5.9 WATER SUPPLY

Water supply benefits were analyzed for the intake facilities along all of the lake and river reaches between the headwaters of Fort Peck Lake and the mouth of the Missouri River at St. Louis. This analysis comprehensively addressed economic benefits, measured in terms of millions of dollars, and is documented in the Water Supply Economics technical report (Corps, 1994g). The analysis includes benefits for the powerplants along the lake and river reaches that are dependent on the Mainstem Reservoir System for cooling water. The powerplant benefits are associated not only with the intake of water to the powerplants, but also with the discharge of the water back to the river for those powerplants that do not have alternative cooling technologies. The water supply analysis, therefore, includes a water quality benefits analysis for these powerplants based on limits on the thermal discharge of the water after use for cooling. In some cases, the effects can be water supply-related, and in other cases, water quality-related. The two effects have been combined to eliminate any potential for "double counting" benefits for a single facility.

Table 5.9-1 and Figure 5.9-1 present the average annual Missouri River water supply benefits for the alternatives. The table also presents the average annual water supply benefits for each reach evaluated. In each of the submitted alternatives about 81 percent of the benefits occur along the Lower River reach. About 16 percent of the benefits occur along the Upper River (downstream from Fort Peck, Garrison, and Fort Randall Dams) reaches, and the remaining 3 percent occurs along the lake reaches of the Mainstem Reservoir System.

Figure 5.9-1 graphically illustrates the average annual water supply benefits of all the alternatives discussed in Chapter 5. One alternative, the MLDDA alternative, at $611.38 million, stands out from the other alternatives. Three of the alternatives are closely grouped together between $610.07 and $610.43 million, a difference of $0.36 million. Two alternatives, the BIOP and FWS30 alternatives, are more closely aligned with a difference of $0.22 million. At the lower end of the range, the ARNRC alternative also stands out at $600.82 million. Because the three alternatives with reduced summer flows in all years have the lowest benefits, the summer low-flow value appears to be the primary factor causing the reduction in water supply benefits.

The CWCP has a flat release from Gavins Point Dam in the spring and a summer release of 34.5 kcfs in non-drought periods and 28.5 kcfs in major droughts. Estimated average annual benefits for the CWCP total $610.08 million. Setting aside an additional 2 MAF of system storage for flood control, as with the MLDDA alternative, increases the total average annual water supply benefits over the CWCP by 0.2 percent, or $1.30 million. Under the MLDDA alternative, the average annual water supply benefits decrease for the lakes by $0.18 million, or 0.9 percent, increase for the Upper River by $1.99 million, or 2.1 percent, and decrease for the Lower River by $0.52 million, or 0.1 percent.

The ARNRC alternative, with its higher conservation measures and a 15-kcfs spring rise from mid-May to mid-June followed by an 18-kcfs summer release until September 1 from Gavins Point Dam, decreases the total average annual water supply benefits from the CWCP by 1.5 percent, or $9.26 million. The average annual benefits increase by 3.5 percent, or $0.71 million, for the lakes and by 2.0 percent, or $1.91 million, for the Upper River. Under the ARNRC alternative, average annual water supply benefits decrease for the Lower River by 2.4 percent, or $11.89 million. This dramatic decrease for the Lower River is due primarily to the reduced capability to discharge thermal wastes from the powerplants dependent on the Missouri River for cooling water. Under the ARNRC alternative, replacement power from alternative sources will be required to make up for the lost generation associated with the cutbacks in generation to limit thermal waste discharges during the summer months.

The MRBA alternative provides higher drought conservation measures than the CWCP. It includes a 7.1-month navigation season and, typically, a decrease of 3 kcfs in the navigation service level (relative to full service) in drought years. Under this alternative, total water supply benefits increase over those benefits provided by the CWCP by about 0.1 percent, or $0.35 million. The average annual benefits increase for the lakes by $0.31 million, or 1.5 percent, and for the Upper River by $1.89 million, or 2.0 percent. Compared to the CWCP, the MRBA alternative results in a 0.4 percent, or $1.85 million, decrease in water supply benefits for the Lower River subtotal.

