all ground water pumping, ground water pumping recharge, and surface water recharge within the model study boundary for the period 1918 to the current accounting year “on”. The “no State pumping” run is the simulation run with the same model inputs as the base run with the exception that all ground water pumping and pumping recharge for that particular State is turned “off.” The amount of recharge from precipitation is recalculated by converting all ground water-only irrigated land to non-irrigated lands. The amount of depletions charged to each respective State is the difference between the “base run” and the “no State pumping run”. In a similar manner, the “no NE import” run is the simulation with the same model inputs as the base run with the exception that surface water recharge from irrigation and canal leakage that is associated with Nebraska’s Imported Water Supply is turned “off.” The amount of recharge from precipitation is recalculated by converting all surface water-only irrigated land to non irrigated lands and the Imported Water Supply Credit is the difference in stream flows between these two model simulation runs. For commingled lands, defined as receiving irrigation water from a combination of surface and ground water supplies, there is no switch or conversion from irrigated to non-irrigated lands because it is assumed any deficit from one supply source will be replaced by the other. Therefore, while the surface or ground water return flows may be removed in a no pumping or import simulation run, the derivation of recharge from precipitation remains unchanged for commingled lands.

An output of the model is baseflows at selected stream cells. Changes in the baseflows predicted by the model between the “base” run and the “no-State-pumping” model run are considered to be the depletions to streamflows, or ground water computed beneficial consumptive use due to State ground water pumping at that location. The values for each Sub-basin include all depletions and accretions upstream of the confluence with the Main Stem. For sub-basins with reservoirs and the Main Stem, the model’s output totals the depletions and accretions above and below each federal reservoir and in the reservoir reaches. The values for the Main Stem include all depletions and accretions in stream reaches not otherwise accounted for in a Sub-basin. The values for the Main Stem are computed separately for the reach above Guide Rock, and the reach below Guide Rock. For subsequent years, the RRCA Model will be extended to include new hydrologic, pumping, climate, and other annualized datasets. The data will be compiled and exchanged in accordance with the RRCA Accounting Procedures.

For illustrative purposes, impact tables that quantify the depletion of ground water well pumping and imported water supply accretions by stream reach are provided in Appendix U for the period 1981-2000.

CONCLUSIONS

The RRCA Model fulfills the requirements of the FSS to develop a ground water model for use by the RRCA to aid in the administration of the Republican River Compact. The RRCA Model quantifies the amount, location, and timing of streamflow depletions caused by ground water well

pumping and the accretions to streamflow from imported water across the model domain on an annual basis. The RRCA Model provides the required output information in an acceptable format to describe the amounts and timing of said ground water pumping depletions and imported water accretions that are necessary for application within the prescribed annual RRCA Accounting Procedures. The RRCA Model calibration represents the physical and hydrogeological characteristics of the Republican River Basin to a reasonable degree. The use of specific methods or computational procedures within the RRCA Model does not necessarily mean that any party represents or accepts them to be the best or only method for purposes other than that, which is applied in the RRCA Model. The RRCA Model will be used as is, with only annual updates to the appropriate data files and necessary modifications to pre-processor programs required to accommodate modified future data formats, but without recalibration, until such time as the RRCA approves any changes. The RRCA may consider revisions to the model as set forth in the FSS.

