## *INTRODUCTION*

Annual reports on actual operations and operating plans for reservoir regulation activities were initiated in 1953. The Montana Are Office, Wyoming Area Office, Dakota Area Office and the Regional Office are all responsible for preparing reports on actual operations and operating plans for reservoir within the Upper Missouri River Basin above Sioux City, Iowa. This report briefly summarizes weather and strearnflow conditions in the Upper Missouri river Basin during water year 2003, which are principal factors governing the pattern of reservoir operations. This report also describes operations during water year 2003 for reservoirs constructed by the Bureau of Reclamation (Reclamation) for providing flood control and water supplies for power generation, irrigation, municipal and industrial uses, and to enhance recreation, fish, and wildlife benefits.

This report includes operating plans to show estimated ranges of operation for water 2004, with a graphical presentation on a monthly basis. The operating plans for the reservoirs are presented only to show possible operations under a wide range of inflows, most of which cannot be reliably forecasted at the time operating plans are prepared; therefore, plans are at best only probabilities. The plans are updated monthly, as the season progresses, to better coordinate the actual water and power requirements with more reliable estimates of inflow.

A report devoted to "Energy Generation" is included at the end of this report. The energy generation and water used for power at Reclamation and Corps of Engineers' (Corps) plants are discusses, and the energy generated in 2003 is compared graphically with that of previous years. Energy produced at the Reclamation and Corps mainstem plants is marketed by the Department of Energy. Table CET6, entitled "Total Reservoir Storage Contents at the End of Water years 2000 and 2003," compares the water storage available at the beginning of water year 2004 to that available at the beginning of water year 2003. Table CET7 is a summary of the end of month storage contents for each reservoir during water year 2003. The Montana Area Office also assists in the preparation of plans for operation of the Corps reservoir on the main stem of the Missouri river by furnishing depletion **estimates** based upon the operating plans presented in this report.

All references to a year in this report will mean the water year extending from October I through September 30, unless specifically stated otherwise.

## SUMMARY OF HYDROLOGIC CONDITIONS AND FLOOD CONTROL DURING 2003

**Antecedent Conditions:**

There were extremely dry conditions that existed following the 2002 water year. The temperatures and precipitation for water year 2002 varied significantly between basins. Temperatures were warm in the fall and ranged from cooler to warmer than average for the spring and summer. Precipitation for many basins was much below normal with the only exceptions being areas in northcentral and central Montana. The Marias, Milk and St. Mary basins all finished the water year with above normal mountain and valley precipitation. The Sun River basin finished the year with near average mountain and valley precipitation.

The 2002 snowpack as of April 1 ranged from below to above normal in the river basins in Montana and Wyoming. It ranged from 73 percent of normal in the Bighorn River basin to 118 percent of normal in the St. Mary River basin. The low snowpack, in addition to the below average valley rains produced dry conditions east of the Continental Divide, excluding the north and northcentral parts of Montana. The dry conditions were reflected in the inflows for the year.

Inflows for water year 2002 were much below average and several low inflow records were set. The exceptions were Lake Sherburne, Lake Elwell and Fresno Reservoir which received above average annual inflow. Annual inflow was the fourth lowest on record for Canyon Ferry, the second lowest for Clark Canyon Reservoir, and the lowest on record for Bighorn Lake.

The end of September storage for Reclamation reservoirs ranged from much below average to above average for the month of September. Releases during 2002 were very conservative at Reclamation projects. At three major Reclamation projects, Yellowtail, Clark Canyon, and Canyon Ferry Dams releases were below the minimum desired for the fishery as recommended by the Montana Fish, Wildlife, and Parks (MFWP).

**October through December:**

The 2003 snowfall season got off to a very slow start. Even slower than last year at this time. The mountain snowpack distribution during 2003 was generally like year 2002, where low and mid elevation mountain snowpack was generally worse than the high elevation mountain snowpack. Persistent north winds resulted in cooler and drier conditions for much of October. The El Nino forecast for above average temperatures and below average precipitation held true for much of the early part of water year 2003, with the exception of October temperatures. For most Montana reporting stations located east of the Continental Divide, precipitation during October through December ranged from below normal to much below normal. This was an indication of what was to come. For the northern Rockies, the drought

kept its grip for the fourth consecutive year. Precipitation for the Bighorn Basin in Wyoming was also much below normal, Table MTT3.

October through December inflows were much below normal at all Reclamation reservoirs in Montana east of the Continental divide with the exception of Fresno Reservoir. During the fall several new record low inflows were set. A new record low inflow was recorded at Canyon Ferry for November, while Clark Canyon had a new record low for December. A new record low inflow was recorded for Bighorn Lake during both November and December.

**January through March:**

On January 1, the Natural Resources Conservation Service reported mountain snowpack in Montana east of the Continental Divide where Reclamation facilities are located ranged from 9 percent of normal in the Milk River Basin to 68 percent of normal in the Beaverhead River Basin. The mountain snowpack was 72-74 percent of normal in the Bighorn River Basin of Wyoming. Mountain snow water content statewide was 63 percent of average and 77 percent of last year and was generally 20 to 30 percent below 2002. West of the Continental Divide, mountain snow water content was 61 percent of average and 71 percent of last year. East of the Continental Divide, mountain snow water content was 66 percent of average and 88 percent of last year.

January through March cumulative precipitation was much below average to above average. Storm activity during January and February in Montana added significant amounts of mountain snow and due to the warmer temperatures the snow was able to carry a lot of moisture. January average temperature departures state-wide were generally 5 to 6 degrees above normal. The above average temperatures carried into February; however, towards the end of the month, record cold air pushed across Montana and the associated snowfall had much less moisture. By March 1, mountain snow water content east of the Continental Divide, was 84 percent of average and 109 percent of last year. The above average precipitation continued into March with a few basins reporting about twice the normal amount. East of the Continental Divide, March mountain and valley precipitation was 133 percent of average and 144 percent of last year. During March valley temperatures were generally above average west of the Continental Divide and generally near to below average east of the Continental Divide. Temperature variations throughout the month caused some low land flooding.

January through March inflows were below normal to much below normal. The exception was Lake Sherburne which was 117 percent of average. Inflow for January and February to Bighorn Lake was the lowest on record and January inflow to Clark Canyon was also the lowest on record.

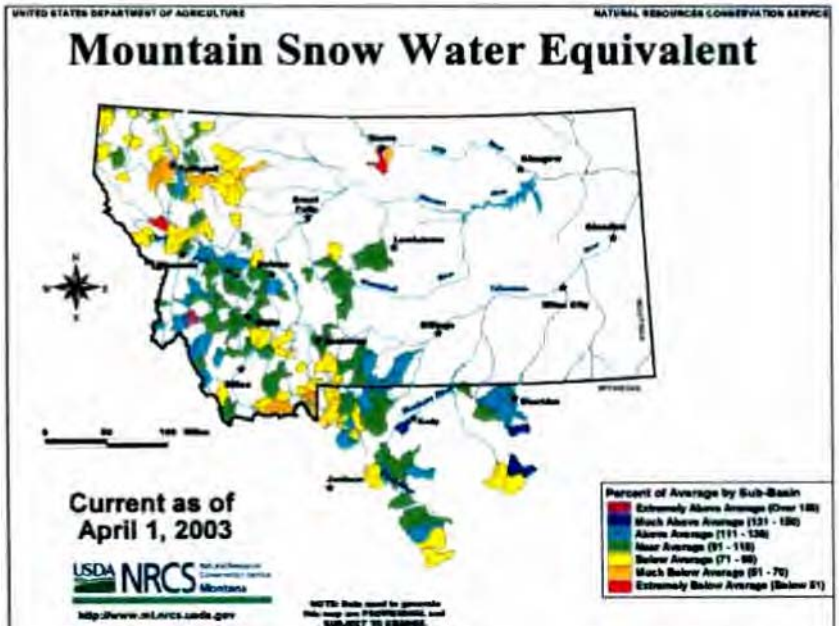
**April through July:**

Some drought relief was seen in parts Montana with near to above normal precipitation during February through May. In addition, late snow in the second half of April helped to reduce the

snow melt in some basins in Montana. As of April 1, mountain snow water contents statewide were 93 percent of average and 97 percent of last year. West of the Continental Divide snowpack was 92 percent of average and 85 percent of last year. East of the Continental Divide snowpack was 96 percent of average and 115 percent of last year. During April, precipitation varied across the state with mountain areas in the Columbia River basin at 90 percent of average, the Missouri River basin at 126 percent of average and the Yellowstone River basin at 76 percent of average. Overall, April mountain and valley precipitation across the state was 116 percent of average and 130 percent of last year. April temperatures were generally near average in the southwest and above average across other areas of Montana.

Precipitation was reduced in May. Mountain and valley precipitation across the state was 85 percent of average and 93 percent of last year, while east of the Continental Divide mountain and valley precipitation was 94 percent of average and 111 percent of last year. May was a month of extremes. Early in the month snow was accumulating in the mountains and record low temperatures were seen in southwest Montana. By the end on the month, temperatures rebounded to record highs with snow melt well above average. The cold temperatures early in the month held on to snow that melted rapidly with the high temperatures later in the month. With above average temperatures there were several areas that reported flooding. Flooding was generally minor and occurred mainly on farm land.

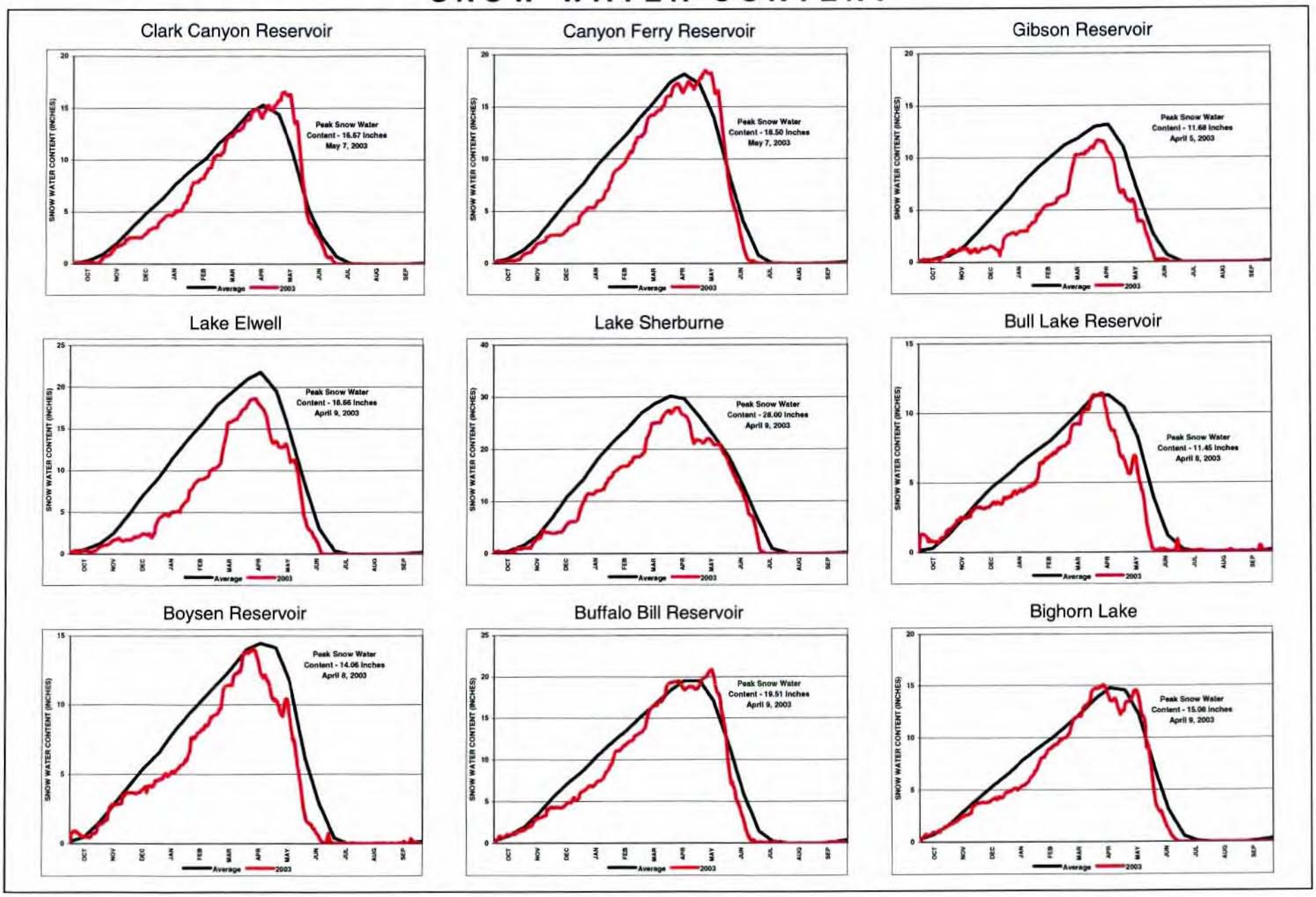
As of June 1, remaining mountain snow water contents were generally ranging from near average to severely below average. In Montana, east of the Continental Divide snowpack was 73 percent of average and west of the Continental Divide snowpack was 89 percent of average. Statewide, mountain snow water content was 85 percent of average. The peak mountain snowpack was below normal for basins in north and northcentral Montana and near to above normal for the Bighorn River Basin in Wyoming and basins in southwest Montana. The peak snowpack for Reclamation reservoirs occurred between March 11 and May 7. The peak generally occurs around April 15; however, spring storms above Clark Canyon and Canyon Ferry extended it by a fey weeks, while most of the snowpack above Fresno Reservoir melted slightly earlier than usual Figure MTG1.



August through September:

August and September precipitation varied across the state. Generally, August remained very dry. However, during September areas west of the Continental Divide and extreme eastern portions of the state received over two inches of rainfall. This brought monthly precipitation for September to above normal in some of the basins in Montana. The exceptions were areas of southwest Montana and the Bighorn River basin in Wyoming which remained dry. August temperatures were above average with new record high temperatures set in Helena and Havre. September temperatures were above normal west of the Continental Divide, while areas east of the Continental divide were near average.

# Figure MTG1
# WATER YEAR 2003
# SNOW WATER CONTENT



The inflow conditions for August through September ranged from below average to much below average. The total annual inflows ranged from 40 percent of normal at Clark Canyon Reservoir to 89 percent of normal at Fresno Reservoir. Leading into water year 2004 the drought remained prominent in the Bighorn Basin in Wyoming and most basins in Montana east of the Continental Divide, where Reclamation facilities are located.

**Reservoir Storm, Releases and Inflows:**

The 2003 water year storage began with Reclamation reservoirs ranging from much below average to above average storage. October 1 storage in the Upper Missouri Basin was 2,657,600 acre-feet, 97 percent of average. Storage for the Milk River Project was 110,000 acre-feet, 103 percent of normal. Storage in Bighorn Lake in the Bighorn River Basin was 635,000 acre-feet, 62 percent of normal. These storage levels continued through December. January through April end-of-month storages were new record lows for Bighorn Lake. New record low end-of-month storages were set for Clark Canyon Reservoir for the entire year.

The only Reclamation reservoirs in Montana that filled were Canyon Ferry, Gibson, Fresno, Pishkun, and Willow Creek Reservoirs. Canyon Ferry filled into the flood pool and Fresno filled into the surcharge pool.

The flood damages prevented in 2003 totaled $9,892,300. The largest contributor to the total was Yellowtail Dam, which prevented $6,239,500 in mainstem damage. The other two principle contributors were Canyon Ferry and Tiber Dams which prevented $1,814,700 and $1,477,500 respectively in mainstem damage. Clark Canyon Dam also prevented mainstem damage in the amount of $360,000.

The winter storage in Reclamation reservoirs ranged from much below average to above average. January through March storages had reservoirs in central and northcentral Montana near to above average, while reservoirs in the Bighorn Basin in Wyoming and southwest Montana were much below average. For example, the end of February storage ranged from 40 percent of normal at Clark Canyon Reservoir to 136 percent of normal at Fresno Reservoir.

These conditions continued into April and May. The storage in Reclamation facilities east of the Continental Divide continued to be much below average to above average. However, by the end of May when conditions became extremely dry demands on reservoir storage increased significantly.

June through August storage ranged from much below average to above average. Storage in Clark Canyon and Gibson Reservoirs were much below normal. Due to minimal precipitation across Montana, some reservoirs that were near to above average had large storage demands thus causing storage to drop much below normal. For example the end of August storage in Gibson Reservoir was only 14 percent of normal, as compared to the end-of-May storage which was 112 percent of normal. Areas in southwest Montana did not improve throughout the summer, which lead to Clark Canyon Reservoir being only 9 percent of normal at the end

of August. Conversely, the end of August storage in Lake Elwell was the sixth highest on record.

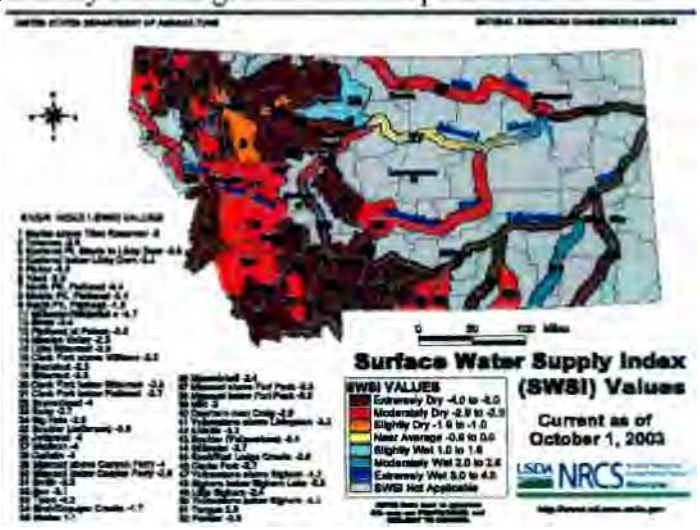
Water year 2003 ended with storage ranging from much below average to above average. Some Reclamation reservoirs in northcentral and central Montana entered water year 2004 with near or above normal storage. The Reclamation reservoirs with the least amount of carryover storage were Clark Canyon and Gibson. Clark Canyon began the 2004 water year at a record low level, while Gibson Reservoir began the water year at the lowest level in twenty-six years.

Releases from nearly all Reclamation reservoirs were very conservative for the entire year because of the severe drought conditions. In general, releases were only increased when absolutely necessary to control the spring runoff or irrigation demands_ In the Missouri and Bighorn Rivers, flows were maintained at rates below the desired minimum fishery flows for most of water year 2003. Releases from Clark Canyon Dam were set for the winter at approximately 25 cfs, well below the desired minimum for river fisheries, beginning in early September.

**Water Supply and Runoff:**

As of April 1 it appeared that almost all reservoirs in Montana would be water short. The January 1 forecasted April-July runoff volumes ranged from 33 to 79 percent of average among Reclamation reservoirs east of the Continental Divide. The outlook improved slightly as winter came to an end. The April I forecasted runoff volumes ranged from 39 to 83 percent of average. The actual runoff for water year 2003 ranged from 28 to 87 percent of average, MTT2.

The peak release was greater than peak inflow at Clark Canyon and Gibson Reservoirs. At Clark Canyon, the peak release was approximately 500 cfs Greater than the Weak inflow. Peak release was 810 cfs on June 12, while the inflow peaked at 296 cfs on March 14, which was much below normal. Canyon Ferry peak inflow was 20,361 cfs on June 21, while the peak release was 9,958 cfs on June 4. In the Sun River Basin, Gibson Reservoir inflow peaked at 5,246 cfs, while the release peaked at 5,475 cfs both occurring on May 30. The peak inflow for Pishkun and Willow Creek Reservoirs were 1,378 cfs on June 8; and 73 cfs on May 10, respectively. The Sun River Basin inflows were below average for all three reservoirs. In northcentral and central Montana the peak inflows were higher than average. Inflow to Lake Elwell peaked at 3,134 cfs on May 31 and releases



peaked at 631 cfs on July 11. In the Milk River Basin, Lake Sherburne peak inflow was 1,507 on May 26 and releases peaked at 691 cfs on July 12. The peak inflow for Fresno Reservoir was 3,292 cfs on March 29 while the release peaked at 1,200 cfs on May 30. Peak inflow at Nelson Reservoir was 410 cfs on March 29 while the release peaked at 398 on July 9. In the Bighorn River Basin, Bighorn Lake peak inflow was 7,515 cfs on June 20 and the peak release was 2,279 cfs on July 13, which were below normal.

TABLE MTT1
2003 MOUNTAIN SNOW WATER CONTENT
AS A PERCENT OF NORMAL

| DRAINAGE BASIN | JAN 1 | FEB 1 | MAR 1 | APR 1 | MAY 1 |
|---|---|---|---|---|---|
| Beaverhead | 68 | 81 | 89 | 95 | 105 |
| Jefferson | 62 | 75 | 91 | 99 | 105 |
| Madison | 66 | 73 | 75 | 80 | 88 |
| Gallatin | 59 | 74 | 86 | 91 | 92 |
| Missouri Headwaters above Toston | 65 | 76 | 86 | 93 | 97 |
| Sun-Teton | 46 | 52 | 54 | 82 | 62 |
| Marias | 45 | 49 | 52 | 81 | 61 |
| Milk River | 9 | 17 | 66 | 34 | 0 |
| St. Mary | 70 | 73 | 71 | 88 | 82 |
| Wind | 72 | 70 | 82 | 97 | 69 |
| Shoshone | 74 | 85 | 87 | 105 | 96 |
| Bighorn (Boysen-Bighorn) | 73 | 75 | 87 | 104 | 81 |

TABLE MTT2
2003 WATER SUPPLY FORECASTS

| RESERVOIR | JAN 1" | | FEB 1" | | MAR 1" | | **APR 1'** | | MAY 1[31] | | JUN 1' | | ACTUAL APRIL-JULY' | | % OF APRIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 AC-FT | % OF AVG | 1,000 AC-FT | % OF AVG | 1,000 AC-FT | % OF AVG | 1,000 AC-FT | % OF AVG | 1,000 AC-FT | % OF AVG | 1,000 AC-FT | % OF AVG | 1,000 AC-FT | % OF AVG | FORE-CAST RECD |
| Clark Canyon | 37.6 | 33 | 37.0 | 33 | 36.0 | 32 | 43.9 | 39 | 46.3 | 51 | 20.3 | 32 | 31.0 | 28 | 71 |
| Canyon Ferry | 1,134.0 | **56** | 1,122.0 | 55 | 1,121.0 | **55** | 1,090.0 | 54 | 1,324.0 | 79 | 820.0 | 74 | 1,361.3 | 67 | 125 |
| Gibson | 269.8 | 56 | 239.4 | 50 | 254.0 | 53 | 312.6 | 65 | 283.0 | **65** | 167.2 | 63 | 307.1 | 64 | 98 |
| Tiber | 249.7 | 51 | 238.1 | 49 | 254.0 | 52 | 335.0 | 69 | 258.0 | 61 | 115.0 | 45 | 267.4 | 55 | 80 |
| Sherburne | 82.2 | 79 | 79.8 | 77 | 77.0 | 74 | 86.4 | 83 | 77.9 | 82 | 50.8 | 81 | 90.5 | 87 | 105 |
| Fresno | 38.0 | 46 | 31.0 | 37 | 39.0 | 47 | 42.0 | 69 | 26.0 | 62 | 17.4 | 89 | 54.5 | **65** | 140 |
| Yellowtail | 629.3 | 53 | 633.3 | 53 | 719.4 | 60 | 710.9 | 60 | 493.6 | 48 | 294.8 | 39 | 548.2 | 46 | 77 |

1/ Runoff Forecast for April-July; Fresno Reservoir is March-July.
2/ Runoff Forecast for April-July.
3/ Runoff Forecast for May-July.
4/ Runoff Forecast for June-July.
5/ Actual Runoff for April-July; Fresno Reservoir is March-July.

# TABLE MTT3
# PERCENT OF AVERAGE PRECIPITATION
# 2003 VALLEY PRECIPITATION

| BASIN | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Beaverhead | | | | | | | | | | | | |
| Monthly % of Average | 27 | 76 | 44 | 37 | 111 | 54 | 231 | 28 | 33 | 65 | 58 | 16 |
| Year-to-Date % of Average | 27 | 43 | 43 | 42 | 50 | 51 | 101 | 76 | 66 | 66 | 65 | 60 |
| Jefferson | | | | | | | | | | | | |
| Monthly % of Average | 24 | 50 | 59 | 72 | 155 | 73 | 233 | 53 | 39 | 57 | 69 | 22 |
| Year-to-Date % of Average | 24 | 35 | 41 | 47 | 61 | 64 | 106 | 89 | 77 | 74 | 73 | 69 |
| Madison | | | | | | | | | | | | |
| Monthly % of Average | 23 | 81 | 63 | 105 | 152 | 61 | 222 | 80 | 35 | 57 | 76 | 17 |
| Year-to-Date % of Average | 23 | 55 | 58 | 70 | 85 | 81 | 100 | 97 | 87 | 84 | 84 | 79 |
| Gallatin | | | | | | | | | | | | |
| Monthly % of Average | 12 | 20 | 23 | 175 | 277 | 120 | 174 | 81 | 99 | 25 | 43 | 8 |
| Year-to-Date % of Average | 12 | 15 | 17 | 47 | 79 | 88 | 109 | 101 | 101 | 94 | 90 | 82 |
| Missouri Above Toston | | | | | | | | | | | | |
| Monthly % of Average | 21 | 69 | 57 | 104 | 168 | 74 | 221 | 69 | 49 | 51 | 68 | 20 |
| Year-to-Date % of Average | 21 | 45 | 49 | 62 | 79 | 78 | 105 | 96 | 87 | 83 | 81 | 76 |
| Sun-Teton | | | | | | | | | | | | |
| Monthly % of Average | 78 | 29 | 78 | 51 | 107 | 200 | 153 | 115 | 79 | 9 | 37 | 138 |
| Year-to-Date % of Average | 78 | 52 | 61 | 58 | 67 | 88 | 98 | 102 | 98 | 89 | 84 | 88 |
| Marias | | | | | | | | | | | | |
| Monthly % of Average | 72 | 43 | 32 | 21 | 118 | 71 | 203 | 84 | 94 | 10 | 19 | 102 |
| Year-to-Date % of Average | 72 | 60 | 52 | 45 | 55 | 59 | 97 | 92 | 92 | 80 | 72 | 74 |
| Milk | | | | | | | | | | | | |
| Monthly % of Average | 90 | 69 | 16 | 57 | 122 | 68 | 211 | 101 | 92 | 32 | 65 | 78 |
| Year-to-Date % of Average | 90 | 82 | 62 | 61 | 70 | 69 | 104 | 103 | 100 | 88 | 86 | 85 |
| St. Mary | | | | | | | | | | | | |
| Monthly % of Average | 58 | 22 | 66 | 52 | 77 | 377 | 97 | 50 | 49 | 4 | 8 | 74 |
| Year-to-Date % of Average | 58 | 37 | 47 | 49 | 53 | 88 | 89 | 81 | 76 | 69 | 63 | 64 |
| Bighorn Above Yellowtail | | | | | | | | | | | | |
| Monthly % of Average | 106 | 87 | 19 | 75 | 198 | 171 | 58 | 69 | 93 | 27 | 89 | 77 |
| Year-to-Date % of Average | 106 | 99 | 83 | 81 | 97 | 112 | 97 | 88 | 89 | 82 | 82 | 82 |

# 2003 MOUNTAIN PRECIPITATION

| BASIN | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lima Resevoir | | | | | | | | | | | | |
| Monthly % of Average | 39 | 56 | 93 | 63 | 73 | 55 | 172 | 84 | 26 | 33 | 48 | 31 |
| Year-to-Date % of Average | 39 | 49 | 67 | 66 | 67 | 65 | 80 | 81 | 74 | 71 | 70 | 68 |
| Clark Canyon Reservoir | | | | | | | | | | | | |
| Monthly % of Average | 46 | 65 | 57 | 113 | 122 | 112 | 142 | 62 | 40 | 40 | 74 | 42 |
| Year-to-Date % of Average | 46 | 57 | 57 | 72 | 81 | 87 | 96 | 90 | 84 | 82 | 81 | 79 |
| Jefferson Drainage | | | | | | | | | | | | |
| Monthly % of Average | 45 | 64 | 62 | 122 | 127 | 136 | 137 | 73 | 49 | 39 | 94 | 43 |
| Year-to-Date % of Average | 45 | 56 | 58 | 76 | 85 | 95 | 101 | 97 | 91 | 88 | 88 | 86 |
| Madison Drainage | | | | | | | | | | | | |
| Monthly % of Average | 62 | 53 | 75 | 98 | 82 | 94 | 152 | 100 | 33 | 44 | 77 | 44 |
| Year-to-Date % of Average | 62 | 57 | 64 | 73 | 75 | 79 | 89 | 90 | 85 | 83 | 82 | 80 |
| Gallatin Drainage | | | | | | | | | | | | |
| Monthly % of Average | 50 | 54 | 41 | 107 | 136 | 109 | 90 | 72 | 48 | 47 | 45 | 44 |
| Year-to-Date % of Average | 50 | 52 | 48 | 64 | 77 | 84 | 85 | 83 | 79 | 77 | 75 | 73 |
| Canyon Ferry Reservoir | | | | | | | | | | | | |
| Monthly % of Average | 51 | 59 | 64 | 113 | 111 | 118 | 132 | 78 | 44 | 40 | 80 | 44 |
| Year-to-Date % of Average | 51 | 56 | 59 | 74 | 81 | 88 | 95 | 92 | 87 | 84 | 84 | 82 |
| Gibson Reservoir | | | | | | | | | | | | |
| Monthly % of Average | 78 | 27 | 55 | 93 | 75 | 204 | 80 | 44 | 65 | 17 | 56 | 134 |
| Year-to-Date % of Average | 78 | 48 | 51 | 62 | 65 | 86 | 86 | 79 | 78 | 74 | 72 | 76 |
| Lake Elwell Reservoir | | | | | | | | | | | | |
| Monthly % of Average | 71 | 32 | 60 | 81 | 74 | 209 | 70 | 52 | 62 | 16 | 37 | 120 |
| Year-to-Date % of Average | 71 | 48 | 53 | 61 | 63 | 86 | 84 | 80 | 78 | 75 | 73 | 75 |
| Sherburne Reservoir | | | | | | | | | | | | |
| Monthly % of Average | 30 | 58 | 86 | 87 | 56 | 204 | 76 | 72 | 60 | 5 | 24 | 78 |
| Year-to-Date % of Average | 30 | 48 | 62 | 69 | 67 | 86 | 85 | 83 | 81 | 77 | 75 | 75 |
| Bighorn Lake | | | | | | | | | | | | |
| Monthly % of Average | 98 | 78 | 50 | 115 | 134 | 172 | 75 | 76 | 93 | 24 | 93 | 85 |
| Year-to-Date % of Average | 98 | 87 | 75 | 85 | 93 | 108 | 102 | 97 | 97 | 91 | 91 | 91 |

## FLOOD BENEFITS

The Corps of Engineers evaluated the reservoir regulation data pertaining to Reclamation reservoirs within the jurisdiction of the Montana Area Office and indicated that 4 reservoirs provided flood relief during water year 2003. They were: Clark Canyon on the Beaverhead River near Dillon, Montana; Canyon Ferry on the Missouri River near Helena, Montana, Lake Elwell on the Marias River near Chester, Montana, and Bighorn Lake on the Bighorn River near Fort Smith, Montana.

Bighorn Lake played the most important role in preventing flood damages during the 2003 runoff season. The most notable examples of peak flows regulated by Bureau reservoirs during the spring runoff are as follows:

| Reservoir | Peak Inflow fcfs) | River Discharge (cfs) | Date |
|---|---|---|---|
| Clark Canyon | 296 | 28 | 03/14/03 |
| Canyon Ferry | 20,361 | 2,274 | 06/02/03 |
| Lake Elwell | 3,134 | 612 | 05/31/03 |
| Bighorn Lake | 7,515 | 1,496 | 06/20/03 |

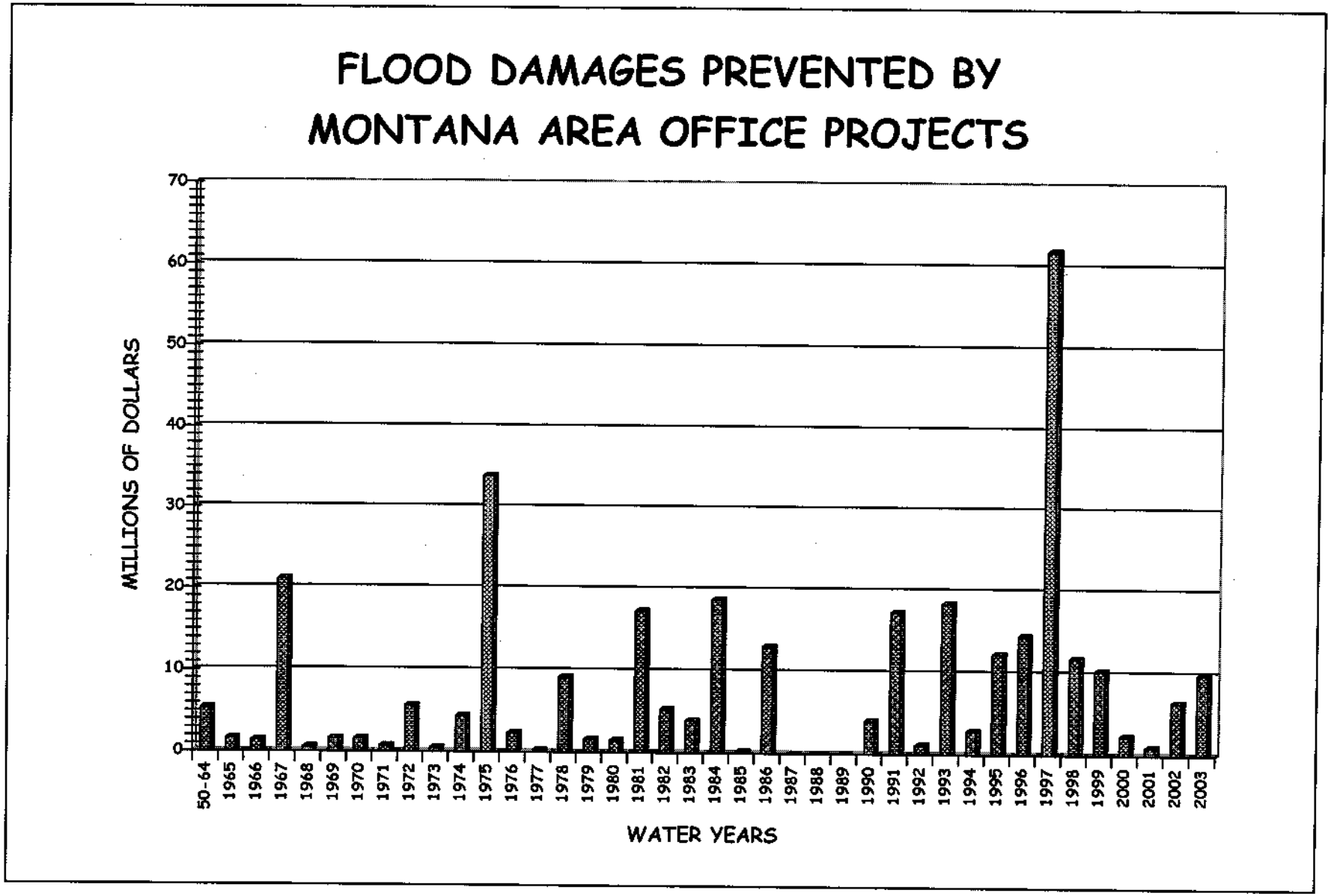
The Corps estimated these four Bureau reservoirs in Montana reduced flood damages by $9,892,300 in 2003. All of these benefits were derived by storing water which would have contributed to flooding downstream on the main stem of the Missouri River below Fort Peck Reservoir. The distribution of flood damages prevented is as listed in Table MTT4. For additional information on the operations of the reservoirs which provided flood control, refer to the individual "Summary of Operations for 2003" for each reservoir in this report. Figure MTG2 shows the annual flood damages prevented by Montana Area Office reservoirs since 1950.

TABLE MTT4
FLOOD DAMAGES PREVENTED
(THOUSANDS OF DOLLARS)

| Reservoir | Local | Main Stem | 2003 Total | Prev. Accum. | 1950-2003 Accum. Total |
|---|---|---|---|---|---|
| Clark Canyon | $ 0.0 | $ 360.6 | $ 360.6 | $ 11,949.7 | $ 12,310.3 |
| Canyon Ferry | 0.0 | 1,814.7 | 1,814.7 | 136,317.8 | 138,132.5 |
| Gibson' | 0.0 | 0.0 | 0.0 | 3,044.5 | 3,044.5 |
| Lake Elwell | 0.0 | 1,477.5 | 1,477.5 | 57,190.1 | 58,667.7 |
| Fresno | 0.0 | 0.0 | 0.0 | 13,059.3 | 13,059.3 |
| Yellowtail | 0.0 | 6,239.5 | 6.239.5 | 95 012.8 | 96,257.3 |
| Total | $ 0.0 | $ 9,892.3 | $ 9,892.3 | $316,574.3 | $326,466.6 |

[1] No space allocated to flood control, but some flood protection provided by operation for other purposes.

FIGURE MTG2


FLOOD DAMAGES PREVENTED BY
MONTANA AREA OFFICE PROJECTS
MILLIONS OF DOLLARS
0
10
20
30
40
50
60
70
50-64
1965
1966
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WATER YEARS

## UNIT OPERATIONAL SUMMARIES FOR WATER YEAR 2003

### Clark Canyon Reservoir

Clark Canyon Reservoir, a Pick-Sloan Missouri Basin Program (P-S MBP) project, is located on the Beaverhead River approximately 20 miles upstream from Dillon, Montana. It has a total capacity of 257,152 acre-feet (255,643 acre-feet active). The reservoir is the storage facility for the East Bench Unit providing a full water supply for irrigation of 21,800 acres and a supplemental supply for about 28,000 acres. Flood control, recreation, and fish and wildlife are among the other functions served by the reservoir.

In 2000, Reclamation surveyed Clark Canyon Reservoir to develop a topographic map and compute a present storage-elevation relationship (area-capacity tables). The data were used to calculate reservoir capacity lost due to sediment accumulation since dam closure in August of 1964. The 2000 survey determined that Clark Canyon Reservoir has a storage capacity of 174,367 acre-feet and a surface area of 5,151 acres at a reservoir elevation of 5546.10. Since closure in 1964, the reservoir has accumulated a sediment volume of 4,106 acre-feet below elevation 5546.10. This volume represents a 2.3 percent loss in capacity and an average annual loss of 114.7 acre-feet. The revised area-capacity table was put into effect on October 1, 2001, reflecting the new storage levels.

Valley and mountain precipitation in the Beaverhead River Basin was well below normal during August and September of 2002. Inflow to Clark Canyon during August and September was 46 and 35 percent of average respectively. Large irrigation demands during water year 2002 had placed a heavy demand on storage in Clark Canyon Reservoir. Following the conclusion of the irrigation season and after the Labor Day weekend, releases from Clark Canyon were reduced to the desired fall and winter flow rate of between 25-30 cfs on September 10. Beginning at that time, storage in Clark Canyon began to steadily increase and entered water year 2003 with a content of 16,901 acre-feet at elevation 5495.69. At 14 percent of average, this was a new record low level for this time of year and 19,569 acre-feet or 11.36 feet lower than at the beginning of water year 2002.

The water year began with minor storm activity thus resulting in valley and mountain precipitation much below average. This pattern continued through the fall and into December. On January 1, the Natural Resources and Conservation Service measured snowpack in the Beaverhead River Basin at 68 percent of average. As the winter of 2002-2003 proceeded, monthly mountain precipitation fell at near or above normal rates and by late April snowstorms had improved snowpack conditions significantly. By May 1, the snowpack was measured at 105 percent of average, an increase of almost 40 percent from that recorded on January 1. This was a 28 percent improvement over that experienced during 2002. The valley precipitation had improved to 101 percent of average by the end of April. Even with near average snowpack and

valley precipitation, the May 1 water supply forecast was still much below average, primarily due to the extremely dry soil conditions.

The water year 2003 fall and winter inflow to Clark Canyon Reservoir for October through March was 59,633 acre-feet, or 53 percent of normal. This was 1,946 acre-feet or 3 percent lower than experienced in 2002 and the second lowest inflow of record since construction of Clark Canyon Dam. Because of the near record low runoff into Clark Canyon Reservoir and the low reservoir level of Clark Canyon, fall and winter releases to the Beaverhead River were reduced and maintained between 25-30 cfs through April. This allowed storage to slowly increase to a peak for the year of 73,004 acre-feet at elevation 5522.15 on May 15, 2003. This was 47 percent of normal and 42 percent of full capacity. This was also 13,697 acre-feet or 4.11 feet lower than at this same time a year ago.

Based on the mountain snowpack, the water supply forecast prepared on April 1, indicated the April-July runoff into Clark Canyon would be 39 percent of normal, totaling 43,900 acre-feet. At a meeting held on April 9, the Bureau of Reclamation presented East Bench Irrigation District with this latest water supply forecast. Using this forecast, the East Bench Irrigation District set the irrigation allotments for the 2003 irrigation season at 1.0 acre-feet per acre for Class I & II lands and 1.3 acre-feet per acre for Class III lands. These allotments were 32 and 42 percent of the full contract allotment, respectively. Weather conditions improved in April. Late spring storms moved across southwestern Montana in April, bringing welcomed snow and rain showers in the valleys and significant amounts of snow in the surrounding mountains. Valley precipitation in the Beaverhead River Basin improved to 101 percent of average while mountain precipitation climbed to 96 percent of average. The welcomed moisture helped delay the irrigation demands until the second week of May. As a result, releases from Clark Canyon Dam were maintained at approximately 30 cfs until May 15 when they were gradually increased to meet the irrigation demands. However, by the end of May, valley and mountain precipitation were once again below average. Valley precipitation for the Beaverhead basin was only 28 percent of average for May, which largely caused the significant increase in irrigation demands.

Several years of consecutive drought had a significant affect in southwestern Montana. This area, along with the Bighorn Basin in south central Montana, appeared to be the worst areas in the State that was suffering from the droughts of 2000 through 2002, and now 2003. The mountain snowmelt in the Beaverhead River Basin normally begins in late April or early May. However, in 2003, there was only a slight increase in streamflows during the peak runoff. This was due to the lack of normal spring precipitation and the extremely dry subsoils that were quickly absorbing the snowmelt. In addition, the lack of precipitation caused an increased upstream irrigation demand. Consequently, streamflows into Clark Canyon Reservoir continued to slowly recede and by May 19, inflow to Clark Canyon had dropped to as low as 57 cfs. The beginning of irrigation season was delayed until May 15 due to timely precipitation in late April and early May. In June, the Board of the East Bench Irrigation District met and agreed to increase the irrigation allotments to 1.2 acre-feet per acre for Class I and II lands, and 1.4 acre-feet per acre for Class III lands because canal losses were less than anticipated.

Snowmelt runoff during April through July was well below normal. Inflows into Clark Canyon Reservoir averaged 107 cfs during April, 88 cfs during May, 177 cfs during June and 142 cfs during July. These resulted in respective monthly total inflows of 6,341 acre-feet, 5,416 acre-feet, 10,499 acre-feet and 8,756 acre-feet. The peak inflow for the year was recorded on March 14 at 296 cfs. This was the fourth lowest peak inflow to Clark Canyon during March 1-July 31 since construction of the dam. The total April-July inflow to Clark Canyon was 28 percent of average totaling 31,013 acre-feet and was the lowest April-July inflow of record since construction of Clark Canyon Dam.

Precipitation in the Beaverhead River Basin continued to remain well below normal during July through September. The lack of precipitation produced heavy demands on storage out of Clark Canyon to meet the downstream irrigation demands. Storage in Clark Canyon was quickly being depleted. By the end of July, only 15,622 acre-feet of storage remained in Clark Canyon Reservoir and continued to drop until it reached a record low content of 10,721 acre-feet on August 18. As a result, the releases out of Clark Canyon were gradually reduced from about 350 cfs in early August to about 90 cfs by the end of August.

The majority of the storage water released from Clark Canyon Reservoir during water year 2003 to meet the downstream irrigation demands was released during May 15 through September 1. During this time, releases averaged 430 cfs and, at one point, reached a peak for the year of 810 cfs on June 12 to satisfy the downstream water needs. The average release of 430 cfs was about 7 cfs lower than the average release experienced a year ago during this similar time period. Beginning in mid-May, storage in Clark Canyon declined dramatically from 73,004 acre-feet at elevation 5522.15 on May 15 to a low for the year of 10,721 acre-feet at elevation 5490.01 on August 18. This storage level was recorded as the lowest storage level ever recorded at Clark Canyon. This storage level was nearly 49,000 acre-feet below the target level of 60,000 acre-feet recommended by the Montana Fish, Wildlife and Parks as the minimum required to sustain an adequate and healthy lake fishery.

Shortly after the Labor Day Weekend, the releases were reduced to the desired fall and winter flow of approximately 30 cfs on September 4. During August 19 through the end of the water year, Clark Canyon Reservoir slowly began refilling and ended the water year with a storage content of 15,837 acre-feet at elevation 5494.82. This was 13 percent of normal and 9 percent of normal full capacity. This was also 1,064 acre-feet and 0.87 feet below the end of water year 2002. East Bench Irrigation District water users received approximately 40 percent and Clark Canyon Water Supply Company received about 82 percent of their contract supply. The total annual inflow to Clark Canyon Reservoir during 2003 was 40 percent of normal, totaling 105,189 acre-feet, the lowest annual inflow of record and 5,646 acre-feet and 30,931 acre-feet less than experienced during the drought years of 2002 and 2001 respectively. The total annual release to the Beaverhead River from Clark Canyon was 106,253 acre-feet or 39 percent of normal and was also the lowest annual release of record since construction of the dam. This was also 22,709 acre-feet less than what was released during the drought of 2002.

Lima Reservoir is a private irrigation facility located upstream of Clark Canyon Reservoir on the Red Rock River, a tributary of the Beaverhead River. Lima Reservoir did not fill in water year

2003 and peaked at 35,613 acre-feet, which is 42 percent of full capacity on May 23. The drainage area above Lima Reservoir accounts for about 25 percent of the total drainage area above Clark Canyon Reservoir.

Streamflow of the Beaverhead River at Barretts peaked at 860 cfs on June 11 due to irrigation releases from storage, but the streamflow would have peaked at 527 cfs on June 2 if Clark Canyon Reservoir would not have been controlling the releases.

The Corps of Engineers determined that during 2003, Clark Canyon did not prevent any local flood damages but did prevent $360,600 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since construction of Clark Canyon Dam in 1964, Clark Canyon Reservoir has reduced flood damages by a total of $12,310,300.0

Additional hydrologic and statistical information pertaining to the operation of Clark Canyon Reservoir during 2003 can be found in Table MTT5 and Figure MTG3.

## Important Events - 2003

September 6: Following the 2002 irrigation season, releases from Clark Canyon to the Beaverhead River were reduced to 28 cfs to conserve storage and allow Clark Canyon Reservoir to gradually increase throughout the fall and winter.

March 14: Inflow to Clark Canyon reached a peak for the year at 296 cfs.

April 9: Met with East Bench Irrigation District to discuss operation plans for remainder of the water year 2003. The April 1 mountain snowpack was 95 percent of normal and water supply forecast indicated the April-July runoff into Clark Canyon would be about 39 percent of normal. Based on this forecast, irrigation districts set reduced irrigation allotments for their water users at 1.0 acre-feet per acre for Class I & II lands and 1.3 acre-feet per acre for Class III lands.

May 15: Clark Canyon Reservoir reached a peak storage content of 89,226 acre-feet at elevation 5522.15, 73,004 acre-feet or 23.95 feet below normal full pool level.

May 15: This marked the beginning of when releases from Clark Canyon were increased to meet downstream irrigation demands.

June 12: Releases from Clark Canyon Reservoir reached a peak of 810 cfs to meet downstream water demands from the Beaverhead River.