The MODC alternative's flat release, which is extended out to mid-September to allow for continuing low flows for the pallid sturgeon, results

in a minimal decrease ($0.01 million and less than 0.1 percent) in the total average annual water supply benefits compared to the CWCP. The lakes and the Upper River show an overall increase in water supply benefits while the Lower River shows a decrease in benefits. Under the MODC alternative, the increase for the lakes is $0.38 million, or 1.8 percent, and the increase for the Upper River is $1.94 million, or 2.1 percent. The Lower River benefits decrease by $2.34 million, or 0.5 percent. These lost benefits are primarily due to the lost powerplant benefits during the 1930 to 1941 drought when navigation is suspended in several years.

The BIOP alternative has a 17.5-kcfs spring rise followed by a 25/21-kcfs summer low flow. It also has the same drought conservation measures as the MRBA alternative. The BIOP alternative results in a decrease in the total average annual water supply benefits from those of the CWCP (a decrease of 0.2 percent, or $1.5 million); however, as with the MODC alternative, there is an increase in benefits for the lakes and Upper River and a decrease for the Lower River. The average annual benefits increase for the lakes is 2.0 percent, or $0.42 million, and for the Upper River, the benefits increase by 2.1 percent, or $1.95 million. Under the BIOP alternative, the decrease for the Lower River would be 0.8 percent, or $3.88 million, which is less than for the CWCP.

The FWS30 alternative, also suggested by the USFWS, is identical to the BIOP alternative except that the spring rise is 30 kcfs. Its water supply benefits are similar to those for the BIOP alternative. Compared to the CWCP, the FWS30 alternative decreases the total average annual water supply benefits by 0.3 percent, or $1.72 million. It provides an increase in benefits for the lakes (2.6 percent, or $0.54 million) and the Upper River (2.1 percent, or $1.95 million). The average annual benefits decrease by 0.9 percent, or $4.22 million, for the Lower River under the FWS30 alternative. The loss of benefits for the Lower River under both the BIOP and FWS30 alternatives is primarily a result of the thermal powerplant discharge restrictions. The 21-kcfs summer low flow in most years and the 18-kcfs summer flow in the nonnavigation years (during the 1930 to 1941 drought) require generation cutbacks at some of the powerplants along the Missouri River.

The annual values of total water supply benefits for the alternatives are shown in Figures 5.9-2 through 5.9-4. These figures show that there is little difference among the alternatives except for the lower summer flow alternatives. Noticeable

Table 5.9-1. Average annual water supply benefits ($millions).

Lake/Reach	CWCP	MLDDA	ARNRC	MRBA	MODC	BIOP	FWS30
Fort Peck Lake	0.57	0.57	0.55	0.58	0.58	0.56	0.56
Lake Sakakawea	6.28	6.25	6.74	6.62	6.61	6.54	6.69
Lake Oahe	5.97	5.82	6.21	5.94	6.01	6.09	6.08
Lake Sharpe	4.74	4.74	4.74	4.74	4.74	4.74	4.74
Lake Francis Case	2.34	2.34	2.38	2.32	2.33	2.38	2.37
Lewis and Clark Lake	0.65	0.65	0.66	0.65	0.66	0.66	0.66
Lake Subtotal	**20.55**	**20.37**	**21.26**	**20.86**	**20.93**	**20.97**	**21.09**
Fort Peck	1.39	1.38	1.40	1.40	1.42	1.49	1.48
Garrison	92.37	94.36	94.27	94.25	94.28	94.23	94.23
Fort Randall	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Upper River Subtotal	**93.77**	**95.76**	**95.68**	**95.66**	**95.71**	**95.72**	**95.72**
Gavins Point	1.53	1.53	1.53	1.53	1.53	1.53	1.53
Sioux City	32.15	32.15	32.17	32.14	32.11	32.14	32.14
Omaha	198.76	198.46	190.71	197.69	197.29	196.24	196.00
Nebraska City	145.44	145.23	141.69	144.89	144.88	144.29	144.23
St. Joseph	24.26	24.25	24.28	24.25	24.23	24.25	24.24
Kansas City	49.18	49.20	49.11	49.03	49.01	49.05	49.03
Boonville	0.64	0.64	0.64	0.64	0.63	0.64	0.64
Hermann	43.81	43.79	43.77	43.76	43.74	43.76	43.74
Lower River Subtotal	**495.77**	**495.25**	**483.88**	**493.92**	**493.43**	**491.89**	**491.55**
Total	**610.08**	**611.38**	**600.82**	**610.43**	**610.07**	**608.58**	**608.36**