Version 12p: Impact of Colorado Pumping (acre-feet)																											
Year	Arkaree	Beaver	Buffalo	Driftwood	Frenchman	North Fork	Above Swanson	Swanson-Harlan	Harlan-Guide Rock	Guide Rock-Hardy	Medicine	Prairie Dog	Red Willow	Rock	Sappa	South Fork	Hugh Butler	Bonny	Keith Sebellius	Enders	Harlan	Harry Strunk	Swanson	Mainstem Total	Total		
1981	1049	0	33	0	255	7485	-540	0	0	0	0	0	0	0	0	9654	0	758	0	0	0	0	0	0	-540	18703	
1982	2335	0	40	0	305	7822	-883	0	0	0	0	0	0	0	0	8566	0	760	0	0	0	0	0	0	0	18954	
1983	1678	0	46	0	366	7908	-1775	0	0	0	0	0	0	0	0	8193	0	780	0	0	0	0	0	0	0	-1775	17208
1984	1109	0	53	0	421	8342	-1391	0	0	0	0	0	0	0	0	7822	0	835	0	0	0	0	0	0	0	-1391	17205
1985	516	0	61	0	471	8627	-1455	0	0	0	0	0	0	0	0	9579	0	841	0	0	0	0	0	0	0	-1455	18656
1986	455	0	69	0	532	8757	-1572	0	0	0	0	0	0	0	0	7544	0	850	0	0	0	0	0	0	0	-1572	18661
1987	511	0	78	0	604	9256	-1899	0	0	0	0	0	0	0	0	9783	0	900	0	0	0	0	0	0	0	-1899	19451
1988	955	0	89	0	676	9684	-1978	0	0	0	0	0	0	0	0	7770	0	950	0	0	0	0	0	0	0	-1978	18167
1989	245	0	98	0	724	9766	-1957	0	0	0	0	0	0	0	0	8562	0	968	0	0	0	0	0	0	0	-1957	18417
1990	589	0	109	0	713	10426	-2114	0	0	0	0	0	0	0	0	9811	0	985	0	0	0	0	0	0	0	-2114	20543
1991	1462	0	121	0	738	10837	-1181	0	0	0	0	0	0	0	0	10622	0	975	0	0	0	0	0	0	0	-1181	23598
1992	2233	0	134	0	745	11199	-1052	0	0	0	0	0	0	0	0	10355	0	994	0	0	0	0	0	0	0	-1052	24633
1993	2018	0	146	0	1000	11400	-1067	0	0	0	0	0	0	0	0	9497	0	1005	0	0	0	0	0	0	0	-1067	24025
1994	1149	0	157	0	901	11607	-2716	0	0	0	0	0	0	0	0	8999	0	1044	0	0	0	0	0	0	0	-2716	21171
1995	1870	0	171	0	814	12011	-2056	0	0	0	0	0	0	0	0	12038	0	1053	0	0	0	0	0	0	0	-2056	25935
1996	1774	0	184	0	946	12257	-847	-20	0	0	0	0	0	0	0	11006	0	1054	0	0	0	0	0	0	0	-867	26391
1997	1667	0	197	0	981	12307	-2563	0	0	0	0	0	0	0	0	9123	0	1078	0	0	0	0	0	0	0	-2566	22847
1998	1239	0	207	0	717	12521	-3330	0	0	0	0	0	0	0	0	11290	0	1121	0	0	0	0	0	0	0	-3333	23799
1999	981	0	220	0	1010	13004	-761	0	0	0	0	0	0	0	0	12429	0	1116	0	0	0	0	0	0	0	-765	28050
2000	1918	0	234	0	599	13173	-4253	0	0	0	0	0	0	0	0	9280	0	1170	0	0	0	0	0	0	0	-4252	22178
Average 1981-2000	1289	0	122	0	676	10419	-1759	0	0	0	0	0	0	0	0	9595	0	962	0	0	0	0	0	0	0	-1761	21330

Version 12p: Impact of Kansas Pumping (acre-feet)																										
Year	Arikaree	Beaver	Buffalo	Driftwood	Frenchman	North Fork	Above Swanson	Swanson-Harlan	Harlan-Guide Rock	Guide Rock-Hardy	Medicine	Prairie Dog	Red Willow	Rock	Sappa	South Fork	Hugh Butler	Bonny	Keith Sebelius	Enders	Harlan	Harry Strunk	Swanson	Mainstem Total	Total	
1981	216	5205	0	0	0	0	298	214	0	230	0	4068	0	0	-586	11006	0	0	359	0	26	0	0	0	741	21036
1982	192	5893	0	0	0	0	225	-25	0	165	0	4542	0	0	2088	5907	0	0	486	0	24	0	0	0	365	19488
1983	96	5812	0	0	0	0	277	-132	0	187	0	4086	0	0	2089	4280	0	0	453	0	21	0	0	0	332	17176
1984	151	5974	0	0	0	0	191	-320	0	281	0	4055	0	0	2319	7733	0	0	754	0	20	0	0	0	152	21166
1985	153	5960	0	0	0	11	163	203	0	208	0	3525	0	0	2719	6660	0	0	654	0	19	0	0	0	573	20277
1986	126	4894	0	0	0	0	188	-201	0	238	0	2195	0	0	905	6038	0	0	616	0	18	0	0	0	235	15141
1987	170	5169	0	0	0	13	168	76	0	213	0	4498	0	0	244	8101	0	0	551	0	17	0	0	0	458	19221
1988	154	4567	0	0	0	13	261	-315	0	271	0	2498	0	0	-112	7218	0	0	612	0	16	0	0	0	217	15187
1989	156	2321	0	0	0	15	185	190	0	213	0	751	0	0	803	6683	0	0	682	0	17	0	0	0	589	10414
1990	211	1150	0	0	0	14	-27	123	0	233	0	780	0	0	-758	9655	0	0	641	0	18	0	0	0	330	12046
1991	276	1223	0	0	0	21	163	20	0	252	0	2180	0	0	-1024	10674	0	0	658	0	19	0	0	0	436	14468
1992	178	2904	0	0	0	12	428	-50	0	50	0	4455	0	0	-1726	6603	0	0	425	0	17	0	0	0	428	13302
1993	223	7614	0	0	0	0	236	124	-14	18	0	14166	0	0	2795	8378	0	0	404	0	66	0	0	0	364	34024
1994	101	7570	0	0	0	0	236	-221	0	188	0	6357	0	0	3782	3327	0	0	475	0	114	0	0	0	213	21949
1995	202	6882	0	0	0	12	19	-369	0	218	0	3889	0	0	2176	8931	0	0	485	0	83	0	0	0	-130	22336
1996	211	7005	0	0	0	16	326	328	0	218	0	5918	0	0	3011	7546	0	0	334	0	65	0	0	0	875	24988
1997	141	6815	0	0	0	14	232	-395	0	178	0	4121	0	0	2478	5911	0	0	427	0	54	0	0	0	19	19984
1998	167	5618	0	0	0	12	39	-386	0	168	0	2543	0	0	837	7752	0	0	404	0	46	0	0	0	-176	17212
1999	239	5686	0	0	0	15	352	-32	0	201	0	2479	0	0	-198	8864	0	0	356	0	45	0	0	0	524	18019
2000	128	4560	0	0	0	15	159	-224	0	257	0	1392	0	0	-670	6320	0	0	407	0	42	0	0	0	196	12398
Average 1981-2000	175	5146	0	0	0	12	206	-70	0	199	0	3915	0	0	977	7379	0	0	508	0	37	0	0	0	337	18492

