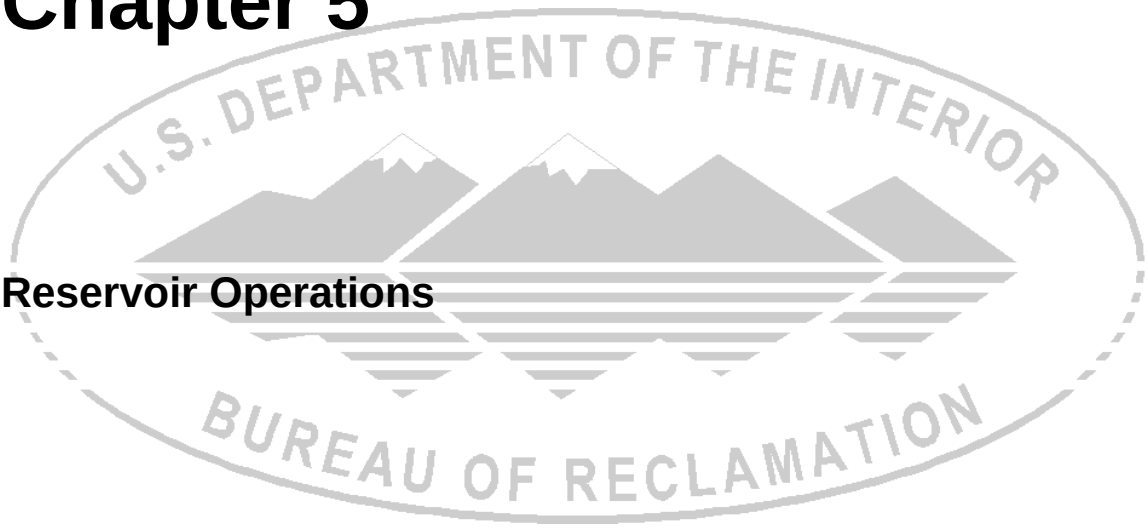
Chapter 5



Reservoir Operations

Chapter 5 - Reservoir Operations

Reservoir's Authorized Purposes

Box Butte Dam impounds water from the Niobrara River to form Box Butte Reservoir. The authorized purposes of Box Butte Dam and Reservoir are to provide storage for irrigation, recreation, fish and wildlife, and sediment control.

Contract between the Mirage Flats Irrigation District, the Nebraska Game and Parks Commission and the United States

In March, 1990 the District, the Commission, and Reclamation entered into an agreement to establish a minimum pool elevation at Box Butte Reservoir of 3978.0 ft. to support and maintain a viable fishery resource in Box Butte Reservoir. This agreement was modified in March, 2000 to add one foot to the minimum pool elevation (3979.0 ft). (See Appendix A5) This agreement is in effect through 2025. These reservoir elevations raised the lowest allowable operating elevation from the previous historical level of 3976.5 ft. At higher reservoir elevations, an effort should be made to provide as near optimum conditions as possible for fisheries and recreation while meeting the other authorized purposes. It is clearly understood that the primary purpose of Box Butte Reservoir is the delivery of water from the storage space for irrigation purposes and that the reservoir level will fluctuate widely above the 3979.0 ft. minimum elevation. There is no agreement for a minimum reservoir releases to the Niobrara River for fish and wildlife purposes.

Reservoir Operations and Flood Control

The Nebraska-Kansas Area Manager in Grand Island, Nebraska, is responsible for the O&M of the dam and reservoir and appurtenant features. Box Butte Reservoir is not a flood control storage reservoir. Reservoir capacity allocations (storage capacity in relation to water elevations) are shown in Table 6, followed by definitions of the various types of storage. Table 7 shows historic maximum/minimum reservoir levels for 1965 to 2007. No reservoir elevation data is available prior to 1965.

Table 6 – Box Butte Reservoir Capacity Allocations

Space	Net Capacity (acre-ft)	Water Elevation (feet msl)
Dead Storage[1]	188	3,969.0
Inactive Storage[2]	2,204	3,979.0
Conservation Storage[3]	27,769	4,007.0
No Flood Pool	-----	-----
Surcharge Pool[4]	16,740	4,016.0

[1] Dead Storage: Capacity from which stored water cannot be evacuated by gravity.
[2] Inactive Storage: Capacity that can be released from the dam but is below design capacity for irrigation.
[3]Conservation Storage: The pool allocated to storage of water for irrigation purposes only.
[4]Surcharge Pool: Capacity between the top of conservation pool (4007.0) and the maximum water surface elevation (4016.0)

Reservoir Operations and Fisheries

The reservoir experiences extreme water draw-downs usually within a two month period during the summer. This results not only in an extreme loss of benthic fauna and shoreline habitat, but also significant losses in young-of-year fish. Drawdowns concentrate the predators, prey, and fishermen in one small area. The results are that prey is consumed, the predators get larger, and the fishermen catch more fish. This can be a healthy situation if the prey base does not collapse or the angler pressure does not become too extensive.