June 25: East Bench Irrigation District raised the allotment for their water users to 1.2 acre-feet per acre for Class I & II lands and 1.4 acre-feet per acre for Class III lands. This was a result of the canal losses being lower than anticipated; consequently more water would be used on the fields from their storage allotment.

July 20: East Bench Irrigation District had used their storage allotment and discontinued diversions. However, storage water was still released to satisfy downstream senior water users.

August 18: Storage in Clark Canyon Reservoir was drafted to a minimum content of 10,721 acre-feet at elevation 5490.01, the lowest storage level of record since construction of Clark Canyon Dam. This was 6 percent of full capacity and 163,646 acre-feet or 56.01 feet below normal full pool level.

September 4: Release from Clark Canyon Dam to the Beaverhead River reduced to the winter release of approximately 30 cfs.

# TABLE MTT5
# HYDROLOGIC DATA FOR 2003
# CLARK CANYON - EAST BENCH UNIT

NEW SEDIMENT SURVEY DATA EFFECTIVE 10/1/2001

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 5470.60 | 1,061 | 1,061 |
| TOP OF ACTIVE CONSERVATION | 5535.70 | 124,160 | 123,099 |
| TOP OF JOINT USE | 5546.10 | 174,367 | 50,207 |
| TOP OF EXCLUSIVE FLOOD CONTROL | 5560.40 | 253,442 | 79,075 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 5495.69 | 16,901 | OCT 01, 2002 |
| END OF YEAR | 5494.82 | 15,837 | SEP 30, 2003 |
| ANNUAL LOW | 5490.01 | 10,721 | AUG 18, 2003 |
| ANNUAL HIGH | 5522.15 | 73,004 | MAY 15, 2003 |
| HISTORIC HIGH | 5564.70 | 283,073 | JUN 25, 1984 |

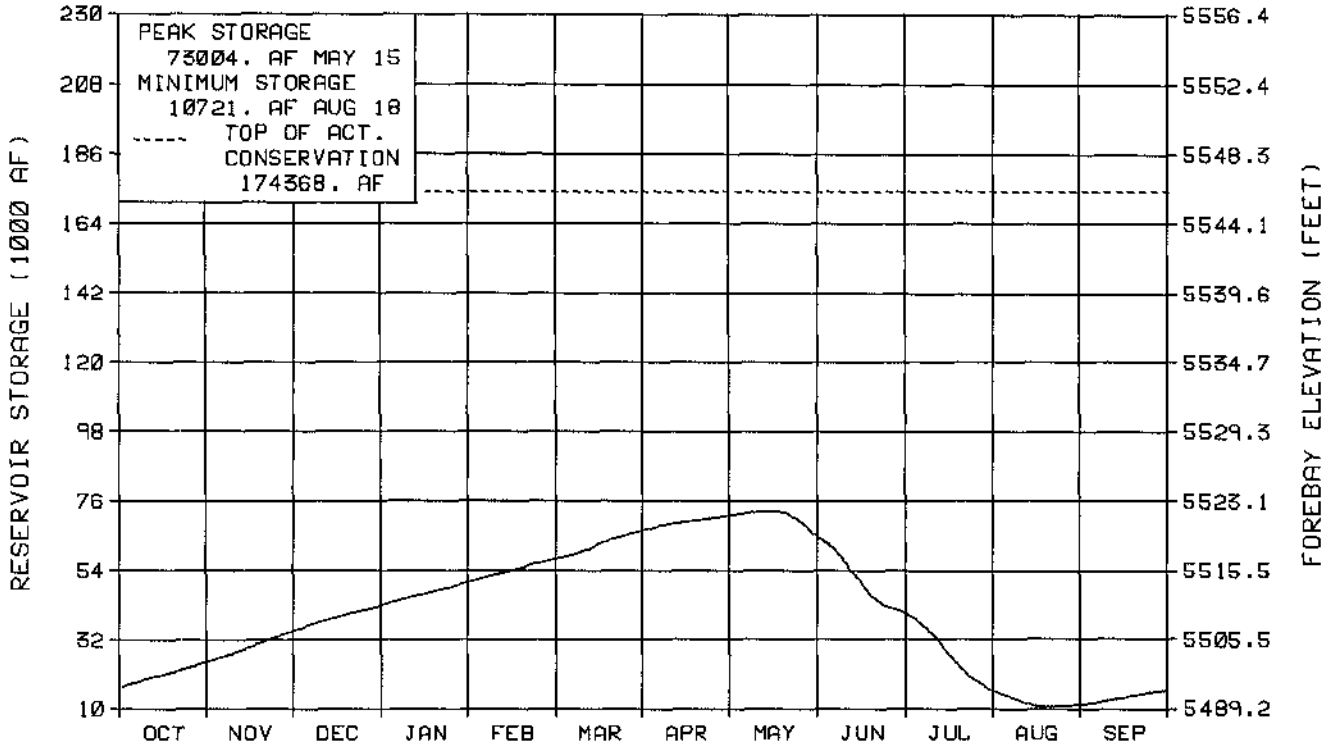
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 105,189 | OCT 02-SEP 03 | 106,253 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 296 | MAR 14, 2003 | 810 | JUN 12, 2003 |
| DAILY MINIMUM (CFS) | 57 | MAY 19, 2003 | 25 | MAR 20, 2003 |
| DAILY FLOW AT BARRETTS (CFS) | | | 860 | JUN 11, 2003 |
| DAILY FLOW AT BARRETTS W/O CLARK CANYON RESERVOIR (CFS) | | | 527 | JUN 02, 2003 |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

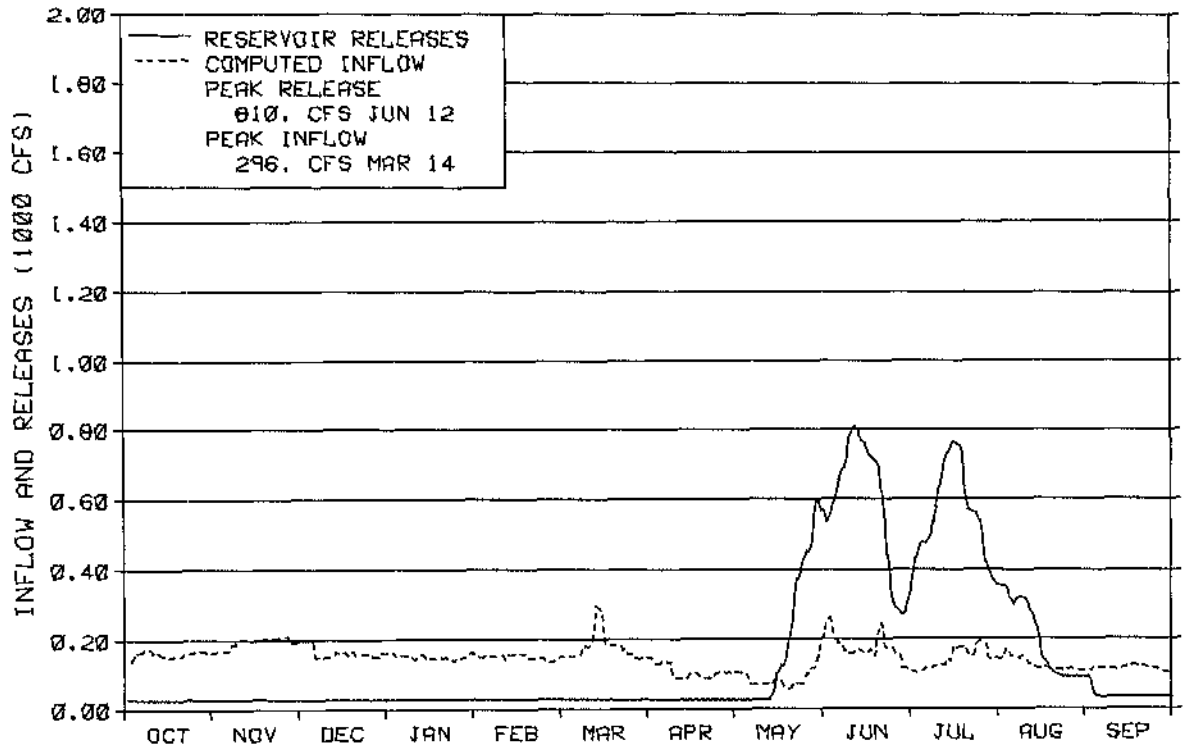
| MONTH | INFLOW | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 9.8 | 42 | 1.7 | 11 | 25.0 | 20 |
| NOVEMBER | 11.4 | 51 | 1.7 | 11 | 34.7 | 26 |
| DECEMBER | 10.0 | 53 | 1.7 | 12 | 43.1 | 31 |
| JANUARY | 9.2 | 58 | 1.7 | 14 | 50.6 | 36 |
| FEBRUARY | 8.2 | 57 | 1.5 | 14 | 57.3 | 40 |
| MARCH | 10.9 | 58 | 1.6 | 15 | 66.6 | 45 |
| APRIL | 6.3 | 29 | 1.5 | 11 | 71.4 | 45 |
| MAY | 5.4 | 20 | 11.9 | 39 | 64.9 | 39 |
| JUNE | 10.5 | 29 | 34.8 | 83 | 40.6 | 24 |
| JULY | 8.8 | 32 | 33.7 | 71 | 15.6 | 10 |
| AUGUST | 7.7 | 40 | 12.2 | 30 | 11.2 | 9 |
| SEPTEMBER | 6.8 | 34 | 2.1 | 10 | 15.8 | 13 |
| ANNUAL | 105.2 | 40 | 106.3 | 39 | | |
| APRIL-JULY | 31.0 | 28 | | | | |

* Average for the 1965-2003 period.

# FIGURE MTG3

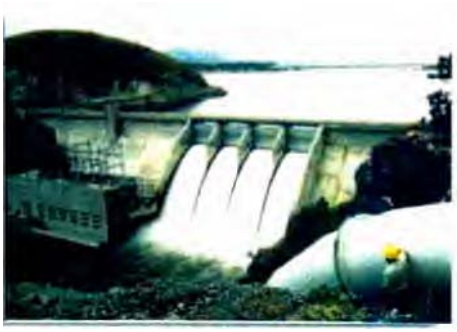
## CLARK CANYON RESERVOIR




WATER YEAR 2003

**Canyon Ferry Lake and Powerplant**



Canyon Ferry Lake (P-S MBP), formed by Canyon Ferry Darn, is located on the Missouri River near Helena, Montana. It has a total capacity of 1,992,977 acre-feet. The top 3 feet were allocated to exclusive flood control in February 1966. The next 27 feet are allocated to joint conservation and flood control purposes. The joint-use space will be evacuated for flood control purposes only to the extent that refill during the spring runoff is reasonably assured. The conservation space was constructed mainly for power generation and to provide replacement storage for several new irrigation developments located on the Missouri River and its tributaries above Great Falls, Montana. To date, however, the conservation storage has been used primarily for power production. The only new areas under irrigation are 5,000 acres being irrigated on the Crow Creek Unit (P-S MBP), 13,900 acres on the Helena Valley Unit (P-S MBP), and 20,300 acres on the East Bench Unit (P-S MBP). In addition, about 5,200 acres in tile Helena Valley Unit that were once irrigated by pumping from Lake Helena and from other streams, are now irrigated by pumping from Canyon Ferry Reservoir. About 28,000 acres on the East Bench Unit also receives a supplemental water supply. A small amount of municipal water is also furnished to the city of Helena, Montana, through facilities for the Helena Valley Unit.

In 1997, a hydrographic and a topographic survey was conducted and a new elevation-area-capacity table and curve was developed. The 1997 survey determined that Canyon Ferry Lake has a storage capacity of 1,992,977 acre-feet and a surface area of 34,048 acres at reservoir elevation 3800. Since closure in 1953, the reservoir has accumulated a sediment volume of 59,746 acre-feet below reservoir elevation 3800. This volume represents a 2.91 percent loss in capacity and an average annual loss of 1,345.6 acre-feet. The revised area-capacity table was put into effect on October 1, 1998, reflecting the new storage levels.

The droughts of 2001 and 2002 continued to severely impact Montana and the inflow to Canyon Ferry Lake. According to the National Weather Service records, valley precipitation during August and September was recorded at 83 and 72 percent of average, respectively while the mountain precipitation was recorded at 72 and 79 percent of average, respectively. Inflow to Canyon Ferry during August and September totaled 91,108 acre-feet and 121,788 acre-feet respectively and were 53 and 57 percent of nonnal, respectively, making the total August-September inflow to Canyon Ferry Lake was the seventh lowest of record. After experiencing near record low inflow, releases from Canyon Ferry Lake continued to be maintained at rates that would sustain flows in the Missouri River below Holter Dam between 3,000-3,200 cfs during August and September. As a result, storage in. Canyon Ferry Lake slowly declined throughout the summer and entered water year 2003 with a storage content of 1,687,629 acre-feet at elevation 3790.75. This was 293,031 acre-feet or 9.51 feet greater than at the beginning of water year 2002.

Precipitation in the Missouri River Basin above Canyon Ferry Reservoir during October through December was well below normal, contributing to below normal streamflows. Valley precipitation during October through December was only 49 percent of average while the mountain precipitation was only 59 percent of average. Precipitation improved to above normal to well above normal during January through April, with the exception of March, where the valley precipitation remained at only 74 percent of average. By May, the monthly precipitation above Canyon Ferry dropped and continued to remain well below normal throughout the remainder of the year. During September, the valley precipitation dropped to as low as 20 percent of average with the mountain precipitation declining to 44 percent of average. The total annual valley precipitation above Canyon Ferry was 76 percent of average while the mountain precipitation was 82 percent of average.

Water year 2003 marked the fourth consecutive year of drought across much of Montana. Severe effects of the persistent drought were being felt across the State. The total annual inflow to Canyon Ferry was 67, percent of average, totaling 2,660,233cre-feet. Inflow to Canyon Ferry during October through December was 66 percent of normal, totaling 545,667 acre-feet. This was the second lowest October-December inflow of record and was only 18,786 acre-feet greater than reported during the record drought year of 2002. During January-March the inflow to Canyon Ferry Lake improved slightly to 82 percent of average, totaling 576,850 acre-feet. However, this was still only the sixth lowest inflow of record since construction of the dam. During October through November 6, releases out of Canyon Ferry were maintained at about 3,000 cfs in order to conserve storage. By November 7 storage in Canyon Ferry was 280,151 acre-feet or 9.13 feet greater than in water year 2002 . Based on the November water supply outlook, it became possible to increase and maintain the total release from Canyon Ferry Lake to the Missouri River at about 3,500 cfs through March.

Mountain snowfall during the winter of 2002-2003 started out light but slowly improved to near normal rates as the winter progressed. On January 1, the Natural Resources and Conservation Service (NRCS) measured the mountain snowpack in the Missouri River Basin above Canyon Ferry to be 65 percent of average, about 19 percent less than a year ago. Snowpack in the Jefferson, Madison, and Gallatin River Basins, major tributaries of the Missouri River Basin was 62, 66 and 59 percent of normal, respectively. As the winter proceeded, mountain snowfall accumulated at above normal rates and by May 1, mountain snowpack in the Missouri River Basin had increased to 97 percent of normal. This was a 17 percent improvement from that experienced a year ago. Snowpack in the tributaries of the Jefferson, Madison, and Gallatin River Basins reported 105, 88 and 92 percent of normal as compared to 76, 85 and 84 percent of normal a year ago. These snowpack conditions were an early indication that the drought of 2003 was somewhat relieved from that experienced in 2002 but there was still some uncertainty of how severe the drought might be in water year 2003. Water users were encouraged to continue implementing strict water conservation measures on their projects.

On March 1, snowpack in the Missouri River Basin upstream of Canyon Ferry Lake was measured at 86 percent of average. Storage in Canyon Ferry on that same date was 104 percent of average. By March 10, storage was drafted to 1,563,686 acre-feet at elevation 3786.84. With snowpack above Canyon Ferry Lake well below normal, the decision was made to continue maintaining powerplant turbine releases to the Missouri River at about 3,500 cfs through April.

This would better assure Canyon Ferry Lake of filling to the top of the joint-use pool by the end of June if there was no improvement in the mountain snowpack. On April 1, the first irrigation deliveries to the Helena Valley Project were initiated, thus increasing the total discharge to the Missouri River by proportionate amounts.

During March through much of May, milder and warmer weather frequented the area. Valley and mountain precipitation during April varied from normal to above normal in the Missouri River Basin above Canyon Ferry Lake as well. However, by May, precipitation in the upper Missouri River Basin dropped well below average and remained that way through the remainder of the year.

Streamflows into Canyon Ferry Lake began to slowly increase in March and continued this way through much of May. By late May, temperatures reached record high levels and began to quickly melt the high elevation mountain snow. Beginning on May 25, inflows rose dramatically from 4,575 cfs to a peak inflow for the year of 20,361 cfs on June 2. As the inflow increased, storage in Canyon Ferry Lake was also gradually increasing. To control the runoff into Canyon Ferry Lake, the total release was gradually increased. Turbine releases were gradually increased from 3,500 cfs on May 7 to full powerplant capacity of about 5,500 cfs on May 27. However, these releases were not large enough to control the runoff into Canyon Ferry Lake. On May 27, a release in excess of full powerplant capacity was initiated and gradually increased, resulting in a peak total discharge for the year of 9,958 cfs recorded on June 3. By the end of the first week of June, cooler weather returned, slowing the runoff into Canyon Ferry Lake. Inflow quickly receded to 5,942 cfs by June 20. To conserve storage in Canyon Ferry Lake and allow the reservoir to slowly fill to the top of the conservation pool, all spills were discontinued during June 5-7 and turbine release was maintained at full powerplant capacity of about 5,200 cfs. On June 13, storage reached the top of the conservation pool at elevation 3797 and continued to increase until reaching a peak content of 1,913,944 acre-feet at elevation 3797.66 on June 25.

By the end of June, the mountain snowmelt into Canyon Ferry Lake was essentially over. Inflow to Canyon Ferry Lake had dropped to less than 3,000 cfs by July 1 and continued to drop until reaching 1,372 cfs on July 13. This was the third lowest inflow of record for this date into Canyon Ferry Lake since construction of the dam. The rapid and critical decline in streamflow to Canyon Ferry Lake was a big concern for Reclamation. Low streamflows and below normal spring precipitation were signaling the effects of another servere drought in Montana. To conserve storage in Canyon Ferry Lake throughout the remainder of the year, it was necessary to reduce and maintain the minimum river flows out of Canyon Ferry Lake to the Missouri River at rates less than the desired minimum river fishery flow of 4,100 cfs. This was done by varying the discharges out of the powerplant turbines and the Helena Valley Project releases.

The April-July runoff into Canyon Ferry totaled 1,361,274 acre-feet. At 70 percent of normal, this was 218,339 acre-feet higher than that experienced during the drought of 2002. Because of the near record low inflows to Canyon Ferry Lake, releases from Canyon Ferry were closely regulated to maintain river flows downstream of Holter Dam between 2,800-3,400 cfs during late July through September, in an effort to conserve storage in Canyon Ferry Lake. The amount of water released from Canyon Ferry to the Missouri River during April-July was 74 percent of normal, totaling 1,137,763 acre-feet and was 490,499 acre-feet more than released in 2002.

The drought of 2003 did not let up during August and September as minimal amounts of precipitation fell in the Missouri River Basin. Valley precipitation was recorded at 68 and 20 percent of average, respectively, while mountain precipitation was 80 and 44 percent of average, respectively. As the mountain snowmelt slowly declined, inflow to Canyon Ferry Lake also slowly receded to a low for the year of 1,156 cfs on August 10. Since the construction of Canyon Ferry Dam and Reservoir in 1954, this was the fifth lowest inflow of record recorded for this date. Inflow to Canyon Ferry during August and September totaled 82,838 acre-feet and 93,603 acre-feet, respectively, and were 49 and 44 percent of normal, respectively. The August inflow to Canyon Ferry Lake was the eighth lowest of record while the September inflow was the lowest of record since construction of Canyon Ferry Dam.

During August and September river releases from Canyon Ferry Lake continued to be maintained at rates necessary to maintain flows in the Missouri River below Holter Dam between 2,800-3,000 cfs. With near record low inflows being experienced, storage in Canyon Ferry Lake continued to slowly draft throughout the summer to 1,547,182 acre-feet at elevation 3786.31 at year-end. This was 90 percent of normal and 4.44 feet or 140,447 acre-feet lower than at the end of water year 2002. Annual runoff into Canyon Ferry Lake totaled 2,660,233 acre-feet and was 67 percent of normal. This was 253,221 acre-feet more than experienced during the drought year of 2002 and is the seventh lowest annual inflow to Canyon Ferry Lake since construction of the dam.

During 2003, Canyon Ferry powerplant generated 322,771,000 kilowatt-hours, the second lowest since construction of the powerplant. This was 79 percent of the long-term average and 93,600 kilowatt-hours more than generated in 2002. The plant used 92 percent of the water released from the dam in 2003. The remainder of the water released was to meet the irrigation needs of the Helena Valley Irrigation District (189,025 acre-feet) and spilled through the river outlet works and spillway (47,096 acre-feet) to allow for scheduled maintenance outages at Canyon Ferry Dam and Powerplant and release water in excess of full powerplant capacity at Canyon Ferry Dam and Powerplant.

The Corps of Engineers estimated that during 2003, even though the operations of Canyon Ferry did not prevent any local flood damages, they did however prevent $1,814,700 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since construction of the Canyon Ferry Dam in 1954, Canyon Ferry Reservoir has reduced flood damages by a total of $138,132,600.

## **Important Events - Water Year** 2003

October 1: All irrigation deliveries to the Helena Valley Unit were discontinued for the 2002 irrigation season. To continue conserving storage in Canyon Ferry, turbine releases were adjusted to maintain river flows in the Missouri River downstream of Holter Dam at 3,000 cfs.

October 4: With a river release of 2,700 cfs out of Canyon Ferry, PPL-MT reported difficulty in maintaining stable levels in Hauser and Holter Reservoirs while maintaining river flows

downstream of Holter Dam above 2,800. In response, turbine releases to the Missouri River were increased by 150 cfs to 2,850 cfs.

October 8: With a river release of 2,850 cfs out of Canyon Ferry, PPL-MT still reported difficulty in maintaining stable levels in Hauser and Holter Reservoirs while maintaining river flows downstream of Holter Dam above 2,800. In response, turbine releases to the Missouri River were increased by 100 cfs to 2,950 cfs.

November 7-8: Based on the November 1 water supply forecast, turbine releases were increased to rates that would maintain river flows downstream of Holter Dam at 3,500 cfs, while still conserving storage in Canyon Ferry Lake.

April 1-September 30: Irrigation deliveries to Helena Valley Unit were initiated on April 1 and adjusted periodically throughout the irrigation season to meet the irrigation demands. Because of the low snowpack and persistent dry weather conditions, as irrigation deliveries to the Helena Valley Project were increased, turbine releases were decreased by proportionate amounts to rates no lower than required to maintain minimum river flows between 2,800-3,000 cfs below Holter Dam.

April 23: Reclamation attended and participated in the Upper Missouri River Advisory Group meeting held in Helena, Montana, in the Lee Metcalfe Building. Tim Felchle, Chief of Reservoir and River Operations, presented the water supply outlook for the upper Missouri River Basin and the proposed operations for Canyon Ferry for 2003.

May 7-14: Mountain snowpack above Canyon Ferry improved to 97 percent of normal by May 1. Based on the May 1 water supply forecast and in order to begin preparing for the spring runoff, total release from Canyon Ferry Lake was gradually increased from 3,740 cfs to 5,790 cfs (z 5,460 cfs through the powerplant and 330 cfs for the Helena Valley Project).

May 27-29: The spring snowmelt runoff was well underway. In preparation to control the spring runoff into Canyon Ferry Lake, total release from Canyon Ferry Lake was gradually increased from 5,790 cfs to 8,130 cfs (z 5,370 cfs through the powerplant, 2,000 cfs through the spillway, and 760 cfs for the Helena Valley Project).

June 2-3: Mountain snowmelt accompanied by moderate precipitation in the Missouri River Basin caused streamflows to increase. Streamflows into Canyon Ferry quickly rose to 20,361 cfs on June 2. With storage in Canyon Ferry Lake only 2.5 feet below the top of the joint-use pool, total release from Canyon Ferry Lake was gradually increased from 8,130 cfs to 10,105 cfs 5,330 cfs through the powerplant, 4,000 cfs through the spillway, and 775 cfs for the Helena Valley Project) to control the spring runoff.

June 5-7: Cooler weather slowed the mountain snowmelt into Canyon Ferry Lake. To assure Canyon Ferry Lake of filling to the top of the joint-use pool, total release from Canyon Ferry Lake was gradually decreased from 9,960 cfs to 5,925 cfs (-=, 5,200 cfs through the powerplant, 0 cfs through the spillway and river outlet gates, and 725 cfs for the Helena Valley Project).

July 3-5: Mountain snowmelt was essentially over and streamflows into Canyon Ferry Lake were quickly receding. To slow the rate of drawdown and conserve storage in Canyon Ferry, total release from Canyon Ferry was gradually decreased from 5,760 cfs to 4,465 cfs 3,750 cfs through the powerplant and 715 cfs for the Helena Valley Project).

July 17-18: Streamflows into Canyon Ferry Lake continue to quickly recede. To slow the rate of drawdown and conserve storage in Canyon Ferry, total release from Canyon Ferry was gradually decreased from 4,550 cfs to 3,750 cfs 3,055 cfs through the powerplant and 695 cfs for the Helena Valley Project).

August 5-8: The water supply forecast indicates a need to reduce releases from Canyon Ferry Lake to conserve storage and slow the rate of drawdown. As a result, the total release from Canyon Ferry was gradually decreased from 3,830 cfs to 3,220 cfs (`-z 2,455 cfs through the powerplant and 765 cfs for the Helena Valley Project).

August 13: To provide more efficient operation of the hydro-powerplants on the Missouri River, the total release from Canyon Ferry Lake was reduced to 3,160 cfs (z 2,400 cfs through the powerplant and 760 cfs for the Helena Valley Project).

August 17: PP L-MT reported difficulty in maintaining stable levels in Hauser and Holter Reservoirs. At the request of PPL-MT, the river releases out of Canyon Ferry were increased by 150 cfs to prevent the reservoir levels of Hauser and Holter Reservoirs from dropping while maintaining river flows below Holter Dam no lower than 2,800 cfs.

August 27: PPL-MT reported recent flow measurements were actually higher than anticipated and river releases from Canyon Ferry could be reduced. At the request of PPL-MT, the river releases out of Canyon Ferry were decreased by 200 cfs to prevent the reservoir levels of Hauser and Holter Reservoirs from increasing while maintaining river flows below Holter Dam no lower than 2,800 cfs.

September 4: PPL-MT reported difficulty in maintaining stable levels in Hauser and Holter Reservoirs. At the request of PPL-MT, the river releases out of Canyon Ferry were increased by 200 cfs to prevent the reservoir levels of Hauser and Holier Reservoirs from dropping while maintaining river flows below Holter Dam no lower than 2,800 cfs.

September 8-19: A maintenance outage was scheduled on unit #3 to allow for installation of an air injection system on the penstock. In response, turbine releases were restricted and limited to 2-unit capacity during the outage.

October 1: All irrigation deliveries to the Helena Valley Unit were discontinued for the 2003 irrigation season. To continue conserving storage in Canyon Ferry, turbine releases were maintained at rates that maintained river flows downstream of Holter Dam near 3,000 cfs.

Additional statistical information of Canyon Ferry Reservoir and its operations during 2003 can be found on Table MTT6 and Figure MTG4.

TABLE MTT6
HYDROLOGIC DATA FOR 2003
CANYON FERRY RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 3728.00 | 396,031 | 396,031 |
| TOP OF ACTIVE CONSERVATION | 3770.00 | 1,097,599 | 701,568 |
| TOP OF JOINT USE | 3797.00 | 1,891,888 | 794,289 |
| TOP OF EXCLUSIVE FLOOD CONTROL | 3800.00 | 1,992,977 | 101,089 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 3790.75 | 1,687,629 | OCT 01, 2002 |
| END OF YEAR | 3786.31 | 1,547,182 | SEP 30, 2003 |
| ANNUAL LOW | 3786.31 | 1,547,182 | SEP 30, 2003 |
| ANNUAL HIGH | 3797.66 | 1,913,944 | JUN 25, 2003 |
| HISTORIC HIGH | 3800.00 | 2,050,900 | JUN 23, 1964 |

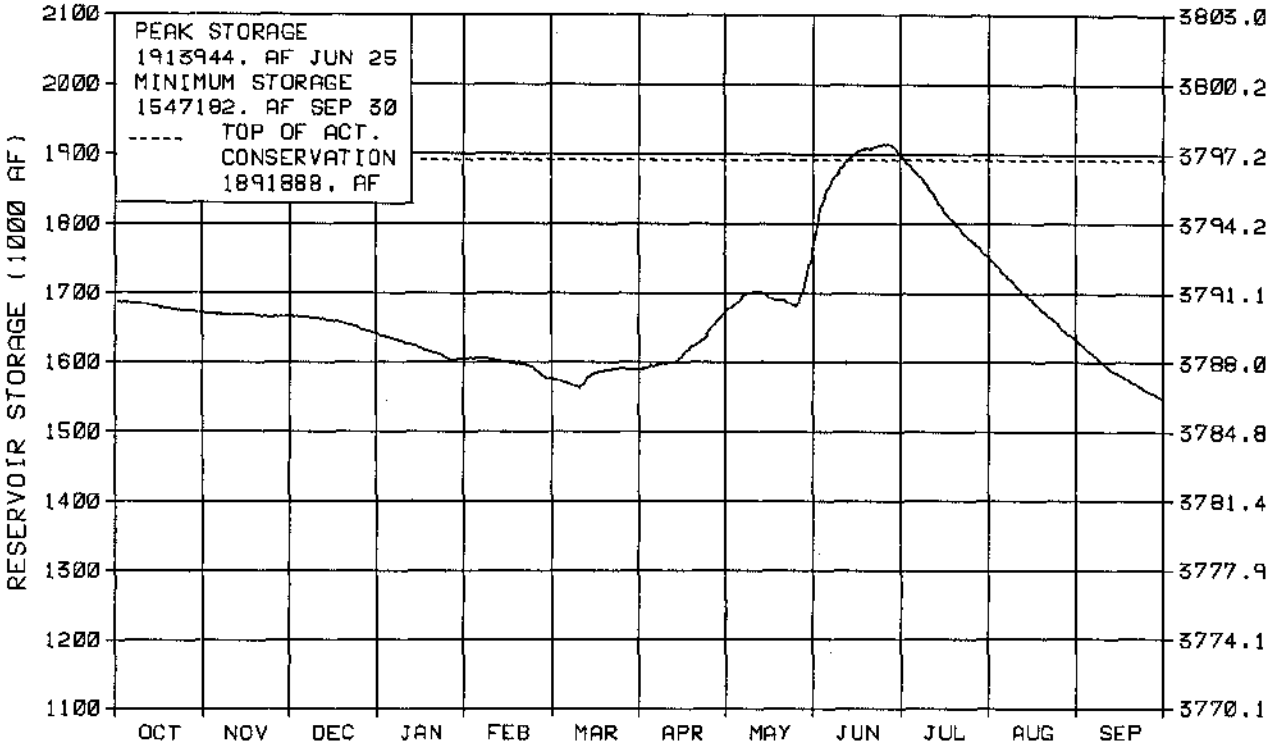
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 2,660,233 | OCT 02-SEP 03 | 2,707,570 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 20,361 | JUN 2, 2003 | 9,584 | JUN 4, 2003 |
| DAILY MINIMUM (CFS) | 1,156 | AUG 10, 2003 | 2,671 | OCT 4, 2002 |
| PEAK SPILL (CFS) | | | 3,984 | JUN 4, 2003 |
| TOTAL SPILL (AF) | | | 22,596 | 6/02-05/2003 |

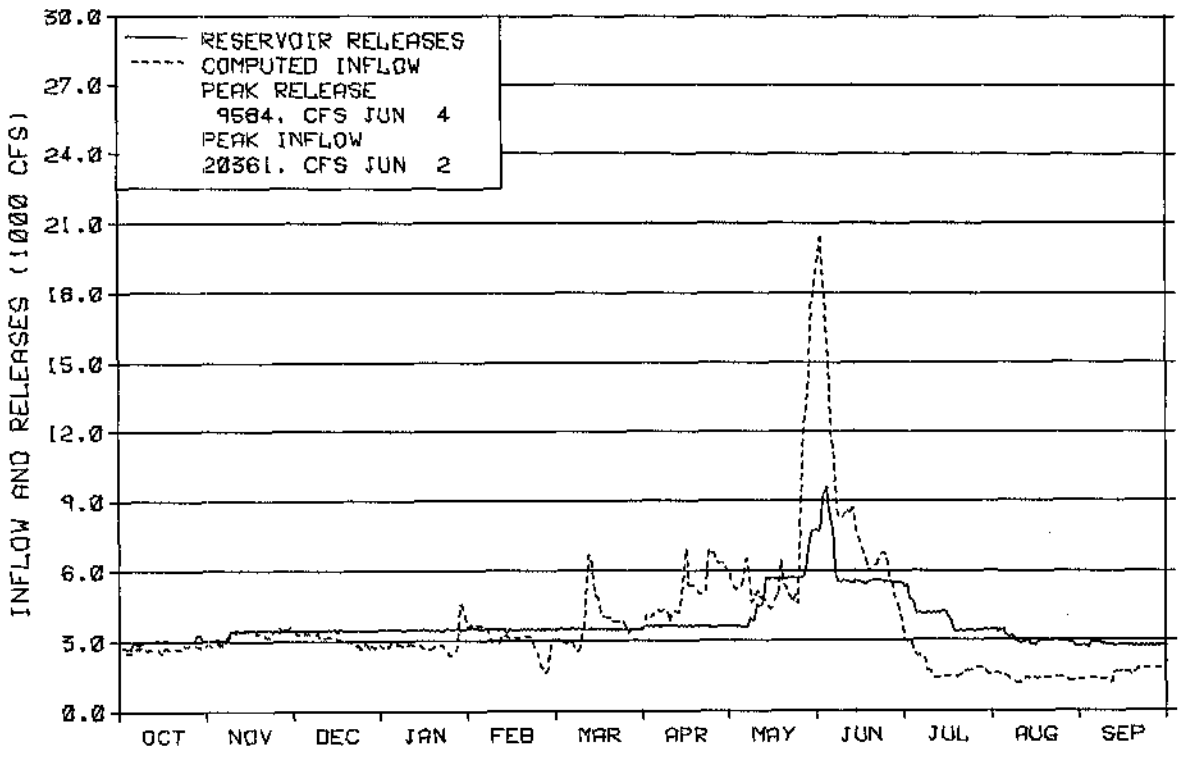
| MONTH | INFLOW | | OUTFLOW* | | | | CONTENT | |
|---|---|---|---|---|---|---|---|---|
| | KAF | % OF AVG | PUMPED TO HELENA VALLEY (KAF) | % OF AVG | RIVER KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 164.9 | 58 | 0.1 | 16 | 182.0 | 68 | 1,670.3 | 97 |
| NOVEMBER | 195.3 | 66 | 0 | --- | 200.1 | 72 | 1,665.5 | 95 |
| DECEMBER | 185.5 | 77 | 0 | --- | 212.9 | 70 | 1,638.1 | 98 |
| JANUARY | 181.2 | 82 | 0 | --- | 214.5 | 71 | 1,604.8 | 102 |
| FEBRUARY | 165.2 | 75 | 0 | --- | 194.1 | 71 | 1,575.9 | 104 |
| MARCH | 230.5 | 86 | 0 | --- | 215.7 | 71 | 1,590.6 | 110 |
| APRIL | 302.6 | 87 | 7.4 | 135 | 216.5 | 70 | 1,669.4 | 114 |
| MAY | 422.3 | 74 | 11.6 | 93 | 317.5 | 85 | 1,762.6 | 108 |
| JUNE | 523.9 | 68 | 22.1 | 146 | 362.4 | 73 | 1,901.9 | 101 |
| JULY | 112.5 | 33 | 22.3 | 135 | 241.3 | 66 | 1,750.9 | 96 |
| AUGUST | 82.8 | 49 | 21.7 | 143 | 183.7 | 72 | 1,628.3 | 94 |
| SEPTEMBER | 93.6 | 44 | 8.0 | 109 | 166.7 | 71 | 1,547.2 | 90 |
| ANNUAL | 2,660.2 | 67 | 93.1 | 127 | 2,707.6 | 72 | | |
| APRIL-JULY | 1,142.9 | 56 | | | | | | |

* Average for the 1955-2003 period.

# FIGURE MTG4

## CANYON FERRY LAKE




WATER YEAR 2003

**Helena Valley Reservoir**

Helena Valley Reservoir is a regulating offstream reservoir for Helena Valley Unit (P-S MBP), located west of Canyon Ferry. It has a total capacity of 10,451 acre-feet, which is used for irrigation and for furnishing a supplemental municipal supply to the city of Helena, Montana. Helena Valley Reservoir receives its entire water supply by pumping from Canyon Ferry Reservoir. When fully developed, Helena Valley Unit will irrigate about 14,100 acres of full-service land plus 3,500 acres of supplemental-service lands. Present development is about 13,867 full-service acres, including 5,200 acres previously irrigated by pumping from Lake Helena or from other streams.

At the beginning of the year, storage in Helena Valley Reservoir was 7,980 acre-feet at an elevation of 3814.85 feet. Helena Valley Reservoir reached a low for the spring of 6,190 acre-feet at an elevation of 3810.22 feet on March 30, 2003. Diversions to the Helena Valley Unit from Canyon Ferry Reservoir were started on April 1. Storage in Helena Valley Reservoir then steadily increased to a peak for the year of 9,791 acre-feet at an elevation of 3818.77 feet on July 8, 2003. During 2003, 93,110 acre-feet of water was pumped to Helena Valley from Canyon Ferry Reservoir. Helena Valley Irrigation District released 86,329 acre-feet for irrigation. Irrigation deliveries were discontinued for the season on October 1.

In April 2003, a Static Risk Analysis for Helena Valley Darn was conducted by the Denver Technical Service Center. As a result of the study, recommendations were made to obtain additional information regarding the geology at the dam site, conduct investigations of the internal condition of the darn, and investigate known sinkhole locations at the darn as soon as possible in order to more accurately quantify the piping risk associated with the darn.

To facilitate the investigations, the reservoir was towered to an elevation of 3791.50 on October 19, 2003. The investigations occurred during the latter half of October and the reservoir was refilled in November to an elevation of approximately 3811.66 by November 24. The reservoir provided an adequate water supply to satisfy all irrigation requirements for the Helena Valley Unit in 2003 and supplement the City of Helena's municipal water supply.

Statistical information pertaining to Helena Valley Reservoir is shown on Table MTT7 below.

TABLE MTT7
HYDROLOGIC DATA FOR 2003

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | RESERVOIR STORAGE GAF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| Top of Inactive Storage | 3805.00 | 4,554 | 4,554 |
| Top of Active Conservation Storage | 3820.07 | 10,451 | 5,897 |
| STORAGE ELEVATION DATA | ELEVATION (FEET) | STORAGE (AF) | DATE |
| Se,inning of Year | 3814.85 | 7,980 | 10/1/02 |
| End of Year | 3802.75 | 3,950 | 9/30103 |
| Annual Low | 3802.75 | 3,950 | 9/30/03 |
| Annual High | 3818.77 | 9,791 | 7108/03 |
| Historic High | 3820.60 | 10,738 | 6/02/75 |
| INFLOW-OUTFLOW DATA | | | ANNUAL |
| Pumped from Canyon Ferry to Helena Valley Unit | | | 93,110 AC-FT |
| Inflow to Helena Valley Reservoir | | | 83,967 AC-FT |
| Released from reservoir for irrigation | | | 86,329 AC-FT |
| Delivered to the City of Helena for municipal use | | | 1,674 AC-FT |

**Sun River Project**

Storage for the Sun River Project is provided by Gibson, Willow Creek, and Pishkun Reservoirs, which are all single-purpose irrigation structures. The project serves 95,000 acres on the Greenfields and Fort Shaw Irrigation Districts. A diversion dam is located on the Sun River about 3 miles below Gibson Reservoir to allow flows to be diverted down the Pishkun Supply Canal to Pishkun Reservoir, or down the Willow Creek Feeder Canal to Willow Creek Reservoir. Releases are made from Pishkun Reservoir to supply the canals of the Greenfields Irrigation District. Releases from Willow Creek Reservoir re-enter the Sun River where they can be diverted at the Fort Shaw Diversion Dam to supply the canals of the Fort Shaw Irrigation District.

**Gibson Reservoir** is located on the Sun River above Augusta, Montana, and has a total capacity of 96,477 acre-feet. In 1996, a hydrographic and topographic survey was conducted to measure the reservoir volume lost due to sediment accumulations that occurred in the drainage basin since the major forest fires that occurred in 1988. As a result of the survey, a new elevation-area-capacity table and curve was developed.

The 1996 survey determined that Gibson Reservoir has a storage capacity of 96,477 acre-feet and a surface area of 1,296 acres at reservoir elevation 4724. Since closure in 1929, the reservoir has accumulated a sediment volume of 8,383 acre-feet below reservoir elevation 4724. This volume represents a 7.99 percent loss in capacity and an average annual loss of 125.7 acre-feet. The 1996 survey also showed the average annual rate of sediment deposition since 1973 was 113.1 acre-feet per year and that most of the sediment contribution came after the 1988 fires. The revised area-capacity table was developed and put into effect on October 1, 1997, reflecting the new storage levels.

The spillway crest is at elevation 4712.0 (81,255 acre-feet). Depending on the runoff conditions and reservoir levels, the spillway gates remain open during the spring until the inflows and remaining snow cover indicate that the runoff is receding. Once it is apparent that the runoff has peaked and begun to recede, the spillway gates are progressively closed to allow the reservoir to fill to the top of the conservation pool at elevation 4724.0 (96,477 acre-feet).

The improved conditions in 2002 provided near to above average storage water supply in the Sun River Basin, heading into water year 2003. During August and September of 2002, precipitation in the Sun River watershed was near to above average at 125 and 112 percent of average respectively in the valley and 105 and 101 percent of average respectively in the mountains. The August-September inflow to Gibson Reservoir was 84 percent of average, totaling 38,339 *acre-feet. Total release from Gibson Reservoir was* gradually reduced during the month of September from 455 cfs to 60 cfs. With the inflows

averaging 245 cfs and releases averaging 225 cfs during September, storage in Gibson Reservoir slowly filled and entered water year 2003 with a storage content of 26,208 acre-feet at elevation 4652.54. This was 95 percent of average and 28 percent of full capacity and 70,269 acre-feet or 71.46 feet below the top of the conservation pool. Storage at the beginning of water year 2003 was 18,542 acre-feet or 35.89 feet greater than at the beginning of water year 2002.

The October 1 reservoir operating plans indicated Gibson Reservoir filling to a storage content of at least 50,000 acre-feet by the end of March even with fall inflows being well below average. Fall and winter releases from Gibson Reservoir to the Sun River were reduced in late September and maintained at a minimum flow rate of 65-70 cfs through November 20. Releases were then slightly increased in late November to approximately 100 cfs. By the end of January inflows to the reservoir were still much below average and releases were slightly decreased to between 85-90 cfs in an effort to conserve storage. Storage in Gibson Reservoir had slowly but steadily increased to 37,796 acre-feet at elevation 4669.10 by the end of December.

Precipitation in the Sun River basin varied from much above average to much below average during water year 2003. Cumulative precipitation for October through December was much below average for both valley and mountain areas in the Sun River basin. In January conditions improved slightly in the mountains with near average precipitation, however the valley precipitation was still only 51 percent of average. In contrast, valley precipitation in February was 107 of average, while mountainous areas only received 75 percent of average. By this point in the water year, cumulative precipitation was still much below average. During March overall conditions did improve slightly, because valley and mountain precipitation were 200 and 204 percent of average respectively. This still was not a large enough gain in precipitation to significantly improve the conditions. Even with twice the average amount of valley precipitation it equated to only approximately an extra inch for the month. Above average valley precipitation continued into April and May; however, the mountain precipitation was much below average and thus contributing to a below average spring runoff volume. June through August valley and mountain precipitation was slightly below average to much below average. Concluding the water year, September valley and mountain precipitation were both much above average at 138 and 134 percent of average respectively.

By January 1, the Natural Resources and Conservation Service (NRCS) measured snowpack in the Sun-Teton River Basins at 46 percent of average, even further reduced from a year ago. However, as the winter progressed, snowfall in the mountains above Gibson Dam improved slightly and by the beginning of April snowpack was 82 percent of average. But by May 1, snowpack had been reduced to 62 percent of average, 72 percent lower than a year ago. Snowpack peaked in early April near average time and was melted out by mid June.

Snowmelt runoff began entering Gibson Reservoir near the middle of March when streamflows gradually increased from about 140 cfs in early March to near 362 cfs by the

end of the month. During April streamflows continued to increase from April 7 through the 14 until reaching 1,267 cfs on April 14. Cool temperatures then reduced the snowmelt and inflows began to recede to 738 cfs on April 19. As the temperatures once again increased, streamflows increased to 2,051 cfs on April 25. Temperatures again cooled and inflow decreased until May 11, when it was 706 cfs. By mid-May, warmer temperatures prevailed thus causing the mountain snowmelt to be well underway. The peak inflow for the year of 5,246 cfs occurred on May 30 and by the end of June inflow had declined to 839 cfs. As the inflows increased, the releases from Gibson Reservoir to the Sun River were gradually increased to control the rate of fill in storage. On May 25, Gibson Reservoir reached a peak storage content for the year of 96,413 acre-feet at elevation 4723.95, 0.05 feet from the top of the active conservation pool. The peak discharge to the Sun River over the Sun River Diversion Dam was recorded on May 26 at 4,189 cfs, while the peak discharge from Gibson Reservoir was recorded on May 30 at 5,475 cfs.

April was the only month of water year 2003 that inflows were reported above average. Snowmelt runoff during 2003 followed the average timing and was essentially over by middle to late June. With the snowmelt runoff essentially over and the lack of much precipitation, inflow to Gibson Reservoir was only 55 and 44 percent of average for June and July respectively. This resulted in the actual April-July inflow totaling 307,122 acre-feet, which is approximately 170,000 acre-feet or 36 percent below average.

The August-September inflow to Gibson Reservoir was 56 percent of average totaling 25,402 acre-feet. As releases were made to meet downstream irrigation demands, storage in Gibson Reservoir slowly declined to a low content for the year of 4,569 acre-feet at elevation 4607.45, on September 2. Beginning on September 17, releases from Gibson Dam to the Sun River were gradually reduced to about 55 cfs allowing storage to gradually fill to 6,246 acre-feet at elevation 4612.81 by the end of the water year. This was 22 percent of average and only 7 percent of full capacity or 90,231 acre-feet or 111.19 feet below the top of the conservation pool. Storage at the end of water year 2003 was 19,962 acre-feet or 39.73 feet lower than at the end of water year 2002.

Total annual inflow for water year 2003 was 63 percent of average, totaling 386,745 acre-feet. This was 138,132 acre-feet or 22 percent less than the inflow experienced during water year 2002.

Diversions to the Pishkun Supply Canal were started on April 23 and were adjusted periodically throughout the year to meet the downstream irrigation demands on the Sun River Project. Diversions were discontinued August 6 because Gibson Reservoir was at minimum pool elevation and river releases had to be maintained to ensure that downstream senior water rights were fulfilled. Then on September 23, water was once again diverted to the Pishkun Supply Canal to begin replacing storage in Pishkun Reservoir in order to meet the winter reservoir elevation requirements. The diversions continued into water year 2004 and after meeting the operational objectives of attaining adequate carry-over storage in Pishkun Reservoir, all diversions for the season to the Pishkun Supply Canal were discontinued on October 23, 2003.

5,246 cfs occurred on May 30 and by the end of June inflow had declined to 839 cfs. As the inflows increased, the releases from Gibson Reservoir to the Sun River were gradually increased to control the rate of fill in storage. On May 25, Gibson Reservoir reached a peak storage content for the year of 96,413 acre-feet at elevation 4723.95, 0.05 feet from the top of the active conservation pool. The peak discharge to the Sun River over the Sun River Diversion Dam was recorded on May 26 at 4,189 cfs, while the peak discharge from Gibson Reservoir was recorded on May 30 at 5,475 cfs.