Version 12p: Impact of Nebraska Pumping (acre-feet)																									
Year	Arkaree	Beaver	Buffalo	Driftwood	Frenchman	North Fork	Above Swanson	Swanson-Harlan	Harlan-Guide Rock	Guide Rock-Hardy	Medicine Dog	Prairie Dog	Red Willow	Rock	Sappa	South Fork	Hugh Butler	Bonny	Keith Sebeitus	Enders	Harlan	Harry Strunk	Swanson	Mainstem Total	Total
1981	261	5335	1400	835	50240	271	9755	40493	12594	1492	8786	0	4047	1101	1187	1004	840	0	0	1695	623	188	143	64334	142490
1982	211	5795	1476	830	51039	287	8711	31087	12456	1433	8595	0	3414	1282	2904	607	882	0	0	1802	672	207	136	53688	138625
1983	118	5301	1498	922	51364	366	7137	21529	13871	1541	8766	0	3131	1364	2865	612	926	0	0	1895	681	226	137	44077	124237
1984	181	5281	1550	1039	54366	390	9567	32874	14519	1380	9668	0	3700	1426	2909	673	994	0	0	2037	774	245	150	58340	143724
1985	191	5369	1647	1052	56320	435	10049	36237	14576	1552	10213	0	4168	1504	3263	727	1041	0	0	2200	713	266	157	62414	151881
1986	178	4545	1729	1073	57353	453	9138	28874	14815	1368	10679	0	4039	1590	2126	722	1109	0	0	2342	790	288	155	54195	143406
1987	190	4736	1799	1103	58503	516	9262	35060	15649	1398	11095	0	4227	1705	1461	730	1123	0	0	2440	715	308	154	61370	152176
1988	170	4097	1874	1098	59767	568	9340	30341	16179	1572	11387	0	4174	1833	1269	726	1171	0	0	2547	821	325	160	59432	151420
1989	164	2155	1940	1101	60367	603	9010	28409	17745	1691	11889	0	4163	1915	687	422	1263	0	0	2661	896	342	160	58855	147573
1990	204	1119	2056	1122	63991	692	10698	32804	18139	1603	12775	0	4550	2037	615	794	1336	0	0	2795	909	364	173	63445	158975
1991	298	1446	2221	1150	67075	693	12558	38384	20759	1985	13916	0	5185	2224	576	976	1421	0	0	2933	995	385	166	73386	175046
1992	210	3120	2297	1153	64303	689	10270	49739	18849	1723	13628	0	5476	2373	710	933	1307	0	0	3040	844	404	147	80581	181215
1993	192	7110	2266	1076	63516	693	8532	45586	16874	1404	12098	0	5083	2501	4354	806	1114	0	0	3081	642	409	131	72396	177488
1994	117	6727	2296	1044	67838	792	9125	28337	18763	1399	12198	0	4383	2563	4897	603	1349	0	0	3165	868	477	157	57624	167037
1995	233	6402	2413	1117	70355	848	10632	41753	22113	1905	13695	0	5471	2642	3552	889	1449	0	0	3300	957	436	155	76403	180318
1996	239	6270	2503	1146	70624	860	11074	52670	20709	1876	13687	0	5934	2775	4117	934	1363	0	0	3386	770	452	143	86330	201533
1997	164	5964	2568	1150	72910	970	10951	34408	22506	1830	13892	0	5313	2839	3495	853	1480	0	0	3464	963	484	162	69695	186346
1998	206	4978	2690	1196	73764	1045	10150	35058	21974	1726	14510	0	5338	2894	2419	806	1549	0	0	3606	949	483	180	68849	185461
1999	313	4870	2799	1171	75119	1030	12815	49574	21936	1793	13913	0	6346	3023	1149	1048	1345	0	0	3711	862	494	179	86117	203490
2000	196	3568	2912	1153	74876	1156	10260	30832	25316	1926	14585	0	5179	3125	792	982	1601	0	0	3848	989	505	220	68335	184022
Average 1981-2000	202	4720	2098	1077	63186	667	9947	36203	18114	1630	11999	0	4666	2136	2267	792	1233	0	0	2797	822	360	158	65893	165073