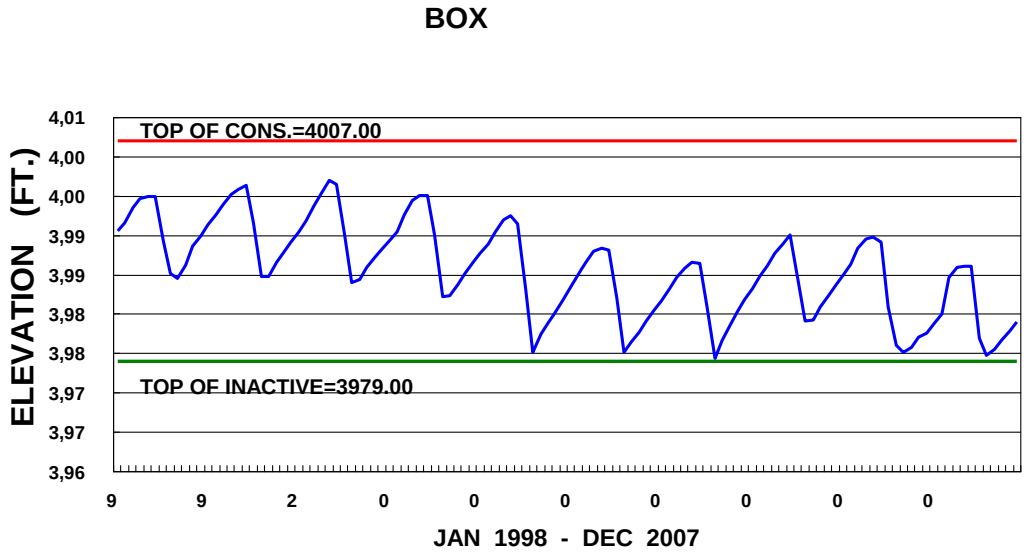


Figure 10 – Box Butte Reservoir 10-Year Reservoir Level

Reservoir Operations and Recreation

Recreational use of reservoir facilities is somewhat restricted during low-water levels and causes some public-use inconvenience. The fluctuating water levels expose once submerged objects which may become safety hazards to boaters. The Commission does not place buoys around the exposed objects. The bottom of the concrete at the low water boat ramp is elevation 3979.6.