April was the only month of water year 2003 that inflows were reported above average. Snowmelt runoff during 2003 followed the average timing and was essentially over by middle to late June. With the snowmelt runoff essentially over and the lack of much precipitation, inflow to Gibson Reservoir was only 55 and 44 percent of average for June and July respectively. This resulted in the actual April-July inflow totaling 307,122 acre-feet, which is approximately 170,000 acre-feet or 36 percent below average.

The August-September inflow to Gibson Reservoir was 56 percent of average totaling 25,402 acre-feet. As releases were made to meet downstream irrigation demands, storage in Gibson Reservoir slowly declined to a low content for the year of 4,569 acre-feet at elevation 4607.45, on September 2. Beginning on September 17, releases from Gibson Dam to the Sun River were gradually reduced to about 55 cfs allowing storage to gradually fill to 6,246 acre-feet at elevation 4612.81 by the end of the water year. This was 22 percent of average and only 7 percent of full capacity or 90,231 acre-feet or 111.19 feet below the top of the conservation pool. Storage at the end of water year 2003 was 19,962 acre-feet or 39.73 feet lower than at the end of water year 2002.

Total annual inflow for water year 2003 was 63 percent of average, totaling 386,745 acre-feet. This was 138,132 acre-feet or 22 percent less than the inflow experienced during water year 2002.

Diversions to the Pishkun Supply Canal were started on April 23 and were adjusted periodically throughout the year to meet the downstream irrigation demands on the Sun River Project. Diversions were discontinued August 6 because Gibson Reservoir was at minimum pool elevation and river releases had to be maintained to ensure that downstream senior water rights were fulfilled. Then on September 23, water was once again diverted to the Pishkun Supply Canal to begin replacing storage in Pishkun Reservoir in order to meet the winter reservoir elevation requirements. The diversions continued into water year 2004 and after meeting the operational objectives of attaining adequate carry-over storage in Pishkun Reservoir, all diversions for the season to the Pishkun Supply Canal were discontinued on October 23, 2003.

Greenfields Irrigation District was forced to discontinue water delivery seven weeks early, thus causing water users to receive approximately 100,000 acre-feet less than their average water supply. In addition, supplemental water contracts were only satisfied for eight days while Gibson Reservoir was making releases through the spillway. This is significantly less than the usually forty-five days that these contracts are fulfilled. Based on average diversions

to Pishkun Reservoir and supplemental water delivered Greenfields received approximately seventy-live percent of their average allotment. The total diversion for Fort Shaw Irrigation District was near normal during 2003; however, it varied significantly from below average during May and June to above average during July and August The total water diverted was approximately 52.000 acre-feet. which is ninety-five percent of average.

Even though there is no space allocated to flood control. the Corps of Engineers still estimates flood damages that are prevented by Gibson Reservoir. During 2003 Gibson Reservoir did not contribute to the reduction of flood damages locally or downstream on the Missouri River below Fort Peck Reservoir.

Additional hydrologic and statistical data pertaining to the operation of Gibson Reservoir can be found in Table MTT8-A and Figure MTGS.

**Pishkun Reservoir,** near Augusta, Montana, is an off-stream reservoir supplied by a feeder canal which diverts water from the Sun River below Gibson Reservoir. The reservoir serves the 81.000-acre Greenfields Division. The total capacity of the reservoir is 46,670 acre-feet at elevation 4370.0.

All canal diversions from the Sun River to Pishkun during the 2002 irrigation season were discontinued on September 13, 2002. Reservoir content in Pishkun at the beginning of water year 2003 was 36,810 acre-feet at elevation 4363.08. This was about 112 percent of average and about 79 percent of full capacity and 814 acre-feet or 0.63 feet lower than at the beginning of water year 2002.

Average reservoir losses throughout the winter and early spring of 2003 caused storage to slowly decline to 35,402 acre-feet at elevation 436 I.99 on April 21. Diversions from the Sun River to Pishkun Reservoir began on April 23. increasing storage to a peak for the year of 47,209 acre-feet at elevation 4370.33 on May 25. Irrigation releases from Pishkun Reservoir were started on May 10 with a maximum release of 1.679 cfs recorded on July 14. All irrigation releases from Pishkun Reservoir were discontinued on August 9. All diversions from the Sun River to Pishkun Reservoir were discontinued on August 25. Approximately 222,944 acre-feet of water, 86 percent of average. was released from Pishkun Reservoir during May 10 through August 9 to help meet the irrigation demands on the Sun River Project. The minimum storage during water year 2003 was 29.949 acre-feet at elevation 4357.37 on July 26. Irrigation demands were then reduced and Pishkun Reservoir was allowed to refill to a content of 33.389 acre-feet at elevation 4360.43 on August 6. Releases were then made for irrigation, drawing Pishkun Reservoir down to 31,121 acre-feet at elevation 4358.44 by August 9. Subsequently, releases were discontinued and by the end of the water year. the reservoir was allowed increase to 33,479 acre-feet at elevation 4360.50. This was 101 percent of average and 72 percent of full capacity. This was also 3,331 acre-feet or 2.58 feet lower than at the end of water year 2002.

TABLE MTT8-A
HYDROLOGIC DATA FOR 2003
GIBSON RESERVOIR (SUN RIVER PROJECT)

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4557.50 | 0 | 0 |
| TOP OF ACTIVE CONSERVATION | 4724.00 | 96,477 | 96.477 |

| STORAGE-ELEVATION **DATA** | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| **BEGINNING** OF **YEAR** | 4652.54 | 26,208 | OCT 01, 2002 |
| **END** OF **YEAR** | 4612.81 | 6,246 | SEP 30, 2003 |
| ANNUAL LOW | 4607.45 | 4,569 | SEP 02, 2003 |
| ANNUAL HIGH | 4723.95 | 96,413 | MAY 25, 2003 |
| HISTORIC II1GH | 4732.23 | 116,400 | JUN 08, 1964 |

| INFLOW-OUTFLOW DATA | INFLOW | **DATE** | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 386,745 | OCT 02-SEP 03 | 406,003 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 5,246 | **MAY** 30, 2003 | 5,475 | **MAY** 30. 2003 |
| DAILY MINIMUM (CFS) | 128 | NOV 05. 2002 | 6 | OCT 03. 2002 |

| MONTH | INFLOW | | OUTFLOW* | | | | CONTENT | |
|---|---|---|---|---|---|---|---|---|
| | KAF | % OF AVG | TOTAL CANAL KAF | % OF AVG | RIVER KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 11.0 | 58 | 0 | --- | 5.0 | 48 | 33.0 | 110 |
| NOVEMBER | 7.7 | 45 | 0 | | 5.5 | 48 | 35.9 | 104 |
| DECEMBER | 8.1 | 52 | 0 | --- | 6.9 | 60 | 37.8 | 99 |
| JANUARY | 8.3 | 61 | 0 | --- | 6.9 | 68 | 40.0 | 96 |
| FEBRUARY | 7.6 | 62 | 0 | --- | 5.6 | 67 | 42.8 | 95 |
| MARCH | HA | 79 | 0 | --- | 6.1 | 62 | 48.8 | 102 |
| APRIL | 53.6 | 133 | 7.7 | ɔo | 13.9 | 60 | 82.0 | 153 |
| MAY | 114.6 | 67 | 43.1 | 112 | 59.9 | 60 | 95.1 | 112 |
| JUNE | 109.0 | 55 | 82.7 | 146 | 42.8 | 31 | 83.3 | 94 |
| JULY | 29.9 | 44 | 85.5 | 120 | 8.9 | 33 | 18.7 | 32 |
| AUGUST | 14.3 | 54 | 19.1 | 47 | 8.6 | 63 | 4.6 | 14 |
| SEPTEMBER | i. | 58 | 1.7 | 15 | 6.1 | 59 | 6.2 | 22 |
| ANNUAL | 386.7 | 63 | 239.7 | 103 | 176.1 | 47 | | |
| APRIL-JULY | 307.1 | 64 | | | | | | |

* Average for the 1931-2003 period.

Additional hydrologic and statistical data pertaining to Pishkun Reservoir can be found in Table MTT8-B and Figure MTGE.

**Willow Creek Reservoir** obtains its water supply from Willow Creek and the Sun River via the Willow Creek Feeder Canal. The total reservoir capacity is 32,300 acre-feet at elevation 4142.0 feet. Releases from Willow Creek Reservoir enter the Sun River and can he diverted for irrigation at the Fort Shaw Diversion Dam, the Floweree Canal of the Broken 0 Ranch, and other downstream senior water users.

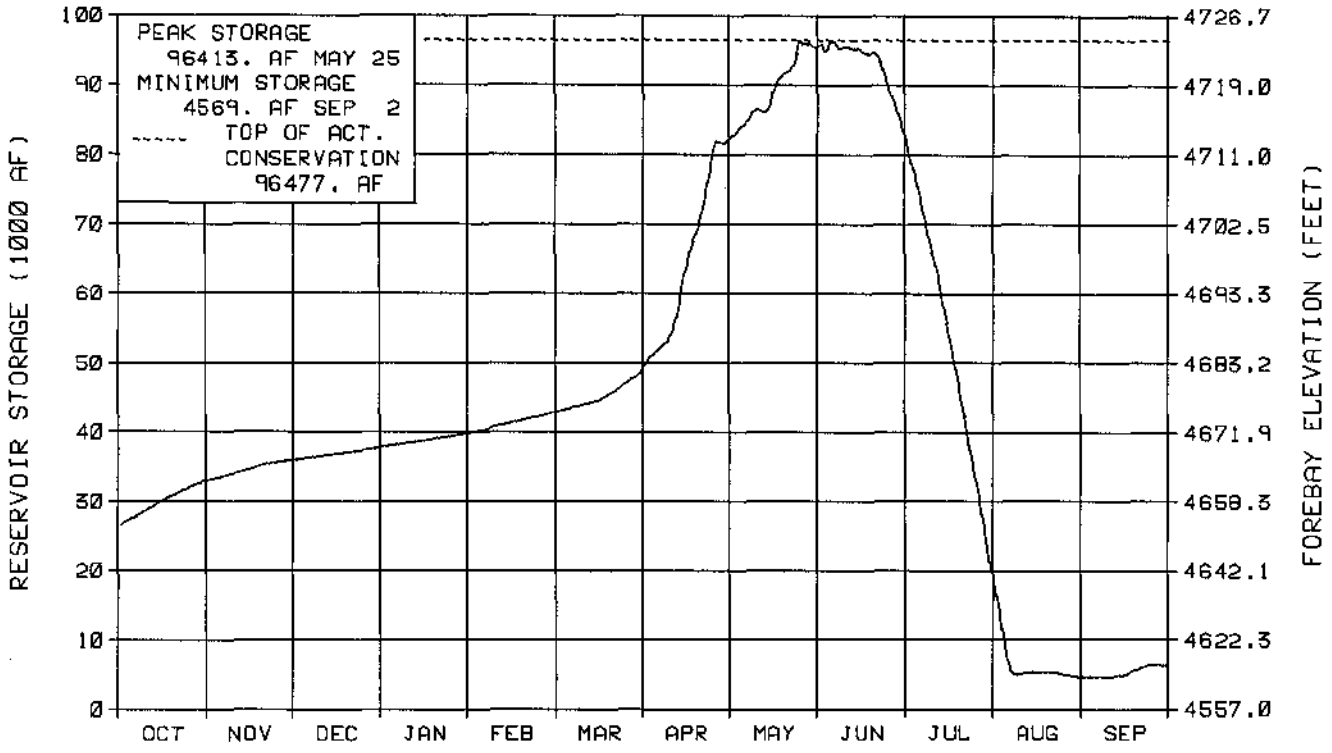
Ali diversions from the Sun River to Willow Creek during the 2002 irrigation season were discontinued on June 25, 2002, about three months earlier than average. Reservoir content in Willow Creek at the beginning of water year 2003 was 27.700 acre-feet at elevation 4138.75. This was 154 percent of average and 86 percent of full capacity and 13.848 acre-feet or 11.73 feet greater than at the beginning of water year 2002.

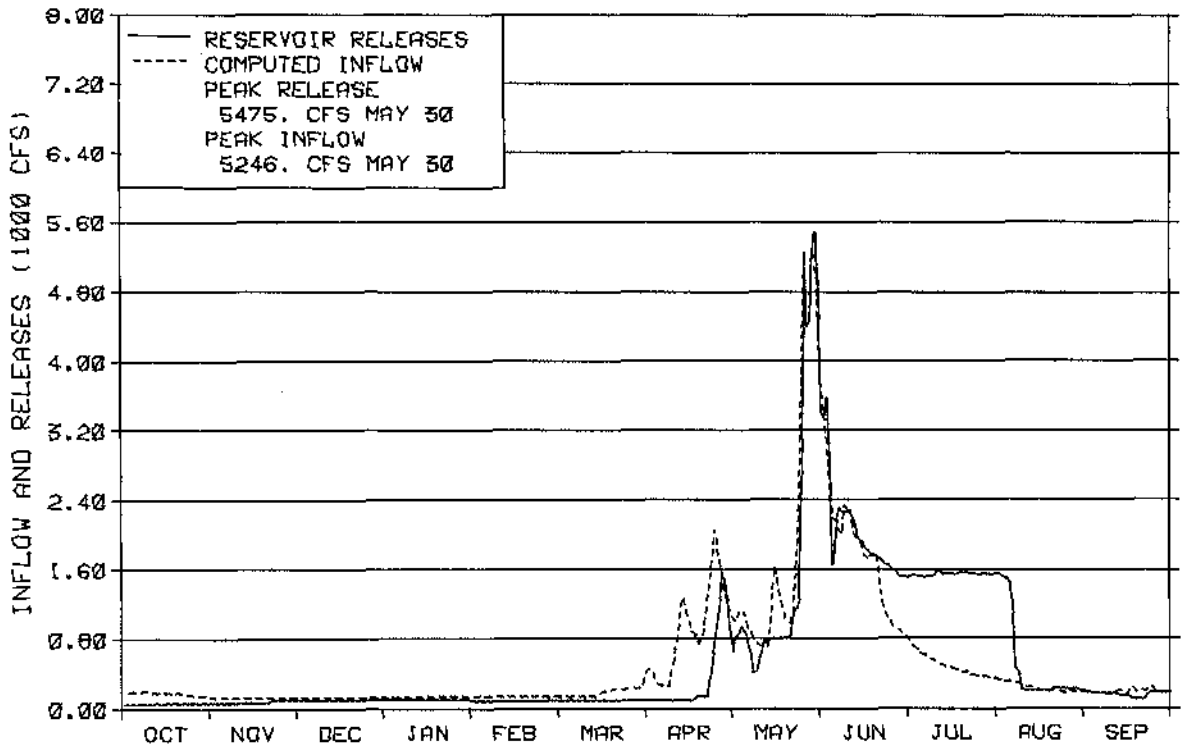
Storage in Willow Creek Reservoir remained fairly stable and with a slight increase throughout the winter. Diversions from the Sun River to Willow Creek Reservoir during 2003 were initiated on April 24 at a rate of about 22 cfs and were eventually increased to a peak of 100 cfs during May 8-25. The diversions began to reach Willow Creek Reservoir on April 26 and storage began to steadily increase to a peak storage content for the year of 32.360 acre-feet at elevation 4142.04 on May 30. This storage level was 1 15 percent of average and was at 1(X) percent of full capacity. Due to the reservoir approaching average full pool all diversions from the Sun River to Willow Creek were discontinued for the year on May 25. To help meet irrigation demands within the Sun River Irrigation Projects a release of 32 cfs was initiated from Willow Creek Reservoir on June 30 and steadily increased to 100 cfs on July 2. Releases were adjusted through July and August according to downstream water user needs, until they were discontinued on August 26. Approximately 11,985 acre-feet of storage was released from Willow Creek Reservoir during June 30 through August 26 to help meet the irrigation demands in 2003. As a result, storage was drafted to 19.969 acre-feet at elevation 4132.77 on August 26. Willow Creek Reservoir slowly decreased through the remainder of the year and ended the year with a storage content of 19.650 acre-feet at elevation 4132.50. This was 109 percent of average and 61 percent of full capacity. This was also 7.731 acre-feet or 6.25 feet lower than at the end of water year 2002.

Additional hydrologic and statistical data pertaining to Willow Creek Reservoir can be found in Table MTT8-C and Figure MTG7.

# FIGURE MTG5

## GIBSON RESERVOIR




WATER YEAR 2003

TABLE MTT8-B
HYDROLOGIC DATA FOR 2003
PISHKUN RESERVOIR (SUN RIVER PROJECT)

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4342.00 | 16,250 | 16,250 |
| TOP OF ACTIVE CONSERVATION | 4370.00 | 46,670 | 30,420 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 4363.08 | 36,810 | OCT 01, 2002 |
| END OF YEAR | 4360.50 | 33,479 | SEP 30, 2003 |
| ANNUAL LOW | 4357.37 | 29,949 | JUL 26, 2003 |
| ANNUAL HIGH | 4370.33 | 47,209 | MAY 25, 2003 |
| HISTORIC HIGH | 4371.40 | 48,950 | JUL 04, 1953 |

| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 219,612 | OCT 02-SEP 03 | 222,944 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 1,378 | JUN 08, 2003 | 1,679 | JUL 14, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |

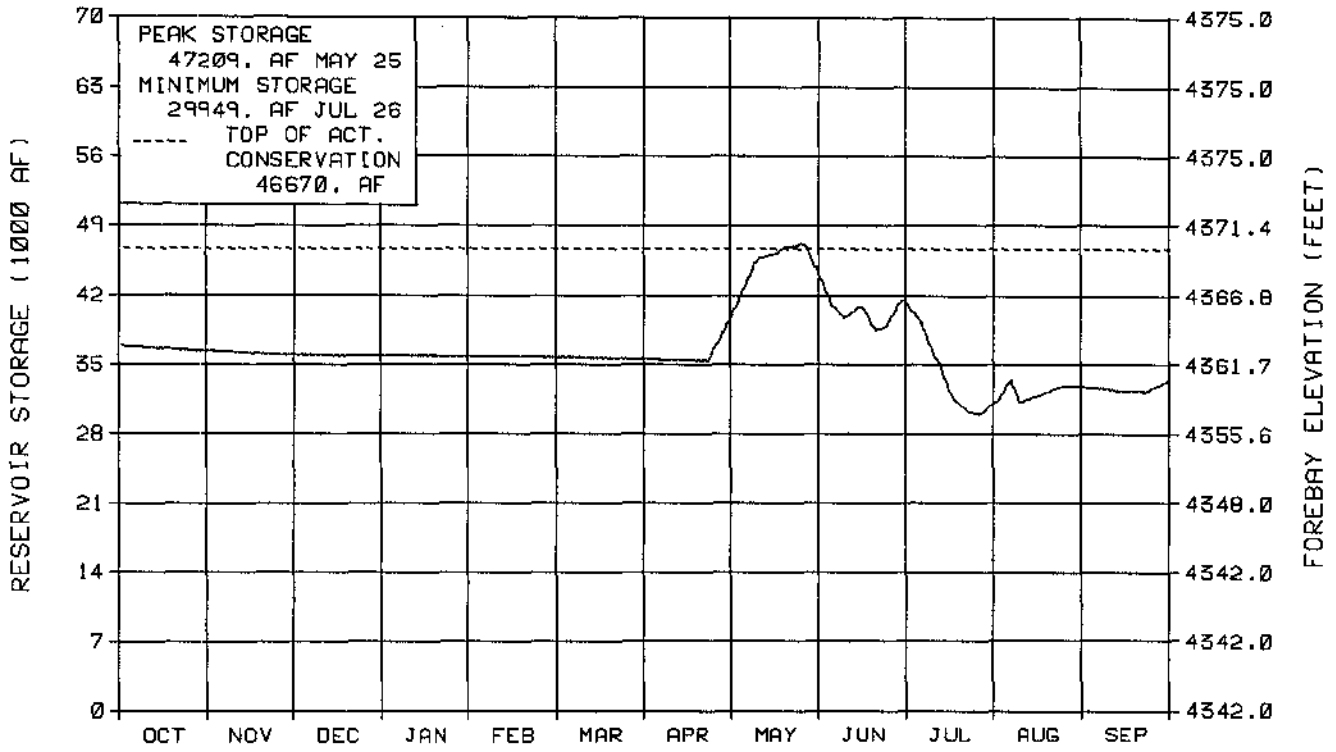
* During nonirrigation season

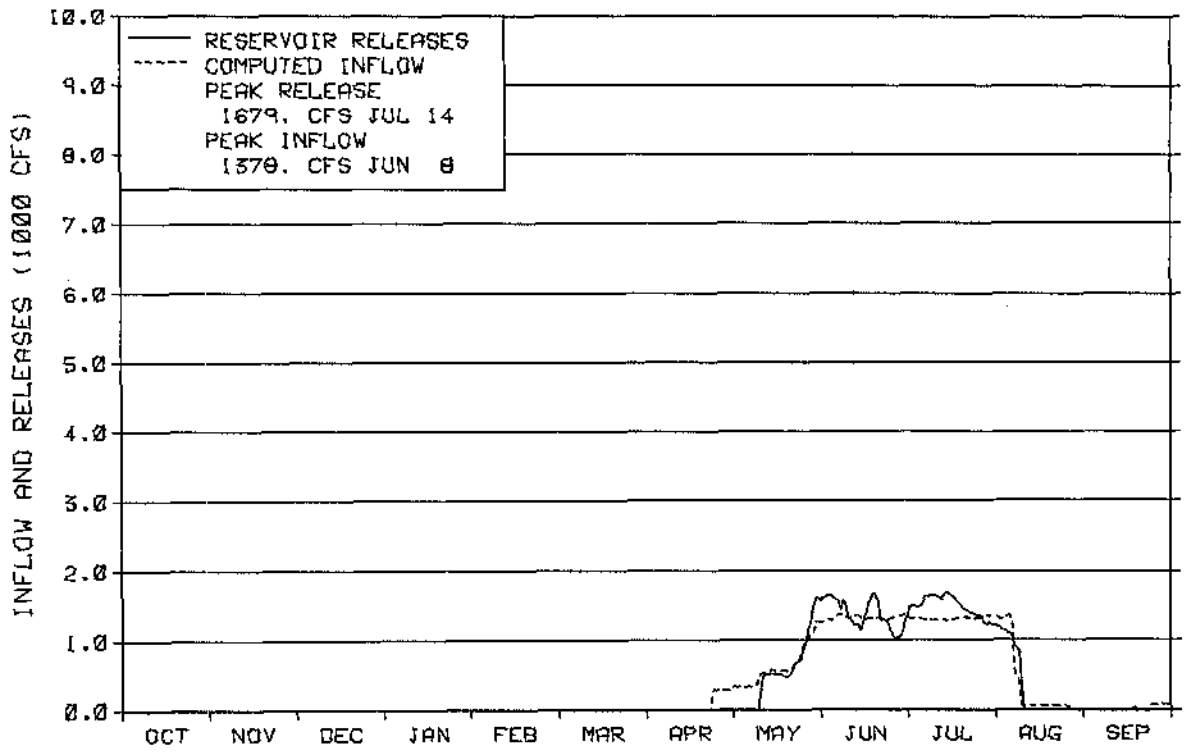
| MONTH | INFLOW* | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | -0.4 | --- | 0 | --- | 36.4 | 106 |
| NOVEMBER | -0.4 | --- | 0 | --- | 36.0 | 104 |
| DECEMBER | -0.1 | --- | 0 | --- | 35.9 | 104 |
| JANUARY | -0.1 | --- | 0 | --- | 35.8 | 104 |
| FEBRUARY | -0.1 | --- | 0 | --- | 35.8 | 105 |
| MARCH | -0.2 | --- | 0 | --- | 35.5 | 104 |
| APRIL | 3.8 | 55 | 0 | --- | 39.3 | 97 |
| MAY' | 38.3 | 107 | 33.4 | 111 | 44.2 | 97 |
| JUNE | 78.7 | 136 | 81.4 | 133 | 41.5 | 98 |
| JULY | 80.3 | 117 | 90.7 | 124 | 31.0 | 83 |
| AUGUST | 19.1 | 45 | 17.4 | 40 | 32.7 | 93 |
| SEPTEMBER | 0.8 | 6 | 0 | --- | 33.5 | 101 |
| ANNUAL | 219.6 | 97 | 222.9 | 98 | | |
| APRIL-JULY | 201.0 | 119 | | | | |

* Average for the 1947-2003 period.

# FIGURE MTG6

## PISHKUN RESERVOIR




WATER YEAR 2003

TABLE MTT8-C
HYDROLOGIC DATA FOR 2003
WILLOW CREEK RESERVOIR (SUN RIVER PROJECT)

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4085.28 | 67 | 67 |
| TOP OF ACTIVE CONSERVATION | 4142.00 | 32,300 | 32,233 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 4138.75 | 27,700 | OCT 01, 2002 |
| END OF YEAR | 4132.50 | 19,650 | SEP 30, 2003 |
| ANNUAL LOW | 4132.50 | 19,650 | SEP 30, 2003 |
| ANNUAL HIGH | 4142.04 | 32,360 | MAY 30, 2003 |
| HISTORIC HIGH | 4144.00 | 35,300 | JUN 22, 1975 |

| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 3,944 | OCT 02-SEP 03 | 11,994 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 73 | MAY 10, 2003 | 173 | JUL 14, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |

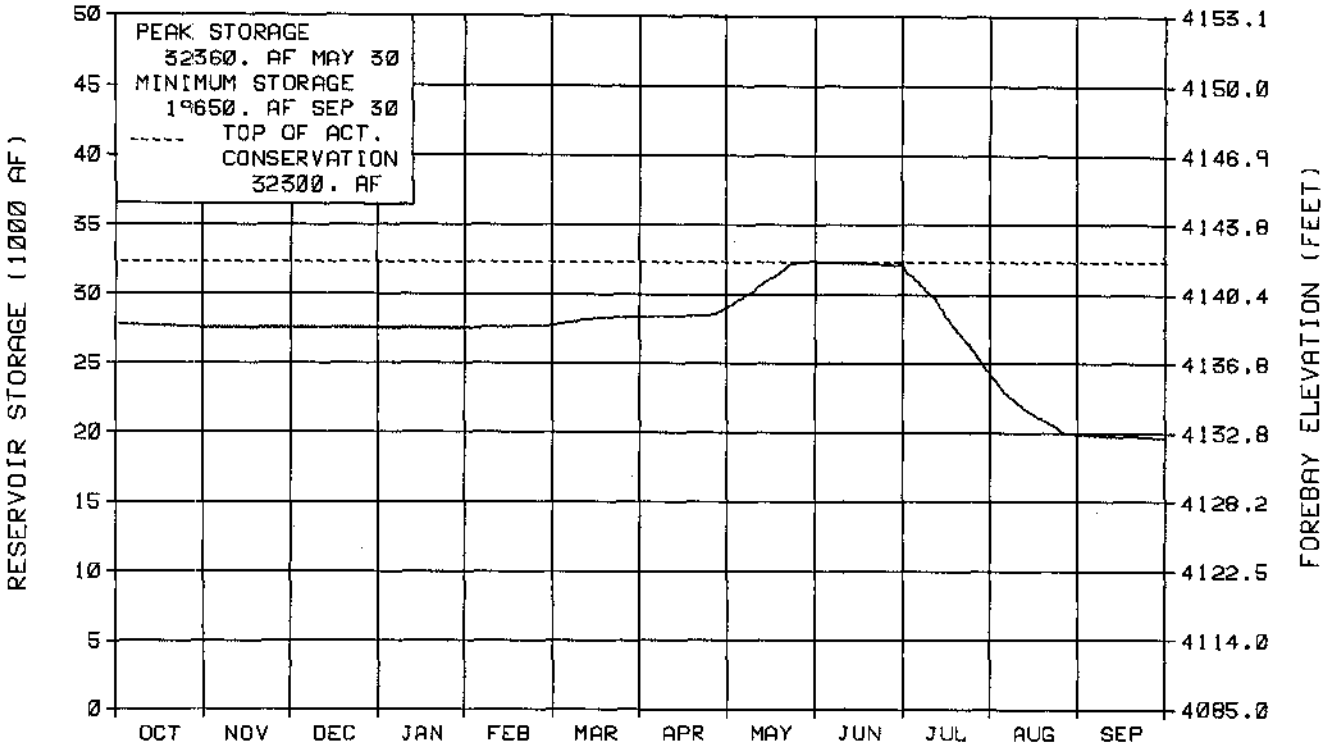
* During nonirrigation season

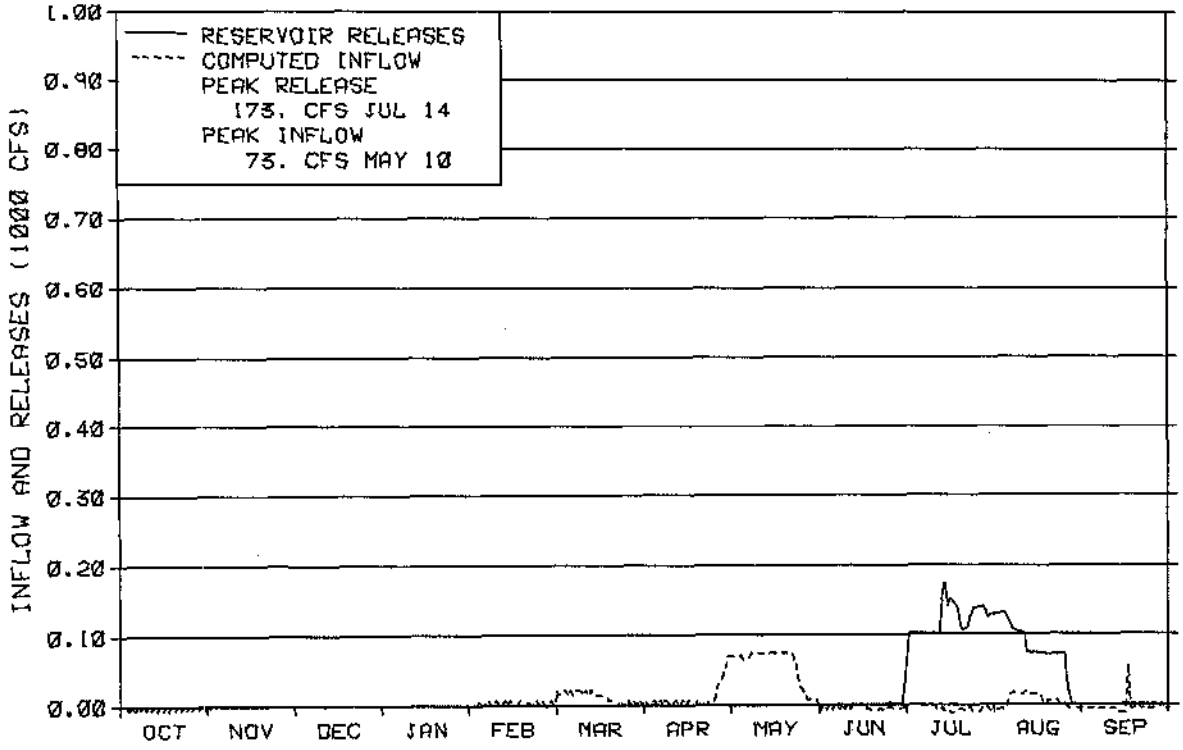
| MONTH | INFLOW* | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | -0.2 | --- | 0 | --- | 27.5 | 140 |
| NOVEMBER | 0.0 | --- | 0 | --- | 27.5 | 136 |
| DECEMI3ER | 0.0 | --- | 0 | --- | 27.5 | 134 |
| JANUARY | 0.0 | --- | 0 | --- | 27.5 | 132 |
| FEBRUARY | 0.1 | 27 | 0 | --- | 27.6 | 130 |
| MARCH | 0.7 | 71 | 0 | --- | 28.3 | 127 |
| APRIL | 0.6 | 31 | 0 | --- | 28.9 | 118 |
| MAY | 3.4 | 84 | 0 | --- | 32.4 | 115 |
| JUNE | -0.3 | --- | 0.1 | 2 | 32.0 | 109 |
| JULY | -0.4 | --- | 7.4 | 141 | 24.2 | 101 |
| AUGUST | 0.2 | --- | 4.5 | 125 | 19.9 | 104 |
| SEPTEMBER | -0.3 | --- | 0 | --- | 19.6 | 109 |
| ANNUAL | 3.9 | 27 | 12.0 | 83 | | |
| APRIL-JULY | 3.3 | 31 | | | | |

* Average for the 1952-2003 period.

# FIGURE MTG7

## WILLOW CREEK RESERVOIR




WATER YEAR 2003

**Lake Elwell (Tiber Dam)**

Lake Elwell (Tiber Dam) (P-S M.B.P.) is located on the Marias River near Chester, Montana. It was built to provide an adequate water supply for 127,000 acres in the Marias Unit and for flood control. The crest se of Tiber Darn spillway began settling in 1956, following initial filling of the reservoir. Restrictions were placed on reservoir operating levels in the late 1950s to safeguard the structure until repairs could he made. The settling continued despite attempts to halt it. The rate of settlement was alarming following the flood of 1964 and the heavy runoff of 1965. This settlement was attributed to a weakness of the underlying shale formation in which small lenses of gypsum were slowly being dissolved as water passed through the shale. Measures to protect the structure were approved by Congress, and construction was initialed in 1967. This work, completed in 1970, consisted of modifying the canal outlet works for use as an auxiliary outlet works and closing the entrance channel of the spillway by a temporary earthfill cofferdam. To accommodate these changed conditions, the reservoir operating criteria was further revised and the active capacity was eliminated. Work on modification of the spillway to restore active conservation capacity was begun in 1976. This work, completed in October 1981, consisted of replacing the upstream section of the spillway and raising the dam 5 feet. Since that time, all restrictions on operating levels were lifted and normal operations were restored at Lake Elwell.

Because the irrigation distribution works have not yet been constructed, the reservoir is operated primarily for flood control and for increased fishery and recreation benefits. However, the reservoir provides irrigation water to several individual operators by water service contracts and provides about 1,500 acre-feet to the Tiber County Water District for municipal, industrial, rural domestic, and livestock use. The city of Chester, Montana, receives a small amount of water from the reservoir annually for municipal use. Approximately 3,000 acres are irrigated by contract from Lake Elwell storage.

During July through September of 2002, the monthly precipitation in the valley was above average but the mountain precipitation was only 80 percent of average. Inflow into Lake Elwell during July-September totaled 156,774 acre-feet and was 160 percent of average, the fourth highest ever recorded during this time. At the end of water year 2002, normal operations of Lake Elwell drafted storage to 862,374 acre-feet at elevation 2986.84. This was 105 percent of normal, 7.73 feet higher than reported the previous year, and the fourth highest end of September elevation ever reported at Lake Elwell.

Water year 2003 started off very dry with precipitation in the Marias River basin upstream of Lake Elwell being well below normal during October 2002 through January of 2003. Valley precipitation during this time was 72, 43, 32, and 21 percent of normal, respectively, while the mountain precipitation was 71, 32, 60, and 81 percent of normal, respectively. Inflow into Lake

Elwell during October through February was 76 percent of normal, totaling 76,957 acre-feet. In accordance with the October 1 operating plan, releases were reduced to the desired minimum winter rate of 500 cfs on October 28, 2002, to conserve storage.

During the winter of 2002-2003, mountain snowpack in the Marias Basin above Lake Elwell accumulated at below normal rates, and by January 1 the Natural Resources and Conservation Service (NRCS) measured the mountain snowpack in the Marias River Basin above Lake Elwell to be only 45 percent of average. The January 1 water supply forecast, based on mountain snowpack, indicated the April-July runoff into Lake Elwell would be 249,700 acre-feet, only 51 percent of normal. Storage in Lake Elwell slowly drafted to a low content for the year of 763,070 acre-feet at elevation 2980.46 on March 13.

As the winter progressed, mountain snowfall began increasing at normal to above normal rates and by April 1, mountain snowpack in the Marias River Basin had improved to 81 percent of normal. The April 1 water supply forecast indicated the April-July runoff into Lake Elwell would be 335,000 acre-feet or 69 percent of normal. Mountain snowpack peaked on April 9 at 87 percent of normal.

The May 1 water supply forecast indicated the May-July runoff into Lake Elwell would be 258,000 acre-feet or 61 percent of normal. Even with the water supply forecast to be 61 percent of normal, releases were increased to 610 cfs on May 13 to control the rate of fill. Inflow into Lake Elwell reached a peak for the year of 3,134 cfs on May 31, 2003. Releases were increased to a summer peak of 630 cfs on June 20, 2003. Storage steadily increased until reaching the peak content for the year of 945,744 acre-feet at elevation 2991.78 on June 26, 2003. Actual April-July runoff into Lake Elwell totaled 267,446 acre-feet which was 55 percent of normal and 416,546 acre-feet less than in 2002.

Precipitation in the Marias River Basin above Lake Elwell was well below normal during July and August. Valley precipitation was recorded at 10 and 19 percent of average, respectively, while mountain precipitation was 16 and 37 percent of average, respectively. Inflow to Lake Elwell continued to drop in early July and by mid August, upstream demands and evaporation caused inflow to be less than zero. Inflow into Lake Elwell during August-September totaled 1,436 acre-feet, the fifth lowest inflow ever recorded during this time. The total annual runoff into Lake Elwell during 2003 was 390,492 acre-feet, 58 percent of normal. This was the ninth lowest annual inflow ever recorded into Lake Elwell.

By the end of the year, normal operations Lake Elwell drafted storage to 857,180 acre-feet at an elevation of 2986.52 feet. This was 104 percent of normal and 0.32 feet lower than reported on September 30, 2002.

The Corps of Engineers determined that during 2003, Lake Elwell did not prevent any local flood damages but did prevent $1,477,500 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since closure of Tiber Dam in 1954, Lake Elwell has reduced flood damages by a total of $58,667,700.00.

## Important Events - 2003

October 3, 2002: To control the rate of drawdown and conserve storage, releases were decreased to 880 cfs.

October 16, 2002: To allow for a preliminary facility review, flows were discontinued through the river outlet works and initiated at a rate of approximately 900 cfs through the auxiliary outlet works.

October 23, 2002: After the inspection of the river outlet works is complete, flows are discontinued through the auxiliary outlet works and initiated through the river outlet works at a rate of about 820 cfs.

October 28, 2002: To control the rate of drawdown and conserve storage prior to the brown trout spawn, releases were reduced to the desired winter release of 500 cfs.

November 4, 2002: Downstream water user requested flows be reduced to 350 cfs for approximately 24 hours to allow for maintenance of downstream pump site.

November 5, 2002: Maintenance on downstream pump site is completed and flows are returned to the desired winter rate of 500 cfs.

December 1, 2002: Natural Resources and Conservation Service measured snowpack conditions in the watershed above Lake Elwell to be about 35 percent of normal.

January 1, 2003: Natural Resources and Conservation Service measured snowpack conditions in the watershed above Lake Elwell to be about 45 percent of normal.

April 1, 2003: Natural Resources and Conservation Service measured snowpack conditions in the watershed above Lake Elwell to have increased to only 81 percent of normal. Water supply forecast indicated the April-July runoff into Lake Elwell would be 335,000 acre-feet or 69 percent of normal.

April 15, 2003: Personnel from the Reservoir and River Operations Branch met with the Marias Management Committee to discuss the projected water supply for the Marias River Basin and proposed operations of Lake Elwell.

May 13, 2003: To control rate of fill, releases are increased to approximately 600 cfs.

June 18, 2003: Tiber MT LLC conducted pressure testing on the river outlet works at flows of 0, 300, 625, and 700 cfs for 10 minutes at each flow rate. Initiate flow from auxiliary outlet works to maintain current rate of approximately 625 cfs.

June 26, 2003: Lake Elwell reaches a peak elevation for the year of 2991.78 feet, 1.22 feet below the top of the joint use pool.

July 17, 2003: To control rate of drawdown and conserve storage, releases are decreased to 550 cfs.

July 29, 2003: To control rate of drawdown and conserve storage, releases are decreased to 500 cfs.

August 28-September 2, 2003: To aid in the construction of a FERC permitted powerplant releases were altered to allow the fish to gradually adjust to an increase in the water temperature, flows were maintained at the current rate of 500 cfs and mixed between the auxiliary outlet works and the river works prior to switching completely to the auxiliary works.

Additional hydrologic and statistical information pertaining to the operation of Lake Elwell during 2003 can be found in Table MTT9 and Figure MTGS.

TABLE MTT9
HYDROLOGIC DATA FOR 2003
LAKE ELWELL (TIBER DAM)

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2966.40 | 577,625 | 577,625 |
| TOP OF ACTIVE CONSERVATION | 2976.00 | 699,325 | 121,700 |
| TOP OF JOINT USE | 2993.00 | 967,319 | 267,994 |
| TOP OF EXCLUSIVE FLOOD CONTROL | 3012.50 | 1,368,157 | 400,838 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2986.84 | 862,374 | OCT 01, 2002 |
| END OF YEAR | 2986.52 | 857,180 | SEP 30, 2003 |
| ANNUAL LOW | 2980.46 | 763,070 | MAR 13, 2003 |
| ANNUAL HIGH | 2991.78 | 945,744 | JUN 26, 2003 |
| HISTORIC HIGH | 3005.59 | 1,214,417 | JUL 12, 1965 |

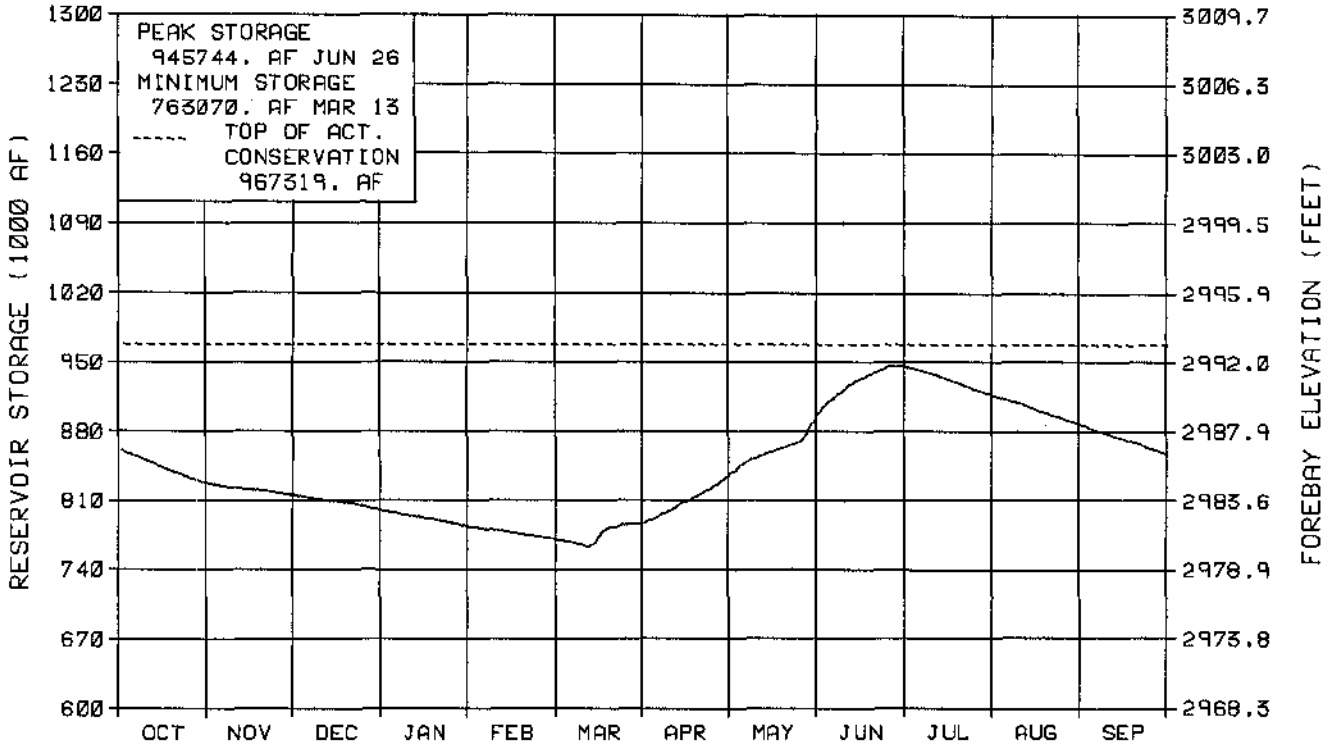
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 390,493 | OCT 02-SEP 03 | 999,999 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 3,134 | MAY 31, 2003 | 1,019 | OCT 01, 2002 |
| DAILY MINIMUM (CFS) | 0 | 08/08-09/02/2003 | 425 | NOV 04, 2002 |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

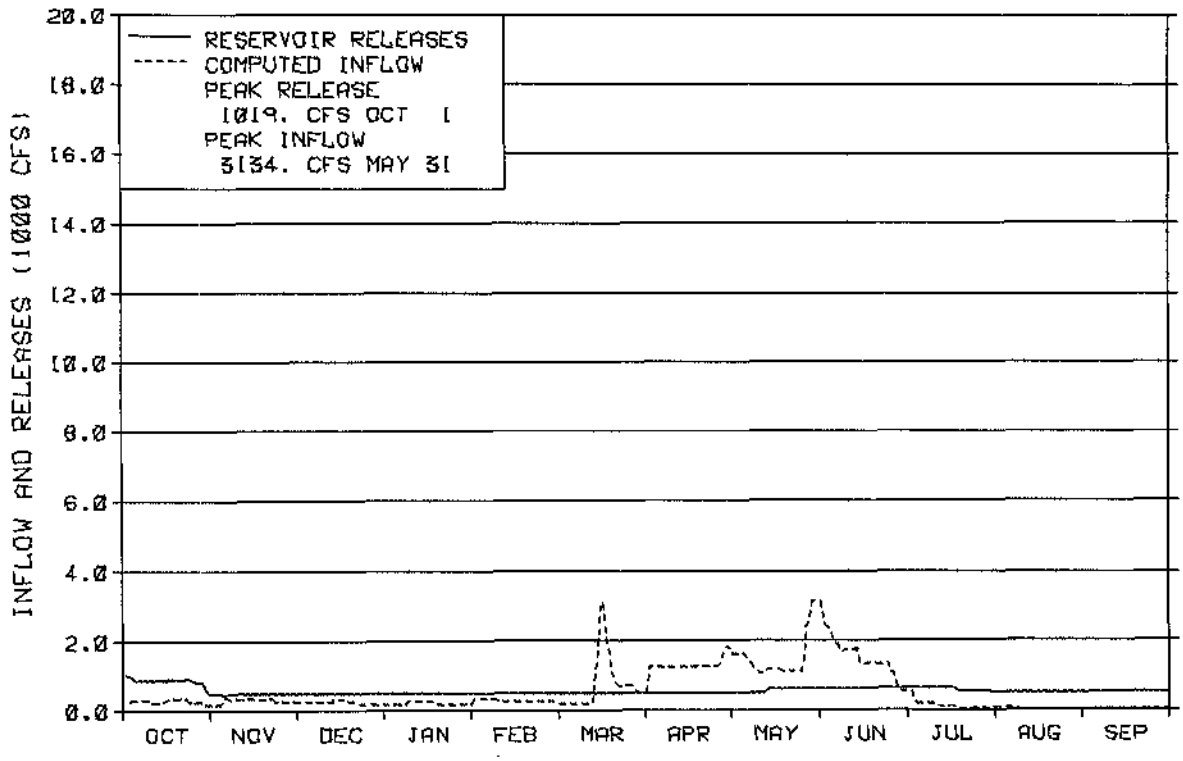
| MONTH | INFLOW | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 16.8 | 75 | 52.3 | 113 | 826.9 | 105 |
| NOVEMBER | 17.7 | 80 | 29.4 | 81 | 815.2 | 106 |
| DECEMBER | 14.7 | 79 | 30.2 | 109 | 799.7 | 108 |
| JANUARY | 12.5 | 77 | 29.8 | 117 | 782.5 | 109 |
| FEBRUARY | 15.2 | 70 | 26.9 | 109 | 770.8 | 110 |
| MARCH | 44.7 | 90 | 29.8 | 84 | 785.7 | 111 |
| APRIL | 77.0 | 122 | 28.8 | 62 | 833.9 | 113 |
| MAY | 93.4 | 56 | 34.6 | 49 | 892.7 | 107 |
| JUNE | 89.5 | 47 | 37.0 | 36 | 945.2 | 98 |
| JULY | 7.5 | 12 | 36.0 | 45 | 916.7 | 96 |
| AUGUST | 0.4 | 2 | 30.6 | 50 | 886.6 | 100 |
| SEPTEMBER | 1.0 | 6 | 30.4 | 57 | 857.2 | 104 |
| ANNUAL | 390.5 | 58 | 395.7 | 65 | | |
| APRIL-JULY | 267.4 | 55 | | | | |

* Average for the 1957-2003 period.