reduced values occur in most years for the ARNRC, BIOP, and FWS30 alternatives. There are noticeable differences during the years included in the 1930 to 1941 drought for all of the alternatives. These differences show up in the nonnavigation years, which are the years with the lowest summer flows (9 or 18 kcfs, depending on the alternative), and the nonnavigation years vary among the alternatives. The four major dips in the annual values occur in the years 1898, 1928, 1958, and 1988. Major capital improvements are assumed to be made in those years to the thermal powerplants and the water intakes included in the water supply analysis. The fourth dip is smaller as fewer than 30 years are included in the remainder of the water supply economic computations.

5.9.1 Water Supply for Tribal Reservations

Currently, there are approximately 302 intakes and intake facilities along the mainstem Missouri River that are identified for Native American Tribes. The total water supply benefits provided to the Tribes are $5.37 million. Only the MLDDA alternative reduces the total benefits (0.7 percent, or $0.04 million) provided to the Tribes on a combined basis relative to those provided under the CWCP. The increases for the other five alternatives range from 2.6 percent (BIOP alternative) to 6.9 percent (ARNRC alternative).

The alternatives have different impacts to individual Reservations, depending upon the location along the Missouri River. Currently, there are 109 water supply intakes and intake facilities located on the Missouri River serving Fort Peck Reservation. The data from Table 5.9-2 indicate that the CWCP provides $0.21 million of water supply benefits to this Reservation. All of the alternatives except the MLDDA and MRBA alternatives increase the water supply benefits to this Reservation. The MLDDA and MRBA alternatives do not result in a benefit change from the CWCP for Fort Peck Reservation. The BIOP and FWS30 alternatives both provide the maximum average annual water supply benefits, a 14.3 percent increase in benefits over those of the CWCP, while the ARNRC and MODC alternatives provide a 9.5 and 4.8 percent increase in water supply benefits, respectively.

Fort Berthold Reservation has 79 water supply intakes and intake facilities along Lake Sakakawea. The CWCP provides $1.75 million of benefits to this Reservation on an average annual basis. The ARNRC alternative provides the greatest increase in average annual water supply benefits (12.0 percent) and the MODC and FWS30 alternatives both provide the second largest benefits increase (6.9 percent) to this Reservation. The MRBA alternative increases the water supply benefit for this Reservation by 6.3 percent, while the BIOP alternative yields only a 1.1 percent increase over the CWCP. Of the alternatives, the MLDDA alternative is the only one that results in lost water supply benefits compared to the CWCP (0.6 percent decrease).

Standing Rock Reservation has 14 water supply intakes along Lake Oahe on Reservation land. Under the CWCP, these benefits average $0.67 million per year. As with Fort Berthold Reservation, the ARNRC alternative provides the greatest average annual water supply benefits to the Reservation (17.9 percent increase) compared to those of the CWCP. The BIOP alternative results in an increase in water supply benefits to this Reservation (11.9 percent), as do both the MODC and FWS30 alternatives (10.4 percent). The MRBA alternative shows a slightly lower increase than the above alternatives (9.0 percent). The MLDDA alternative is the only one that provides lower average annual water supply benefits to Standing Rock Reservation, with lost benefits of 6.0 percent compared to those of the CWCP.