Table 7 – Maximum and Minimum Reservoir Levels

Year	Date	Max Level (feet msl)	Contents (acre-feet)	Date	Min. Level (feet msl)	Contents (acre-feet)
1965	May 20	4002.55	24,440	Sept. 7	3979.62	3,530
1966	July 11	4002.10	23,790	Oct. 11	3983.00	5,300
1967	July 11	4002.08	23,793	Sept. 10	3986.59	7,560
1968	June 23	4003.34	25,555	Sept. 15	3990.21	10,455
1969	May 26	4001.90	23,546	Sept. 12	3978.30	2,950
1970	June 15	3999.35	20,181	Sept. 6	3971.68	1,105
1971	June 27	3999.72	20,652	Sept. 4	3970.42	868
1972	June 30	3996.49	16,749	Sept. 9	3976.24	2,211
1973	June 12	3999.32	20,143	Sept. 6	3972.95	1,368
1974	May 15	3998.51	19,132	Aug. 30	3975.22	1,918
1975	May 31	3996.51	16,761	Aug. 30	3970.44	872
1976	June 30	3994.31	14,391	Aug. 23	3969.82	764
1977	June 19	3994.90	15,009	Aug. 31	3980.18	3,808
1978	June 10	3997.75	18,214	Sept. 11	3975.75	2,067
1979	May 31	3995.81	15,993	Sept. 15	3980.50	3,962
1980	May 31	3998.84	19,540	Sept. 5	3979.58	3,515
1981	June 10	3995.83	16,015	Sept. 10	3975.70	2,052
1982	July 9	3996.09	16,301	Sept. 14	3981.48	4,470
1983	June 30	4001.11	22,475	Sept. 10	3985.73	6,968
1984	June 30	4000.30	21,402	Sept. 7	3978.15	2,889
1985	May 31	3995.28	15,416	Aug. 26	3969.00	640
1986	June 30	3997.70	18,155	Sept. 8	3976.80	2,391
1987	May 20	3998.40	18,996	Sept. 1	3974.80	1,806
1988	June 21	3996.10	16,312	Aug. 30	3973.01	1,381
1989	May 30	3992.09	12,186	Aug. 16	3969.00	640
1990	June 14	3992.47	12,550	Aug. 17	3980.47	3,947
1991	July 1	3998.47	19,082	Aug. 31	3984.08	5,925
1992	July 8	3997.57	18,000	Sept. 6	3894.97	6,473
1993	July 7	3999.75	20,691	Sept. 13	3985.76	6,988
1994	May 27	3999.96	20,961	Aug. 31	3983.15	5,384
1995	July 4	4000.56	21,743	Sept. 15	3984.60	6,242
1996	June 16	3999.46	20,320	Aug. 28	3987.40	8,150
1997	June 24	4000.03	21,051	Sept. 5	3988.49	8,997
1998	May 22	4000.10	21,142	Sept. 4	3988.89	9,324
1999	July 5	4001.43	22,907	Sept. 3	3988.95	9,374
2000	June 1	4002.14	23,876	Sept. 2	3988.67	9,143
2001	July 14	4000.36	21,481	Sept. 7	3986.34	7,384
2002	May 31	3997.55	17,976	Aug. 21	3979.87	3,652
2003	July 8	3994.12	14,195	Aug. 24	3979.72	3,579
2004	May 19	3991.78	11,893	Aug. 31	3979.39	3,423
2005	June 28	3995.04	15,158	Sept. 3	3982.95	5,270
2006	May 17	3994.98	15,094	Sept. 11	3979.92	3,676
2007	June 21	3991.30	11,444	Aug. 13	3978.91	3,204

(No reservoir elevation data available prior to 1965)
(Note: new area capacity tables effective January 1, 2008)

The Mirage Flats Project map is on page 52a; please refer to it for more

information.

Downstream Releases and Operations Land

The dam, outlet works, and delivery system is operated and maintained by the MFID for the protection of project facilities. The majority of Federal lands located on the downstream side of Box Butte Dam is designated as a WMA, operated and maintained by the Commission. Reclamation retains primary jurisdiction over the designated operations area. Reclamation retains full access to and unlimited use of any area developed for wildlife habitat, if required for the purpose of ensuring proper operations and protection of Box Butte Dam/Reservoir.

The District's contracted irrigation season is from April through September. Irrigation water can be released any time during this period, although the District typically takes water from late June through August. The District has a storage right to store water in Box Butte Reservoir, a supplemental irrigation water right for the release of District water, and a natural flow right for surface water from the Niobrara River. The storage rights, supplemental irrigation right, and appropriated natural flow rights are used in combination with each other to meet the water supply needs for 11,662 acres of irrigable project lands in the District. Water is released from Box Butte Reservoir to the Niobrara River and diverted into the Mirage Flats Canal at the Dunlap Diversion Dam. The diversion dam is located approximately 8 miles downstream of the reservoir. See Mirage Flats Project map on page 52a.

Ground-water depletions of the base flow and numerous farm conservation practices have greatly reduced inflow to the reservoir. Since the mid 1950s the surface water supply in the Niobrara River basin has decreased significantly (see Figures 2 & 11). The average annual precipitation amount has been generally steady while the average annual reservoir inflow continues to decline. The 10-year average annual inflow to Box Butte Reservoir has decreased from 22,100 acre-feet from 1947 through 1956, to 19,400 acre-feet from 1977 through 1986, to 16,200 acre-feet from 1997 through 2006.

Although the District has access to the entire conservation pool of 27,816 acre-feet of water, plus the inflow, average annual release from Box Butte Reservoir for irrigation over the past 10 years has been approximately 11,800 acre-feet. This average is reduced to approximately 9,800 acre-feet over the past 5 years. This decrease in reservoir inflow has drastically changed District operations. The reduced inflow has created lower pool levels, and the increased demands cause a greater fluctuation in water levels. See Table 7 for historic maximum/minimum reservoir levels for Box Butte Reservoir. Reclamation and the District are very concerned with the historic increase of groundwater development above Box Butte Reservoir and the close correlation with the decrease in reservoir inflows. Reclamation will continue to work with the Upper Niobrara White Natural

LOCATION MAP

EXPLANATION

FEATURE	EXISTING	POTENTIAL
DIVERSION DAM		
RESERVOIR		
CANAL		
LATERAL		
DRAIN		
SIPHON		
TRANSMISSION LINE		
DEEP WELL		
IRRIGATED PROJECT LAND		