# FIGURE MTG8

## LAKE ELWELL




WATER YEAR 2003

Milk **River Project**

The 120,000-acre Milk River Project, located in north-central Montana, is served by Sherburne, Fresno, and Nelson Reservoirs. Sherburne and Nelson Reservoirs are single-purpose irrigation structures. Fresno Reservoir has joint-use flood control space, provides a municipal water supply to several municipalities on or near the project, and serves as the primary irrigation storage structure for the Milk River Project. Approximately 101,500 acres are presently served by irrigation districts, 9,500 acres are served by private facilities; and between 5,00❑ and 6,000 acres are served supplemental water by the Ft. Belknap Indian Irrigation Project.

**Sherburne Reservoir** is located in Glacier National Park on Swiftcurrent Creek, a tributary of the St. Mary River in the Hudson Bay Drainage Basin. Lake Sherburne has a total capacity of 67,854 acre-feet at elevation 4788.0. The use of boundary waters of the St. Mary and Milk Rivers are divided between Canada and the United States by the 1909 Boundary Waters Treaty. The United States utilizes its entitlement to St. Mary River water by regulating flows through storage in Lake Sherburne and diverting St. Mary River flows through the St. Mary Canal to the Milk River basin. The river outlet works have a capacity of 2,100 cfs at elevation 4788.0 feet. The maximum combined discharge of the spillway and river outlet works is 4,000 cfs at a maximum water surface elevation of 4810.0 feet.

Storage in Lake Sherburne at the beginning of water year 2003 was 11,436 acre-feet, 112 percent of normal, at elevation 4741.38. The St. Mary Canal was shutdown on October 8, 2002, but some water was released from Lake Sherburne during October 9-15 to satisfy requirements under the Boundary Waters Treaty. After this date releases were discontinued until spring of 2003.

Inflows during October through December were much below normal at 64, 46, and 65 percent of normal, respectively. inflows during January through April were near normal to above normal. April 1 storage was 20,984 acre-feet, 85 percent of normal. The April 1 water supply forecast for April through July runoff indicated that the runoff would be 86,400 acre-feet, 83 percent of normal. The actual April through July runoff was 90, 500 acre-feet, 87 percent of normal. Inflow during August and September were 84 and 62 percent of normal, respectively.

Fall precipitation in both the mountains and the valley were much below average. Cumulative valley precipitation from October to the end of December was only 47 percent of normal. During the same period cumulative mountain precipitation was only 62 percent of average. Conditions remained similar until March when several storm events occurred. Valley and mountain precipitation during March were 377 and 204 percent of average,

respectively. Following excellent March precipitation, conditions returned to below average once again. Mountain snowpack was 70 percent of normal by January 1 and improved to 88 percent of normal by April 1 due to the above average precipitation in March. The July through September monthly valley precipitation ranged from 4 to 74 percent of average, while the monthly mountain precipitation ranged from 5 to 78 percent of average.

Generally, diversions into the St. Mary Canal in the spring began as soon as weather permits, which in mild years can be as early as March. However in water year 2003, snow storms and freezing temperatures prevented diversions from beginning until April. Releases from Lake Sherburne began on April 4 and St. Mary Canal diversion began on April 8. Once releases were started, storage decreased until April 24 when warm weather melted low elevation snow beginning the snowmelt runoff for 2003. Due to this melt the reservoir increased in storage from April 25 to May 5. In early may colder temperatures returned and snowmelt runoff into Lake Sherburne decreased thus causing storage to draft from May 6 until May 13. After this date the snow began to melt again and continued until early July. Storage on May 13 was 18,537 acre-feet. Daily inflow to Lake Sherburne peaked for the year at 1,507 cfs on May 26. Diversion by the St. Mary Canal averaged 338 cfs during April and 454 cfs during May. Releases from Lake Sherburne were reduced to about 35 cfs on May 29 to increase storage as the flow of the St. Mary River was adequate to meet the canal diversions. The releases were maintained between 35 to 44 cfs until the canal diversions exceeded the United States portion of the St. Mary River flow, which occurred on June 24.

Lake Sherburne storage peaked on June 29 at 59,864 acre-feet, at elevation 4783.09, which was 4.91 feet from normal full pool. The snow pack peaked on April 9 slightly earlier than the normal time, and was essentially melted out during the first week of July near the normal time.

Storage on September 30, 2003, was 7,846 acre-feet, 77 percent of normal. Inflow for the water year totaled 121,063 acre-feet, 84 percent of normal.

According to preliminary data, diversions from the St. Mary River to the Milk River totaled 167,762 acre-feet, 114 percent of the long-term average. The long-term average annual diversion is 149,500 acre-feet and the 1980-2002 average is 174,000 acre-feet. The largest diversion previously recorded was 277,000 acre-feet during 1989. During 2003, canal diversions were discontinued on September 19 because storage in Lake Sherburne was near minimum pool and flow in the St. Mary River was much below average. The gates at Lake Sherburne were closed on September 18; however, water was released from the reservoir during October 28-31 to satisfy requirements under the Boundary Waters Treaty. After this date releases were discontinued for the winter.

Additional hydrologic and statistical information pertaining to the operation of Sherburne Reservoir during 2003 can be found in Table MTT10-A and Figure MTG9.

TABLE MTT10-A
HYDROLOGIC DATA FOR 2003
SHERBURNE RESERVOIR (MILK RIVER PROJECT)

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4729.30 | 3,061 | 3,061 |
| TOP OF ACTIVE CONSERVATION | 4788.00 | 67,854 | 64,793 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 4741.38 | 11,436 | OCT 01, 2002 |
| END OF YEAR | 4736.72 | 7,846 | SEP 30, 2003 |
| ANNUAL LOW | 4731.66 | 4,425 | OCT 15, 2002 |
| ANNUAL HIGH | 4783.09 | 59,864 | JUN 29, 2003 |
| HISTORIC HIGH | 4788.30 | 68,371 | JUN 30, 1986 |

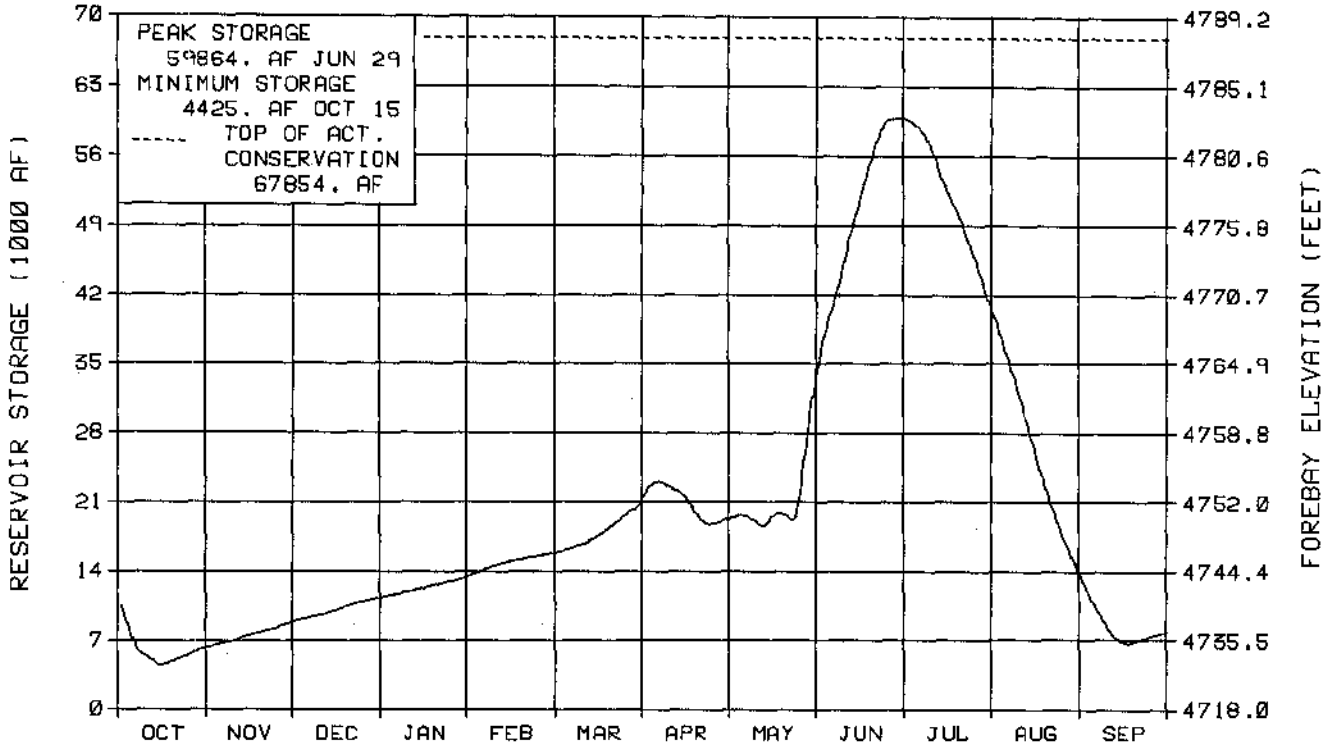
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 121,064 | OCT 02-SEP 03 | 124,671 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 1,507 | MAY 26, 2003 | 691 | JUL 12, 2003 |
| DAILY MINIMUM (CFS) | 23 | FEB 28, 2003 | 0 | * |

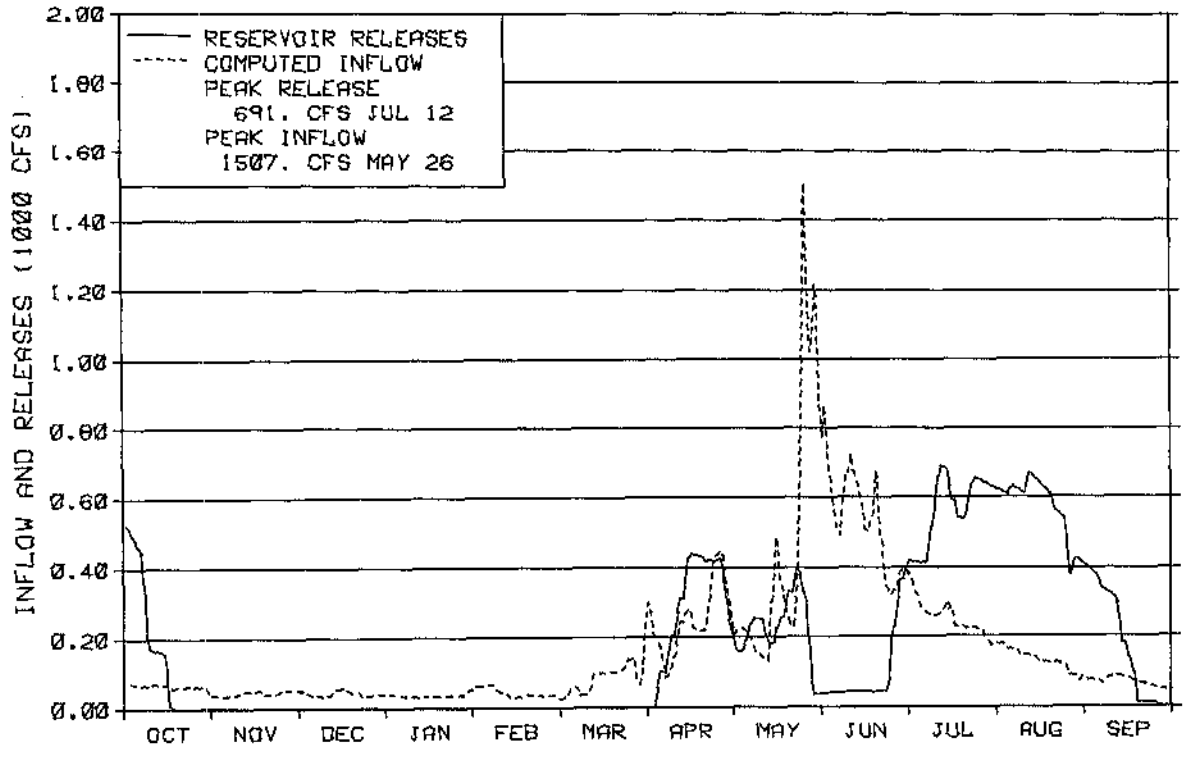
* During nonirrigation season

| MONTH | INFLOW | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 3.9 | 64 | 9.1 | 228 | 6.3 | 56 |
| NOVEMBER | 2.6 | 46 | 0.0 | --- | 8.9 | 57 |
| DECEMBER | 2.5 | 65 | 0.0 | --- | 11.3 | 58 |
| JANUARY | 2.2 | 80 | 0.0 | --- | 13.6 | 60 |
| FEBRUARY | 2.2 | 93 | 0.0 | --- | 15.8 | 64 |
| MARCH | 5.2 | 172 | 0.0 | --- | 21.0 | 85 |
| APRIL | 15.0 | 167 | 16.8 | 127 | 19.2 | 91 |
| MAY | 27.7 | 86 | 13.6 | 67 | 33.3 | 105 |
| JUNE | 32.3 | 77 | 5.7 | 29 | 59.8 | 109 |
| JULY | 15.5 | 74 | 34.8 | 139 | 40.5 | 81 |
| AUGUST | 7.9 | 84 | 35.0 | 109 | 13.5 | 52 |
| SEPTEMBER | 4.0 | 62 | 9.6 | 43 | 7.8 | 77 |
| ANNUAL | 121.1 | 84 | 124.7 | 87 | | |
| APRIL-JULY | 90.5 | 87 | | | | |

* Average for the 1955-2003 period.

# FIGURE MTG9
## LAKE SHERBURNE




WATER YEAR 2003

**Fresno Reservoir** is located above all project lands on the Milk River near Havre, Montana. A sediment re-survey done during 1999 and finalized during 2000 determined the normal full pool capacity was 92,880 acre-feet, a loss of 10,517 acre-feet from the previous capacity. The new revised elevation-area-capacity data was used beginning in water year 2001. The top 32,802 acre-feet is used jointly for flood control and conservation and is not filled until the start of the spring runoff. Fresno stores the natural flow of the Milk River along with water diverted into the Milk River from the St. Mary River and Lake Sherburne. Stored water is used principally for irrigation, but Havre and Chinook, Montana, have contracted for a minimum flow in the river of 25 cfs during the winter to maintain a suitable water quality for municipal use. The city of Harlem and the Hill County Water District have also contracted for municipal use.

Fresno Reservoir began water year 2003 with storage content of 44,341 acre-feet, 111 percent of normal and 48 percent of full capacity. Releases were made from Fresno Reservoir to transfer water to Nelson Reservoir beginning October 1. The total release through October 25 was approximately 14,269 acre-feet, however due to river losses only ninety-seven percent of the release (13,909 acre-feet) made it to Nelson Reservoir. The releases were then decreased to the minimum flow of approximately 40 cfs for the remainder of the fall and winter. Storage at the end of October was 48,348 acre-feet, 123 percent of normal.

Accumulated valley precipitation from October through December was only 62 percent of normal. By April 1, cumulative valley precipitation was only 69 percent of normal. However, much above average precipitation in April increased the cumulative precipitation to near normal by May 1. Precipitation during May and June was near normal and by the end of June, cumulative precipitation was 100 percent of average. During July weather patterns changed significantly, and hot, dry conditions prevailed through the rest of the summer. At the end of September the cumulative annual precipitation was 85 percent of normal.

Reservoir inflow was above average into Fresno from October to January and storage remained fairly constant. Storage on March 1 prior to the start of the normal runoff period was 48,532 acre-feet, 136 percent of average. The spring runoff season for the Milk River generally occurs from March through June. Therefore, the peak snowpack and most reliable water supply runoff forecast for the Milk River is March 1. The March 1 water supply forecast indicated that 39,000 acre-feet of runoff could be expected, which was only 47 percent of normal. However, based upon the March 1 forecast, Fresno Reservoir was still expected to fill to the top of the conservation pool even with the below normal forecasted runoff and water from the St. Mary Canal. The carry-over storage in Fresno

was enough to get the season started and St. Mary water was not required immediately. Therefore, making releases to Nelson Reservoir in early April did not affect Fresno Reservoir filling to normal full pool. The March through June inflow, excluding St. Mary canal water, was approximately 54,500 acre-feet, 65 percent of average. Inflow to Fresno Reservoir peaked during this time at 3,292 cfs, on March 19.

Reclamation and the Milk River Basin irrigation districts discussed water supply often, either through meetings or through conference calls. The irrigation water supply was estimated to be 1.5 acre-feet per contract acre diverted from the river. This was approximately equal to the previous year. Releases from Fresno Reservoir were increased on April 10 to begin transferring water to Nelson Reservoir. Approximately 7,700 acre-feet of Fresno Storage was transferred to Nelson Reservoir to provide sufficient water in Nelson Reservoir to satisfy the irrigation allotment. This was augmented by an additional 10,500 acre-feet of natural flow that was diverted into Nelson Reservoir.

At the April 8 meeting, Reclamation and the districts agreed water users would be allotted 1.5 acre-feet per acre for the irrigation season. Irrigation releases from Fresno Reservoir peaked at approximately 1,200 cfs on May 30. Reclamation did not meet with the water users again until September. However, during that time conference calls were conducted to discuss water supply and water allotments. On July 30, there was a conference call between Reclamation staff and water users to discuss water supply and usage by the various districts. Reclamation informed them that most districts were approaching their allotment that was initially set. After extended discussion, the Milk River Joint Board of Control (MRJBC) voted to increase irrigation allotments to 2.0 acre-feet per acre. Another conference call was conducted on August 13 and an update of water supply and usage was again provided to the water users. In conclusion, the MRJBC decided to increase irrigation allotments; in contrast, this increase did not have an associated volume, each district was allotted all necessary water to irrigate through the end of August. The average releases for June, July and August were 964, 1052, and 790 cfs, respectively.

Precipitation was near to above normal during April through June, satisfying much of the early irrigation demand. This allowed reservoir storage to continue to increase until May 11, when storage peaked at 94,454 acre-feet at elevation 2575.32. Total inflow for the year was 239,779 acre-feet, 89 percent of normal. Diversions from the St. Mary River Basin to the Milk River Basin accounted for about 65 percent of the inflow to Fresno Reservoir. Storage on September 30, 2003 was 27,756 acre-feet 70 percent of normal and 30 percent of full capacity.

The Corps of Engineers estimated that during 2003 inflows to Fresno Reservoir were not large enough to have caused local flooding even if passed downstream undiminished. In addition, Fresno did not contribute to the reduction of flood damages downstream on the Missouri River below Fort Peck Reservoir. Since construction of Fresno Dam in 1939, the reservoir has reduced flood damages by a total of $13,059,200.

Additional hydrologic and statistical information pertaining to the operation of Fresno Reservoir during 2003 can be found in Table MTT10-B and Figure MTG10.

TABLE MTT10-B
HYDROLOGIC DATA FOR 2003
FRESNO RESERVOIR (MILK RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/1/2000

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2530.00 | 448 | 448 |
| TOP OF ACTIVE CONSERVATION | 2567.00 | 60,346 | 59,898 |
| TOP OF JOINT USE | 2575.00 | 92,880 | 32,534 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2561.28 | 44,341 | OCT 01, 2002 |
| END OF YEAR | 2553.65 | 27,756 | SEP 30, 2003 |
| ANNUAL LOW | 2549.22 | 19,839 | AUG 29, 2003 |
| ANNUAL HIGH | 2575.32 | 94,454 | MAY 11, 2003 |
| HISTORIC HIGH | 2579.35 | 154,023 | APR 03, 1952 |

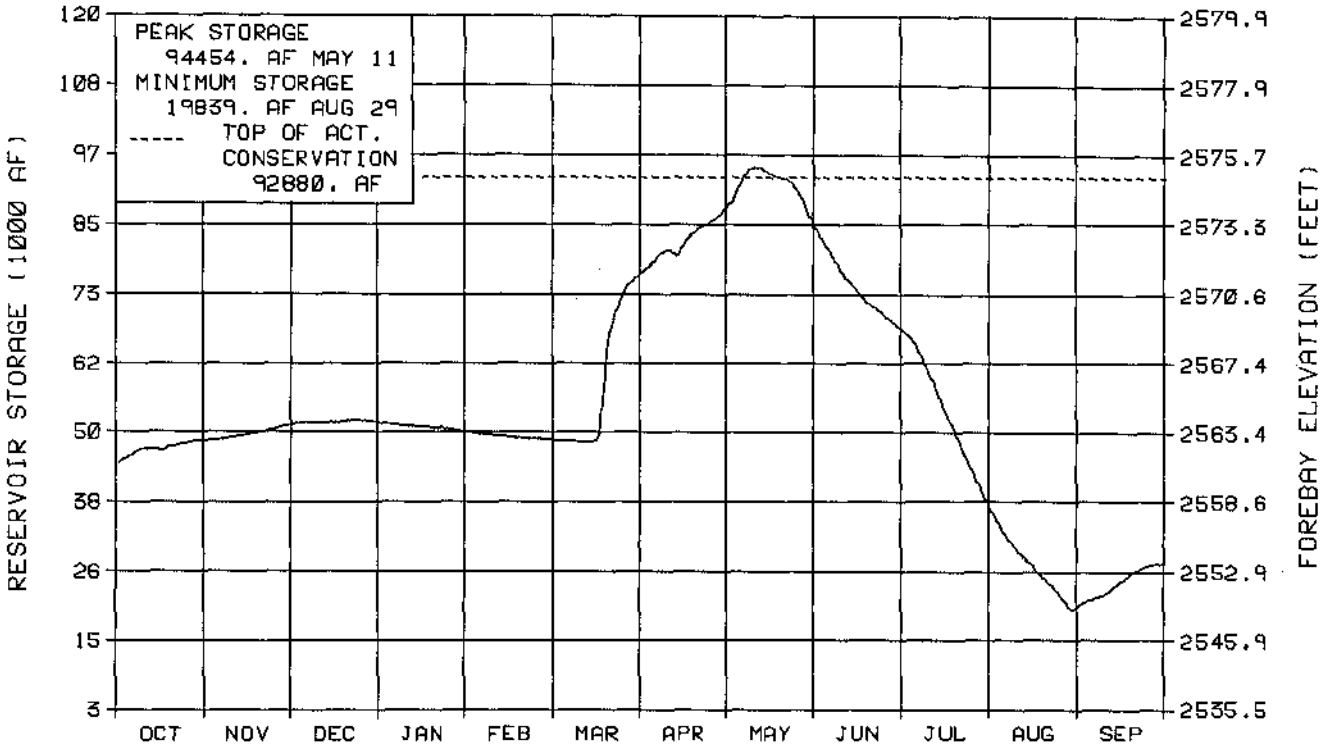
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 239,779 | OCT 02-SEP 03 | 256,364 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 3,292 | MAR 19, 2003 | 1,200 | MAY 30, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 35 | SEP 13, 2003 |

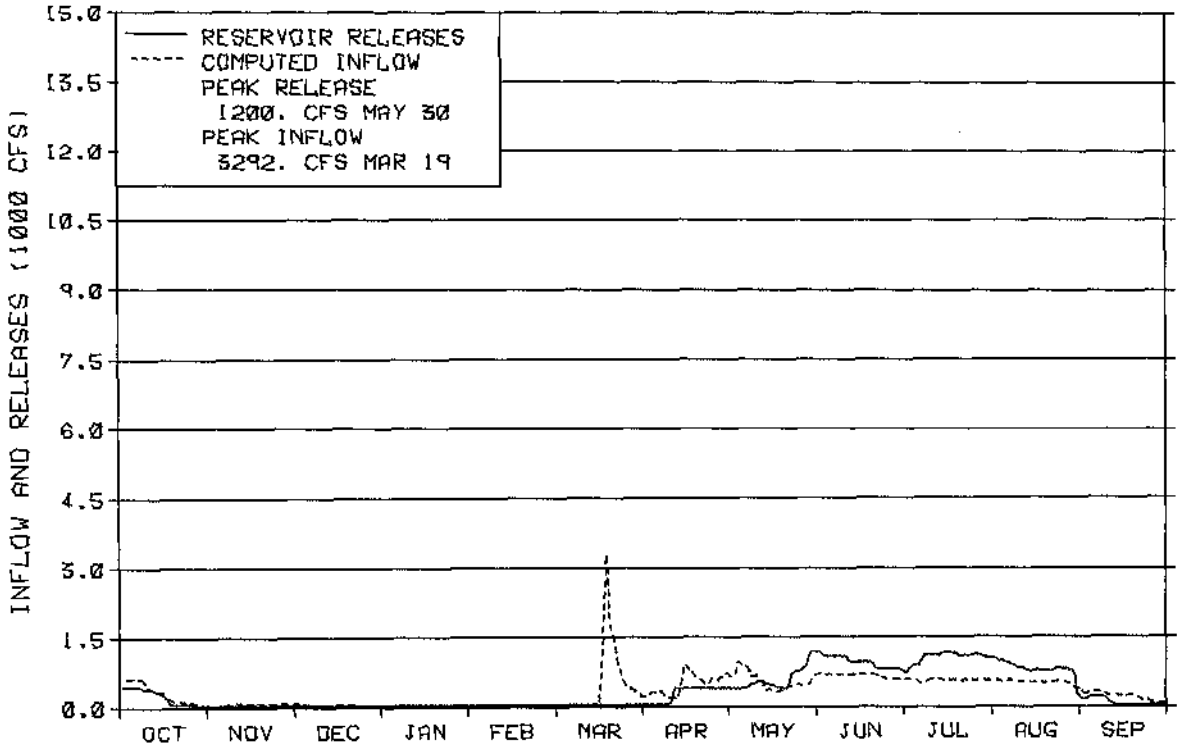
* During nonirrigation season

| MONTH | INFLOW | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 18.8 | 250 | 14.8 | 186 | 48.3 | 123 |
| NOVEMBER | 5.2 | 247 | 2.5 | 81 | 51.0 | 132 |
| DECEMBER | 3.0 | 298 | 2.7 | 102 | 51.3 | 137 |
| JANUARY | 1.1 | 224 | 2.6 | 103 | 49.8 | 139 |
| FEBRUARY | 1.1 | 32 | 2.4 | 98 | 48.5 | 136 |
| MARCH | 30.5 | 100 | 2.7 | 40 | 76.3 | 145 |
| APRIL | 27.9 | 70 | 16.8 | 80 | 87.4 | 124 |
| MAY | 34.0 | 78 | 36.2 | 75 | 85.2 | 130 |
| JUNE | 39.6 | 87 | 57.4 | 115 | 67.4 | 109 |
| JULY | 34.7 | 98 | 64.7 | 115 | 37.4 | 84 |
| AUGUST | 31.7 | 96 | 48.6 | 108 | 20.6 | 55 |
| SEPTEMBER | 12.2 | 47 | 5.0 | 22 | 27.8 | 70 |
| ANNUAL | 239.8 | 89 | 256.4 | 96 | | |
| APRIL-JULY | 136.7 | 83 | | | | |

* Average for the 1949-2003 period.

# FIGURE MTG10
## FRESNO RESERVOIR




WATER YEAR 2003

**Nelson Reservoir,** located near Malta, Montana, is an off-stream reservoir which receives its water supply from the Milk River by diversion through the Dodson South Canal. Nelson Reservoir is the only source of supply for the lower portion of the Malta Irrigation District. Nelson Reservoir can also serve the Glasgow Irrigation District when water is not available from Fresno Reservoir. In 1999 a sediment re-survey was performed and then finalized during 2000-01. Since Nelson Reservoir operation began in 1916, the measured total volume loss due to sedimentation was 446 acre-feet. The new revised elevation-area capacity data was implemented at the beginning of water year 2002. Nelson Reservoir now has a total capacity of 78,950 acre-feet and an active capacity of 60,810 acre-feet.

Nelson Reservoir began the water year with a storage content of 54,176 acre-feet, at elevation 2215.26, 96 percent of average. About 13,909 acre-feet of water was transferred from Fresno Reservoir to Nelson Reservoir during October of 2002. Storage gradually decreased through the winter until mid-March. Natural runoff in the Milk River was available for diversion during March and when natural runoff decreased, releases from Fresno Reservoir were made to continue filing Nelson Reservoir. Releases from Fresno Reservoir were initiated on April 10 and reached Nelson Reservoir on April l9. Irrigation releases from Nelson Reservoir began on April 23 and continued through the end of August. Storage in Nelson Reservoir peaked at 73,374 acre-feet at elevation 2220.28 on May 1. From the beginning of May storage steadily decreased until mid-June when irrigation demand was slightly decreased and thus allowed storage to increase until July 1. Total inflow into Nelson Reservoir during March through May was 18,233 acre-feet. Nesting piping plover did not affect the filling of Nelson Reservoir during 2003 and water levels were allowed to increase during late June through early July. Inflow to Nelson Reservoir during June and July totaled 7,865 acre-feet. Releases to the Milk River during July 1 through August 31 were made for use by Glasgow Irrigation District. Water was diverted into Nelson Reservoir during August and September totaling 13,476 acre-feet. Storage on September 30, 2003 was 50,164 acre-feet at elevation 2214.09, 88 percent of average.

Additional hydrologic and statistical information pertaining to the operation of Nelson Reservoir during 2003 can be found in Table MTT10-C and Figure MTG11.

Important Events - 2003

March 1: Milk River runoff forecast indicates only 47 percent of normal runoff.

March 19: Inflow to Fresno Reservoir peaked at 3,292 cfs.

April 4: Releases begin from Lake Sherburne.

April 8: St. Mary Canal begins to divert. Reclamation and the irrigation districts met in Malta again to review the water supply and plan beginning date for irrigation diversion. Allotment is set at 1.5 acre-feet per acre.

April 10: Releases from Fresno Reservoir were increased to begin transfer of water to Nelson Reservoir.

May 11: Fresno Reservoir storage peaks for the year at 94,454 acre-feet at elevation 2575.32, 0.32 feet above normal full pool level.

May 26: Inflow to Lake Sherburne peaked for the year at 1,507 cfs.

June 29: Lake Sherburne storage peaked at 59,864 acre-feet, at elevation 4783.09, which is 4.91 feet from normal full pool.

July 30: Allotments are increased to 2.0 acre-feet per acre during a conference call between Reclamation and the Milk River Joint Board of Control.

August 13: Allotments are once again increased during a conference call between Reclamation and the Milk River Joint Board of Control. New allotments specify no set increase in volume, irrigators are allowed all water needed until September 1.

September 1: Irrigation diversions end for the season on the Milk River.

September 17: Lake Sherburne releases are discontinued.

September 18: St. Mary Canal diversions are discontinued.

October 28-31: Releases from Lake Sherburne were made to satisfy requirements under the Boundary Waters Treaty.

TABLE MTT10-C
HYDROLOGIC DATA FOR 2003
NELSON RESERVOIR (MILK RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/1/2001

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2200.00 | 18,140 | 18,140 |
| TOP OF ACTIVE CONSERVATION | 2221.60 | 78,950 | 60,810 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2215.26 | 54,176 | OCT 01, 2002 |
| END OF YEAR | 2214.09 | 50,164 | SEP 30, 2003 |
| ANNUAL LOW | 2211.95 | 43,469 | AUG 31, 2003 |
| ANNUAL HIGH | 2220.28 | 73,374 | MAY 01, 2003 |
| HISTORIC HIGH | 2221.60 | 79,224 | JUL 12, 1965 |

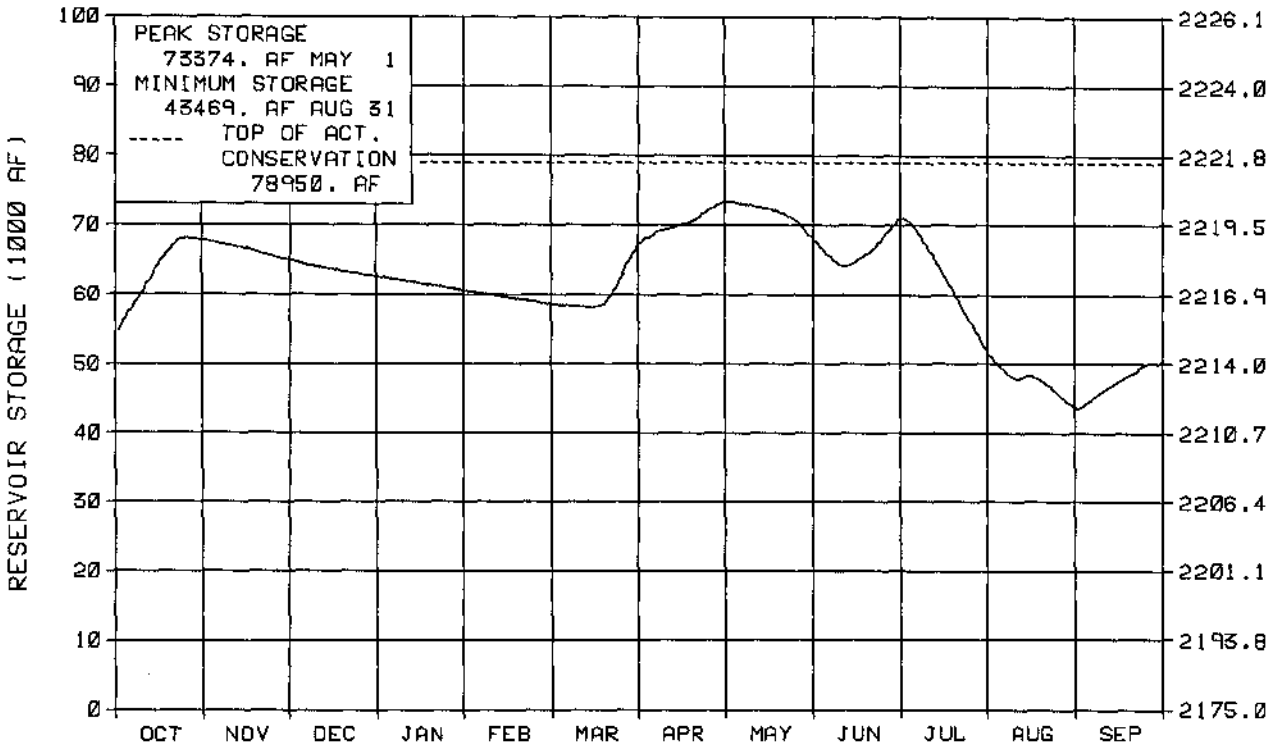
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 44,059 | OCT 02-SEP 03 | 48,071 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 410 | MAR 29, 2003 | 398 | JUL 09, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |

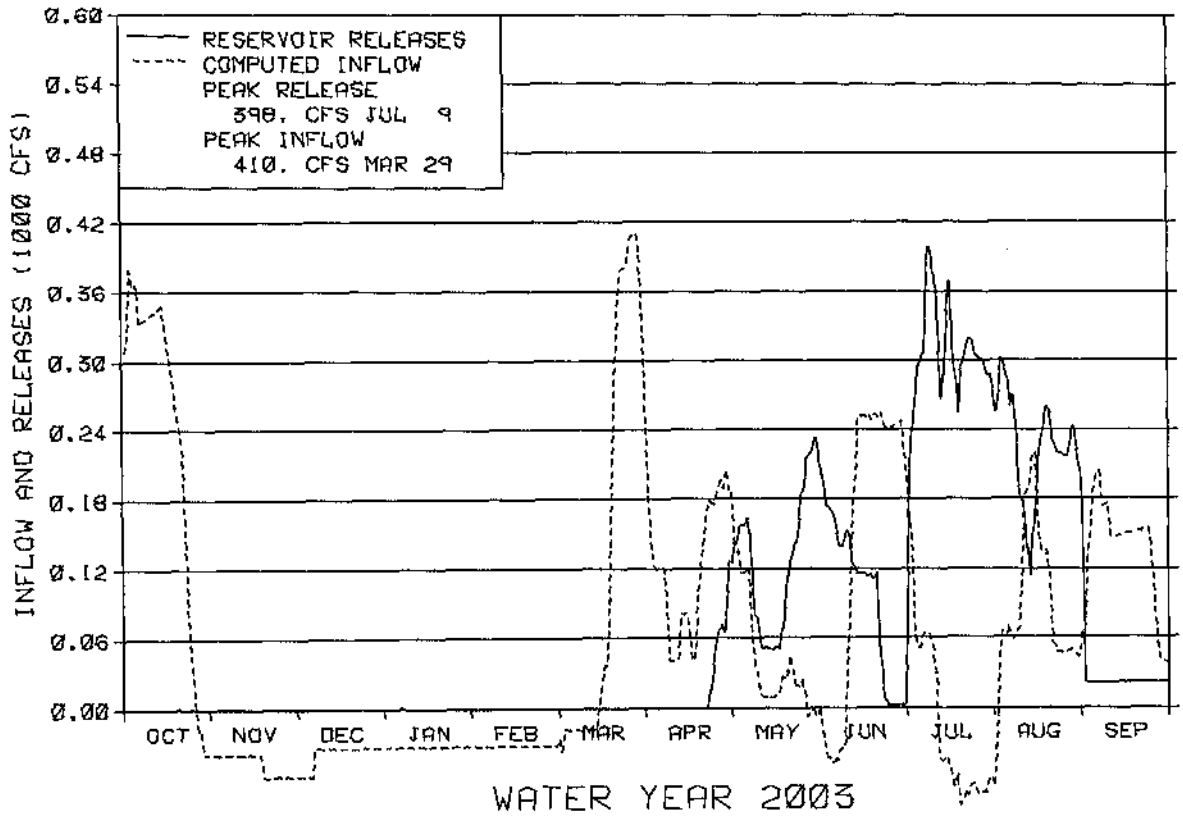
* During nonirrigation season

| MONTH | INFLOW* | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 13.5 | 323 | 0.0 | --- | 67.7 | 114 |
| NOVEMBER | -2.9 | --- | 0.0 | --- | 64.8 | 111 |
| DECEMBER | -2.3 | --- | 0.0 | --- | 62.5 | 110 |
| JANUARY | -2.0 | --- | 0.0 | --- | 60.5 | 110 |
| FEBRUARY | -1.8 | --- | 0.0 | --- | 58.7 | 109 |
| MARCH | 8.2 | 672 | 0.0 | --- | 66.9 | 123 |
| APRIL | 7.4 | 106 | 1.1 | 184 | 73.3 | 121 |
| MAY | 2.6 | 38 | 7.8 | 104 | 68.0 | 112 |
| JUNE | 8.6 | 112 | 5.8 | 77 | 70.8 | 119 |
| JULY | -0.7 | --- | 18.4 | 192 | 51.6 | 94 |
| AUGUST | 5.5 | 81 | 13.7 | 181 | 43.5 | 80 |
| SEPTEMBER | 8.0 | 138 | 1.3 | 36 | 50.2 | 88 |
| ANNUAL | 44.1 | 111 | 48.1 | 124 | | |
| APRIL-JULY | 18.9 | 68 | | | | |

* Average for the 1947-2003 period.

# FIGURE MTG11
## NELSON RESERVOIR



**Bighorn Lake and Yellow**tail Powerplant

Bighorn Lake (P-S, MBP) is located on the Bighorn River about 45 miles southwest of Hardin, Montana. It has a total capacity of 1,328,360 acre-feet. The dam and reservoir were built for power generation, irrigation, flood control, fish and wildlife and recreation. The nameplate capacity of Yellowtail Powerplant is 250,000 kilowatts. Provisions have been made for gravity diversions from the reservoir to the proposed Hardin Unit which contains 42,600 acres of irrigable lands needing a full water supply and 950 acres to receive a supplemental supply. Stored water can also he used to irrigate additional lands along the Yellowstone River. Reclamation has negotiated an industrial water service contract with Pennsylvania Power & Light, MT (PPL-MT), formerly known as Montana Power Company (MPC) for 6,000 acre-feet. All other industrial water service contracts with different entities expired as of May 1982, and none were renewed. Bull Lake, Boysen and Buffalo Bill Reservoirs are three major tributary reservoirs located in Wyoming upstream of Bighorn Lake. Because these reservoirs are operated and managed by the Wyoming Area Office (WYAO), all reservoir and river operations in the Bighorn River Basin are closely coordinated between the Montana Area Office (MTAO) and WYAO.

In 1982, a hydrographic and a topographic survey was conducted and a new elevation-area-capacity table and curve was developed. The 1982 survey determined that Bighorn Lake has a storage capacity of 1,328,360 acre-feet and a surface area of 17,279 acres at reservoir elevation 3657.0 (the top of the spillway gates). Since closure in 1965, the reservoir has accumulated a sediment volume of 53,950 acre-feet below reservoir elevation 3657. This volume represents a 3.9 percent loss in capacity and an average annual loss of 3,224 acre-feet from November 1965 through July 1982. Sediment was deposited at the annual rate of 0.314 acre-feet per square mile during that period. The revised area-capacity table was put into effect on August 1, 1986, reflecting the new storage levels.

Fours consecutive years of severe drought continued to have a significant impact on the climatic and hydrologic conditions in the Bighorn Basin during water year 2003. Record low precipitation was recorded at many locations across Montana and Wyoming during August and September, 2002. Upstream irrigation demands remained high and inflow to Bighorn Lake during August and September remained well below normal at 53 percent of average. The August-September inflow totaled 182,875 acre-feet and was the 4" lowest inflow of record.

Stream flows into Bighorn Lake increased moderately during late September. Inflows rose from 1,355 cfs on September 6 to 2,237 cfs on September 29 and averaged 1,857 cfs during September. Maintaining releases from Bighorn Lake to the Bighorn River at 1,500 cfs allowed storage to slowly increase. Storage in Bighorn Lake entered water year 2003 with a content of 634,991 acre-feet at elevation 3578.61. This was about 62 percent of normal and was also

435,038 acre-feet or 61.39 feet below the top of the joint-use pool. This was the lowest October 1 storage level ever recorded since construction of Yellowtail Dam and was also 24.21 feet or 125,373 acre-feet lower than the previous record low set at the beginning of water year 2002.

It appeared there was no relief from the severe drought being experienced. Preliminary operation plans prepared for Bighorn Lake indicated a severe winter draw-down of storage in Bighorn Lake. If this held true, this critically low level would severely impact the operations of the hydro-electric powerplant and may even cause it to be shut down. Never in the history of the operations of Yellowtail powerplant has this been a potential problem or concern.

On October 22, 2003, a public meeting was held at the Holiday Inn in Billings, Montana to discuss the water supply outlook for the Bighorn River Basin and the proposed operations for Bighorn Lake. As a result of the meeting, it was mutually agreed upon that in order to conserve storage in Bighorn Lake and prevent the reservoir level from dropping to a level that would require the powerplant to be shut off, fall and winter releases out of Bighorn Lake would need to be reduced. During October 27-28, the river releases were gradually reduced from 1,500 cfs to 1,300 cfs. This was 200 cfs less than the absolute minimum fishery flow of 1,500 cfs needed to protect the downstream river fishery.

October inflow to Bighorn Lake was 61 percent of normal, averaging 1,890 cfs. This was the fourth lowest October inflow of record. Things only got worse as streamflows dropped to 43 percent of normal during November through March, averaging 1,120 cfs and making them the second lowest November-March inflow of record. With inflow to Bighorn Lake slightly higher than the releases, storage slowly increased from 634,991 acre-feet at elevation 3578.61 at the beginning of the year to 669,311 acre-feet at elevation 3585.60 on November 25. Now the inflows began to slowly recede, allowing storage to gradually drop to a yearly low content of 607,405 acre-feet at elevation 3572.81 on March 11. On February 25, inflow to Bighorn Lake reached a low for the year of 669 cfs.

The fall and winter of 2002-2003 for the Bighorn River Basin started out very mild and dry. Snows accumulated at near normal rates in the higher elevations during October but quickly dropped to well below normal rates during November through mid-January. It was not until late January that frequent winter storms moved into Montana, bringing with them larger accumulations of snow. On January 1, the Natural Resources Conservation Service (NRCS) measured mountain snowpack in the Bighorn Basin at about 73 percent of normal. The Wind and Shoshone River Basins, major tributaries of the Bighorn River, were measured at 72 and 74 percent of normal, respectively. These were nearly the same as that reported a year ago on January 1, 2002.

Weather conditions improved during February and March as the Bighorn Basin received above normal precipitation. The valley precipitation improved to 200 and 183 percent of average, respectively, while the mountain precipitation was reported at 134 and 172 percent of average, respectively. By April 1, the mountain snowpack in the Bighorn River Basin was measured at 104 percent of average. The Wind and Shoshone River Basins, major tributaries of the Bighorn River, were measured at 97 and 105 percent of normal, respectively. This was a significant

improvement over that reported a year ago. On April 1, 2002, the mountain snowpack in the Bighorn River Basin was measured at only 73 percent of average while the Wind and Shoshone River Basins reported only 75 and 81 percent of average, respectively.

By the middle of March, temperatures warmed a bit causing inflows to Bighorn Lake to rapidly increase from about 922 cfs on March 7 to 5,148 cfs on March 14. This was short lived once cooler temperatures returned and inflows once again receded to 984 cfs by March 25. Storage rose from 607,405 acre-feet at elevation 3572.81 on March 11 to 632,239 acre-feet at elevation 3578.04 on March 21 and remained within about one foot of this level through early May.

The above normal precipitation received during February and March had little affect on the inflow to Bighorn Lake as much of the precipitation was absorbed into the very dry soils. Inflow to Bighorn Lake is heavily dependent upon the releases out of Boysen and Buffalo Bill Reservoirs located upstream of Bighorn Lake on the Wind and Shoshone Rivers, respectively. Historically, the water released from Boysen and Buffalo Bill Dams accounts for about 60-70 percent of the inflow to Bighorn Lake. Because storages in these reservoirs were well below normal and at critically low levels, all natural inflows to these reservoirs would be stored with little opportunity for Bighorn Lake to receive any excess flows released out of these reservoirs. At this time, it appeared the only inflow that could be expected to flow into Bighorn Lake would be attributed to other tributary flows. These too, were forecast to be well below normal. Largely due to the conservative releases maintained out of Boysen and Buffalo Bill Dams, the inflow to Bighorn Lake during March, April and May were only 53, 42 and 56 percent of average, respectively.

The end of May signaled the beginning of the spring snowmelt into Bighorn Lake. Beginning on May 23, inflows rose quickly from 1,316 cfs to 6,104 cfs on May 31. As the inflows increased, storage in Bighorn Lake also gradually increased. Temperatures cooled off briefly during early June, slowing the high elevation snowmelt and rate of fill in Bighorn Lake. Generous rains near the middle of June accompanying the snowmelt once again triggered the inflows to Bighorn Lake to increase and reach a peak for the year of 7,515 cfs on June 20. Storage in Bighorn Lake continued to steadily increase until reaching a peak content for the year of 843,949 acre-feet at elevation 3616.02 on July 7, 2003. This was 226,080 acre-feet or 23.98 feet below the top of the joint use pool or 81 percent of average and 79 percent of full capacity and was 141,334 acre-feet or 23.87 feet greater than recorded on this date in 2002.

In early June, the Montana Fish, Wildlife and Parks were preparing to conduct a fish study in the Bighorn River. To assist them with the study, the river releases were increased from 1,300 cfs to 1,500 cfs on June 8. Based upon the June water supply forecast, it was determined this release rate would be maintained throughout the remainder of the year.