Version 12p: Impact of Nebraska Imports (acre-feet)

Year	Anikaree	Beaver	Buffalo	Driftwood	Frenchman	North Fork	Above Swanson	Swanson-Harlan	Harlan-Guide Rock	Guide Rock-Hardy	Medicine	Prairie Dog	Red Willow	Rock	Sappa	South Fork	Hugh Butler	Bonny	Keith Sebelius	Enders	Harlan	Harry Strunk	Swanson	Mainstem Total	Total	
1981	0	0	0	0	0	0	0	8539	49	0	8637	0	11	0	0	0	0	0	0	0	0	0	0	0	8587	15238
1982	0	0	0	0	0	0	0	6969	56	0	6719	0	13	0	0	0	0	0	0	0	0	0	0	0	7045	13783
1983	0	0	0	0	0	0	0	6358	63	0	6705	0	13	0	0	0	0	0	0	0	0	0	0	0	6417	13140
1984	0	0	0	0	0	0	0	6532	70	0	7122	0	15	0	0	0	0	0	0	0	0	0	0	0	6800	13742
1985	0	0	0	0	0	0	0	9461	80	0	7222	0	16	0	0	0	0	0	0	0	0	0	0	0	9540	16787
1986	0	0	0	0	0	0	0	5852	88	0	7195	0	16	0	0	0	0	0	0	0	0	0	0	0	5939	13154
1987	0	0	0	0	0	0	0	9202	100	0	7438	0	18	0	0	0	0	0	0	0	0	0	0	0	9298	16759
1988	0	0	0	0	0	0	0	6077	107	0	7604	0	20	0	0	0	0	0	0	0	0	0	0	0	6181	13809
1989	0	0	0	0	0	0	0	6178	114	0	7538	0	18	0	0	0	0	0	0	0	0	0	0	0	6290	13849
1990	0	0	0	0	0	0	0	7020	115	0	7662	0	19	0	0	0	0	0	0	0	0	0	0	0	7133	14815
1991	0	0	0	0	0	0	0	4515	113	0	8038	0	20	0	0	0	0	0	0	0	0	0	0	0	4625	12698
1992	0	0	0	0	0	0	0	6175	100	0	8371	0	24	0	0	0	0	0	0	0	0	0	0	0	6272	14672
1993	0	0	0	0	0	0	0	15487	191	0	8878	0	40	0	14	0	0	0	0	0	0	0	0	0	15673	24611
1994	0	0	0	0	0	0	0	7251	188	0	8467	0	30	0	17	0	0	0	0	0	0	0	0	0	7435	15954
1995	0	0	0	0	0	0	0	8908	189	0	8770	0	35	0	0	0	0	0	0	0	0	0	0	0	9094	17916
1996	0	0	0	0	0	0	0	14968	219	0	9153	0	39	0	15	0	0	0	0	0	0	0	0	0	15181	24395
1997	0	0	0	0	0	0	0	7171	204	0	9020	0	39	0	0	0	0	0	0	0	0	0	0	0	7372	16447
1998	0	0	0	0	0	0	0	8578	174	0	8891	0	34	0	0	0	0	0	0	0	0	0	0	0	8750	17694
1999	0	0	0	0	0	0	0	8764	165	0	9482	0	33	0	0	0	0	0	0	0	0	0	0	0	8925	18450
2000	0	0	0	0	0	0	0	9413	155	0	9058	0	31	0	0	0	0	0	0	0	0	0	0	0	9584	18664
Average 1981-2000	0	0	0	0	0	0	0	8172	127	0	7998	0	24	0	0	0	0	0	0	0	0	0	0	0	9296	16328