Nine water supply intakes have been identified along Lake Oahe on Cheyenne River Reservation. Average annual benefits to the Reservation under the CWCP total $0.08 million. None of the alternatives decrease water supply benefits to this Reservation. The MLDDA, ARNRC, MRBA, and FWS30 alternatives all provide the greatest average annual water supply benefits to the Reservation, with a 12.5 percent increase in benefits for each over the CWCP. The MODC and BIOP alternatives do not result in a change in water supply benefits from the CWCP.

Lower Brule Reservation has 22 water supply intakes identified along Lake Sharpe. Average annual benefits for these intakes total $0.54 million under the CWCP. Compared to the CWCP, all of the other alternatives provide the same benefits because the level of Lake Sharpe does not vary under any of the alternatives.

There are 55 water supply intakes serving the Crow Creek Reservation from Lake Sharpe and Lake

Francis Case. Average annual benefits to these intakes under the CWCP total $1.98 million. All but one of the alternatives, the MLDDA alternative, slightly increase the average annual water supply benefits to the Reservation (0.5 percent increase) and provide additional benefits over those of the CWCP. This Reservation is located along both Lake Sharpe and the headwaters of Lake Francis Case, and the differences arise for those intakes located on the Lake Francis Case reach. The MLDDA alternative does not result in a change in water supply benefits compared to those of the CWCP.

Four irrigation intakes pulling water from Lake Francis Case are located on Yankton Reservation. None of the alternatives increase water supply benefits to these intakes compared to the CWCP. Santee Reservation has seven water supply intakes located on Lewis and Clark Lake. All of the alternatives provide average annual benefits of $0.11 million to these intakes.

Of the 49 water supply intakes located on the Missouri River in the Sioux City reach, there is one irrigation intake on Winnebago Reservation and two irrigation intakes on Omaha Reservation. For Winnebago and Omaha Reservation irrigation intakes, all of the alternatives provide $0.01 million and $0.02 million, respectively, in average annual water supply benefits to these Reservations. Compared to the CWCP, there is no change in water supply benefits under any of the remaining alternatives.

None of the nine water supply intakes located on the St. Joseph reach of the Missouri River are on Iowa Reservation or Sac and Fox Reservation.

Table 5.9-2. Average annual reservation water supply benefits ($millions).

Reservation	CWCP	MLDDA	ARNRC	MRBA	MODC	BIOP	FWS30
Fort Peck	0.21	0.21	0.23	0.21	0.22	0.24	0.24
Fort Berthold	1.75	1.74	1.96	1.86	1.87	1.77	1.87
Standing Rock	0.67	0.63	0.79	0.73	0.74	0.75	0.74
Cheyenne River	0.08	0.09	0.09	0.09	0.08	0.08	0.09
Lower Brule	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Crow Creek	1.98	1.98	1.99	1.99	1.99	1.99	1.99
Yankton	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santee	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Winnebago	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Omaha	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Total	**5.37**	**5.33**	**5.74**	**5.56**	**5.58**	**5.51**	**5.61**

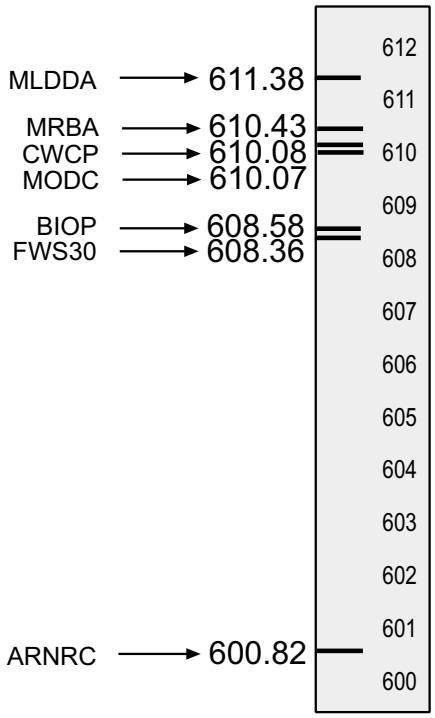

Figure 5.9-1. Average annual water supply benefits for submitted alternatives ($millions).