The severe drought of 2003 kept upstream irrigation demands high, creating a significant affect on the inflow to Bighorn Lake. Inflows continued to drop until reaching a low for the summer of 658 cfs on July 17. Slightly better than in 2002, the inflow to Bighorn Lake during June and July was 55 and 28 percent of average totaling 244,104 and 87,467 acre-feet, respectively. The June inflow was the 10$^{th}$ lowest inflow of record while the July inflow was the 6$^{th}$ lowest inflow of

record. Actual April-July runoff into Bighorn Lake during 2003 was the 3rd lowest of record at 46 percent of normal and totaled 548,248 acre-feet, 12 percent or 139,887 acre-feet greater than last year.

Precipitation in the Bighorn Basin upstream of Bighorn Lake improved slightly during August and September. Valley and mountain precipitation during August was 78 and 93 percent of average, respectively while the precipitation during September was 11 and 85 percent of average. Upstream irrigation demands continued to remain high, forcing the August-September inflow to remain well below normal at 60 percent of average. The August-September inflow totaled 207,192 acre-feet and was the 5th lowest inflow of record. From the time storage peaked on July 7, storage in Bighorn Lake slowly declined to785,928 acre-feet at elevation 3607.20 on September 30. This was 150,937 acre-feet or 28.59 feet higher than the previous record low established a year ago. This was also 284,101 acre-feet or 32.80 feet below the top of the joint-use pool and was the 7th lowest storage level recorded at the end of the water year since construction of Yellowtail Dam.

Annual runoff into Bighorn Lake totaled 1,208,318 acre-feet and will be recorded as the 2nd lowest annual runoff of record since construction of Yellowtail Dam. This was 48 percent of average and 7 percent or 178,706 acre-feet greater than the total runoff experienced during the record drought year of 2002. The total amount of water released to the Bighorn River during 2003 was 1,004,901 acre-feet, 42 percent of normal. This was the lowest amount of water ever released to the Bighorn River since construction of Yellowtail Dam and was 71,422 acre-feet lower than the previous record low released in 2002.

The drought of 2003 severely impacted the operations of Bighorn Lake and the Bighorn River Basin. There was difficulty in managing the critically low water supply in the Bighorn Basin and balancing it among the various competing interest groups. However with strict conservation measures implemented early in the year, it was possible to provide limited opportunities early in the season for partial lake recreation on Bighorn Lake, protect the lake fishery interests, and provide habitat for the renowned trout fishery downstream of Yellowtail Afterbay Dam. Throughout the winter and early spring, the National Park Service worked diligently to extend or lower the end of the boat ramps at Ok-A-Beh and Barry's Landing recreation sites. Although Horseshoe Bend Marina and concessions were never opened in 2002, there were still opportunities to launch boats at Ok-A-Beh and Barry's Landing around Bighorn Lake. This was not true for the downstream river fishery. Even though it was not possible to maintain river flows at 2,500 cfs, releases to the Bighorn River had to be maintained between 1,300-1,500 cfs, in an effort to protect main channel habitat for the fishery without jeopardizing the operations of the powerplant.

The Corps of Engineers estimated during 2003 Bighorn Lake did not prevent any local flood damages but did prevent $6,239,500 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since construction of Yellowtail Dam in 1965, Bighorn Lake has reduced flood damages by a total of $101,251,600.

Total generation produced at Yellowtail Powerplant during 2003 was 313,727,000 kilowatt-hours, the lowest generation generated since construction of the powerplant in 1967. The generation generated in 2003 was 33 percent of the long term average and was also 51,934,000 kilowatt-hours less than generated in 2002. All of the water released from the dam was released through the powerplant.

**Important Events - Water Year 2003**

October 8-10: All irrigation deliveries from the Afterbay to the Bighorn Canal (Canal) were gradually discontinued for the 2002 irrigation season. Power generation also indicated flows in the Bighorn River were lower than anticipated. In response, turbine releases were adjusted to maintain the river flow at 1,465 cfs.

October 17: Power generation indicated flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain river release at 1,465 cfs.

October 22: At a public meeting held at the Holiday Inn in Billings, MT, Tim Felchle with the Montana Area Office presented the water supply outlook for the Bighorn River Basin and discussed the proposed winter operations for Yellowtail Dam and Bighorn Lake.

October 22-23: The Afterbay level was maintained no higher than elevation 3187.50 feet to allow for annual maintenance of the government camp sewage lagoon.

October 27-28: As a result of the public meeting held on October 22, the decision was made to gradually reduce releases to the Bighorn River to 1,300 cfs. This was 200 cfs below the absolute desired minimum flow required for the downstream fishery.

October 31: Power generation indicated flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain river release at 1,300 cfs.

December 18: Power generation indicated flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river release at 1,300 cfs.

December 24: Power generation indicated flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river release at 1,300 cfs.

January 6-February 13: The tailwater level was maintained no higher than elevation 3190.00 to allow for annual maintenance and inspection on the hollow jet valves. During this outage turbine releases were limited to 3-unit capacity.

January 23: Power generation indicated flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river release at 1,300 cfs.

February 22: Power generation indicated flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river release at 1,300 cfs.

March 22-April 8: The National Park Service was-extending or lowering the end of the boat ramps at Barry's Landing and Ok-A-Beh Marinas. Snowmelt runoff was beginning to cause storage in Bighorn Lake to increase. To avoid conflicts with ongoing construction work on the boat ramps, releases from Bighorn Lake to the Bighorn River were increased and maintained at 1,500 cfs.

March 28: Reclamation attended and participated in the Bighorn Interagency Coordination Meeting in Billings to discuss the operations of Bighorn Lake and Bighorn River. Tim Felchle, Chief of Reservoir and River operations, presented the water supply outlook and the proposed operations of Bighorn Lake and Bighorn River for the 2003 season.

April 7-17: An outage was scheduled on unit 1 for annual maintenance. During this outage, turbine releases were limited to 3-unit capacity.

April 21-May 2: A 12-day outage was scheduled on the Afterbay Dam sluice gates for annual maintenance. During this outage, the level of the Afterbay was maintained between elevations 3183-3190 to adequately release the desired flow through the spillway to the Bighorn River.

May 15: The level of the tailwater was maintained no higher than elevation 3183 to allow boats to safely enter the Yellowtail Dam spillway stilling basin for inspection of the spillway tunnel.

Mav 30: Flow measurements indicated flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river release at 1,300 cfs.

June 4-12: Irrigation diversions from the Afterbay Reservoir to the Bighorn Canal were started at a rate of 75 cfs and gradually increased to 475 cfs.

June 8: Montana Fish, Wildlife & Parks planned to conduct fish studies in the Bighorn River. To assist them with these studies, they requested releases to the Bighorn River be increased to 1,500 cfs.

July 2: Power generation indicated river flows were lower than anticipated. Releases were adjusted to maintain a total release of 1,965 cfs (1,500 cfs to the Bighorn River and 465 cfs to the Bighorn Canal).

July 7: The BIA requested an increase in diversions to the Bighorn Canal. Turbine releases were increased to maintain a total release of 2,000 cfs (1,500 cfs to the Bighorn River and 500 cfs to the Bighorn Canal).

July 30-August 2: Diversions to the Bighorn Canal were gradually reduced by 250 cfs to allow the BIA to chemically treat the canal for large growths of algae. After chemically treating the

algae, diversions to the Bighorn Canal were gradually increased to 500 cfs (1,500 cfs to the Bighorn River and 500 cfs to the Bighorn Canal).

August 4: The BIA requested a decrease in diversions to the Bighorn Canal. Turbine releases were decreased to maintain a total release of 2,000 cfs (1,500 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

August 18-29: A 12-day outage was scheduled on the Afterbay Dam sluice gates for annual maintenance. During this outage, the Afterbay level was maintained no lower than elevation 3183 and no higher than elevation 3190 to sufficiently release 1,500 cfs through the spillway gates to the Bighorn River.

August 27: The BIA requested a decrease in diversions to the Bighorn Canal. Turbine releases were decreased to maintain a total release of 1,950 cfs (1,500 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

September 8: The BIA requested a decrease in diversions to the Bighorn Canal. Turbine releases were decreased to maintain a total release of 1,875 cfs (1,500 cfs to the Bighorn River and 375 cfs to the Bighorn Canal).

September 15-18: A 4-day outage was scheduled on units 1&2 for triennial maintenance and doble testing on transformer bank KCA and station service transformer KCC. During this outage, turbine releases were limited to 2-unit capacity.

September 17: The BIA requested a decrease in diversions to the Bighorn Canal. Turbine releases were decreased to maintain a total release of 1,825 cfs (1,500 cfs to the Bighorn River and 325 cfs to the Bighorn Canal).

September 22-25: A 4-day outage was scheduled on units 3&4 for triennial maintenance and doble testing on transformer bank KCB and station service transformer KCD. During this outage, turbine releases were limited to 2-unit capacity.

September 24: The BIA requested a decrease in diversions to the Bighorn Canal. Turbine releases were decreased to maintain a total release of 1,725 cfs (1,500 cfs to the Bighorn River and 225 cfs to the Bighorn Canal).

September 22-October 13: A 21-day outage was scheduled on unit 4 for annual electrical and mechanical maintenance. During this outage, turbine releases were limited to 3-unit capacity.

October 7-8: All irrigation deliveries from the Afterbay to the Bighorn Canal were discontinued for the 2003 irrigation season.

Additional hydrologic and statistical information pertaining to the operations of Bighorn Lake during 2003 can be found on Table MTT11 and MTG12.

For more detailed information on the operations of Boysen and Buffalo Bill Reservoirs during 2003, refer to the narratives for Boysen Reservoir and Powerplant and Shoshone Project under the responsibility of the Wyoming Area Office.

TABLE MTT11
HYDROLOGIC DATA FOR 2003
BIGHORN LAKE (YELLOWTAIL DAM)

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 3547.00 | 493,584 | 493,584 |
| TOP OF ACTIVE CONSERVATION | 3614.00 | 829,687 | 336,103 |
| TOP OF JOINT USE | 3640.00 | 1,070,029 | 240,342 |
| TOP OF EXCLUSIVE FLOOD CONTROL | 3657.00 | 1,328,360 | 258,331 |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 3578.61 | 634,991 | OCT 01, 2002 |
| END OF YEAR | 3607.20 | 785,928 | SEP 30, 2003 |
| ANNUAL LOW | 3572.81 | 607,405 | MAR 11, 2003 |
| ANNUAL HIGH | 3616.02 | 843,949 | JUL 07, 2003 |
| HISTORIC HIGH | 3656.43 | 1,365,198 | JUL 06, 1967 |

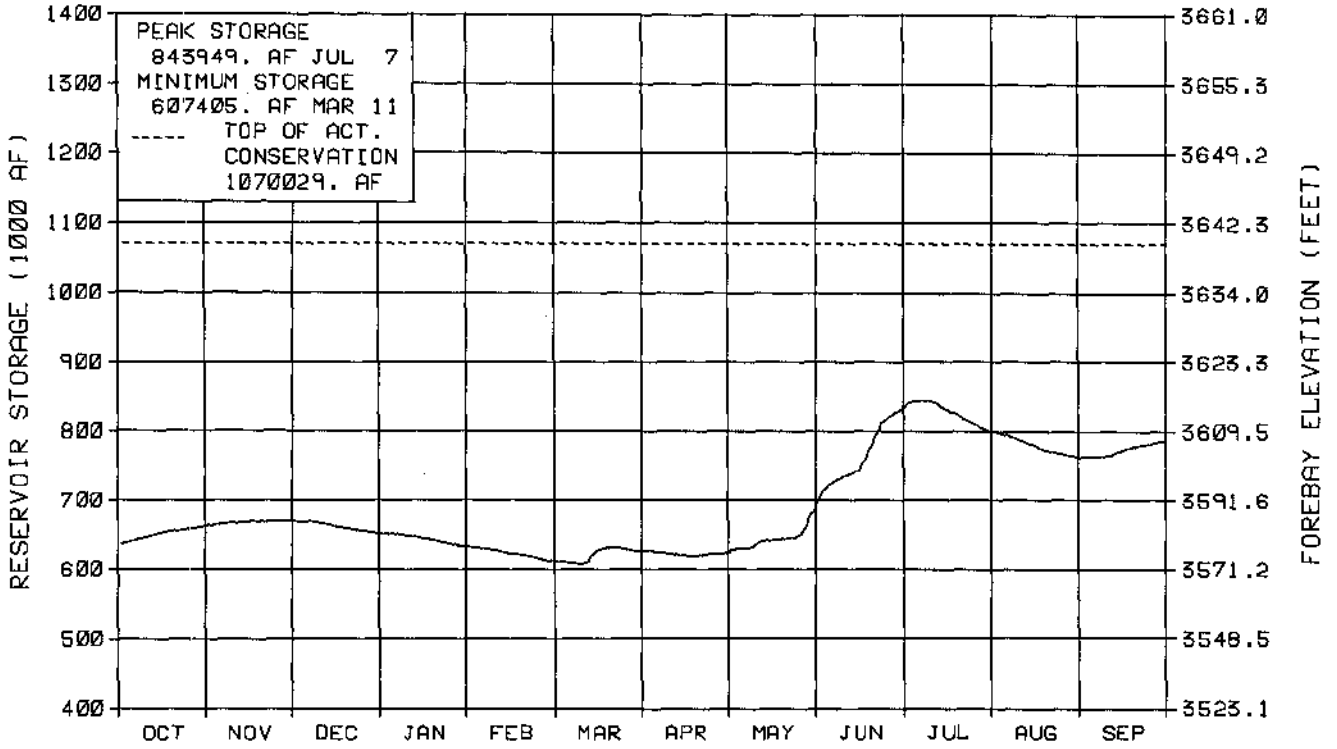
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW* | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 1,208,318 | OCT 02-SEP 03 | 1,004,901 | OCT 01-SEP 02 |
| DAILY PEAK (CFS) | 7,515 | JUN 20, 2003 | 1,547 | JUL 10, 2003 |
| DAILY MINIMUM (CFS) | 585 | FEB 24, 2003 | 1,233 | FEB 05, 2003 |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

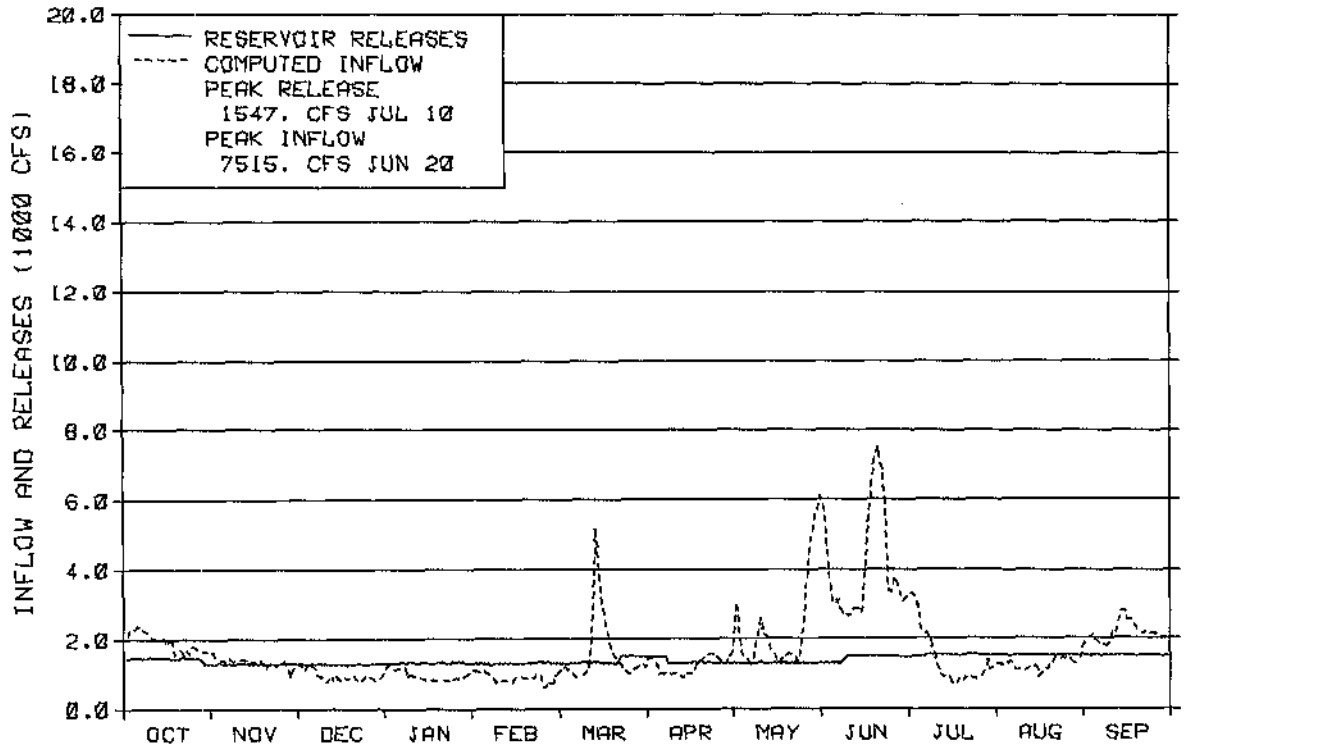
*Discharge to the Bighorn River

| MONTH | INFLOW | | OUTFLOW* | | | | CONTENT | |
|---|---|---|---|---|---|---|---|---|
| | KAF | % OF AVG | CANAL KAF | % OF AVG | RIVER KAF | % OF AVG | KAF | % OF AVG |
| OCTOBER | 116.3 | 61 | 4.6 | 104 | 88.1 | 49 | 663.0 | 66 |
| NOVEMBER | 78.2 | 48 | 0.0 | --- | 77.2 | 41 | 668.6 | 68 |
| DECEMBER | 58.1 | 39 | 0.0 | --- | 79.3 | 41 | 651.6 | 71 |
| JANUARY | 57.5 | 41 | 0.0 | --- | 80.7 | 43 | 632.4 | 73 |
| FEBRUARY | 47.2 | 33 | 0.0 | --- | 72.5 | 42 | 611.5 | 73 |
| MARCH | 95.6 | 53 | 0.0 | --- | 84.4 | 44 | 626.9 | 75 |
| APRIL | 73.3 | 42 | 0.0 | --- | 80.5 | 43 | 624.1 | 76 |
| MAY | 143.4 | 56 | 0.0 | --- | 80.6 | 42 | 691.1 | 79 |
| JUNE | 244.1 | 55 | 21.5 | 98 | 85.8 | 32 | 831.8 | 81 |
| JULY | 87.5 | 28 | 29.8 | 107 | 93.5 | 33 | 800.0 | 77 |
| AUGUST | 78.4 | 46 | 27.6 | 103 | 92.8 | 52 | 762.6 | 75 |
| SEPTEMBER | 128.8 | 72 | 19.8 | 103 | 89.5 | 58 | 785.9 | 77 |
| ANNUAL | 1,208.3 | 48 | 103.2 | 92 | 1,004.9 | 42 | | |
| APRIL-JULY | 548.3 | 46 | | | | | | |

* Average for the 1967-2003 period.

# FIGURE MTG12
## BIGHORN LAKE




WATER YEAR 2003

## CLIMATE SUMMARY

Water year 2003 was a year of contrast within the Bighorn River basin. The Shoshone basin received near normal snowfall during the winter and spring, but precipitation during the summer tended to be well below average. In the Wind River drainage, snowfall was below average for the majority of the snow season while precipitation over the summer was above average. After three years of drought, "average" was a welcomed change in the Shoshone basin as an average snowpack produced average runoff, which was adequate to essentially fill Buffalo Bill Reservoir. As was the case in 2001 and 2002, drought conditions during 2003 were more severe in the Wind River basin. While the snowpack was better than it had been since 1999, it was still below average and produced an April-July runoff that was only 44 percent of average.

Precipitation during October was below average in the Shoshone drainage with temperatures that were about seven degrees below average. Temperatures in the Wind River basin also averaged about seven degrees below normal but precipitation was above average for October. Snow began to accumulate in the mountains early in October as a storm moved through Wyoming during the first week of the month. Little snow fell during the remainder of the month in the Shoshone basin but the Wind River basin received significant snowfall from a storm that stalled over central Wyoming on October 29. November temperatures were near normal in the Shoshone basin and about two degrees below average in the Wind River basin. Precipitation was less than average in both the Shoshone and Wind River drainages, with most of the month's precipitation occurring on November 10 and 23. On December 1, the snowpack stood at 77 percent of average in the Shoshone drainage and 88 percent of average in the Wind River basin. The pattern established in November continued during December with near normal temperature and below average precipitation. In the Wind River valley, a storm on December 17 and 18 brought locally heavy snow to portions of the area but apparently missed the reporting stations as the total precipitation for the month was only 27 percent of average. Snowfall in the Wind River Mountains was also lacking during December as the snowpack fell to 70 percent of average on January 1. In the Shoshone basin the snowpack was 73 percent of average on January 1.

Weather patterns of the previous months began to shift during the last half of January as moist Pacific air brought snow to the mountains of western Wyoming. Temperatures in the Shoshone and Wind River basins were about ten degrees above average in January and low elevation sites received rain while it was snowing in the mountains. Precipitation during January was right on the thirty year average in the Shoshone basin but less than average in the Wind River drainage. A major winter storm moved into the State from the northwest on January 30, helping to bring the February 1 snowpack to 86 percent of average in the Shoshone basin. In the Wind River basin, losses to average that occurred through the month were recouped at the end of the month and the snowpack stood at 70 percent of average on February 1. The brunt of the storm reached the Wind River Mountains on February 2, bringing a ten percent increase to the basin snowpack with reported accumulations of one to two feet of snow. February precipitation was above average in the Shoshone basin and well above average in the Wind River basin, due primarily to the storm on the 2nd. Temperatures were about three degrees below average in the Shoshone basin and seven degrees below average in the Wind River drainage. Snowpack in the Shoshone drainage accumulated at an average rate during February and stood at 87 percent of average on March 1. The Wind River basin received above average snowfall in February and the snowpack increased about eleven percent during the month to 81 percent of average on March 1. Winter

weather continued in March as storms on the 5th, 17th, and 26th brought much needed moisture to the Basin. As a result, the snowpack reached 100 percent of average for the first time in three years in both the Shoshone and Wind River basins. Temperatures for the month of March were near average in both the Shoshone and Wind River basins. On April 1, the snowpack in the Wind River basin was 99 percent of average and the Shoshone basin snowpack was 105 percent of average. April precipitation was well below average in the Wind River basin and the gains that occurred in March were lost as the snowpack fell 26 percent during the month when compared to average. Above average precipitation continued to fall in the Shoshone basin, allowing the snowpack in that basin to remain near average on May 1. Temperatures averaged about four degrees above normal in the Shoshone and Wind River basins during April.

Precipitation in the Shoshone and Wind River basins was below average during May, especially in the mountains of Wind River basin. Temperatures in both basins were near the monthly normal, but the last week of May brought record highs to central and western Wyoming. On May 28 and 29, Lander and Riverton both recorded new record highs for those dates. On the 28th, both towns reached a high of 90 degrees and on the 29th the high was 93 degrees. The rapid warm-up got the runoff started in earnest. Flows into Buffalo Bill increased rapidly during the last week of the month, reaching a peak of 11,690 cfs on May 30. At Boysen the peak inflow of 6,043 cfs occurred on June 1. By the 1st of June, snowpack had fallen to 31 percent of average in the Wind River basin and 69 percent of average in the Shoshone drainage. After record highs in May, June was colder and wetter than average, which helped extend the runoff and slow irrigation use. An unusually strong early summer low pressure system moved into Wyoming on June 21, bringing widespread rainfall of around 1.5 inches. Locations in the Wind River Mountains received a foot or more of late season snowfall. Runoff continued into July in both the Shoshone and Wind River basins. As has been the case in the last few years, only a portion of the runoff reached Boysen as much of the flow of the Big Wind River was diverted upstream of Riverton. During the period when snowmelt runoff was occurring, the inflow to Boysen exceeded outflow from late May through early July, allowing for some much needed storage in the reservoir. Temperatures in July and August rebounded, providing the Bighorn Basin with one of the hottest summers on record. The Weather Service Office in Riverton reported that July and August were both the hottest in Riverton since 1918 and Lander recorded the hottest July and the second hottest August since 1891. Precipitation in the Wind River drainage was below average in July but above average rainfall was received in August and September. In the Shoshone basin, precipitation during July, August, and September was well below average.

The 2003 mountain snow water content for the drainage basins in Wyoming are shown on Table WYT1. The 2003 water supply forecasts are shown on Table WYT2 and the 2003 precipitation in inches and the percent of average is shown on Table WYT3 .

TABLE WYT1
2003 MOUNTAIN SNOW WATER CONTENT'
AS A PERCENT OF THE 1971-2000 AVERAGE

| DRAINAGE BASIN | JAN 1 | | FEB 1 | | MAR 1 | | APR 1 | | MAY 1 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | INCHES | % | INCHES | % | INCHES | % | INCHES | % | INCHES | |
| BULL LAKE | 3.88 | 69 | 5.28 | 72 | 7.60 | 84 | 11.28 | 100 | 6.65 | 64 |
| BOYSEN | 4.59 | 70 | 6.50 | 70 | 9.31 | 81 | 13.83 | 99 | 10.37 | 73 |
| BUFFALO BILL | 6.34 | 73 | 10.51 | 86 | 13.26 | 87 | 19.19 | 105 | 19.23 | 99 |

A composite of the following Natural Resources Conservation Service SNOTEL sites was used to determine snow water content and percent of average for the basins:

Bull Lake ..... Cold Springs, Elkhart Park, Hobbs Park, and St. Lawrence Alt;

Boysen ..... Burroughs Creek, Cold Springs, Hobbs Park, Kirwin, Little Warm, St. Lawrence Alt, South Pass, Togwotee Pass, Townsend Creek, and Younts Peak;

Buffalo Bill ... Blackwater, Evening Star, Kirwin, Marquette, Sylvan Lake, Sylvan Road, and Younts Peak

TABLE WYT2
2003 WATER SUPPLY FORECASTS OF APRIL - JULY SNOWMELT RUNOFF

| | JAN 1 | | FEB 1 | | MAR 1 | | APR 1 | | MAY 1 | | JUN 1 | | ACTUAL | APR-JULY | % OF APRIL FORECAST RECEIVED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG | KAF | % OF AVG | |
| BULL LAKE | 100 | 71 | 100 | 71 | 110 | 78 | 130 | 92 | 110 | 78 | 110 | 78 | 110.1 | 78 | 85 |
| BOYSEN | 250 | 42 | 250 | 42 | 340 | 56 | 450 | 75 | 250 | 42 | 240 | 40 | 262.3 | 44 | 58 |
| BUFFALO BILL | 500 | 74 | 550 | 81 | 550 | 81 | 650 | 96 | 560 | 82 | 540 | 80 | 667.8 | 98 | 103 |

Averages are based on the 1973-2002 period

TABLE WYT3
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE

| BASIN | OCT | | NOV | | DEC | | JAN | | FEB | | MAR | | APR | | MAY | | JUN | | JUL | | AUG | | SEP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % | IN. | % |
| VALLEY PRECIPITATION | | | | | | | | | | | | | | | | | | | | | | | | |
| BUFFALO BILL | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY PRECIP AND % OF AVERAGE | 0.85 | 77 | 1.03 | 93 | 0.51 | 49 | 1.10 | 99 | 1.11 | 127 | 1.58 | 140 | 1.60 | 125 | 1.86 | 91 | 1.53 | 78 | 0.45 | 30 | 0.49 | 39 | 0.77 | 59 |
| YEAR TO:DATE PRECIP..AND % OF AVERAGE | 0.85 | 77 | 1.88 | 85 | 2.39 | 73 | 3.49 | 80 | 4.60 | 88 | 6.18 | 97 | 7.78 | 102 | 9.64 | 99 | 11.17 | 96 | 11.62 | 88 | 12.11 | 84 | 12.88 | 82 |
| BOYSEN | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY PRECIP AND % OF AVERAGE | 1.19 | 155 | 0.42 | 81 | 0.08 | 27 | 0.18 | 63 | 0.82 | 273 | 0.81 | 126 | 0.56 | 45 | 1.67 | 92 | 1.67 | 145 | 0.28 | 30 | 1.03 | 168 | 1.23 | 120 |
| YEAR-T0.-DATE PRECIP.:AND.%:0F:AVERAGE: | 1.19 | 1.55 | 1.61 | 1.25 | 1.69 | 1.06 | 1.87 | 99 | 2.69 | 123 | 3.50 | 124 | 4.06 | 100 | 5.73 | 98 | 7.40 | 105 | 7.68 | 96 | 8.71 | 102 | 9.94 | 103 |
| BULL LAKE | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY PRECIP AND % OF AVERAGE | 1.16 | 190 | 0.55 | 127 | 0.07 | 28 | 0.11 | 56 | 0.62 | 257 | 0.29 | 56 | 0.23 | 21 | 1.63 | 91 | 1.33 | 114 | 0.08 | 8 | 1.25 | 174 | 1.53 | 142 |
| YEAR-TO-DATE:PRECIP AND-%- OF AVERAGE | 1.16 | 190 | 1.71 | 163 | 1.78 | 138 | 1.89 | 127 | 2.51 | 145 | 2.80 | 125 | 3.03 | 90 | 4.66 | 90 | 5.99 | 95 | 6.07 | 82 | 7.32 | 90 | 8.85 | 96 |
| MOUNTAIN PRECIPITATION | | | | | | | | | | | | | | | | | | | | | | | | |
| BUFFALO BILL | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY PRECIP AND % OF AVERAGE | 2.20 | 92 | 2.70 | 73 | 2.20 | 71 | 3.80 | 97 | 3.20 | 128 | 5.70 | 204 | 2.00 | 59 | 3.60 | 95 | 1.70 | 57 | 0.60 | 27 | 1.20 | 75 | 1.80 | 82 |
| YEAR-TO-DATE:PRECIP AND-%- OF AVERAGE: | 2.20 | 92 | 4.90 | 80 | 7.10 | 77 | 10.00 | 82 | 13.20 | 90 | 18.90 | 108 | 20.90 | 100 | 24.50 | 99 | 26.20 | 95 | 26.80 | 90 | 28.00 | 89 | 29.80 | 88 |
| BOYSEN | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY PRECIP AND % OF AVERAGE | 2.10 | 100 | 2.30 | 77 | 1.10 | 44 | 1.80 | 72 | 2.90 | 132 | 4.70 | 162 | 1.20 | 34 | 2.70 | 79 | 2.20 | 92 | 0.70 | 41 | 1.50 | 107 | 1.80 | 90 |
| YEAR TO DATE:PRECIP AND % 0F AVERAGE | 2.10 | 100 | 4.40 | 86 | 5.50 | 72 | 7.30 | 72 | 10.20 | 82 | 14.90 | 98 | 16.10 | 86 | 18.80 | 85 | 21.00 | 86 | 21.70 | 83 | 23.20 | 84 | 25.00 | 84 |
| BULL LAKE | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY PRECIP AND % OF AVERAGE | 2.40 | 120 | 1.50 | 68 | 0.80 | 47 | 1.10 | 69 | 2.20 | 138 | 3.50 | 146 | 1.00 | 31 | 2.30 | 68 | 2.10 | 91 | 0.50 | 33 | 1.80 | 129 | 1.50 | 79 |
| YEAR TO DATE:PRECIP AND % OF AVERAGE | 2.40 | 1:20 | 3.90 | 93 | 4.70 | 80 | 5.80 | 77 | 8.00 | 88 | 11.50 | 100 | 12.50 | 85 | 14.80 | 82 | 16.90 | 83 | 17.40 | 79 | 19.20 | 82 | 20.70 | 82 |

' A composite of the following National Weather Service stations was used to determine monthly vat ey precipitation and percent of average for the drainage basins:
Bull Lake ..... Bums, Diversion Dam, and Dubois;
Boysen ..... Boysen Dam, Burris, Diversion Dam, Dubois, Lander, and Riverton;
Buffalo Bill ..... Buffalo Bill Dam, Lake Yellowstone, and Tower Falls

[2] A composite of the following Natural Resources Conservation Service SNOTEL sites was used to determine monthly mountain precipitation and percent of average for the drainage basins:
Bull Lake ..... Cold Springs, Elkhart Park, Hobbs Park, and St. Lawrence Alt;
Boysen ..... Burroughs Creek, Cold Springs, Hobbs Park, Kirwin, Little Warm, St. Lawrence Alt, South Pass, Togwotee Pass, Townsend Creek, and Younts Peak;
Buffalo Bill ..... Blackwater, Evening Star, Kirwin, Marquette, Sylvan Lake, Sylvan Road, and Younts Peak

Averages for Valley Precipitation are based on the 1973-2002 period
Averages for Mountain Precipitation are based on the 1971-2000 period

# FLOOD BENEFITS

| Flood Damage Prevented in the Wind/Bighorn and Shoshone River Systems' | | | | | |
|---|---|---|---|---|---|
| **Reservoir** | **Local** | **Main Stem** | **2003 Total** | **Previous Accumulation** | **1950 - 2003 Accumulation Total** |
| Bull Lake[2] | $ 0 | $ 0 | $ 0 | $ 2,690,300 | $ 2,690,300 |
| Boysen | $ 0 | $ 4,781,300 | $ 4,781,300 | $76,502,500 | $81,283,800 |
| Buffalo Bill[2] | $ 869,900 | $ 0 | $ 869,900 | $ 9,697,400 | $10,567,300 |

1/ This data is received from the Army Corps of Engineers Omaha District Office and is revised every October. The period of assessment is 1950 through 2003.
2/ No space is allocated to flood control, but some flood protection is provided by operation for other purposes.

**Riverton Unit**

The Riverton Project was reauthorized as the Riverton Unit Pick-Sloan Missouri Basin Program (P-S MBP) on September 25, 1970. Major facilities of this unit are Bull Lake Reservoir, Wind River Diversion Dam, Wyoming Canal, Pilot Butte Powerplant, Pilot Butte Reservoir, and Pilot Butte Canal. The major facilities provide water for irrigation of about 76,000 acres on the Midvale Irrigation District (Midvale). The water supply comes partly from the natural flow of the Wind River and partly from water stored in Bull Lake and Pilot Butte Reservoirs.

**Bull Lake Reservoir** is located on Bull Lake Creek, a tributary of the Wind River near Crowheart, Wyoming. Bull Lake has an active capacity of 151,737 acre-feet (AF), and is above all unit land. It is the principal storage facility for the unit and is operated by Midvale under contract with Reclamation. A small amount of incidental flood control benefit is provided by normal operation for other purposes. Bull Lake also provides a water resource for enhancing fish, wildlife, and recreation.

Bull Lake held 40,907 AF of water at the start of water year 2003, which was an improvement over the previous year but still only 49 percent of the normal end of September content and 27 percent of capacity. Irrigation deliveries to Riverton Unit lands ended on September 16, 2002, nearly a month earlier than normal. Releases from Bull Lake were reduced to approximately 25 cfs at the end of the irrigation season to conserve the remaining storage in Bull Lake.

During water year 2002, Midvale entered into an agreement with Reclamation that allowed the storage of Boysen water in Bull Lake by exchange. Because of this agreement, Bull Lake ended the water year at a higher content. Once irrigation season ended, the Boysen water in Bull Lake was transferred back to Boysen at a rate of approximately 25 cfs to provide a winter flow in Bull Lake Creek. While inflow during October, November, and December was below average, it did exceed the release and storage in Bull Lake increased to 44,026 AF at the end of December. On January 1, snowpack in the basin above Bull Lake was 69 percent of average. Water supply forecasts were prepared each month, beginning in January and continuing through June, for the April-July snowmelt runoff period. The January forecast indicated the April-July snowmelt runoff would be approximately 100,000 AF, which was 71 percent of average. Snow conditions remained near 70 percent of average through January but a storm on February 2 $^{nd}$ provided a ten percent increase to the snowpack. Inflow was slightly greater than outflow for the January through February period, with reservoir storage increasing about 100 AF. At the end of February, Bull Lake held 44,128 AF of water at elevation 5763.71 feet. The snowpack on March 1 had increased to 84 percent of average and the March 1 forecast of April-July snowmelt runoff into Bull Lake was increased to 110,000 AF. The Wind River Mountains received substantial snowfall during March as three major winter storms moved through central Wyoming during the month. On April 1, the snowpack above Bull Lake was right at the 30 year average and prospects for a good runoff were looking up. Inflow during March was also closer to normal and storage at the end of the month had increased to 44,556 AF. The April 1 forecast was increased by 20,000 AF for an expected April-July inflow of 130,000 AF.

Midvale began diverting water into Wyoming Canal on April 6, utilizing the natural flow in the Wind River to flush the canal and continue the fill of Pilot Butte. The 25 cfs release from Bull Lake was maintained until April 21 when higher releases were required to satisfy irrigation demands. With the start of irrigation, and little runoff reaching the reservoir, the lake level fell to 40,586 AF on April 30. Precipitation was in short supply during April and the snowpack

dropped 36 percent compared to average. With the May 1 snowpack standing at 64 percent of average, the snowmelt runoff forecast was reduced to 110,000 AF. Irrigation demands required Bull Lake storage releases to supplement the available natural flow and Bull Lake was drafted to a low of 29,627 AF on May 22. Temperatures warmed rapidly during the last week of the month and runoff was under way. Irrigation needs were satisfied by natural flow in the Wind River so the release from Bull Lake was reduced to 25 cfs and the lake began to rise. Reservoir inflow exceeded outflow from May 23 through July 16, with the peak inflow of 1,908 cfs occurring on May 30. Storage peaked on July 16 at elevation 5791.15 feet with a corresponding content of 111,080 AF. The maximum content was 41,379 AF and 13.85 feet below the top of the active conservation pool. As flows in the Wind River declined and the use of Bull Lake storage was needed to satisfy the irrigation demand, the reservoir level began to fall. By the end of August, the lake level had been drawn down to elevation 5773.50 feet, with 65,590 AF of storage remaining. Irrigation deliveries on the Riverton Unit continued until September 19, and the release from Bull Lake was reduced to approximately 25 cfs at that time.

Actual April-July inflows totaled 110,081 AF, 78 percent of average. Total inflow to Bull Lake for the water year was 142,567 AF, which was 75 percent of average. The flow of the Wind River above the mouth of Bull Lake Creek was estimated to be 77 percent of average, totaling 326,932 AF during the April-July period. The total diversion into the Wyoming Canal for the April-September period was 296,484 AF, 86 percent of average.

Additional hydrologic and statistical information pertaining to Bull Lake operations during 2003 can be found in Table WYT4 and Figure WYG1.

**Pilot Butte Reservoir,** an off-stream reservoir near Kinnear, Wyoming, receives its water supply from the Wind River through the Wyoming Canal. Pilot Butte Reservoir has a total capacity of 33,721 AF. Of this amount, 3,803 AF is allocated for inactive and dead storage and 29,918 AF for active conservation storage. Pilot Butte Darn and the Wyoming Canal which supplies the reservoir are operated by Midvale under contract with Reclamation.

Irrigation releases from Pilot Butte ended on September 15, 2002, and water year 2003 began with a total storage content of approximately 6,142 AF in Pilot Butte Reservoir at elevation 5417.40 feet. As natural flow in the Wind River became available following the 2002 irrigation season, diversions into Wyoming Canal were reinstated on October 10 in order to refill Pilot Butte Reservoir. Diversions continued through the end of October when cold temperatures and ice problems forced a shutdown of the canal. As milder weather returned, diversions into Wyoming Canal began again and continued until November 24, with storage in the reservoir reaching 28,359 AF at elevation 5453.82 feet. After diversions into the lake were terminated for the year, the reservoir level slowly fell through the winter as evaporation reduced the content. Storage on March 31 was 28,093 AF at elevation 5453.50 feet. Diversions into Pilot Butte began April 11 and the reservoir reached its maximum storage content for the year of 31,214 AF at elevation 5457.17 feet on June 20, 2003. Releases from Pilot Butte began on April 8 to flush the canal and irrigation deliveries were initiated on April 15. In water year 2003, irrigation deliveries from Pilot Canal continued through September 19. At the end of water year 2003, Pilot Butte held 12,426 AF of water at elevation 5431.11 feet.

Total generation at the Pilot Butte Powerplant in water year 2003 was 2,258,000 kilowatt-hours (kWh). During water year 2003, 24,821 AF or 14 percent of the water that entered the reservoir

was used to generate power at Pilot Butte Powerplant.

Additional hydrologic and statistical information pertaining to Pilot Butte Reservoir during 2003 can be found in Table WYT5 and Figure WYG2.

# TABLE WYT4
# HYDROLOGIC DATA FOR WATER YEAR 2003
# BULL LAKE RESERVOIR

| **RESERVOIR ALLOCATIONS** | **ELEVATION (FEET)** | TOTAL **RESERVOIR STORAGE** (AF) | **STORAGE ALLOCATION (AF)** |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 5739.00 | 722 | 722 |
| TOP OF ACTIVE CONSERVATION | 5805.00 | 152,459 | 151,737 |

| **STORAGE-ELEVATION** DATA | ELEVATION (FEET) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 5762.12 | 40,907 | OCT 01, 2002 |
| END OF YEAR | 5769.44 | 56,345 | SEP 30, 2003 |
| ANNUAL LOW | 5756.27 | 29,627 | MAY 22, 2003 |
| HISTORIC LOW* | 5743.03 | 6,228 | MAR 31, 1950 |
| ANNUAL HIGH | 5791.15 | 111,080 | JUL 16, 2003 |
| HISTORIC HIGH | 5805.70 | 154,677 | AUG 10, 1965 |

* Prior to 1952 daily records are not available. End of month data was used to determine the historic low.

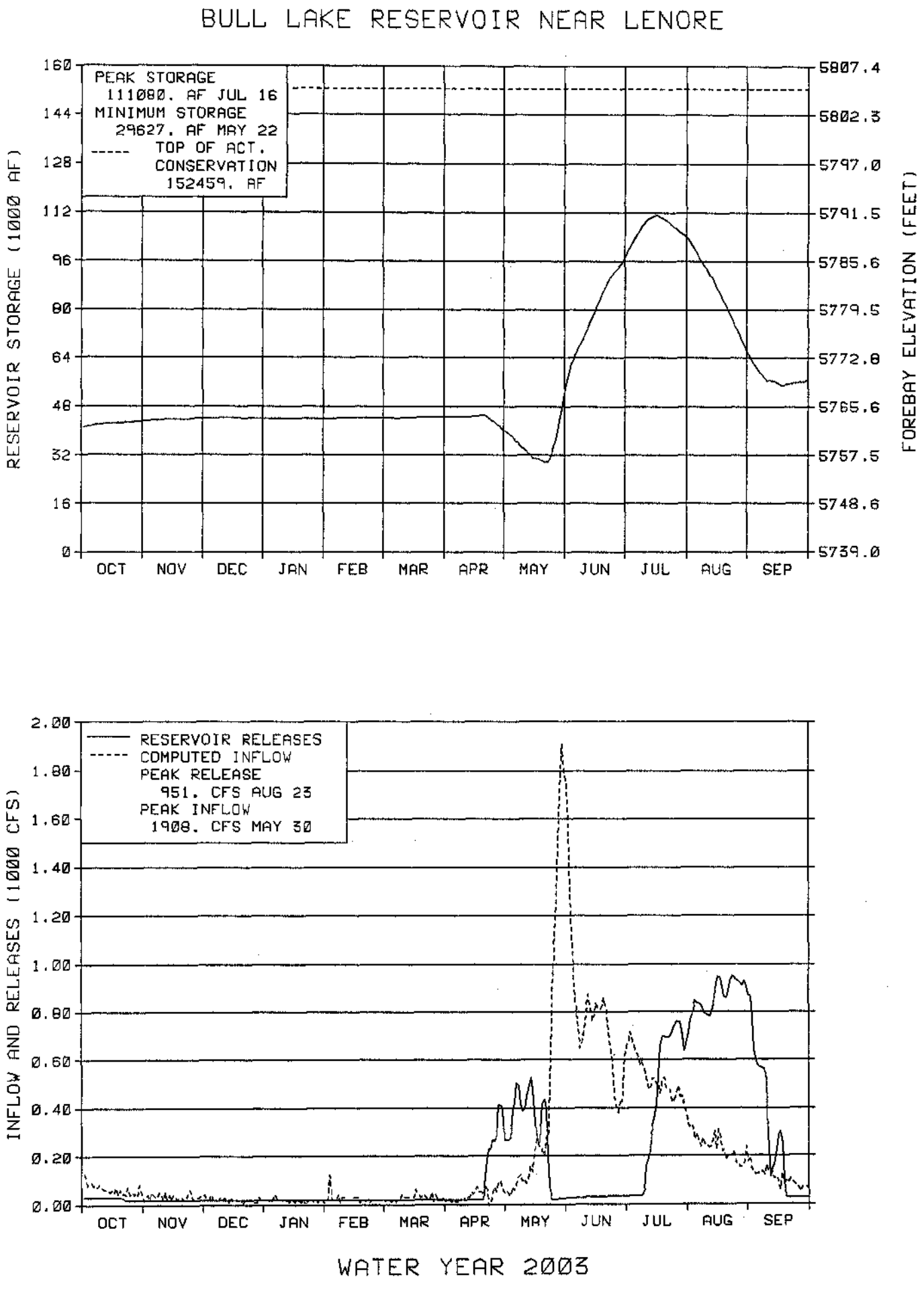
| **INFLOW-OUTFLOW DATA** | **INFLOW** | **DATE** | **OUTFLOW** | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 142,567 | OCT 02-SEP 03 | 127,126 | OCT 02-SEP 03 |
| DAILY PEAK (cfs) | 1,908 | **MAY** 30, 2003 | 951 | AUG 23, 2003 |
| DAILY MINIMUM (cfs) | 0 | DEC 20, 2002 | 20 | JAN 22, 2003 |
| PEAK SPILLWAY FLOW (cfs) | | | 0 | |
| TOTAL SPILLWAY FLOW (AF) | | | 0 | |

| | **INFLOW** | | **OUTFLOW** | | CONTENT | |
|---|---|---|---|---|---|---|
| MONTH | KAF | % of Avg* | KAF | % of Avg* | KAF | % of Avg* |
| OCTOBER | 4.0 | 75 | 1.7 | 24 | 43.2 | 53 |
| NOVEMBER | 2.1 | 70 | 1.2 | 43 | 44.0 | 54 |
| DECEMBER | 1.3 | 52 | 1.3 | 62 | 44.0 | 54 |
| JANUARY | 1.1 | 50 | 1.3 | 62 | 43.9 | 54 |
| FEBRUARY | 1.4 | **88** | 1.2 | 71 | 44.1 | 54 |
| MARCH | 1.7 | 94 | 1.3 | 68 | 44.6 | 55 |
| APRIL | **2.4** | 71 | 6.3 | 154 | 40.6 | 50 |
| MAY | 27.8 | 105 | 17.6 | 125 | 50.7 | 55 |
| JUNE | 47.6 | 77 | 1.8 | 7 | 96.5 | 75 |
| JULY | 32.4 | 66 | 24.6 | 51 | 104.2 | 80 |
| AUGUST | 14.5 | 67 | 53.1 | 117 | 65.6 | 62 |
| SEPTEMBER | 6.3 | 62 | 15.5 | 42 | 56.3 | 70 |
| ANNUAL | 142.6 | 75 | 127.1 | 66 | | |

| APRIL - JULY INFLOW (AF) | |
|---|---|
| ACTUAL | AVERAGE |
| 110,081 | 140,900 |

* Average for the 1973-2002 period

**FIGURE WYG1**


BULL LAKE RESERVOIR NEAR LENORE
PEAK STORAGE
111080. AF JUL 16
MINIMUM STORAGE
29627. AF MAY 22
TOP OF ACT. CONSERVATION
152459. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
160
144
128
112
96
80
64
48
32
16
0
5807.4
5802.3
5797.0
5791.5
5785.6
5779.5
5772.8
5765.6
5757.5
5748.6
5739.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
951. CFS AUG 23
PEAK INFLOW
1908. CFS MAY 30
INFLOW AND RELEASES (1000 CFS)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2003

# TABLE WYT5
# HYDROLOGIC DATA FOR WATER YEAR 2003
# PILOT BUTTE RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 5410.00 | 3,803 | 3,803 |
| TOP OF ACTIVE CONSERVATION | 5460.00 | 33,721 | 29,918 |

| STORAGE-ELEVATION DATA | ELEVATION (FEET) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 5417.40 | 6,142 | OCT 01, 2002 |
| END OF YEAR | 5431.11 | 12,426 | SEP 30, 2003 |
| ANNUAL LOW | 5417.33 | 6,117 | OCT 12, 2002 |
| HISTORIC LOW | 5409.96 | 3,792 | SEP 19, 2001 |
| ANNUAL HIGH | 5457.17 | 31,214 | JUN 20, 2003 |
| HISTORIC HIGH | 5460.00 | 36,910 | 7/7/73 & 6/24/89 |

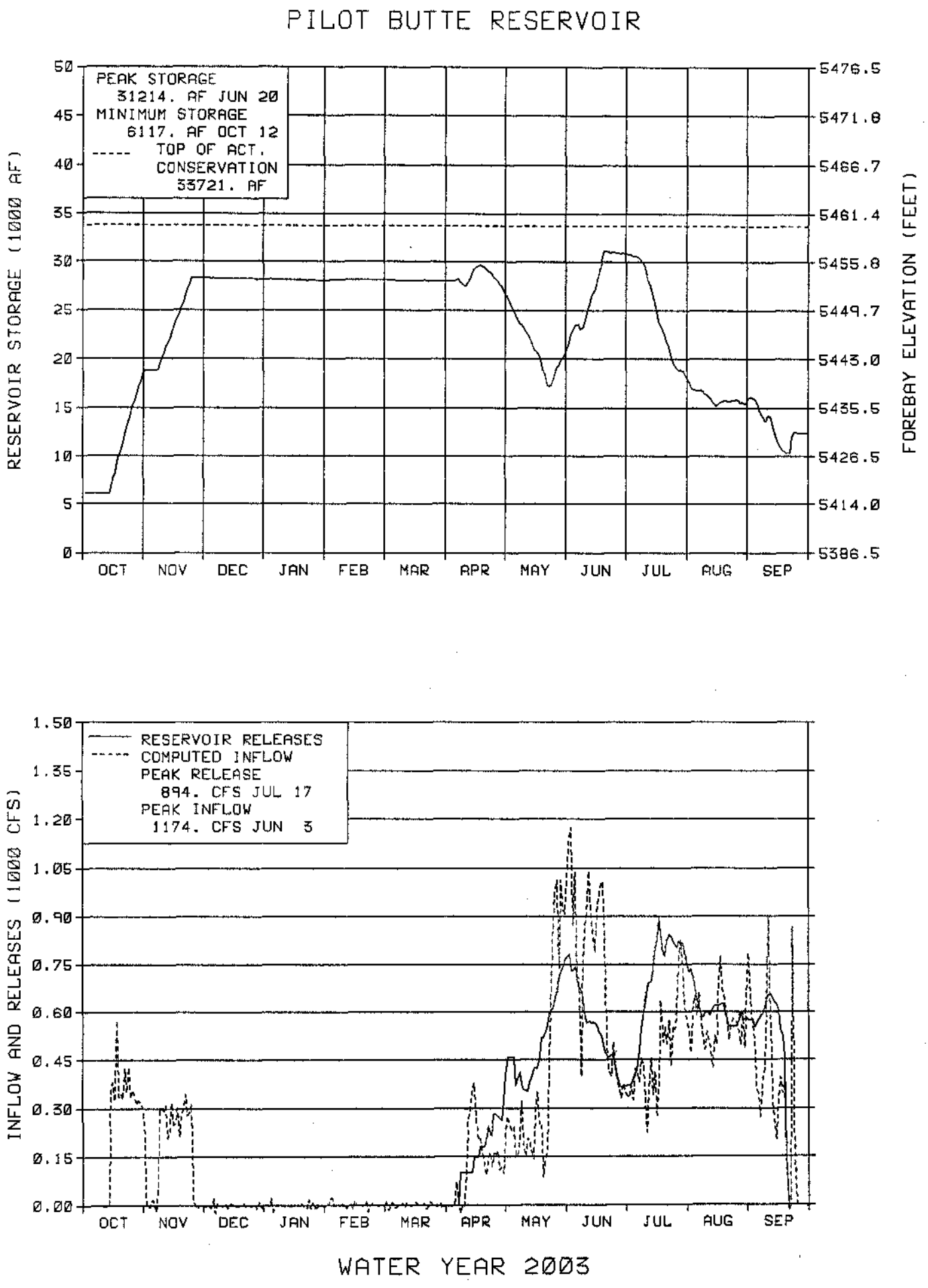
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 179,461 | OCT 02-SEP 03 | 172,944 | OCT 02-SEP 03 |
| DAILY PEAK (cfs) | 1,174 | JUNE 03, 2003 | 894 | JULY 17, 2003 |
| DAILY MINIMUM (cfs) | 0 | WINTER MONTHS | 0 | WINTER MONTHS |
| PEAK SPILLWAY FLOW (cfs) | | | 0 | |
| TOTAL SPILLWAY FLOW (AF) | | | 0 | |

| | INFLOW* | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| MONTH | KAF | % of Avg** | KAF | % of Avg** | KAF | % of Avg** |
| OCTOBER | 12.6 | 156 | 0.0 | 0 | 18.8 | 85 |
| NOVEMBER | 9.6 | 600 | 0.0 | 0 | 28.3 | 123 |
| DECEMBER | -0.1 | 0 | 0.0 | 0 | 28.2 | 124 |
| JANUARY | -0.1 | 0 | 0.0 | 0 | 28.1 | 124 |
| FEBRUARY | 0.0 | 0 | 0.0 | 0 | 28.2 | 125 |
| MARCH | -0.1 | 0 | 0.0 | 0 | 28.1 | 114 |
| APRIL | 7.4 | 83 | 8.4 | 165 | 27.0 | 94 |
| MAY | 24.3 | 108 | 30.9 | 123 | 20.5 | 79 |
| JUNE | 43.3 | 112 | 32.9 | 88 | 30.9 | 112 |
| JULY | 29.2 | 68 | 42.0 | 90 | 18.1 | 77 |
| AUGUST | 35.2 | 109 | 37.3 | 103 | 15.9 | 81 |
| SEPTEMBER | 17.8 | 75 | 21.3 | 80 | 12.4 | 75 |
| ANNUAL | 179.5 | 99 | 172.9 | 96 | | |

* Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.