103°00'
102°35'
42°30'
R.49W.
R.48W.
R.47W.
R.46W.
R.45W.
R.44W.
R.50W.
T.31N.
T.30N.
T.29N.
T.28N.
385
20
87
Hay Springs
Walgren Lake
U.S.B.R. 115 KV.
DAWES CO.
SHERIDAN CO.
BOX BUTTE CO.
CONSUMERS PUBLIC POWER DISTRICT 345 KV.
Pebble Creek
Pepper Creek
Cottonwood Creek
Niobrara River
Box Butte Creek
Sand Canyon Creek
MIRAGE FLATS IRRIGATION DISTRICT BOUNDARY
BOX BUTTE DAM AND RESERVOIR
DUNLAP DIVERSION DAM
MIRAGE FLATS CANAL
21 Miles to Alliance

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION – REGION 7

MIRAGE FLATS PROJECT, NEBRASKA

GENERAL MAP

NOVEMBER 1965 MAP NO. 278-705-20

SCALE OF MILES 1 0 1 2 3 4

GPO 853-869

Resources District and the Nebraska Department of Natural Resources in the development of the Integrated Water Management Plan. This plan provides a mechanism to reduce the groundwater level declines for those areas where the groundwater is hydrologically connected to the streams. With the plan in place reservoir inflows may return to the pre-development condition.

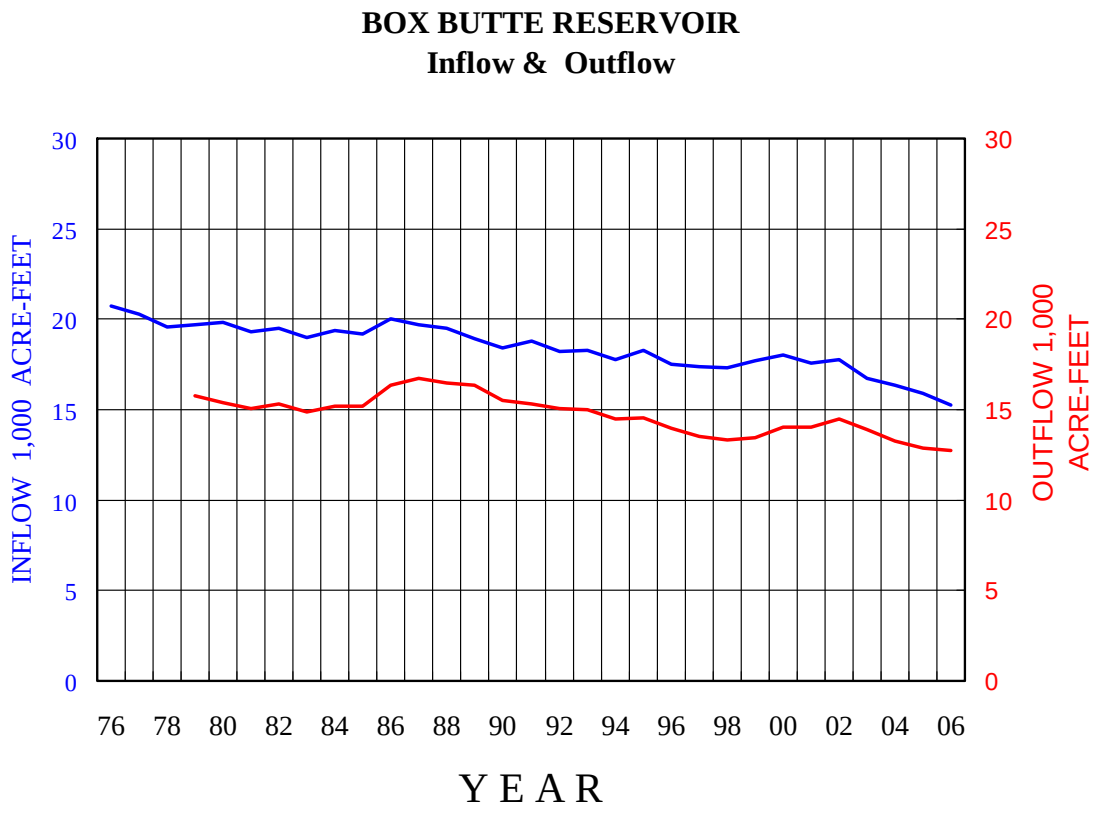


Figure 11 – Box Butte Reservoir Inflow/Outflow