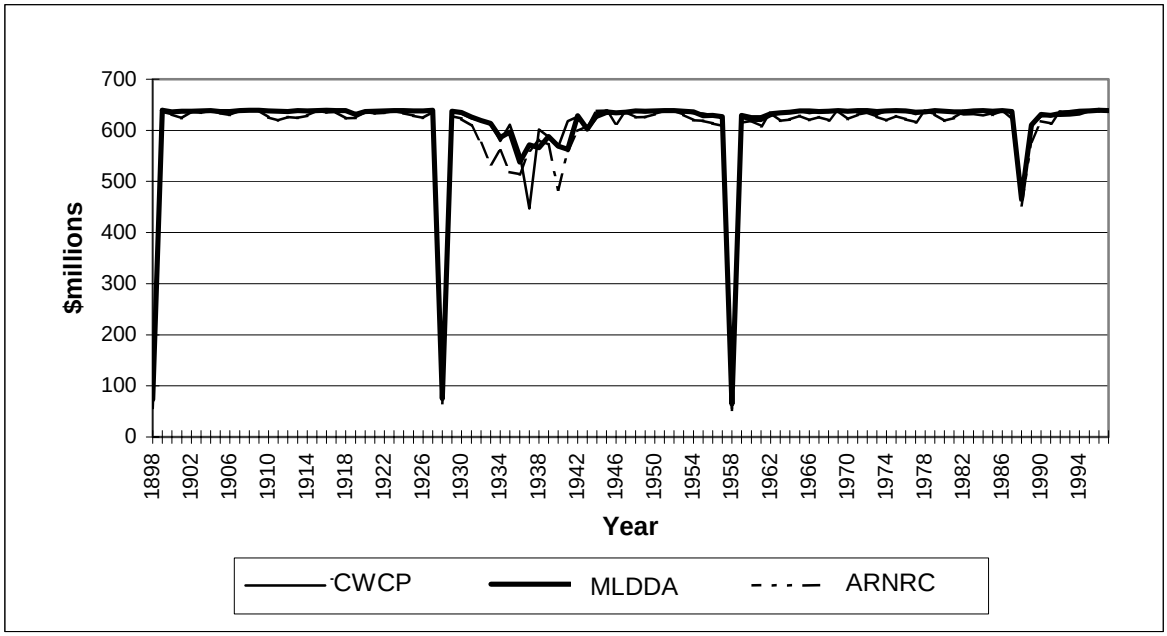

Figure 5.9-2. Average annual water supply benefits for alternatives CWCP, MLDDA, and ARNRC.