** Average for the 1973-2002 period.

**FIGURE WYG2**


PILOT BUTTE RESERVOIR
PEAK STORAGE
31214. AF JUN 20
MINIMUM STORAGE
6117. AF OCT 12
----- TOP OF ACT. CONSERVATION
33721. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
50
45
40
35
30
25
20
15
10
5
0
5476.5
5471.0
5466.7
5461.4
5455.0
5449.7
5443.0
5435.5
5426.5
5414.0
5386.5
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
894. CFS JUL 17
PEAK INFLOW
1174. CFS JUN 3
INFLOW AND RELEASES (1000 CFS)
1.50
1.35
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2003

**Boysen Reservoir and Powerplant**

Boysen Reservoir (P-S MBP) is located on the Wind River above Thermopolis, Wyoming. The dam and reservoir were built for flood control, power generation, irrigation, recreation, and fish and wildlife. Boysen Reservoir has a total capacity of 892,226 AF. Of this amount, 219,181 AF is allocated for inactive and dead storage, 522,413 AF for active conservation storage, and 150,632 AF for exclusive flood control storage. Of the amount allocated for active conservation, 144,229 AF is specifically allocated for joint-use flood control storage. All of the joint-use space is located between elevation 4717.00 feet and elevation 4725.00 feet, which is the top of the spillway gates when closed. The exclusive flood control space is located between elevation 4725.00 feet and elevation 4732.20 feet. When the reservoir rises above elevation 4724.50 feet, the spillway gates must be partially opened to maintain 1/2 foot of the gates above the water to prevent over-topping of the gates. When all flood control space is filled, releases cannot be controlled to less than 14,000 cfs.

Irrigation water is provided from the reservoir for several units, both upstream and downstream of Boysen Dam. Water is furnished downstream to about 7,500 acres in the Hanover-Bluff Unit (P-S MBP) and 3,400 acres on the Lucerne Canal in the Owl Creek Unit (P-S MBP). Supplemental water is also furnished to other irrigation districts and to a number of individual water users below the Dam. The Bighorn Canal Irrigation District and Hanover Irrigation District receive water under long term contracts with Reclamation. Depending on availability, water is also provided to Bluff Irrigation District, Kirby Ditch Company, Lower Hanover Canal Association, Bighorn Canal Irrigation District, and Hanover Irrigation District utilizing temporary water service contracts. In addition, water is provided on a demand basis, by exchange, to Midvale, Riverton Valley, and LeClair Irrigation Districts located on the Wind River upstream of the reservoir. Riverton Valley and LeClair Irrigation Districts hold long term contracts with Reclamation.

Water year 2003 began with 238,985 AF of water stored in Boysen Reservoir, which was 41 percent of the 30 year average. This was the lowest content at the beginning of a water year since the initial filling of Boysen Reservoir. The corresponding reservoir elevation of 4687.23 feet was almost 38 feet below the top of the joint use pool. Irrigation releases for the 2002 season ended on September 27, 2002, as the demand for irrigation water fell below the planned fall and winter release of 300 cfs. With releases limited to 300 cfs, the reservoir level began to rise and on October 31, reservoir storage had increased to 254,226 AF. This was 43 percent of average and the lowest end of October content of record. Snowfall in the watershed above Boysen was near the 30 year average in October but below average during November and well below average in December. While storage had increased to 278,683 AF at elevation 4691.46 feet by the end of December, the reservoir content was the lowest of record for the end of November and December. On January 1, snowpack in the Wind River basin stood at 70 percent of normal.

Forecasts of April-July snowmelt runoff were prepared at the beginning of each month beginning in January and continuing through June. The January 1 forecast indicated approximately 250,000 AF of water, 42 percent of average, would enter Boysen Reservoir during the April-July runoff period. Precipitation during January was enough to maintain the snowpack at 70 percent of average. With snow conditions identical to what they were the previous month, compared to average, the February 1 forecast of April - July runoff remained at 250,000 AF. February precipitation got off to a good start as a storm brought heavy snow to the basin on February 2, increasing the snowpack by 10 percent. While inflows

for the winter months remained below average, they were an improvement over the past couple of years and storage continued to build in the reservoir. At the end of February, Boysen Reservoir content was 308,593 AF at elevation 4694.45 feet and the basin snowpack was 81 percent of average. Conditions on March 1 indicated the snowmelt runoff forecast should be increased to 340,000 AF, which was 56 percent of average. Winter storms moved through the Wind River basin during the first, third, and fourth weeks of March, adding significantly to the mountain snowpack. For the first time since May of 2001, the monthly inflow to Boysen was above average in March. With an April 1 snowpack at 99 percent of average and conditions in the basin looking better than they had in a long time, the April 1 forecast of April - July snowmelt runoff was increased to 450,000 AF, which was 75 percent of average. The release from the Dam continued at 300 cfs and water users were notified that when increased releases were required to meet irrigation demands, Boysen storage water use accounting would begin. Boysen Reservoir storage water use accounting was implemented on April 14, 2003, and all changes in the release were coordinated by and requested through the Wyoming State Engineer's Office in Riverton. As releases were increased to meet irrigation demands, Boysen storage was called on to supplement the natural flow at times prior to the start of runoff. Precipitation during April was well below average and gains that were made during March were more than lost during April as the snowpack dropped 26 percent during the month to 73 percent of average on May 1. At the end of April, Boysen Reservoir held 353,813 AF of water at elevation 4698.70 feet. April inflow was 70 percent of average.

In most years, a couple of heavy, wet spring snowstorms can be expected in April to provide a boost to the snowpack. In 2003 the spring snows did not occur and the May 1 forecast was reduced to 250,000 AF. The snowpack continued to decline through May as temperatures warmed and the melt began. During the last week of the month, temperatures in the upper 80's to low 90's were common in the basin with record highs recorded at the Lander and Riverton weather stations on May 28 and 29. Flow in the Wind River began to increase on May 25 and the peak inflow from the snowmelt occurred on June 1 at 6,043 cfs. Reservoir inflow exceeded the release from May 26 to July 5 when the reservoir reached a maximum content for the year of 421,357 AF at 4704.52 ft. Releases through the irrigation season were only what was required to meet irrigation demand and the reservoir level declined each day after July 5. The maximum release of the irrigation season of 1,372 cfs occurred on June 1.

Actual inflow for the April-July period totaled 262,325 AF, 44 percent of average and the eighth lowest April-July total for the 1952-2003 period of operation of Boysen Dam. Total inflow to Boysen during water year 2003 was 548,242 AF, 54 percent of average. The reservoir ended the water year at 4698.53 feet with a content of 351,939 AF. This was the fourth lowest end of September content since the Dam was closed in 1952.

During water year 2003, Boysen Powerplant generated 25,560,000 kWh of electricity, about 34 percent of average and 641,000 kWh less than was generated in 2002. Of the 435,275 AF of water released from Boysen in water year 2003, 418,787 AF was discharged through the powerplant and 16,488 AF bypassed the powerplant.

During the 2003 irrigation season contractors below Boysen used the following amounts of storage water from Boysen Reservoir: Bighorn Canal Irrigation District used 15,486 AF, of which 13,300 AF was from long term contract and 2,186 AF was from temporary contract; Bluff Irrigation District used 2,035 AF, all from temporary contract; Hanover Irrigation District used 4,671 AF, all from long term contract; Highland Hanover Irrigation District used 14,896 AF, all from long term contract; Kirby Ditch Company used 776 AF, all from temporary contract; Owl Creek Irrigation District used 11,047 AF, all from long term contract; and Upper Bluff Irrigation District used 4,078 AF, all from long term contract. Contractors above Boysen used the following amounts of storage water by exchange: LeClair Irrigation District used 7,763 AF, all from long term contract; Midvale Irrigation District used 4,000 AF, all from temporary contract; and Riverton Valley Irrigation District used 1,705 AF, all from long term contract.

## Important Events - 2003

September 25, 2002: Boysen Reservoir water information meeting was held in Worland to discuss water year 2002 operations, expected 2003 operation, and the winter release.

September 27, 2002: Irrigation demand fell below the planned fall and winter release of 300 cfs, ending storage use accounting. The fall and winter release for water year 2003 was set at 300 cfs.

March 20, 2003: Boysen Water User's meeting was held in Worland to discuss the water supply and proposed operation of Boysen Reservoir in 2003.

April 14, 2003: The release from the Dam was increased to meet irrigation demand. Boysen Reservoir storage water use accounting was initiated and contractors were charged for storage water in accordance with their contracts.

September 29, 2003: Irrigation demand fell below the planned fall and winter release of 350 cfs, ending storage use accounting. The fall and winter release for water year 2003 was set at 350 cfs.

Additional hydrologic and statistical information pertaining to the operation of Boysen Reservoir can be found in Table WYT6 and Figure WYG3.

# TABLE WYT6
# HYDROLOGIC DATA FOR WATER YEAR 2003
# BOYSEN RESERVOIR

| **RESERVOIR ALLOCATIONS** | **ELEVATION** (FEET) | TOTAL **RESERVOIR STORAGE (AF)** | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4685.00 | 219,181 | 219,181 |
| TOP OF ACTIVE CONSERVATION | 4717.00 | 597,365 | 378,184 |
| TOP OF JOINT USE | 4725.00 | 741,594 | 144,229 |
| TOP OF EXCLUSIVE FLOOD CONTROL | 4732.20 | 892,226 | 150,632 |

| **STORAGE-ELEVATION DATA** | **ELEVATION** (FEET) | **STORAGE** (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 4687.23 | 238,985 | OCT 01, 2002 |
| END OF YEAR | 4698.53 | 351,939 | SEP 30, 2003 |
| ANNUAL LOW | 4687.23 | 238,985 | OCT 01, 2002 |
| HISTORIC LOW ELEVATION * | 4684.18 | | MAR 18, 1956 |
| HISTORIC LOW CONTENT * | | 235,737 | SEP 24, 2002 |
| ANNUAL I-flGH | 4704.52 | 421,357 | JUL 05, 2003 |
| HISTORIC HIGH | 4730.83 | 922,406 | JUL 06, 1967 |

* Because storage space in a reservoir is lost as sediment is trapped behind the dam, reservoirs are resurveyed periodically to determine actual capacity. Based on the 1994 resurvey of Boysen Reservoir, the historic low content of 235,737 AF occurred at an elevation that was 2.69 feet higher than the historic low elevation.

| **INFLOW-OUTFLOW** DATA | INFLOW | DATE | **OUTFLOW** | **DATE** |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 548,242 | OCT 02-SEP 03 | 435,275* | OCT 02-SEP 03 |
| DAILY PEAK (cfs) | 6,043 | JUN 01, 2003 | 1,372 | JUN 01, 2003 |
| DAILY MINIMUM (cfs) | 70 | JUL 29, 2003 | 269 | JAN 26, 2003 |
| PEAK SPILLWAY FLOW (cfs)** | | | | |
| TOTAL SPILLWAY FLOW (AF)** | | | | |

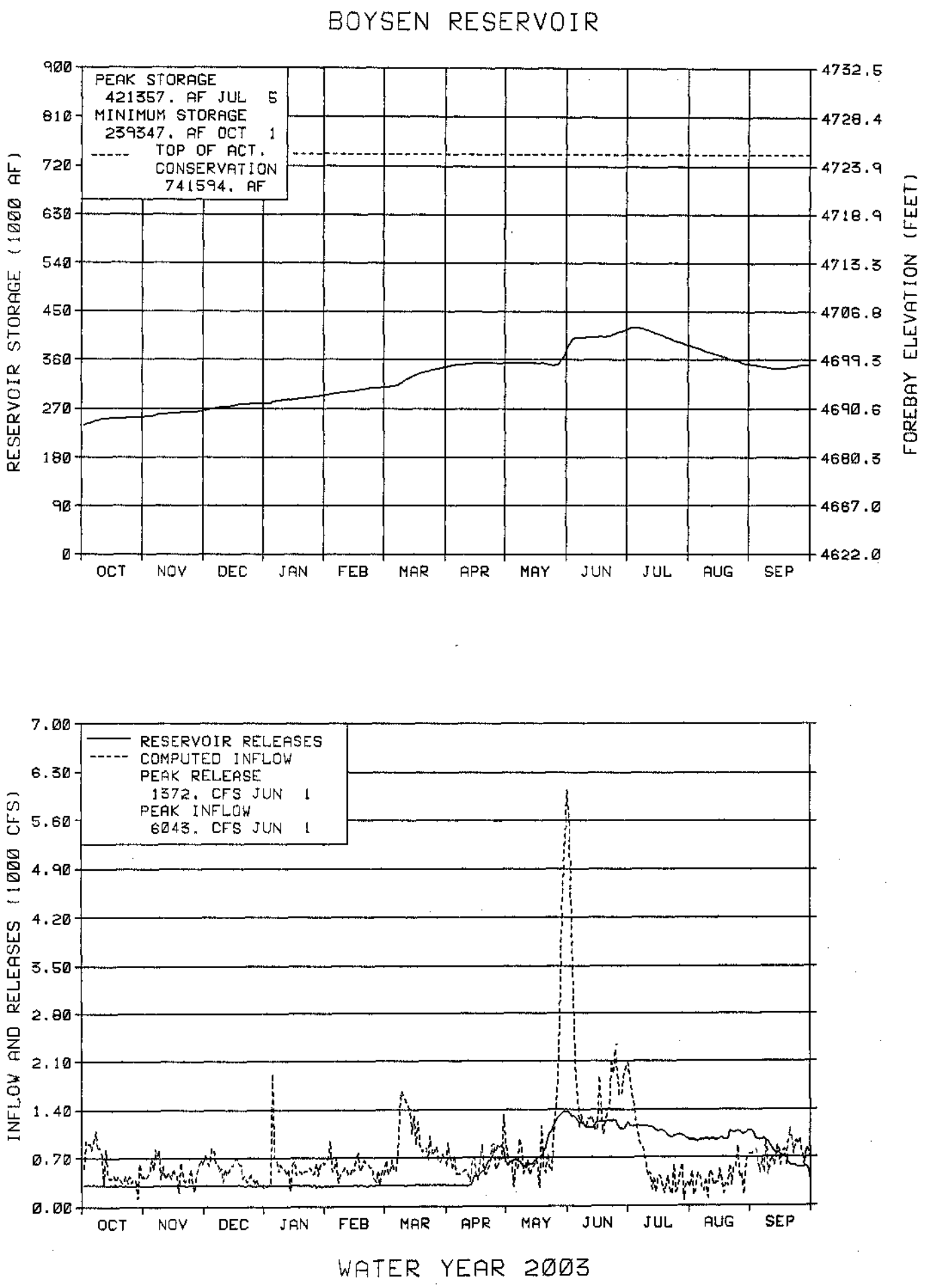
* Of the 435,275 AF of water released from Boysen Reservoir, 16,488 AF bypassed the powerplant.
**Spillway flow refers to water released through the spillway to control the reservoir level.

| | **INFLOW** | | **OUTFLOW** | | CONTENT | |
|---|---|---|---|---|---|---|
| MONTH | KAF | % of Avg* | KAF | % of Avg* | KAF | % of Avg* |
| OCTOBER | 34.0 | 52 | 18.8 | 26 | 254.2 | 43 |
| NOVEMBER | 29.6 | 58 | 18.1 | 28 | 265.7 | 46 |
| DECEMBER | 31.7 | 80 | 18.7 | 28 | 278.7 | 50 |
| JANUARY | 34.5 | 93 | 18.4 | 30 | 294.8 | 55 |
| FEBRUARY | 30.3 | 80 | 16.5 | 30 | 308.6 | 60 |
| MARCH | 56.0 | 104 | 18.7 | 28 | 345.8 | 69 |
| APRIL | 37.0 | 70 | 29.0 | 38 | 353.8 | 74 |
| **MAY** | 71.4 | 53 | 51.5 | 52 | 373.7 | 73 |
| JUNE | 114.8 | **44** | 72.1 | 52 | 416.4 | 66 |
| JULY | 39.1 | 26 | 67.3 | 45 | 388.2 | 62 |
| AUGUST | 25.1 | 38 | 61.7 | 64 | 351.6 | 59 |
| SEPTEMBER | 44.7 | 74 | 44.4 | 56 | 351.9 | 61 |
| ANNUAL | 548.2 | 54 | 435.3 | 42 | | |

| APRIL - JULY INFLOW (AF) | |
|---|---|
| ACTUAL | AVERAGE |
| 262,325 | 603,000 |

* Average for the 1973-2002 period

**FIGURE WYG3**


BOYSEN RESERVOIR
PEAK STORAGE
421357. AF JUL 5
MINIMUM STORAGE
239347. AF OCT 1
TOP OF ACT. CONSERVATION
741594. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
900
810
720
630
540
450
360
270
180
90
0
4732.5
4728.4
4723.9
4718.9
4713.3
4706.8
4699.3
4690.6
4680.3
4667.0
4622.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
1372. CFS JUN 1
PEAK INFLOW
6043. CFS JUN 1
INFLOW AND RELEASES (1000 CFS)
7.00
6.30
5.60
4.90
4.20
3.50
2.80
2.10
1.40
0.70
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2003

**Anchor Reservoir**

Anchor Reservoir (P-S MBP) is located on the South Fork of Owl Creek, a tributary of the Bighorn River near Thermopolis, Wyoming. It has a total storage capacity of 17,228 AF, of which 17,160 AF is active storage. It was constructed to furnish a supplemental irrigation supply for the Owl Creek Unit (P-S MBP). The dam was completed in November 1960. However, several major sinkholes developed in the lower portion of the reservoir after it began to fill, and corrective work to plug the sinkholes has not been successful. There have also been substantial water losses through a rock waste area just upstream from the dam. Two dikes, in service since 1979, partition off the portions of the reservoir with high seepage losses. The top of the dikes are at elevation 6415.00 feet, however, when the reservoir rises above elevation 6412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. The reservoir is operated not to exceed elevation 6412.80 feet. Operation and maintenance of Anchor Dam is performed by contract with Owl Creek Irrigation District. To prevent damage to the dikes and minimize the chance of creating new sinkholes, a reservoir restriction is in place at Anchor Reservoir. Reclamation requires notification from the irrigation district any time the reservoir level is expected to exceed elevation 6400.00 feet. Operation above 6400.00 feet will be directed by Wyoming Area Office (WYAO) staff to avoid overtopping of the dikes.

Storage in Anchor Reservoir at the beginning of water year 2003 was 254 AF at elevation 6355.00 feet. The reservoir level remained fairly constant until mid April when a week of increased inflow caused the lake to slowly rise. Irrigation deliveries also began in mid April and on April 30, 2003, the reservoir contained 348 AF of water. Snowpack in the basin above Anchor was above average through the middle of April but the snowpack at the Owl Creek Snotel site melted rapidly and was almost gone by May 1. The Owl Creek Mountains received some snow in May and the site recovered to some degree by the last week of the month when temperatures warmed and the runoff began. The reservoir reached a maximum content of 1,597 AF at water surface elevation 6378.68 feet on June 1. As inflow subsided and demands increased, the reservoir level fell to 552 AF by the end of June. The reservoir reached a low of 350 AF at elevation 6358.11 feet in late July and remained near that level through the end of September.

Hydrologic and statistical data pertaining to Anchor Reservoir operations during 2003 can be found in Table WYT7 and Figure WYG4. The negative inflows displayed in Figure WYG4 are the result of calculated inflow based on reservoir release and change in reservoir content. During some periods, evaporation and seepage from the reservoir could exceed inflow.

# TABLE WYT7
# HYDROLOGIC DATA FOR WATER YEAR 2003
# ANCHOR RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 6343.75 | 68 | 68 |
| TOP OF ACTIVE CONSERVATION* | 6441.00 | 17,228 | 17,160 |

* District operation has been restricted to elevation 6400.00 feet or less to prevent damage to the dikes and to minimize the chance of creating new sinkholes. Operations above elevation 6400.00 feet are directed by Reclamation.

| STORAGE-ELEVATION DATA | ELEVATION (FEET) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 6355.00 | 254 | OCT 01,2002 |
| END OF YEAR | 6358.11 | 349 | SEP 30, 2003 |
| ANNUAL LOW | 6354.70 | 247 | OCT 31, 2002 |
| HISTORIC LOW | | | |
| ANNUAL HIGH | 6378.68 | 1,597 | JUN 01, 2003 |
| HISTORIC HIGH | 6418.52 | 9,252 | JUL 03, 1967 |

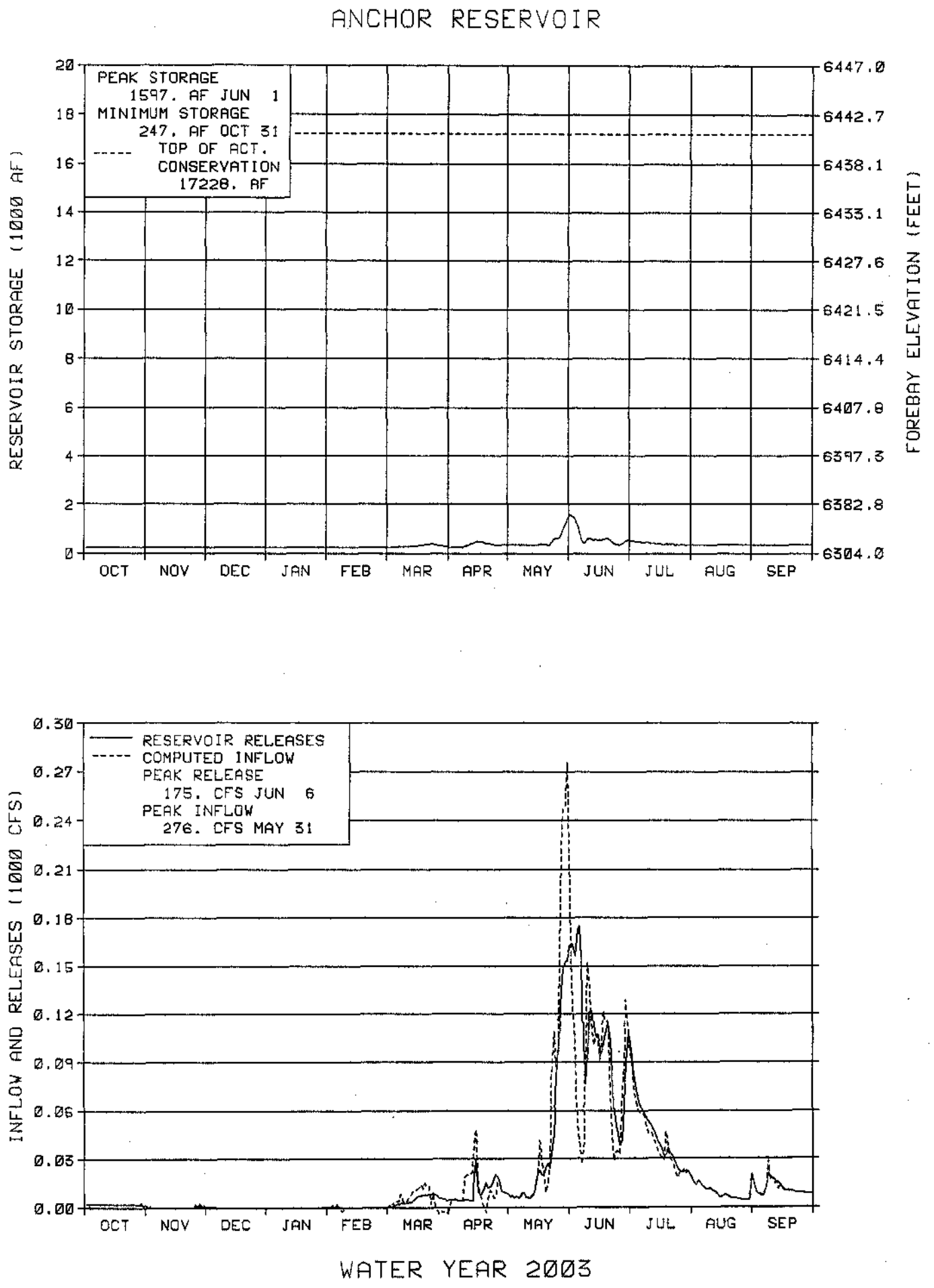
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW* | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 13,832 | OCT 02-SEP 03 | 13,736 | OCT 02-SEP 03 |
| DAILY PEAK (cfs) | 276 | MAY 31, 2003 | 175 | JUNE 06, 2003 |
| DAILY MINIMUM (cfs) | 0 | WINTER MONTHS | 0 | WINTER MONTHS |
| PEAK SPILLWAY FLOW (cfs) | | | 0 | |
| TOTAL SPILLWAY FLOW (AF) | | | **0** | |

* Outflow is water released from the Dam to Owl Creek. When the reservoir level rises above approximately 6412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. This water is neither measured nor accounted for. In 2003, no water flowed over the notch in the dike.

| | INFLOW | | OUTFLOW* | | CONTENT | |
|---|---|---|---|---|---|---|
| MONTH | KAF | % of Avg* | KAF | % of Avg* | KAF | % of Avg* |
| OCTOBER | 0.1 | 14 | 0.1 | 13 | 0.2 | 100 |
| NOVEMBER | 0.0 | 0 | 0.0 | 0 | 0.3 | 100 |
| DECEMBER | 0.0 | 0 | 0.0 | 0 | 0.3 | 150 |
| JANUARY | 0.0 | 0 | 0.0 | 0 | 0.3 | 150 |
| FEBRUARY | 0.0 | 0 | 0.0 | 0 | 0.3 | 150 |
| MARCH | 0.3 | 100 | 0.3 | 150 | 0.3 | 100 |
| APRIL | 0.7 | 100 | 0.6 | 120 | 0.3 | 60 |
| MAY | 3.6 | 77 | 2.4 | 69 | 1.5 | 88 |
| JUNE | 5.4 | 69 | 6.3 | 110 | 0.6 | 16 |
| JULY | 2.6 | 113 | 2.8 | 82 | 0.4 | 15 |
| AUGUST | 0.6 | 150 | 0.6 | 32 | 0.4 | 57 |
| SEPTEMBER | 0.7 | 117 | 0.7 | 70 | 0.4 | 100 |
| ANNUAL | 13.8 | 75 | 13.7 | 76 | | |

* Average is for the 1991-2002 period. This period was used because of the availability of data at Anchor Reservoir.

**FIGURE WYG4**


ANCHOR RESERVOIR
PEAK STORAGE
1597. AF JUN 1
MINIMUM STORAGE
247. AF OCT 31
TOP OF ACT. CONSERVATION
17228. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
20
18
16
14
12
10
8
6
4
2
0
6447.0
6442.7
6438.1
6433.1
6427.6
6421.5
6414.4
6407.8
6397.3
6382.8
6304.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
175. CFS JUN 6
PEAK INFLOW
276. CFS MAY 31
INFLOW AND RELEASES (1000 CFS)
0.30
0.27
0.24
0.21
0.18
0.15
0.12
0.09
0.06
0.03
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2003

**Shoshone Project & Buffalo Bill Unit**

The primary features of the original Shoshone Project included Buffalo Bill Darn and Reservoir, Shoshone and Heart Mountain Powerplants, and the canal and lateral systems for the Willwood, Frannie, Garland, and Heart Mountain Divisions. In 1982, The Buffalo Bill Dam and Reservoir Modifications, Shoshone Project, Wyoming, was authorized as the Buffalo Bill Unit (P-S MBP). The principal modifications to Buffalo Bill Dam included raising the height of the Dam by 25 feet, reconstructing the Shoshone Powerplant, construction of the Buffalo Bill Powerplant, construction of the Spirit Mountain Energy Dissipation Structure, pressurizing a portion of the Shoshone Canyon Conduit, enlarging and gating the spillway, constructing a visitor's center, and constructing the North Fork, South Fork, and Diamond Creek Dikes. The North and South Fork dust abatement dikes were designed to impound water in areas of the enlarged reservoir that would be dry during periods when the reservoir elevation is low, thereby reducing the dust producing area of the reservoir. The Diamond Creek protective dike prevents the enlarged reservoir from inundating Irma Flats.

Controlled releases are made from Buffalo Bill Reservoir at four points: (1) Shoshone Canyon Conduit, (2) Shoshone Powerplant, (3) the gated spillway, and (4) two river outlets (jetflow valve and 4X5 high pressure gates). Water for the Willwood, Frannie, and Garland Divisions of the Shoshone Project is diverted from the Shoshone River below Buffalo Bill Reservoir. The Heart Mountain Division is irrigated by water released at the dam through a high-level outlet to the Shoshone Canyon Conduit and Heart Mountain Canal. Irrigation releases for the project land along the Shoshone River are made through the Shoshone Powerplant, the river outlets, or through the Shoshone Canyon Conduit and Buffalo Bill or Heart Mountain Powerplants. Project works presently serve about 93,000 acres in the four divisions.

**The Heart Mountain Powerplant,** Shoshone Project, with a nameplate capability of 6,000 kilowatts (kW) and maximum discharge capacity of 360 cfs, is located at the end of the Shoshone Canyon Conduit, which obtains its water from a high-level outlet, elevation 5233.00 feet, at Buffalo Bill Dam. The powerplant is located 3.5 miles below the dam and discharges into the Shoshone River. During the summer months, the water released through the powerplant is used to satisfy a portion of the irrigation demand of lands diverting directly from the river.

**The Shoshone Powerplant,** reconstructed as part of the Buffalo Bill Unit (P-S MBP), is located on the left bank of the Shoshone River at the toe of Buffalo Bill Darn and releases water directly into the Shoshone River. After 56 years of continuous use, the Shoshone Powerplant became obsolete because of safety problems beyond economical repair. On March 21, 1980, the original plant was taken out of service. In 1992 one of the three generating units was replaced with a new unit having a nameplate capability of 3,000 kW. In accordance with the Revised Instream Flow Operation Agreement for Buffalo Bill Reservoir Enlargement, a flow of at least 100 cfs is released to the Shoshone River at the base of the dam at all times. This is normally achieved by the use of the Shoshone Powerplant. A maximum release of approximately 200 cfs can be made through the Shoshone Powerplant.

**The Buffalo Bill Powerplant,** Buffalo Bill Unit (P-S MBP), with a nameplate capability of 18,000 kW, is located about one mile downstream of Buffalo Bill Dam on the right bank of the Shoshone River. Water for generation at this powerplant is supplied through a portion of the Shoshone Canyon Conduit, which was pressurized as part of the Buffalo Bill modification. The maximum discharge capacity of the three units at the Buffalo Bill Powerplant is 930 cfs. The powerplant first generated power on July 15, 1992.

**Spirit Mountain Powerplant,** Buffalo Bill Unit (P-S MBP), with a nameplate capability of 4,500 kW and discharge capacity of 560 cfs, is a newly constructed energy dissipator powerplant located about one mile downstream of Buffalo Bill Dam on the right side of the Shoshone River. Water released through the Shoshone Canyon Conduit for Heart Mountain Canal or Heart Mountain Powerplant must be routed through the Spirit Mountain Powerplant or through associated sleeve valves to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow portion of the conduit. The discharge from the powerplant must be carried away from the plant by use of the free-flow conduit and operation of the powerplant depends on the availability of the conduit to carry discharged water.

**Buffalo Bill Dam and Reservoir,** located on the Shoshone River above Cody, Wyoming, is a multipurpose facility that provides water for domestic, irrigation, municipal, fish and wildlife, power, and recreational use. It also provides a small amount of incidental flood control, although no storage space is specifically reserved for this purpose. The total storage capacity of the reservoir is 646,565 AF at elevation 5393.50 feet, the top of the active conservation pool.

Storage in Buffalo Bill Reservoir at the beginning of water year 2003 was 358,903 AF at elevation 5353.59 feet. As the 2002 irrigation season ended, irrigation deliveries to the Heart Mountain Canal were discontinued on October 11 and releases to the river were gradually reduced to 100 cfs by October 19. Because the total inflow to Buffalo Bill Reservoir in water years 2001 and 2002 did not average more than 750,000 AF, Buffalo Bill Reservoir was determined to be in a critical low flow period based on the criteria of the Revised Instream Flow Agreement for Buffalo Bill Reservoir. In years following a critical low flow year or critical low flow period, the Agreement requires a minimum flow of 100 cfs be provided in the river at the Shoshone Powerplant and a minimum flow of 100 cfs be provided in the river at the Buffalo Bill Powerplant. The release of 100 cfs was maintained until April 16, when increases were required to meet the irrigation demands of the downstream districts.

During October, reservoir inflow was 64 percent of average and the reservoir level continued to fall until irrigation releases ended. After the release was reduced to 100 cfs the reservoir began to recover and at the end of the month there was 350,721 AF in storage at elevation 5352.25 feet. Inflow during November and December was below average but greater than the release and the reservoir content gradually increased through the period. Precipitation from October through December was below average in the mountains and the snowpack in the Buffalo Bill watershed stood at 73 percent of average on January 1. Forecasts of the April-July snowmelt runoff are made each month beginning in January and continuing through June for Buffalo Bill Reservoir. Conditions on January 1 indicated that 500,000 AF of runoff could be expected to flow into Buffalo Bill Reservoir during the April through July period, which was 74 percent of the 30 year average. Snowfall was above average during the month of January, primarily due to a storm that brought heavy snow to the Shoshone basin on January 30. By February 1, the snowpack had increased to 86 percent of average, a thirteen percent increase over the previous month. As a result of the improved snow conditions, the February 1 snowmelt runoff forecast was increased to 550,000 AF. Snowfall during February accumulated at a near normal rate and stood at 87 percent of average on March 1. Streamflow above Buffalo Bill continued to be less than average during January and February, with reservoir inflow amounting to 85 and 78 percent of average for those months, respectively. At the end of February, Buffalo Bill Reservoir held 373,258 AF of water at elevation 5355.95 feet. With the snowpack at about the same percent of average as it was on February 1, the March 1 forecast of April-July runoff remained at 550,000 AF, which was 81 percent of average. During March the snowpack in the Shoshone basin made a significant upturn as storms moved through the basin on the 5th, 17th, and 26th. Precipitation in the mountains was double the March normal and the snowpack increased 18 percent during the month to 105 percent of average on April 1. The April 1 snowmelt runoff forecast was increased to 650,000 AF, 96 percent of average, to reflect the improved conditions.

Releases to the river were increased beginning on April 16 in order to meet the downstream irrigation demand and Heart Mountain Canal diversions began on April 17. Releases were adjusted as needed through the month but inflow continued to exceed the reservoir release until late April. The reservoir held 399,591 AF of water at elevation 5360.02 feet on April 30. The snowpack accumulated at a rate that was slightly less than average during April and the forecast prepared on May 1 indicated a reduction in the expected April-July inflow to 560,000 AF. As irrigation demand continued to increase, the reservoir level declined until mid-May when the snowmelt runoff began to enter the reservoir. Temperatures in the basin reached the upper 80's during the last week of May and inflow to the reservoir peaked on May 30 with an average for the day of 11,690 cfs. Provisional data from the U S Geological Survey shows that the inflow on the North Fork of the Shoshone River peaked at 8,550 cfs on May 30 and the peak on the South Fork of 5,010 cfs occurred on May 31. As the runoff continued, releases were increased above irrigation demand beginning on June 13 to control the rate at which the reservoir was filling and a spillway release was initiated on June 17. A maximum daily average river release of 6,147 cfs occurred on June 19 before releases were reduced and the reservoir was allowed to gradually rise. At the end of June the reservoir held 619,637 AF of water at elevation 5390.13 feet and

continued to rise until July 15 when Buffalo Bill reached a maximum content of 635,717 AF at elevation 5392.14 feet. This was 10,848 AF and 1.36 feet below the top of the active conservation pool. As inflows subsided, releases were reduced to the amount needed to satisfy the irrigation demands. Inflow during August and September was well below average as little rain fell in the basin during the summer and at the end of water year 2003, the reservoir held 465,714 AF of water at elevation 5369.70 feet. The end of September content was 108 percent of the 1993-2002 average for the enlarged reservoir. The total inflow to Buffalo Bill during the April through July runoff period was **667,845** AF, which was **98** percent of average. The total water year inflow of 782,723 AF was 90 percent of average.

Total energy generated at all powerplants that directly receive water out of Buffalo Bill Reservoir totaled 92,801,000 **kWh** in 2003. **Of** this total amount, Heart Mountain Powerplant generated 18,170,000 **kWh,** Buffalo Bill Powerplant generated 44,437,000 **kWh,** Shoshone Powerplant generated 15,271,000 **kWh** and Spirit Mountain Powerplant generated 14,923,000 **kWh.** The powerplants used 490,491 AF of water to generate this amount of energy, or 73 percent of the total water released from Buffalo Bill Reservoir during water year 2003. About 32 percent, or 216,311 AF of the total water released from Buffalo Bill Reservoir, was released to the Heart Mountain Canal for irrigation purposes.

## Important Events - 2003

October 11, 2002: Irrigation diversions to the Heart Mountain Canal were discontinued for the 2002 irrigation season.

October 15, 2002: Irrigation releases to the Shoshone River were discontinued for the 2002 irrigation season, control of releases was returned to the Bureau of Reclamation, and a river release of 100 cfs was established for the winter.

April 15, 2003: Control of releases to the Shoshone River was turned over to the irrigation district in order to meet irrigation demands.

April 16, 2003: Releases from Buffalo Bill Reservoir were increased to meet downstream irrigation demand.

April 17, 2003: Irrigation releases to the Heart Mountain Canal were initiated for the 2003 irrigation season.

June 13, 2003: Control of releases to the Shoshone River was returned to the Bureau of Reclamation as releases in excess of irrigation demand were required to control the rate at which Buffalo Bill Reservoir filled.

June 17, 2003: Release through the spillway was initiated.

June 23, 2003: Release through the spillway was discontinued.

July 10, 2003: Control of releases to the Shoshone River was turned over to the irrigation district in order to meet irrigation demands.

July 15, 2003: Buffalo Bill Reservoir reached a maximum elevation for the water year of 5392.14 feet.

Additional hydrologic and statistical information pertaining to the operations of Buffalo Bill Reservoir during water year 2003 can be found in Table WYT8 and Figure WYG5.

# TABLE WYT8
# HYDROLOGIC DATA FOR WATER YEAR 2003
# BUFFALO BILL RESERVOIR

| **RESERVOIR** ALLOCATIONS | ELEVATION (FEET) | **TOTAL RESERVOIR STORAGE (AF)** | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 5259.60 | 41,748 | 41,748 |
| TOP OF ACTIVE CONSERVATION | 5393.50 | 646,565 | 604,817 |

| **STORAGE-ELEVATION DATA** | **ELEVATION (FEET)** | **STORAGE (AF)** | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 5353.59 | 358,903 | OCT 01,2002 |
| END OF YEAR | 5369.70 | 465,714 | SEP 30, 2003 |
| ANNUAL LOW | 5351.24 | 344,642 | OCT 11, 2002 |
| HISTORIC LOW* | | 19,080 | JAN 31, 1941 |
| ANNUAL HIGH | 5392.14 | 635,717 | JUL 15, 2003 |
| HISTORIC HIGH | 5393.51 | 646,647 | JUL 30, 1996 |

* Prior to 1952 daily records are not available. End of month data was used to determine the historic low.

| **INFLOW-OUTFLOW** DATA | **INFLOW** | DATE | OUTFLOW* | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 782,723 | OCT 02-SEP 03 | 675,671 | OCT 02-SEP 03 |
| DAILY PEAK (cfs) | 11,690 | **MAY** 30, 2003 | 6,147 | JUN 19, 2003 |
| DAILY MINIMUM (cfs) | 5 | JAN 27, 2003 | 74 | NOV 01, 2002 |
| PEAK SPILLWAY FLOW (cfs) | | | 3,529 | JUN 20, 2003 |
| TOTAL SPILLWAY FLOW (AF) | | | 34,346 | JUN 17-JUN 23 |

*Daily peak and minimum are releases to the river

| | INFLOW | | **OUTFLOW** | | CONTENT | |
|---|---|---|---|---|---|---|
| MONTH | KAF | % of Avg* | KAF | % of Avg* | KAF | % of Avg* |
| OCTOBER | 15.6 | 64 | 23.7 | 62 | 350.7 | 86 |
| NOVEMBER | 12.6 | 59 | 6.2 | 29 | 357.1 | 88 |
| DECEMBER | 11.2 | 67 | 6.4 | 29 | 361.9 | 90 |
| JANUARY | 13.0 | 85 | 6.4 | 31 | 368.4 | 92 |
| FEBRUARY | 10.6 | 78 | 5.8 | 30 | 373.3 | 95 |
| MARCH | 17.2 | 91 | 6.4 | 26 | 384.1 | 101 |
| APRIL | 48.8 | 117 | 33.2 | 58 | 399.6 | 115 |
| MAY | 193.4 | 126 | 89.8 | 81 | 503.0 | 130 |
| JUNE | 291.9 | 95 | 175.2 | 100 | 619.6 | 114 |
| JULY | 133.8 | 76 | 139.2 | 75 | 614.2 | 111 |
| AUGUST | 20.3 | 42 | 104.0 | 93 | 530.5 | 108 |
| SEPTEMBER | 14.3 | 53 | 79.1 | 102 | 465.7 | 108 |
| ANNUAL | 782.7 | 90 | 675.7 | 78 | | |

| APRIL - JULY INFLOW (AF) | |
|---|---|
| ACTUAL | AVERAGE |
| 667,845 | 679,500 |

* Average for inflow and outflow is the 1973-2002 period. Because of the enlargement of Buffalo Bill Reservoir in 1992, the of record which average content is based on is 1993-2002.