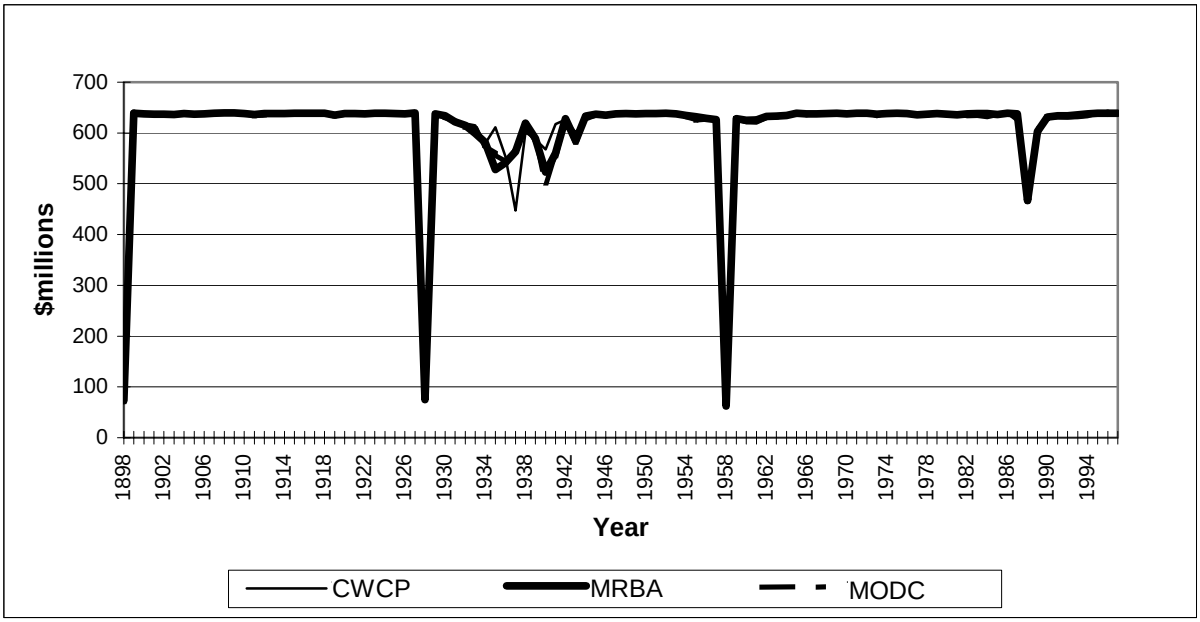

Figure 5.9-3. Average annual water supply benefits for alternatives CWCP, MRBA, and MODC.

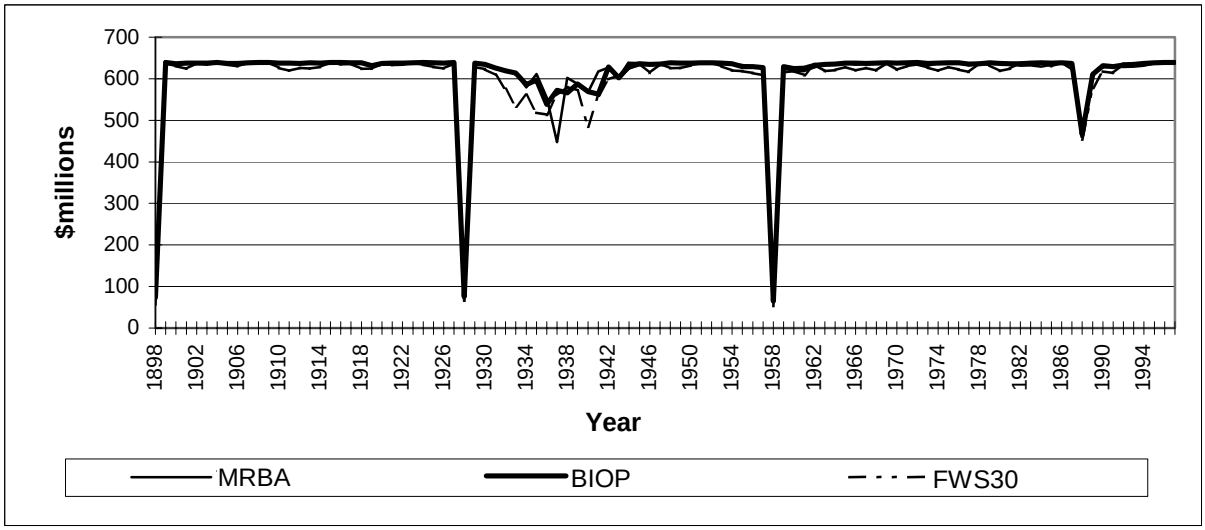

Figure 5.9-4. Average annual water supply benefits for alternatives MRBA, BIOP, and FWS30.