**FIGURE WYG5**

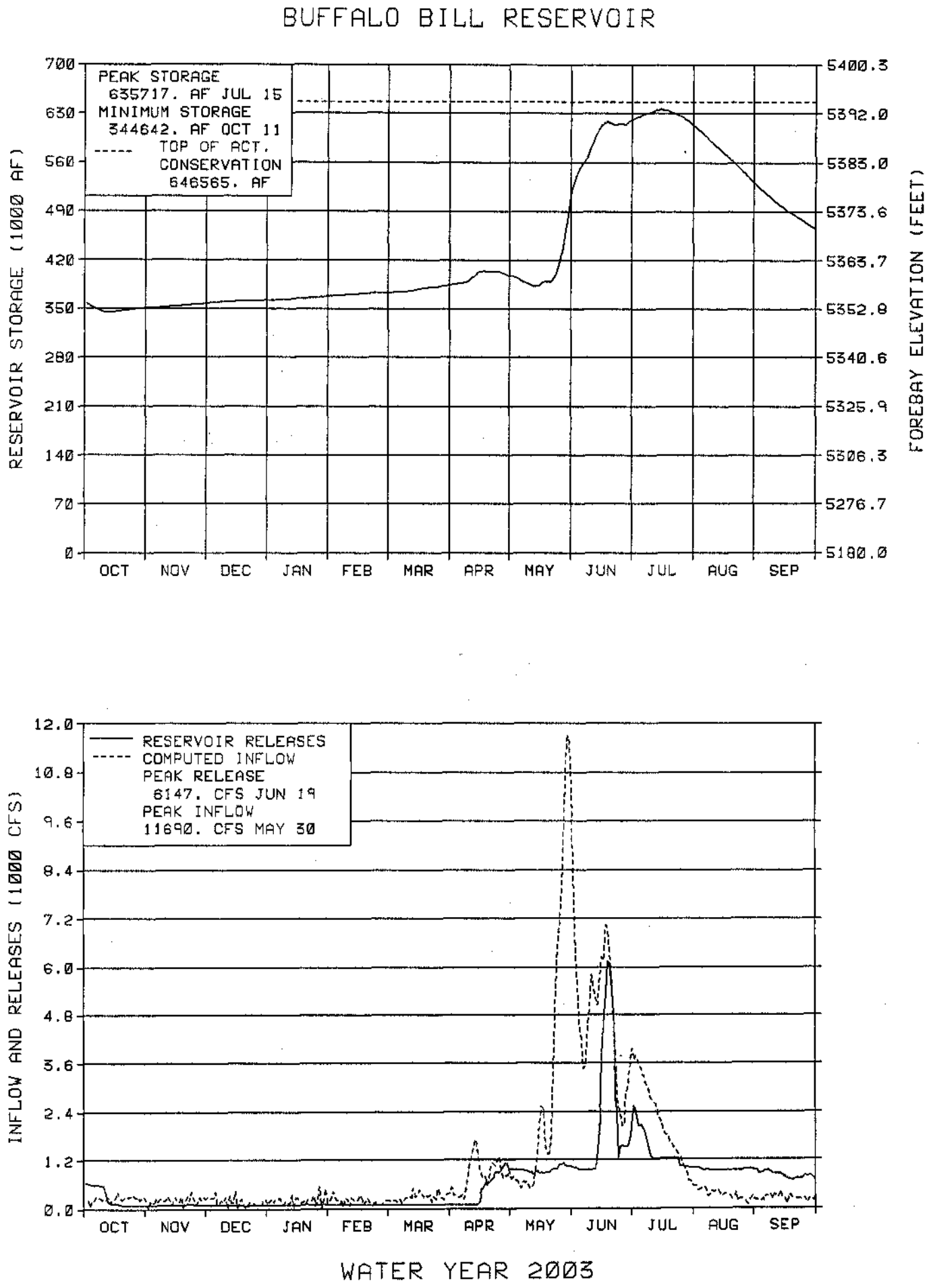

BUFFALO BILL RESERVOIR
PEAK STORAGE
635717. AF JUL 15
MINIMUM STORAGE
344642. AF OCT 11
----- TOP OF ACT. CONSERVATION
646565. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
700
630
560
490
420
350
280
210
140
70
0
5400.3
5392.0
5383.0
5373.6
5363.7
5352.8
5340.6
5325.9
5306.3
5276.7
5180.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
6147. CFS JUN 19
PEAK INFLOW
11690. CFS MAY 30
INFLOW AND RELEASES (1000 CFS)
12.0
10.8
9.6
8.4
7.2
6.0
4.8
3.6
2.4
1.2
0.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2003

Table WYT9

WATER YEAR 2003 ACTUAL OUTAGES FOR WYOMING POWERPLANTS

| Facilities | Description of Work | Outage Dates |
|---|---|---|
| **BOYSEN** | | |
| Unit 1 | K 1 A Maintenance and Doble Testing | 10/21/02 - 11/06/02 |
| Unit 1 | Annual Maintenance | 12/01/02 - 01/02/03 |
| Unit 1 | Wicket Gate Grease System Upgrade | 03/31/03 - 04/14/03 |
| Unit 2 | K 1 A Maintenance and Doble Testing | 10/21/02 - 11/06/02 |
| Unit 2 | Annual Maintenance | 01/07/03 - 01/31/03 |
| PILOT BUTTE | | |
| Unit 1 | Annual Maintenance | 02/10/03 - 03/31/03 |
| Unit 1 | Breaker Panel Rewire | 04/16/03 - 04/30/03 |
| Unit 1 | Clearance for Unit 2 Outage | 06/02/03 - 07/15/03 |
| Unit 1 | Hi-Pot Cables | 09/22/03 - 09/30/03 |
| Unit 2 | Annual Maintenance | 02/10/03 - 03/31/03 |
| Unit 2 | Repair Windings | 06/02/03 - 07/16/03 |
| Unit 2 | Hi-Pot Cables | 09/22/03 - 09/30/03 |
| BUFFALO BILL | | |
| Buffalo Bill Powerplant | | |
| Unit 1 | KZ1A Doble Testing | 10/21/02 - 10/24/02 |
| Unit 1 | Annual Maintenance | 11/12/02 - 11/22/02 |
| Unit 1 | BBP-611 Replacement | 04/01/03 - 04/08/03<br>04/21/03 – 05/14/03<br>05/28/03 – 05/29/03 |
| Unit 2 | KZ1A Doble Testing | 10/21/02 - 10/24/02 |
| Unit 2 | Annual Maintenance | 02/24/03 - 03/26/03 |

Table WYT9 (continued)

WATER YEAR 2003 ACTUAL OUTAGES FOR WYOMING POWERPLANTS

| Facilities | Description of Work | Outage Dates |
|---|---|---|
| **BUFFALO BILL** | | |
| Unit 2 | BBP-611 Replacement | 04/01/03 - 04/08/03<br>04/21/03 – 05/14/03<br>05/28/03 – 05/29/03 |
| Buffalo Bill Powerplant | | |
| Unit 3 | Annual Maintenance | 01/21/03 - 01/30/03 |
| Unit 3 | Annual Maintenance | 09/29/03 - 09/30/03 |
| Shoshone Powerplant | | |
| Unit 3 | Annual Maintenance and Draft Tube Repair | 11/20/02 – 01/28/03 |
| Unit 3 | Ground on Thrust Bearing | 02/04/03 - 02/07/03 |
| Heart Mountain Powerplant | | |
| Unit 1 | Clearance for Spirit Mtn. Outage | 12/03/02 - 01/14/03 |
| Unit 1 | Annual Maintenance | 02/03/03 - 02/13/03 |
| Spirit Mountain Powerplant | | |
| Unit 1 | Annual Maintenance | 10/15/02 - 11/08/02 |
| Unit 1 | Stuffing Box Repair | 12/03/02 - 01/14/03 |
| Unit 1 | BBP-611 Replacement | 04/01/03 - 04/08/03<br>04/21/03 – 05/14/03<br>05/28/03 – 05/29/03 |

## SUMMARY OF RESERVOIR OPERATIONS FOR BENEFIT OF FISH AND WILDLIFE, ENVIRONMENT AND RECREATION

### Bull Lake Reservoir

During water year 2002, Midvale and Reclamation entered into an agreement whereby Reclamation could store up to 11,000 AF of Boysen water in Bull Lake and exchange Bull Lake storage for Boysen Reservoir water which is diverted from the Wind River at the Wind River Diversion Darn when runoff conditions are conducive to allow for such an exchange. The storage water released from Boysen was exchanged for an equal quantity of water held in Bull Lake, which was to be transferred back to Boysen following the irrigation season. When irrigation deliveries to the Riverton unit ended on September 16, 2002, Bull Lake Reservoir held 38,998 AF of water. Of the 38,998 AF held in Bull Lake, 20,538 AF was Boysen water in Bull Lake (9,538 AF was Boysen storage carried over from a similar agreement in 2001 plus 11,000 AF of water exchanged during 2002). When irrigation releases from Bull Lake ended for the season, a release of approximately 25 cfs was maintained as the Boysen water in Bull Lake was transferred back to Boysen Reservoir, providing a winter flow in Bull Lake Creek. The reservoir level slowly increased through April 22 when releases from Bull Lake were required to meet irrigation demands. Through the irrigation season, the release from Bull Lake was adjusted as necessary to satisfy irrigation demands on the Riverton Unit. Reservoir levels in water year 2003 varied from a minimum elevation of 5762.12 feet on October 1, 2002, to a maximum elevation of 5791.15 feet on July 16, or a range of 29.03 feet of fluctuation. Again in 2003, Midvale and Reclamation entered into an agreement whereby Boysen Reservoir storage water could be exchanged for water stored in Bull Lake. This arrangement allows Bull Lake to end the water year at a higher level and also provides a winter flow in Bull Lake Creek as the Boysen water in Bull Lake is transferred back to Boysen during the winter months. At the end of water year 2003, the content of Bull Lake was 56,345 AF, with 19,575 AF of the total being Boysen storage water in Bull Lake.

### Boysen Reservoir

Boysen Reservoir storage at the beginning of water year 2003 was 41 percent of average and 32 percent of capacity. This was the lowest Boysen content at the start of a water year since the initial filling of the reservoir in 1952. Following the 2002 irrigation season, the release from Boysen Dam was set at approximately 300 cfs and was maintained at that rate until irrigation demands required increased flows. The month of April is normally when many species of fish spawn in the upper few feet of the reservoir. To insure a successful spawn, it is important to limit the amount of drawdown on the reservoir during April. By April 14, the release of 300 cfs from the Dam was not adequate to meet irrigation demands and increases were made to satisfy downstream demands. The reservoir level fluctuated slightly during the month but the reservoir level on April 30 was 0.73 feet higher than it was on March 31. May inflow was only 53 percent of average but the reservoir elevation still increased 1.78 feet during the month. The reservoir level was at 4698.46 feet going into the Memorial Day weekend, which was 5.20 feet higher than at the beginning of the holiday weekend in 2002.

**Buffalo Bill Reservoir**

Following the 2002 irrigation season, the release from Buffalo Bill Reservoir was set at approximately 100 cfs. Based on the criteria of the Revised Instream Flow Operation Agreement for Buffalo Bill Reservoir Enlargement, the average water year inflow for the 2001 and 2002 period met the criteria of a critical low flow period and therefore a release of 100 cfs at the Shoshone Powerplant and a total flow of 100 cfs was required at Buffalo Bill Powerplant.

Reclamation continues to support the Wyoming Game and Fish (WGF) Reservoir Research Branch in its efforts to assess fish population and species distribution in the enlarged reservoir through the use of hydro-acoustic technology and by providing WGF river access and an aluminum tube for planting fish in the Shoshone River off the deck of Buffalo Bill Powerplant.

At Buffalo Bill Reservoir, as the reservoir is drawn down, the lake bed is exposed to wind erosion which creates dust in the reservoir area and in the Town of Cody, Wyoming. As a part of the enlargement of Buffalo Bill Reservoir, dust abatement dikes were built on the upper ends of the North and South Fork arms of the reservoir to hold water in areas that would become dry as the reservoir level decreased, thus reducing the area of dry lake bed. During the period from October 1 through May 29, the water surface elevation of Buffalo Bill Reservoir was below the top of the North Fork Dike (elevation 5370.00 feet). The maximum elevation of the pool behind the South Fork Dike of 5394.21 feet occurred on July 15, 2003, and the minimum elevation of 5387.98 feet occurred on April 16, 2003. At the maximum elevation, the pool behind the South Fork Dike covered 209 surface acres. On October 11, 2002, when the water surface elevation of Buffalo Bill Reservoir was at its low for the year of 5351.24 feet, the water surface elevation of the pool behind the North Fork Dike was approximately 5365.00 feet and the water surface elevation of the pool behind the South Fork Dike was 5391.89 feet. At the minimum reported elevation of Buffalo Bill Reservoir, 154 more acres of land would have been exposed without the ability to store water behind the North Fork Dike and 186 more acres would have been exposed without the South Fork Dike.

The number of stoplogs at the outlet control structure on the South Fork Dike has been increased to maintain the static water level of the pond behind the dike at approximately 5391.00 feet at the end of the water year. The increased elevation provides a larger impoundment behind the dike, benefiting waterfowl as well as the fishery.

The Diamond Creek Dike was constructed to prevent Diamond Creek and the Irma Flats area from being inundated by the enlarged reservoir. Inflows from the Diamond Creek drainage enter Diamond Creek Reservoir which lies at the base of the dike. This water is then pumped into Buffalo Bill Reservoir in order to maintain the elevation of Diamond Creek Reservoir between a maximum of 5340.40 feet and a minimum of 5339.50 feet with the normal water surface elevation being 5340.00 feet. In water year 2003, 10,098 AF of water was pumped from Diamond Creek Reservoir into Buffalo Bill Reservoir.

Reservoir levels during all of water year 2003 were adequate for recreational activities on Buffalo Bill Reservoir.

## WEATHER SUMMARY FOR NORTH AND SOUTH DAKOTA

October precipitation was near average at Pactola, and Heart Butte, and above average at Jamestown, and below average at the remaining reservoirs.

November precipitation was below to much below average at all reservoirs.

December precipitation was above average at Heart Butte, near average at Dickinson, and below to much below average at the remaining reservoirs.

January precipitation was slightly above to much above average at the South Dakota reservoirs and much below average at the North Dakota Reservoirs.

February precipitation was below to much below average at Deerfield, Shadehill, Dickinson, Heart Butte and Jamestown, and above to much above average at the remaining reservoirs.

March precipitation was much below average at Heart Butte and Jamestown, and above to much above average at the remaining reservoirs.

April precipitation was below average at Belle Fourche and Shadehill reservoirs, and much below normal at the North Dakota reservoirs, and average to above average at the remaining reservoirs.

May precipitation was below average at all South Dakota reservoirs, and was average or much above average at the North Dakota reservoirs.

June precipitation was near average at Jamestown and above average at Angostura and Deerfield Reservoirs and below average at the remaining reservoirs

July precipitation was below to much below average at all reservoirs.

August precipitation was near average at Heart Butte and slightly above average at Pactola and Dickinson, and below to much below average at the remaining reservoirs.

September precipitation was below average at Deerfield, Pactola, and Jamestown and above to much above average at the remaining reservoirs.

Total annual precipitation for Reclamation facilities in North Dakota, South Dakota, and Northeastern Wyoming are shown on Table DKT1.

| TABLE DKT1<br>Total Annual Precipitation for Reclamation Reservoirs<br>in North Dakota, South Dakota, and Northeastern Wyoming in Inches | | | |
|---|---|---|---|
| **Reservoir** | **2003 Total** | **Average Total** | **Percent** |
| Angostura 1/ | 54.45 | 60.77 | 90 |
| Belle Fourche 2/ | 43.93 | 54.37 | 81 |
| Deerfield | 14.55 | 19.95 | 73 |
| Keyhole 3/ | 25.78 | 33.07 | 78 |
| Pactola | 15.90 | 20.31 | 78 |
| Shadehill 4/ | 22.14 | 32.40 | 68 |
| Dickinson | 14.00 | 16.11 | 87 |
| Lake Tschida | 11.21 | 16.85 | 67 |
| Jamestown | 15.00 | 16.89 | 89 |

1/ Angostura Reservoir's annual precipitation includes data from Oelrichs, SD, Hot Springs, SD, Newcastle, WY, and Red Bird, WY climate stations.

2/ Belle Fourche Reservoir's annual precipitation includes data from Newell, SD, Spearfish, SD, and Sundance, WY climate stations.

3/ Keyhole Reservoir's annual precipitation includes data from Gillette, WY and Sundance, WY climate conditions.

4/ Shadehill Reservoir's annual precipitation includes data from Camp Crook and Lemmon, SD climate stations.

Table DKT2 displays the changes in storage content between September 30, 2002, and September 30, 2003, at reservoirs in North and S Dakota and eastern Wyoming.

**TABLE DKT2**
**Comparison of End-of-Month Storage Content for Reservoirs in North Dakota, South Dakota, and Northeastern Wyoming in Acre-Feet**

| Reservoir | Storage September 30, 2002 | Storage September 30, 2003 | Change in Storage |
|---|---|---|---|
| Angostura | 78,232 | 81,877 | 3,645 |
| Belle Fourche | 56,009 | 56,237 | 228 |
| Deerfield | 15,056 | 15,176 | 120 |
| Keyhole | 116,993 | 111,347 | -5,646 |
| Pactola | 46,233 | 48,061 | 1,828 |
| Shadehill | 81,212 | 77,934 | -3,278 |
| Dickinson | 6,440 | 6,381 | -59 |
| Lake Tschida | 52,188 | 55,260 | 3,072 |
| Jamestown | 29,779 | 29,823 | 44 |

## FLOOD BENEFITS FOR RESERVOIRS IN NORTH AND SOUTH DAKOTA AND EASTERN WYOMING

Several Bureau of Reclamation reservoirs in Northeastern Wyoming, South Dakota, and North Dakota provided flood relief during water year 2003. They are: Lake Tschida on the Heart River near Glen Ullin, North Dakota; Shadehill on the Grand River near Lemmon, South Dakota; Angostura on the Cheyenne River near Hot Springs, South Dakota; Pactola on Rapid Creek near Rapid City, South Dakota; Keyhole on the Belle Fourche River near Moorcroft, Wyoming; and Jamestown on the James River near Jamestown, North Dakota.

The information on the distribution of flood damages prevented is provided by the Corps of Engineers. The distributions of flood damages prevented for each reservoir are as follows:

### FLOOD DAMAGE PREVENTED IN 2003 ACCUMULATED TOTAL 1950-2003

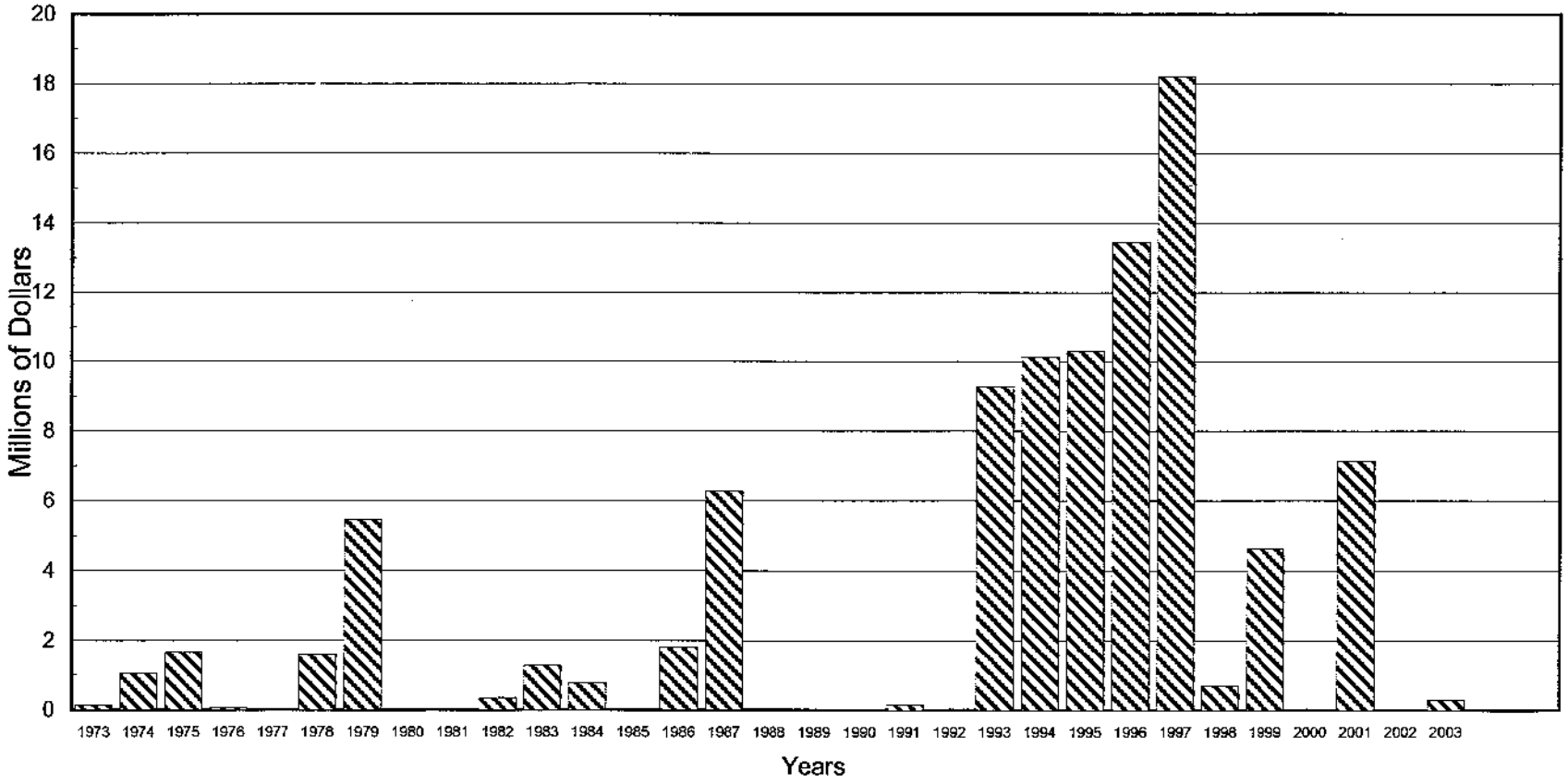
| | Local | Main-Stem | 2003 Total | Previous Accumulations | 1950-2003 Accum Totals |
|---|---|---|---|---|---|
| Lake Tschida | $38,600 | $95,500 | $134,100 | $13,161,600 | $13,295,700 |
| Shadehill | $0 | $53,700 | $53,700 | $8,974,500 | $9,028,200 |
| Angostura | $0 | $0 | $0 | $21,100 | $21,100 |
| Pactola | $0 | $10,200 | $10,200 | $3,106,700 | $3,116,900 |
| Keyhole | $0 | $103,300 | $103,300 | $3,652,800 | $3,756,100 |
| Jamestown | $0 | $0 | $0 | $86,672,300 | $86,672,300 |
| Total | $38,600 | $262,700 | $301,300 | $115,589,000 | $115,890,300 |

Flood damages prevented by Dakotas Area Office between Garrison and Gavins Point Dams are shown on Figure DKG1.

Figure DKG 1

# FLOOD DAMAGES PREVENTED

## By Dakota Area Projects Between Garrison and Gavins Point Dams



# UNIT OPERATIONAL SUMMARIES FOR WATER YEAR 2003

## EDWARD ARTHUR PATTERSON LAKE

BACKGROUND

Edward Arthur Patterson Lake (Dickinson Reservoir) is located on the Heart River near Dickinson, North Dakota. The reservoir has a dead capacity of 356 acre-feet, an inactive capacity of 100 acre-feet and an active conservation capacity of 8,156 acre-feet (for a total storage capacity of 8,612 acre-feet at the top of conservation elevation 2420.00). Reservoir water is utilized for irrigating approximately 230 acres along the Heart River downstream of the dam and for municipal use by the Dickinson parks and Recreation District.

WATER YEAR 2003 OPERATIONS SUMMARY

The water surface elevation of Dickinson Reservoir at the beginning of water year 2003 was 2418.00 feet with storage of 6,440 acre-feet, which is 2.00 feet, and 2,172 acre-feet below the top of the conservation pool (elevation 2420.0). Dickinson Reservoir peaked at elevation 2420.68 feet on March 15th with 9,449 acre-feet of storage. Reservoir releases were made throughout the summer for irrigation of Dickinson-Heart River Mutual Aid Corporation lands and for municipal water needs (golf course irrigation) by the Dickinson Parks and Recreation District. Water was also released from the irrigation bypass valve to help the water quality in the reservoir. The reservoir elevation on September 30, 2003 was 2417.94 feet with storage of 6,381 acre-feet, which is 2.06 feet, and 2,231 acre-feet below the top of conservation pool.
The maximum discharge of 1,116 CFS occurred on March 16th. Reservoir net inflows for water year 2003 totaled 14,847 acre-feet, 74 percent of average. Precipitation for the water year totaled 14.00 inches, which is 87 percent of average.

MONTHLY STATISTICS FOR WATER YEAR 2003

Record and near record inflows were recorded in the following months:
October's inflow was its 6th lowest October in 52 years of record
July's inflow was its 9th lowest July in 52 years of record
September's inflow was its 9th highest September in 52 years of record.

Record end of month content was recorded in the following months:
May's end of month content was its 10th highest May in 52 years of record.

Additional statistical information on E.A. Patterson Lake and its operations during 2003 can be found on Table DKT3 and Figure DKG2.

TABLE DKT3
HYDROLOGIC DATA FOR 2003
E.A. PATTERSON DAM AND LAKE

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2,405.00 | 456 | 456 |
| TOP OF ACTIVE CONSERVATION | 2,420.00 | 8,612 | 8,156 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | | | |

| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2,418.00 | 6,440 | OCT 01, 2002 |
| END OF YEAR | 2,417.94 | 6,388 | SEP 30, 2003 |
| ANNUAL LOW | 2,417.63 | 6,084 | AUG 16, 2003 |
| ANNUAL HIGH | 2,420.68 | 9,449 | MAR 15, 2003 |
| HISTORIC HIGH | 2,422.19 | **9,348 | MAR 21, 1997 |

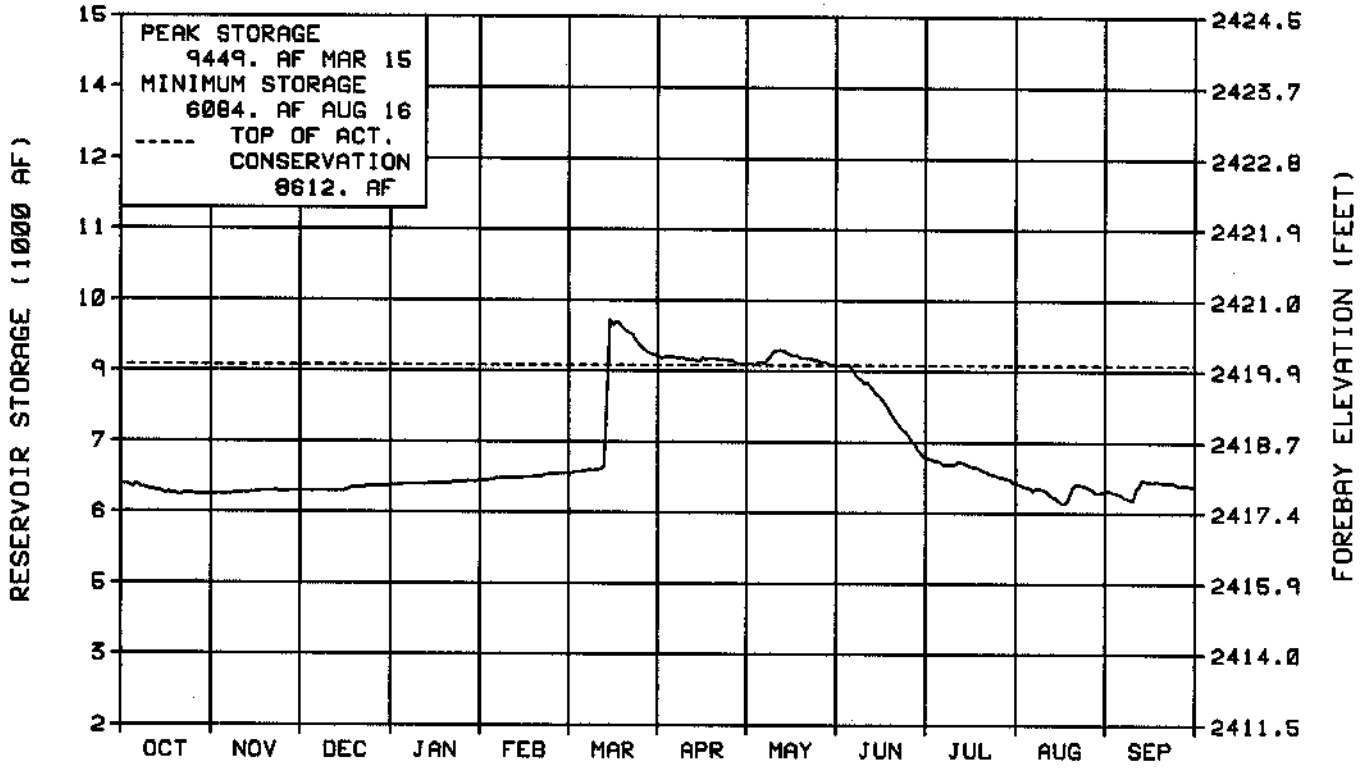
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 14,847 | OCT 02-SEP 03 | 14,906 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 1,464 | MAR 15, 2003 | 1,116 | MAR 16, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |
| PEAK SPILL (CFS) | | | 1,116 | MAR 16, 2003 |
| TOTAL SPILL (AF) | | | 11,924 | OCT 02-SEP 03 |

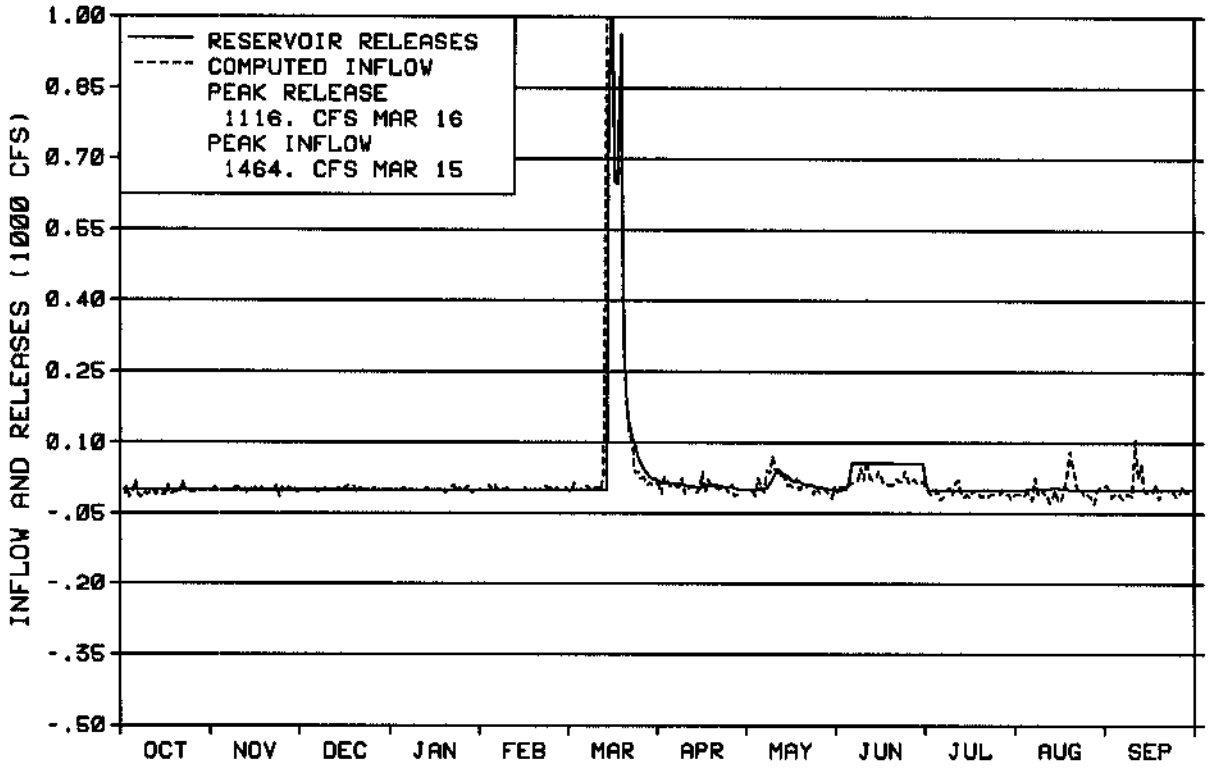
| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | -222 | NA | 0 | NA | 6,218 | 111 |
| NOVEMBER | 67 | 53 | 0 | NA | 6,285 | 113 |
| DECEMBER | 106 | 86 | 0 | NA | 6,391 | 116 |
| JANUARY | 88 | 49 | 0 | NA | 6,479 | 117 |
| FEBRUARY | 149 | 13 | 0 | NA | 6,628 | 113 |
| MARCH | 12,739 | 181 | 10,575 | 173 | 8,792 | 128 |
| APRIL | 417 | 9 | 573 | 14 | 8,636 | 124 |
| MAY | 749 | 31 | 773 | 30 | 8,612 | 125 |
| JUNE | 1,188 | 46 | 2,868 | 112 | 6,932 | 100 |
| JULY | -436 | NA | 36 | 3 | 6,460 | 99 |
| AUGUST | -65 | NA | 81 | 11 | 6,314 | 104 |
| SEPTEMBER | 67 | 146 | 0 | NA | 6,381 | 110 |
| ANNUAL | 14,847 | 74 | 14,906 | 77 | | |
| APRIL-JULY | 1,918 | 19 | | | | |

* Frequently observed during fall and winter months
** Due to new area-capacity table, the capacity that corresponds to the new historic high elevation is less than a previous historic high capacity amount (11,520 AF @ Elevation 2421.08 on June 9, 1982)

# DKG2

## E. A. PATTERSON LAKE




WATER YEAR 2003

## LAKE TSCHIDA

BACKGROUND

Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) is located on the Heart River near Glen Ullin, North Dakota. The reservoir has a dead storage capacity of 5,227 acre-feet, an active conservation capacity of 61,915 acre-feet (for a total storage capacity of 67,142 acre-feet at the top of active conservation elevation 2064.50), and an exclusive flood control space of 147,027 acre-feet. Flood control storage is located above the crest of an ungated glory-hole spillway. Lake Tschida is primarily used for flood control and the authorized irrigation of up to 13,100 acres of which about 7,320 acres are now being irrigated.

WATER YEAR 2003 OPERATIONS SUMMARY

The water surface elevation of Heart Butte Reservoir at the beginning of water year 2003 was 2059.66 feet with storage of 52,188 acre-feet, which is 4.84 feet, and 14,954 acre-feet below the top of conservation pool (elevation 2064.50). Heart Butte Reservoir peaked at elevation 2070.32 on March 20th with 87,807 acre-feet of storage. The reservoir elevation on September 30th 2003 was 2060.71 feet with storage of 55,260 acre-feet, which is 3.79 feet and 11,882 acre-feet below the top of conservation pool.

The maximum discharge of 3,108 CFS occurred on March 20th. Reservoir net inflows for water year 2003 totaled 64,611 acre-feet, 73 percent of average. Precipitation for the water year totaled 11.21 inches, which is 67 percent of average.

MONTHLY STATISTICS FOR WATER YEAR 2003

Record and near record inflows were recorded in the following months:

December's inflow was its 9th highest December in 54 years of record
January's inflow was its 10th highest January in 54 years of record
July's inflow was its 4th lowest July in 54 years of record
August's inflow was its 6th lowest August in 54 years of record

Record end of month content was recorded in the following months:

October's end of month content was its 10th lowest October in 54 years of record.
July's end of month content was its 9th highest July in 54 years of record.
August's end of month content was its 8th highest August in 54 years of record.
September's end of month content was its 9th highest September in 54 years of record.

Additional statistical information on Lake Tschida and its operations during 2003 can be found on Table DKT4 and Figure DKG3.

TABLE DKT4
HYDROLOGIC DATA FOR 2003
LAKE TS CHIDA

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2,030.00 | 5,227 | 5,227 |
| TOP OF ACTIVE CONSERVATION | 2,064.50 | 67,142 | 61,915 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | 2,094.50 | 214,169 | 147,027 |

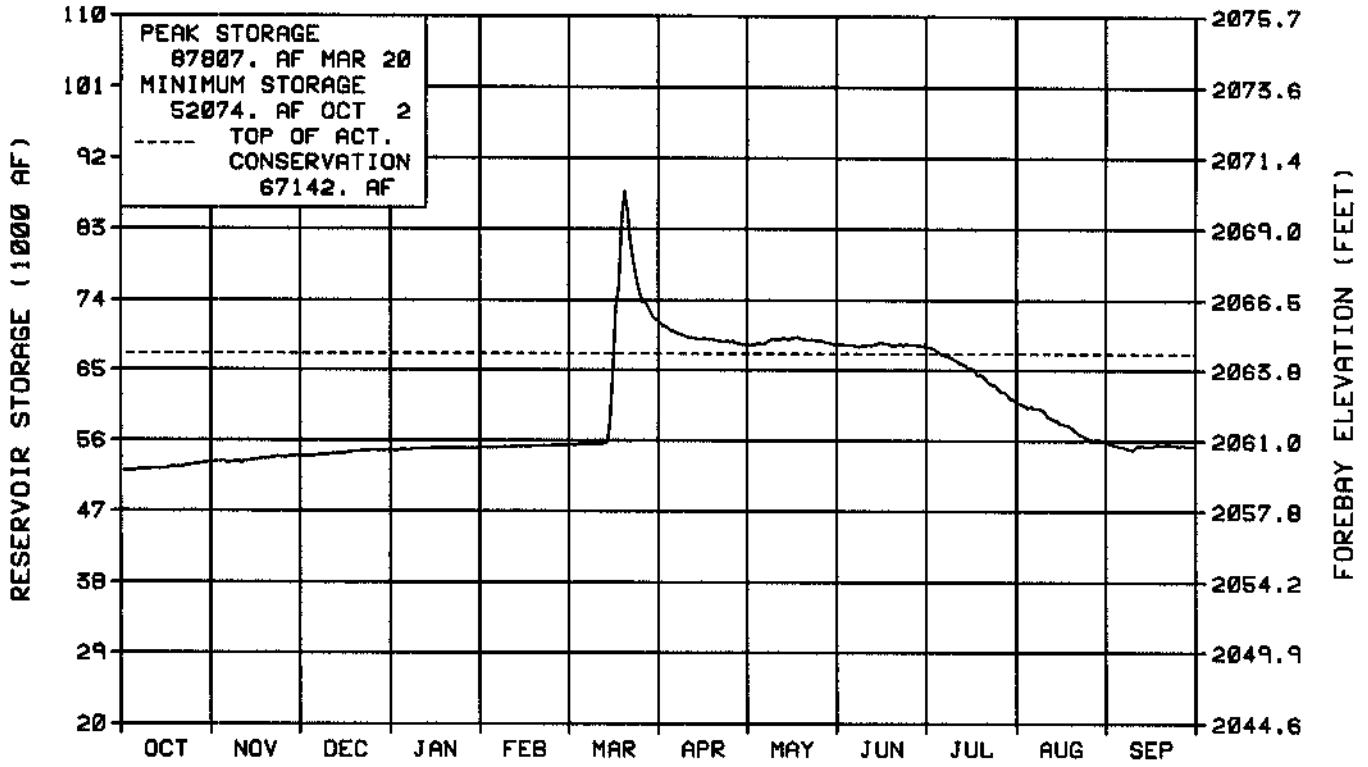
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2,059.66 | 52,188 | OCT 01, 2002 |
| END OF YEAR | 2,060.71 | 55,260 | SEP 30, 2003 |
| ANNUAL LOW | 2,059.62 | 52,074 | OCT 02, 2002 |
| ANNUAL HIGH | 2,070.32 | 87,807 | MAR 20, 2003 |
| HISTORIC HIGH | 2,086.23 | 173,203 | APR 09, 1952 |

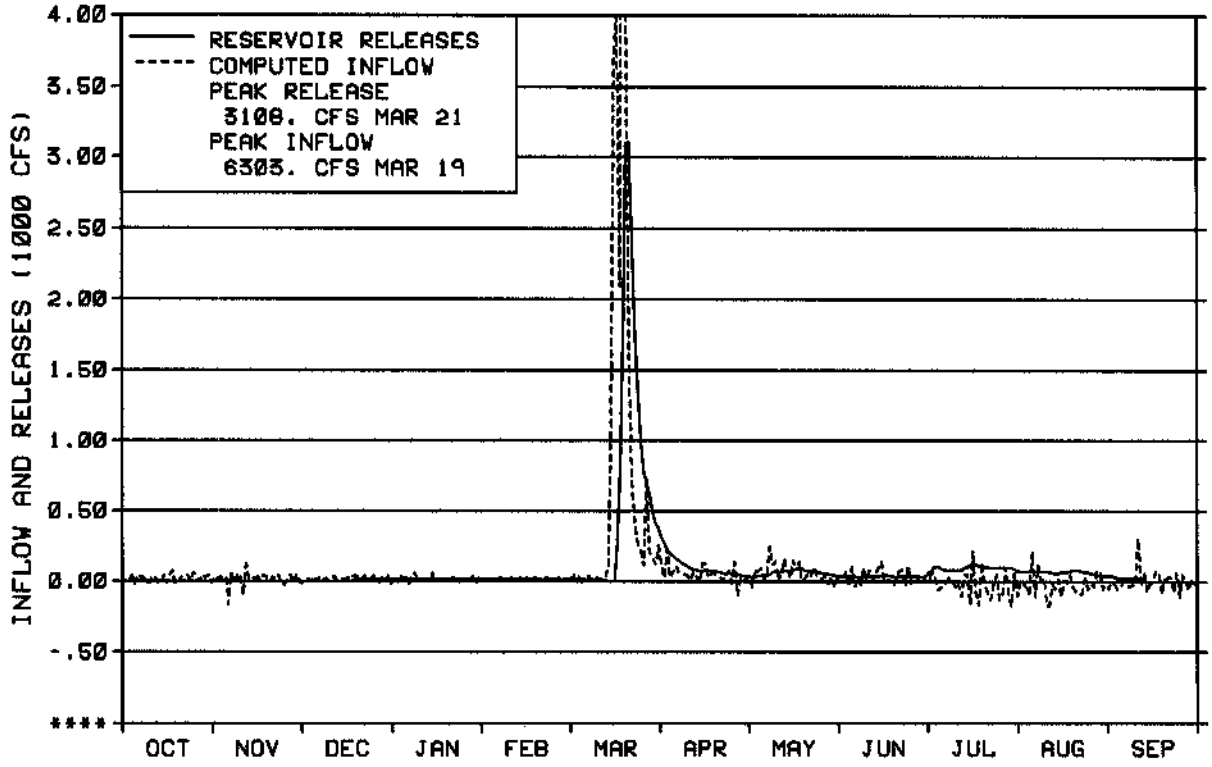
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 64,611 | OCT 02-SEP 03 | 61,540 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 6,303 | MAR 19, 2003 | 3,108 | MAR 21, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |
| PEAK SPILL (CFS) | | | 3,108 | MAR 21, 2003 |
| TOTAL SPILL (AF) | | | 49,813 | OCT 02-SEP03 |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | 1,071 | 108 | 0 | NA | 53,259 | 91 |
| NOVEMBER | 731 | 61 | 0 | NA | 53,990 | 92 |
| DECEMBER | 1,052 | 133 | 286 | 21 | 54,756 | 95 |
| JANUARY | 940 | 107 | 615 | 52 | 55,081 | 96 |
| FEBRUARY | 883 | 23 | 555 | 28 | 55,409 | 93 |
| MARCH | 54,274 | 188 | 38,180 | 208 | 71,503 | 101 |
| APRIL | 3,040 | 13 | 6,174 | 27 | 68,369 | 96 |
| MAY | 3,680 | 36 | 3,680 | 32 | 68,369 | 98 |
| JUNE | 1,798 | 17 | 1,998 | 22 | 68,169 | 96 |
| JULY | -1,489 | NA | 5,712 | 71 | 60,968 | 91 |
| AUGUST | -1,408 | NA | 3,853 | 73 | 55,707 | 88 |
| SEPTEMBER | 39 | 15 | 486 | 18 | 55,260 | 91 |
| ANNUAL | 64,611 | 73 | 61,540 | 71 | | |
| APRIL-JULY | 7,029 | 14 | | | | |

* Frequently observed during fall and winter months

# DKG3
## LAKE TSCHIDA




WATER YEAR 2003

**JAMESTOWN RESERVOIR**

BACKGROUND

Jamestown Reservoir is located on the James River above Jamestown, North Dakota. The reservoir has a dead capacity of 822 acre-feet, an active conservation capacity of 24,535 acre-feet (for a total top of active conservation capacity of 25,357 acre-feet at elevation 1428.00), a joint-use capacity of 6,153 acre-feet, and an exclusive flood control space of 189,468 acre-feet. The exclusive flood control storage is below the crest of an ungated glory-hole spillway, and flood control releases are controlled by the gated outlets. The joint-use space is available for flood control at the beginning of spring runoff and is used for conservation purposes during the summer months.

The Corps of Engineers is in the process of rewriting their Water Control Manual for operations of Jamestown and Pipestem Reservoirs. Flood control operations of Jamestown Reservoir are conducted in accordance with the "Jamestown Reservoir and Pipestem Reservoir, Water Control Plan Review and Update" report dated July 2000. As shown in the report, Flexible Plan B has been selected as the preferred Water Control Plan. A detailed description of Flexible Plan B will be included in the Jamestown Water Control Manual. The plan provides for coordinated releases from Jamestown Reservoir and Pipestem Reservoir, a Corps of Engineers project.

WATER YEAR 2003 OPERATIONS SUMMARY

The water surface elevation of Jamestown Reservoir at the beginning of water year 2003 was 1430.21 feet with storage of 29,779 acre-feet, which is 2.21 feet, and 4,422 acre-feet above the top of the conservation pool (elevation 1428.00). Jamestown Reservoir peaked at elevation 1432.47 feet on May 22nd with 35,038 acre-feet of storage. The reservoir elevation on September 30, 2003 was 1430.23 with storage of 29,823 acre-feet, which is 2.23 feet, and 4,466 acre-feet above the top of active conservation pool.

The maximum discharge of 200 CFS occurred on May 30th. Reservoir net inflows for water year 2003 totaled 31,356 acre-feet, 72 percent of average. Precipitation for the water year totaled 15.00 inches at 89 percent of average.

MONTHLY STATISTICS FOR WATER YEAR 2003

Record and near record inflows were recorded in the following months:

January's inflow was its 2nd lowest January in 50 years of record
June's inflow was its 8th lowest June in 50 years of record
July's inflow was its 9th lowest July in 50 years of record
August's inflow was its 7th lowest August in 50 years of record
February's inflow was its 7th lowest September in 50 years of record

Record end of month content was recorded in the following months:

No record end of month content was recorded at Jamestown Reservoir in Water Year 2003.

Additional statistical information on Jamestown Reservoir and its operations during 2003 can be found on Table DKT5 and Figure DKG4.

TABLE DKT5
HYDROLOGIC DATA FOR 2003
JAMESTOWN RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 1,400.00 | 822 | 822 |
| TOP OF ACTIVE CONSERVATION | 1,428.00 | 25,357 | 24,535 |
| TOP OF JOINT USE | 1,431.00 | 31,510 | 6,153 |
| TOP OF EXCLUSIVE FLOOD CONTROL | 1,454.00 | 220,978 | 189,468 |

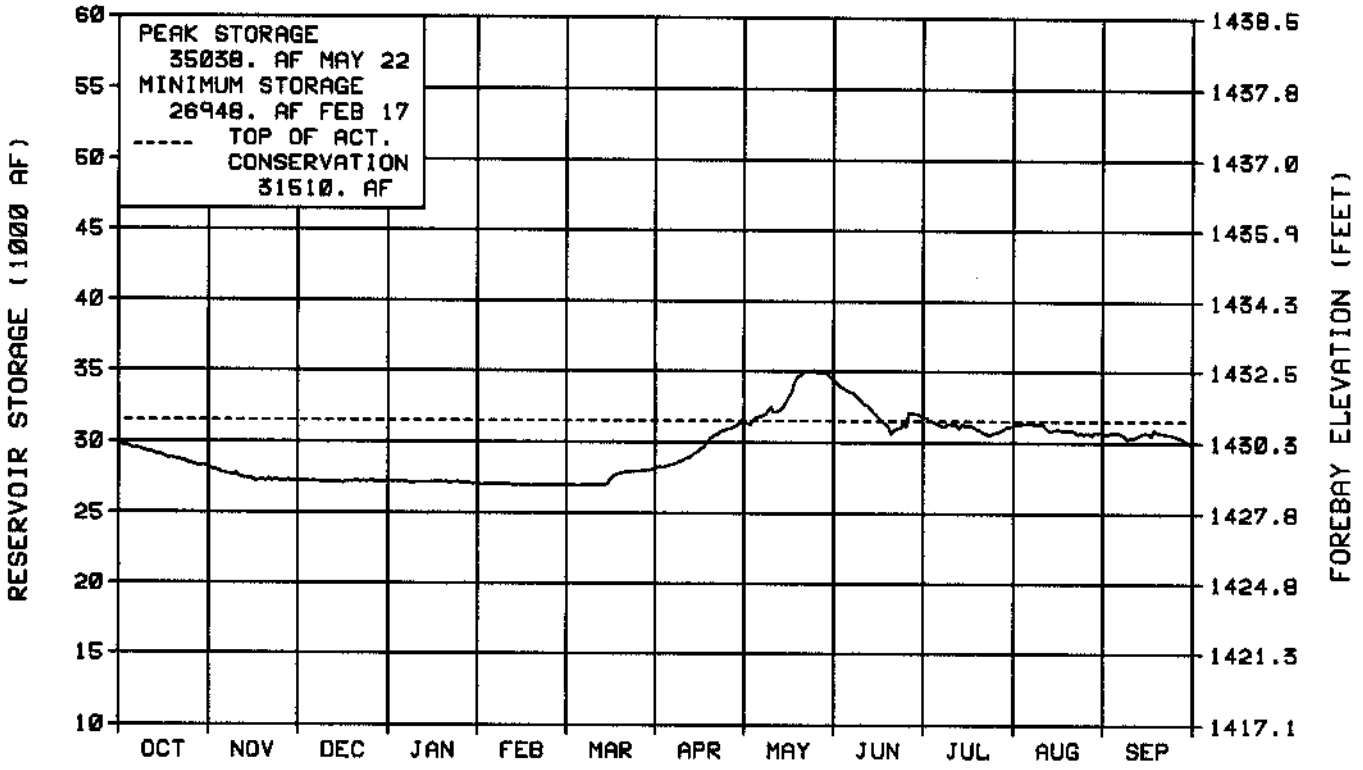
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 1,430.21 | 29,779 | OCT 01, 2002 |
| END OF YEAR | 1,430.23 | 29,823 | SEP 30, 2003 |
| ANNUAL LOW | 1,428.83 | 26,948 | FEB 17, 2003 |
| ANNUAL HIGH | 1,432.47 | 35,038 | MAY 22, 2003 |
| HISTORIC HIGH | 1,445.91 | 126,067 | MAY 05, 1997 |

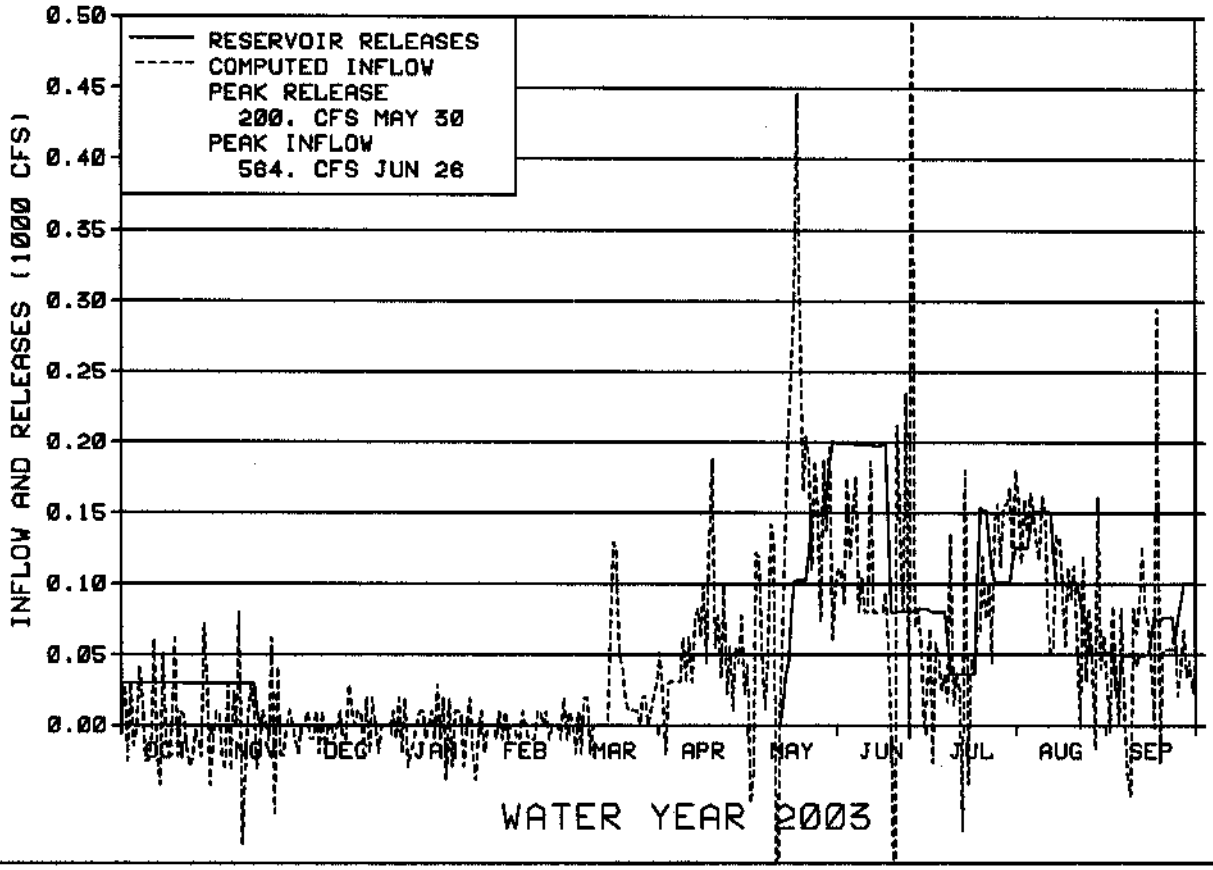
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 31,358 | OCT 02-SEP 03 | 31,542 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 564 | JUNE 26, 2003 | 200 | MAY 30, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | 65 | 8 | 1,851 | 85 | 28,112 | 114 |
| NOVEMBER | -136 | NA | 849 | 86 | 27,236 | 111 |
| DECEMBER | 0 | NA | 0 | NA | 27,236 | 111 |
| JANUARY | -192 | NA | 0 | NA | 27,044 | 111 |
| FEBRUARY | -58 | NA | 0 | NA | 26,986 | 110 |
| MARCH | 1,146 | 18 | 0 | NA | 28,133 | 93 |
| APRIL | 3,224 | 18 | 0 | NA | 31,357 | 76 |
| MAY | 7,666 | 113 | 4,563 | 43 | 34,459 | 91 |
| JUNE | 6,280 | 250 | 8,878 | 130 | 31,862 | 96 |
| JULY | 4,481 | 157 | 5,139 | 106 | 31,203 | 99 |
| AUGUST | 5,900 | 220 | 6,404 | 140 | 30,699 | 104 |
| SEPTEMBER | 2,980 | 336 | 3,857 | 104 | 29,823 | 112 |
| ANNUAL | 31,358 | 74 | 31,542 | 75 | | |
| APRIL-JULY | 21,651 | 71 | | | | |

* Frequently observed during fall and winter months

# DKG4
## JAMESTOWN RESERVOIR



## DEERFIELD RESERVOIR

BACKGROUND

Deerfield Reservoir is located on Castle Creek, a tributary of Rapid Creek above Rapid City. Deerfield Reservoir (Rapid Valley Project) and Pactola Reservoir (Rapid Valley Unit, P-S MBP), furnish a supplemental irrigation supply to about 8,900 acres in the Rapid Valley Water Conservancy District and furnish replacement water for a portion of the water used from Rapid Creek by Rapid City. The majority of prior rights to the flows of Rapid Creek during the irrigation season are held by individuals and ditch companies in the Rapid Valley Water Conservancy District.

In 1985, Deerfield Dam was modified to accommodate a larger flood as determined from the results of the Probable Maximum Flood analysis. These modifications consisted of raising the crest of the dam 38 feet, excavating an unlined auxiliary spillway, removing and filling in the old spillway, and extending the existing emergency gate passageway to the new control house at the higher crest elevation. The reservoir has a total capacity of 15,655 acre-feet with an additional 26,655 acre-feet of surcharge capacity.

During the winter of 95-96 the hollow jet valves were removed to allow the installation of the jet flow valves as part of the outlet works modification contract. The work was done to improve fish habitat in 1.5 miles of the creek immediately downstream of the dam. The stream improvement project was a cooperative effort accomplished by the City of Rapid City, Rapid Valley Water Conservancy District, Black Hills Fly Fishers, Bureau of Reclamation, US Forest Service, and SD Game Fish and Parks. The project was to modify the outlet works of Deerfield Dam by installing Jet Flow Gates to allow greater minimum winter releases than the 6-in bypass is capable of providing.

WATER YEAR 2003 OPERATIONS SUMMARY

Inflows for Deerfield reservoir were near average for water year 2003. The water year began with 15,056 acre-feet of storage, at elevation 5906.55. Water year 2003 ended with Deerfield at elevation 5906.84 and storage content of 15,176 acre-feet. This was the 2nd highest end of water year content in 51 years of record. The high end of water year contents occur now because of the installation of the jet flow gates has allowed for higher winter releases, therefore Deerfield Reservoir is positioned higher before winter freeze up of Castle Creek. Inflows for WY2003 totaled 9,666 acre-feet (98% of the average). The peak reservoir elevation for the year was 5907.74 on April 15 with 15,554 acre-feet of storage.

Rapid Valley Water Conservancy District ordered 3,268 acre feet of water from Deerfield for the 2003 irrigation season.

The Periodic Facility Review was done on September 17, 2003 by personnel from the Rapid City Field Office, the Regional Office in Billings and the City of Rapid City.

The annual Emergency Management/Security orientation was conducted on March 26, 2003.

MONTHLY STATISTICS FOR WATER YEAR 2003

October inflow was above average. October EOM elevation at Deerfield Reservoir was 3rd highest in 50 years of record. Winter release set at 12 cfs. Deerfield finished the month 1.3 feet from full.

November inflow was below average. November EOM elevation at Deerfield Reservoir was 7th highest in 50 years of record. Winter release at 12 cfs. Deerfield finished the month 2.2 feet from full.

December inflow was near average. December EOM elevation at Deerfield Reservoir was much above average. Winter release at 12 cfs. Deerfield finished the month 2.4 feet from full.

January inflow was much below average. January EOM elevation at Deerfield Reservoir was below average. Winter release at 12 cfs. Deerfield finished the month 3.2 feet from full.

February inflow was below average. February EOM elevation at Deerfield Reservoir was above average. Winter release at 12 cfs. Deerfield finished the month 1.5 feet from full.

March inflow was 6$^{th}$ highest in 50 years of record. March EOM elevation at Deerfield was above average. Winter release at 10 cfs. Deerfield finished the month 1.7 feet from full.

April inflow was above average. April EOM elevation at Deerfield was above average. Releases are at 30 cfs. Deerfield finished the month 0.2 feet from full.

May inflow was below average. May EOM elevation at Deerfield Reservoir was above average. Releases are at 15 cfs. Deerfield finished the month 0.2 feet from full.

June inflow was below average. June EOM elevation at Deerfield Reservoir was above average. Releases are at 20 cfs. Deerfield finished the month 0.4 feet from full.

July inflow was below average. July EOM elevation at Deerfield Reservoir was above average. Releases are at 10 cfs. Deerfield finished the month 0.8 feet from full.

August inflow was below average. August EOM elevation at Deerfield Reservoir was above average. Releases are at 10 cfs. Deerfield finished the month 1.0 feet from full.

September EOM elevation at Deerfield Reservoir was 2$^{nd}$ highest in 50 years of record. September inflow was below average. Releases are at 10 cfs. Deerfield finished the month 1.2 feet from full. PFR done September 17.

Additional statistical information on Deerfield reservoir and its operations during 2003 can be found on Table DKT6 and Figure DKG5.

TABLE DKT6
HYDROLOGIC DATA FOR 2003
DEERFIELD RESERVOIR

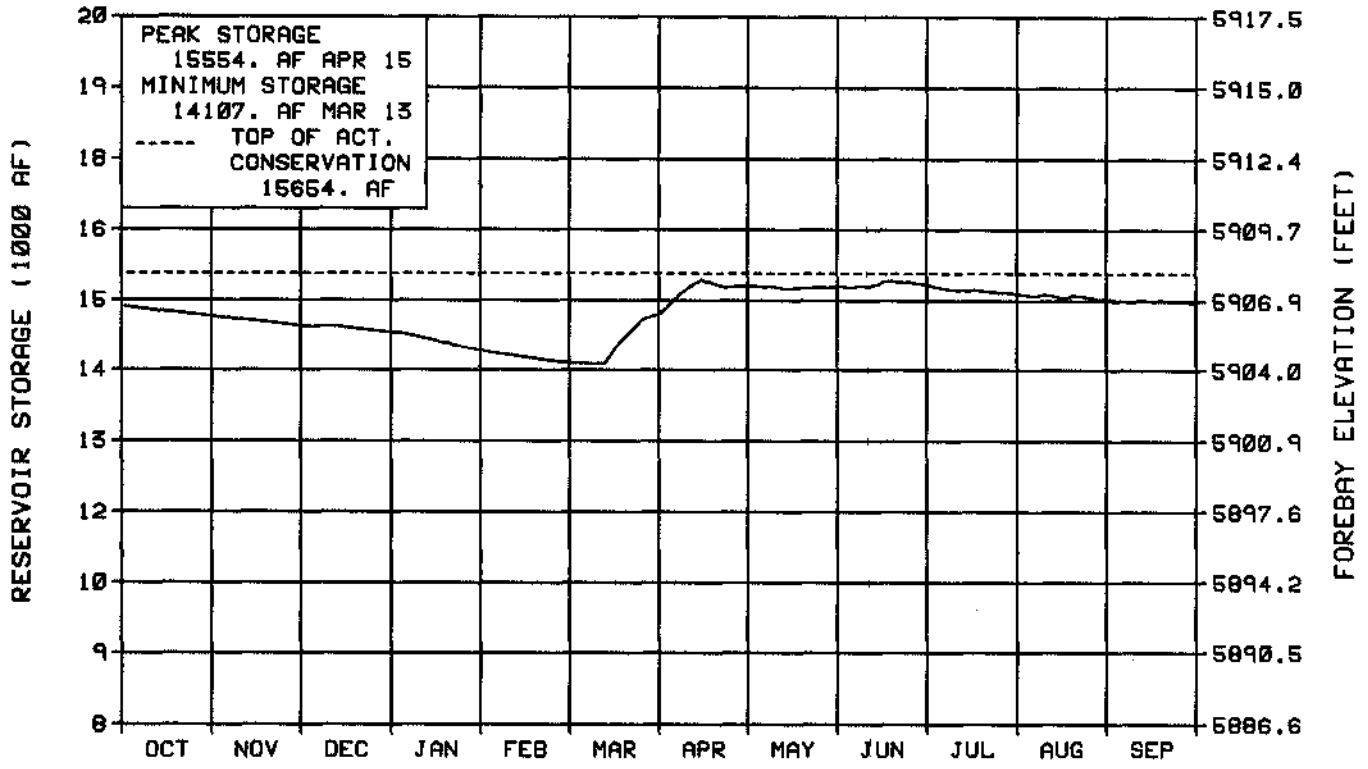
| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 5,839.00 | 151 | 151 |
| TOP OF ACTIVE CONSERVATION | 5,908.00 | 15,655 | 15,504 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | | | |

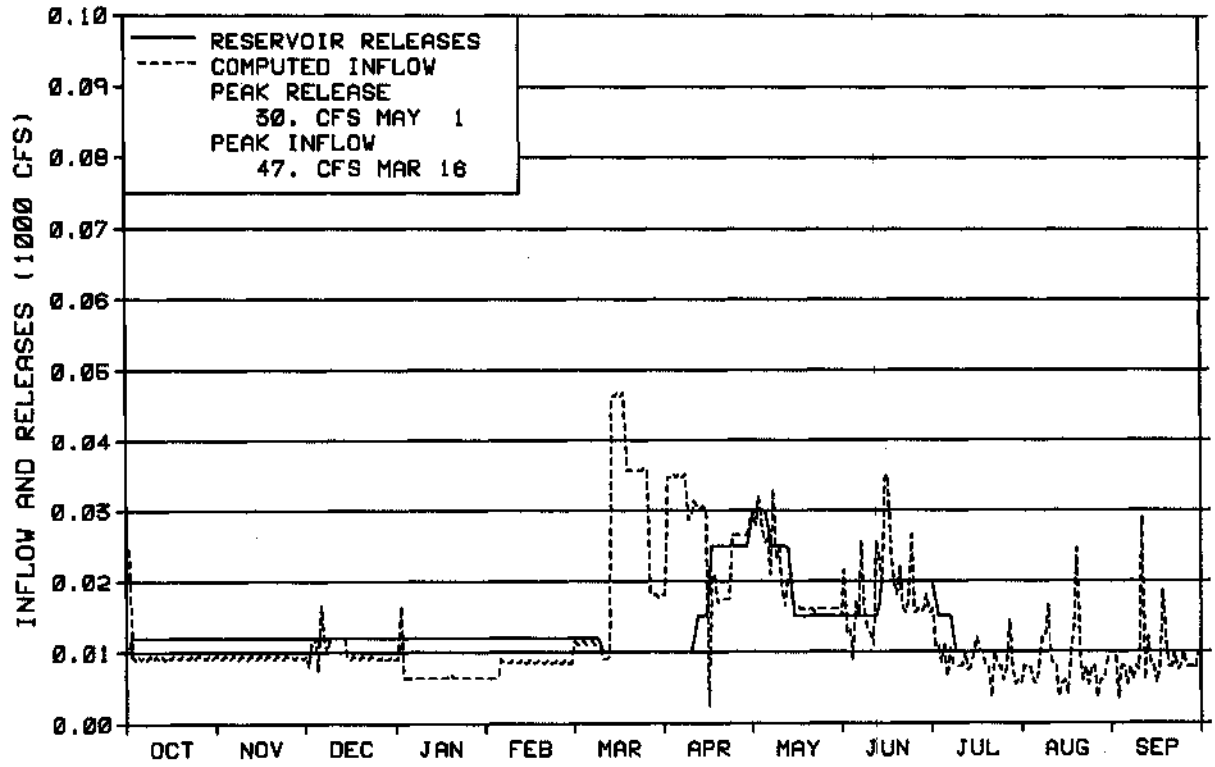
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 5,906.55 | 15,056 | OCT 01, 2002 |
| END OF YEAR | 5,906.84 | 15,176 | SEP 30, 2003 |
| ANNUAL LOW | 5,904.22 | 14,107 | MAR 13, 2003 |
| ANNUAL HIGH | 5,907.74 | 15,554 | APR 15, 2003 |
| HISTORIC HIGH | 5,909.05 | 16,157 | FEB 25, 1985 |

| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 9,666 | OCT 02-SEP 03 | 9,546 | OCT 02-SEP03 |
| DAILY PEAK (CFS) | 47 | MAR 16, 2003 | 30 | MAY 1-5, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 10 | * |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | 602 | 90 | 735 | 95 | 14,923 | 123 |
| NOVEMBER | 554 | 92 | 714 | 227 | 14,763 | 119 |
| DECEMBER | 623 | 98 | 738 | 280 | 14,648 | 114 |
| JANUARY | 418 | 66 | 738 | 280 | 14,328 | 109 |
| FEBRUARY | 466 | 80 | 666 | 235 | 14,128 | 105 |
| MARCH | 1,482 | 171 | 653 | 113 | 14,957 | 109 |
| APRIL | 1,570 | 131 | 1,078 | 101 | 15,449 | 111 |
| MAY | 1,229 | 90 | 1,246 | 94 | 15,432 | 111 |
| JUNE | 1,111 | 90 | 1,065 | 84 | 15,478 | 111 |
| JULY | 539 | 62 | 703 | 60 | 15,314 | 113 |
| AUGUST | 528 | 76 | 615 | 48 | 15,227 | 117 |
| SEPTEMBER | 544 | 88 | 595 | 47 | 15,178 | 123 |
| ANNUAL | 9,666 | 98 | 9,546 | 98 | | |
| APRIL-JULY | 4,449 | 95 | | | | |

# DKG5
## DEERFIELD RESERVOIR




WATER YEAR 2003

## PACTOLA RESERVOIR

### BACKGROUND

Pactola Reservoir, Rapid Valley Unit (P-S MBP), located on Rapid Creek above Rapid City, South Dakota, acts in conjunction with Deerfield Reservoir, Rapid Valley Project, to furnish a supplemental irrigation supply to about 8,900 acres in the Rapid Valley Water Conservancy District, replacement water for Rapid City, and a supply of domestic water for private water systems both above and below the city. The reservoir is also operated to provide flood control. It has a conservation capacity of 55,972 acre-feet (54,955 acre-feet active) and 43,057 acre-feet of exclusive flood control space. The flood control space is all below the ungated spillway crest, and releases in this pool are controlled by the river outlet works. Rapid City has contracts for Pactola and Deerfield Reservoir water. The Rapid Valley Sanitation District and C&J Sanders Water Company also have contracts for water service from Pactola Reservoir. Operation of the two reservoirs is integrated to maintain as much water as possible in the upstream facility, Deerfield Reservoir, and at the same time maintain a uniform outflow from Deerfield to maximize fishery benefits in the stream between the reservoirs. Since no inflow forecasts are available, the reservoir is normally operated as full as possible. Two Snowtel (North Rapid Creek and Blind Park) sites were installed in the Pactola and Deerfield drainage basin in May of 1990.

As part of the Safety Examination of Existing Structures (Safety of Dams) Program, a study was made in the early 1980's to determine the adequacy of Pactola Dam, Spillway, and Reservoir to safely pass the new Inflow Design Flood (IDF) determined on the basis of present day hydrologic technology. The studies showed that the facility was not able to safely handle the new IDF. Modification work was completed in 1987 and provided sufficient surcharge storage and spillway capacity to pass the IDF. Modification work consisted of raising the crest of the dam 15 feet, widening the existing rock-cut spillway chute and stilling basin from 240 feet to 425 feet, relocating Highway 385 to the new dam crest, extending the existing gate access shaft to the higher crest elevation, and reconstructing a new two-level gate control house at the higher crest elevation.

### WATER YEAR 2003 OPERATIONS SUMMARY

Storage in Pactola Reservoir at the beginning of the year was 46,233 acre-feet at elevation 4568.00, which is 9,739 acre-feet and 12.2 feet below the top of the conservation pool. The inflows for water year 2003 were 80 percent of average and totaled 28,810 acre-feet.

The water year maximum storage of 56,415 acre-feet occurred on June 17, 2003 and the annual minimum storage of 46,247 acre-feet occurred on October 1, 2002. At the end of WY 2003, storage was 48,061 acre-feet at elevation 4570.44 ft, 7,939 acre-feet and 9.8 ft below the top of the conservation pool.

The annual Emergency Management/Security review was held on March 26, 2003.

The Periodic Facility Review was done on September 16, 2003 by personnel from the Rapid City Field Office, the Regional Office in Billings and the City of Rapid City.
The City of Rapid City ordered 3,218 acre-feet from Pactola to meet needs over and above natural flow releases required to meet prior rights in Rapid Creek during the summer of 2003.

The operation of Pactola Reservoir provided minimal local and mainstream flood relief during WY2003. The flood plain through Rapid City is designed to pass 6,500 cfs without major property damage, but some areas of the bicycle path near Canyon Lake will inundate at 350 to 400 cfs. Spring releases from Pactola Dam peaked during mid-June at 110 cfs.

MONTHLY STATISTICS FOR WATER YEAR 2003

October inflow was below average. October EOM elevation at Pactola was above average. Winter release set at 20 cfs. Pactola ended the month 11.8 feet from full.

November inflow was below average. November EOM elevation at Pactola was above average. Winter release at 20 cfs. Pactola ended the month 10.5 feet from full.

December inflow was near average. December EOM elevation at Pactola was above average. Winter release at 20 cfs. Pactola ended the month 9.2 feet from full.

January inflow was 8$^{th}$ highest in 47 years of record. January EOM elevation at Pactola was above average. Winter release at 20 cfs. Pactola ended the month 10.9 feet from full.

February inflow was above average. February EOM elevation at Pactola was above average. Winter release at 20 cfs. Pactola ended the month 10.5 feet from full.

March inflow was above average. March EOM elevation at Pactola was above average. Winter release continues at 20 cfs. Pactola ended the month 7.9 feet from fa

April inflow was below average. April EOM elevation at Pactola was above average. Winter release continues at 20 cfs. Pactola ended the month 4.0 feet from full.

May inflow was average. May EOM elevation at Pactola Reservoir was the fifth highest in 47 years of record. Releases are at 60 cfs. Pactola ended the month full.

June inflow was below average. June EOM elevation at Pactola Reservoir was above average. Releases are at 75 cfs. Pactola ended the month 0.1 feet above the conservation pool.

July inflow was below average. July EOM elevation at Pactola Reservoir was above average. Releases are at 77 cfs. Pactola ended the month 3.7 feet from full.

August inflow was 4$^{th}$ lowest in 47 years of record. August EOM elevation at Pactola Reservoir was above average. Release is at 61 cfs. Pactola ended the month 8.5 feet from full.

September EOM elevation at Pactola Reservoir was above average. September inflow was

below average. Releases are at 30 cfs. Pactola ended the month 9.8 feet from full.

Additional statistical information on Pactola reservoir and its operations during 2003 can be found on Table DKT7 and Figure DKG6.

TABLE DKT7
HYDROLOGIC DATA FOR 2003
PACTOLA RESERVOIR

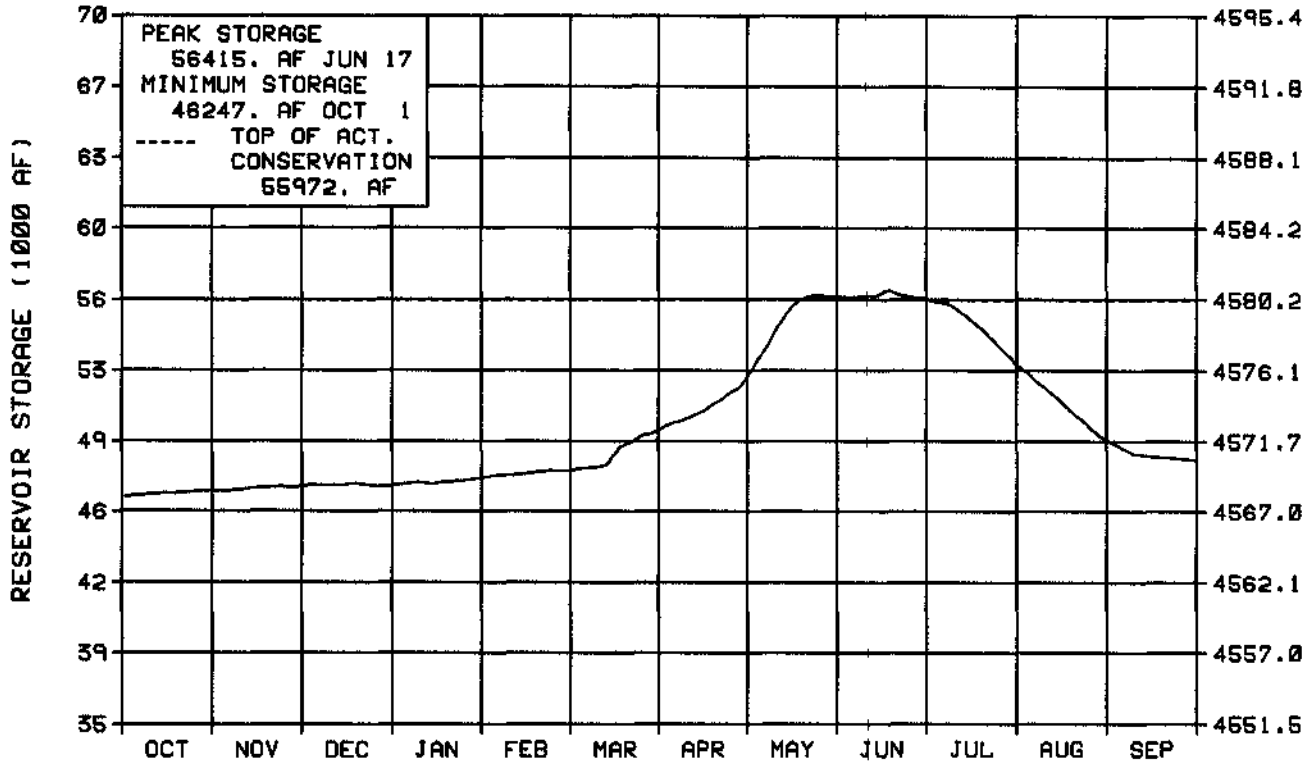
| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4,456.10 | 1,017 | 1,017 |
| TOP OF ACTIVE CONSERVATION | 4,580.20 | 55,972 | 54,955 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | 4,621.50 | 99,029 | 43,057 |

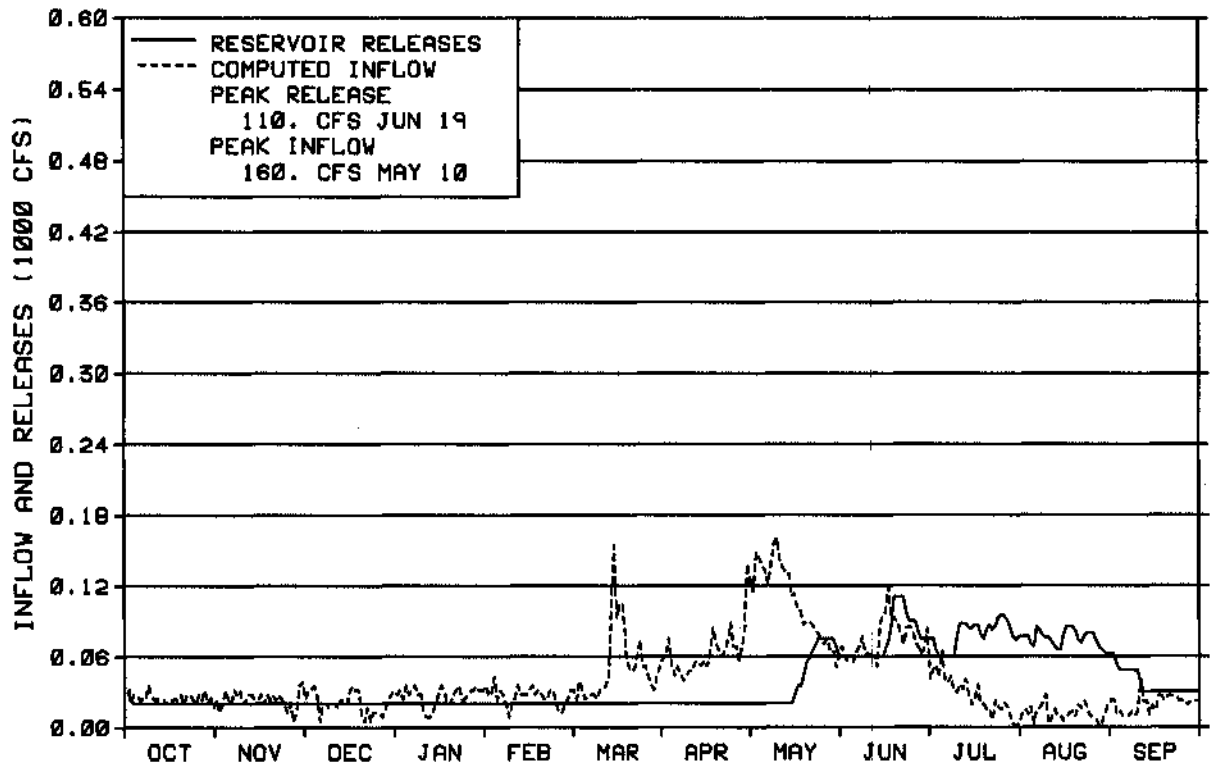
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 4,568.00 | 46,233 | OCT 01, 2002 |
| END OF YEAR | 4,570.44 | 48,061 | SEP 30, 2003 |
| ANNUAL LOW | 4,568.00 | 48,233 | OCT 01, 2002 |
| ANNUAL HIGH | 4,580.71 | 56,415 | JUN 17, 2003 |
| HISTORIC HIGH | 4,585.87 | 61,105 | MAY 19, 1965 |

| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 28,810 | OCT 02-SEP 03 | 26,982 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 160 | MAY 10, 2003 | 110 | JUN 19-22 2003 |
| DAILY MINIMUM (CFS) | 0 | AUG 27, 2003 | 20 | OCT-MAY 03 |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | 1,536 | 73 | 1,255 | 75 | 46,514 | 104 |
| NOVEMBER | 1,414 | 93 | 1,190 | 87 | 46,738 | 104 |
| DECEMBER | 1,282 | 101 | 1,230 | 88 | 46,790 | 105 |
| JANUARY | 1,641 | 126 | 1,230 | 93 | 47,201 | 106 |
| FEBRUARY | 1,442 | 107 | 1,111 | 92 | 47,532 | 106 |
| MARCH | 3,183 | 133 | 1,230 | 70 | 49,485 | 109 |
| APRIL | 3,744 | 87 | 1,190 | 40 | 52,039 | 111 |
| MAY | 6,578 | 99 | 2,512 | 45 | 56,105 | 117 |
| JUNE | 4,411 | 63 | 4,455 | 74 | 56,061 | 116 |
| JULY | 1,639 | 43 | 4,855 | 91 | 52,865 | 113 |
| AUGUST | 764 | 27 | 4,587 | 112 | 49,042 | 110 |
| SEPTEMBER | 1,177 | 50 | 2,158 | 80 | 48,061 | 108 |
| ANNUAL | 28,810 | 80 | 26,982 | 77 | | |
| APRIL-JULY | 16,372 | 76 | | | | |

# DKG6
## PACTOLA RESERVOIR




WATER YEAR 2003

## ANGOSTURA RESERVOIR

### BACKGROUND

Angostura Reservoir (P-S MBP), located on the Cheyenne River above Hot Springs, South Dakota, was built to service about 12,200 acres in the Angostura Unit (P-S MBP) and for power generation. It has a total capacity of 130,700 acre-feet with an additional surcharge capacity of 56,400 acre-feet. Its principle use is for irrigation of the Angostura Unit, which diverts its water from a high-level outlet at the dam. In the early years, water surplus to irrigation needs was released to the river through a small power plant with a nameplate eapacity of 1,200 kilowatts. Because of the low runoff, and because actual irrigation diversions were higher than previously anticipated, it was concluded that continued operation of the power plant was economically infeasible. Except for a few operations of less than 24 hours each, the plant was last operated in February 1959. In 1966, the plant was officially closed and the equipment was declared surplus in March 1968. Disposal of this equipment was completed in 1971. Releases for irrigation are made through the canal outlet works into the Angostura Main Canal having a design capacity of 290 cfs. Releases to the Cheyenne River are only made when the reservoir is assured of filling.

### WATER YEAR 2003 OPERATIONS SUMMARY

Angostura began WY2003 at an elevation of 3173.70 ft and storage of 78,232 acre-feet. Total inflows for the water year were 42,783 acre-feet (52 % of average). Peak inflows occurred in March totaling 16,920 acre-feet for the month.

Water users were allocated full allotments of project water. Releases for irrigation began May 22 and reached a peak of 281 cfs on August 15. The irrigation release was terminated on September 12, with 81,712 acre-feet remaining in storage. Total irrigation releases were 39,139 acre-feet. Storage on September 30, 2003 was 81,877 acre-feet at elevation 3174.82, which is 48,823 acre-feet and 12.38 ft below the top of conservation pool.

The Angostura Dam Spillway and Outlet Works Rehabilitation Contract (specifications no. 60-00445) was started in April 2002. The contract was awarded in February of 2002 to Construction Engineers, LTD of Grand Forks, ND. Principal work items in the contract were as follows: 1) painting of the spillway radial gates, 2) replacement of the spillway radial gate hoist cables and associated hardware, 3) replacement of the existing cathodic protection systems, 4) repair of deteriorated concrete in the spillway, 5) replacement of the fixed-wheel gate hoists and hoist frames for the canal and river outlets, 6) rehabilitation of the fixed-wheel gates for the canal and river outlets, 7) rehabilitation of the superstructure on the spillway, and 8) rehabilitation of the canal outlet pipe. Final completion of the contract was in May of 2003.

The Angostura Dam River Outlet Works Modification Contract (specifications no. 03S1602350) was bid in May of 2003 with work starting in August of 2003. Principal work items in the contract are: 1) furnishing and installing engine-generator system fOr use as a standby generator for the dam, 2) Installation of the new river outlet works control house with 48-inch-jet-flow gate, hydraulic control system and river outlet works pipe. Completion of the contract is scheduled for the spring of 2004.

Annual Emergency Management/Security orientation was conducted on March 24, 2003. The Periodic Facility Review was done on May 13, 2003 by personnel from the Rapid City Field Office, the Regional Office in Billings and the Angostura Irrigation District.

MONTHLY STATISTICS FOR WATER YEAR 2003

October inflow at Angostura Reservoir was below average. October EOM elevation was below average. Angostura ended the month 13.3 feet from full.

November inflow at Angostura Reservoir was slightly below average. November EOM elevation was much below average. Angostura ended the month 12.6 feet from full. Rehab is nearing completion on radial gates.

December inflow at Angostura Reservoir was above average. December EOM elevation was much below average. Angostura ended the month 12.0 feet from full. Rehab completed on radial gates in December.

January inflow at Angostura Reservoir was above average. January EOM elevation was below average. Angostura ended the month 11.2 feet from full.

February inflow at Angostura Reservoir was below average. February EOM elevation was much below average. Angostura ended the month 10.4 feet from full.

March inflow at Angostura Reservoir was above average. March EOM elevation was slightly below average. Angostura ended the month 5.9 feet from full.

April inflow at Angostura Reservoir was slightly below average. April EOM elevation was below average. Angostura ended the month 5.1 feet from full.

May inflow at Angostura Reservoir was below average. May end-of-month (EOM) elevation was below average. Angostura ended the month 4.6 feet from full. The District began filling the canal on May 22, 2003.

June inflow at Angostura Reservoir was below average. June end-of-month (EOM) elevation was slightly above average. Angostura ended the month 3.5 feet from full.

July inflow at Angostura Reservoir was 8$^{th}$ lowest in 51 years of record. July end-of-month (EOM) elevation was below average. Angostura ended the month 7.5 feet from full.

August inflow and August end-of-month (EOM) elevation, at Angostura Reservoir, were below average. Angostura ended the month 11.7 feet from full.

September end-of-month (EOM) elevation and September inflow at Angostura Reservoir were below average. Angostura ended the month 12.4 feet from full. Irrigation releases ended September 12.

Additional statistical information on Angostura reservoir and its operations during 2003 can be found on Table DKT8 and Figure DKG7.

TABLE DKT8
HYDROLOGIC DATA FOR 2003
ANGOSTURA RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 3,163.00 | 48,325 | 48,325 |
| TOP OF ACTIVE CONSERVATION | 3,187.20 | 130,768 | 82,443 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | | | |

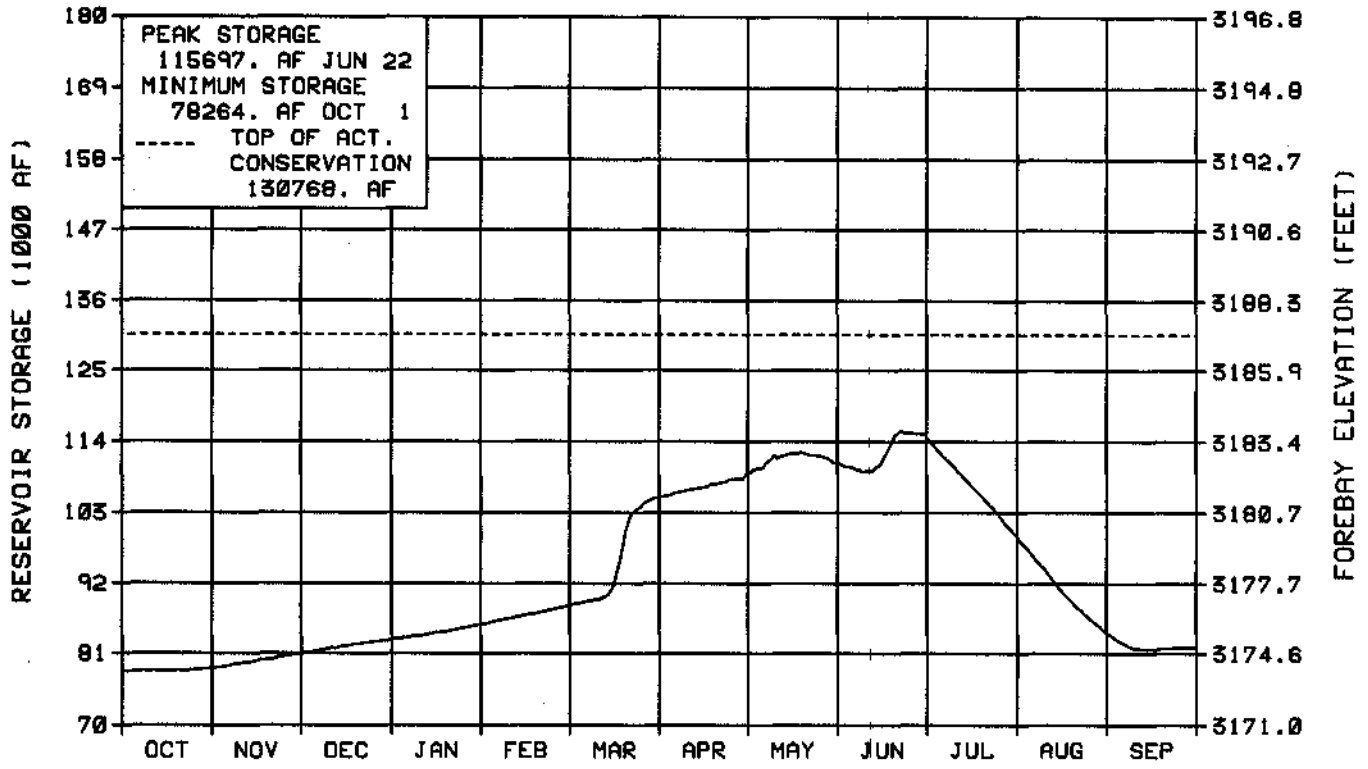
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 3,173.70 | 78,232 | OCT 01, 2002 |
| END OF YEAR | 3,174.82 | 81,877 | SEP 30, 2003 |
| ANNUAL LOW | 3,173.70 | 78,232 | OCT 01, 2002 |
| ANNUAL HIGH | 3,183.78 | 115,697 | JUN 22, 2003 |
| HISTORIC HIGH | 3,189.37 | **152,228 | MAY 20, 1978 |

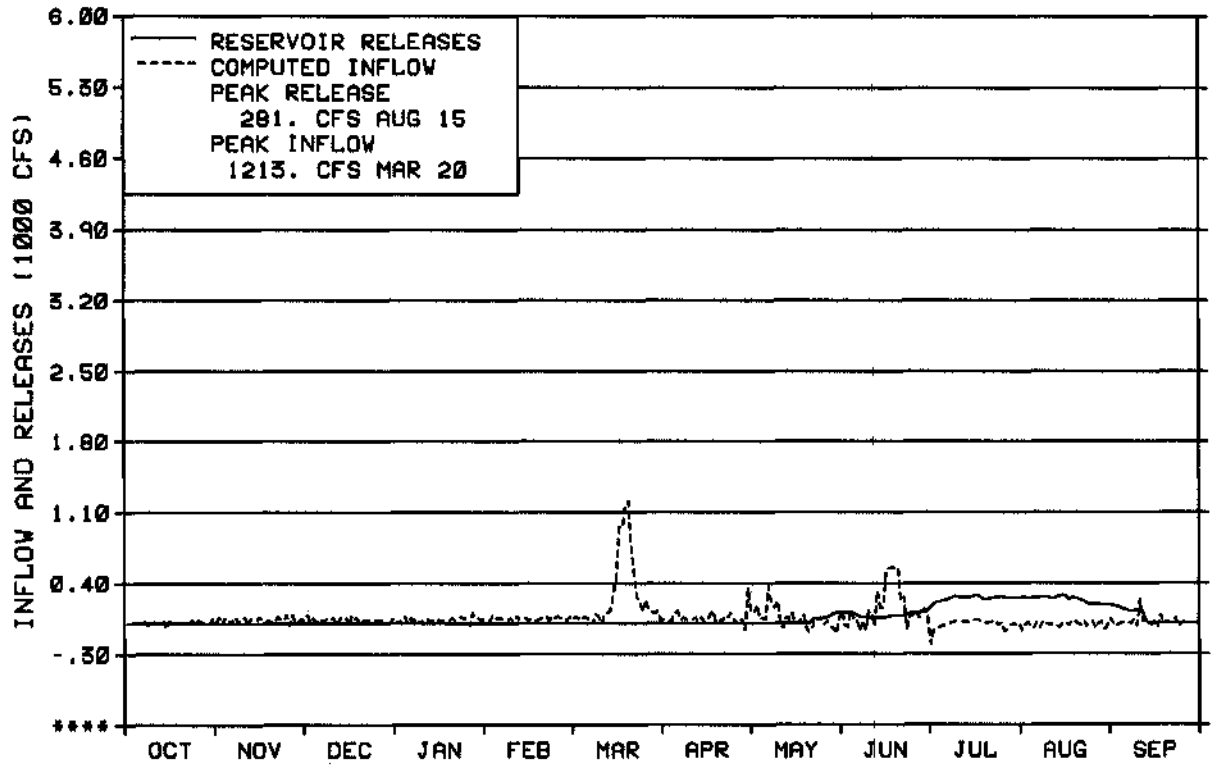
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 42,783 | OCT 02-SEP 03 | 39,139 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 1,213 | MAR 20, 2003 | 281 | AUG 15, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | 547 | 32 | 0 | NA | 78,779 | 76 |
| NOVEMBER | 2,209 | 96 | 0 | NA | 80,989 | 78 |
| DECEMBER | 2,284 | 129 | 0 | NA | 83,272 | 79 |
| JANUARY | 2,435 | 118 | 0 | NA | 85,707 | 80 |
| FEBRUARY | 2,772 | 61 | 0 | NA | 88,479 | 80 |
| MARCH | 16,920 | 144 | 0 | NA | 105,399 | 89 |
| APRIL | 3,460 | 42 | 0 | NA | 108,858 | 89 |
| MAY | 3,151 | 17 | 1,395 | 10 | 110,616 | 87 |
| JUNE | 9,565 | 46 | 5,032 | 24 | 115,148 | 91 |
| JULY | -680 | NA | 15,128 | 91 | 99,341 | 84 |
| AUGUST | -641 | NA | 14,487 | 108 | 84,212 | 78 |
| SEPTEMBER | 762 | 67 | 3,097 | 53 | 81,877 | 80 |
| ANNUAL | 42,783 | 51 | 39,139 | 47 | | |
| APRIL-JULY | 15,496 | 28 | | | | |

* Frequently observed during fall and winter months
** Due to new area-capacity table, the capacity that corresponds to the new historic high elevation is less than a previous high capacity amount (169,020 AF @ Elevation 3189.0 on June 18, 1962)

# DKG7
## ANGOSTURA RESERVOIR




WATER YEAR 2003

## KEYHOLE RESERVOIR

### BACKGROUND

Keyhole Reservoir (P-S MBP) located on the Belle Fourche River below Moorcroft, Wyoming, has a conservation capacity of 193,753 acre-feet (185,801 acre-feet active) and 140,462 acre-feet of exclusive flood control space. It was constructed to furnish a supplemental irrigation supply to 57,000 acres in the Belle Fourche Project and for flood control. Keyhole Reservoir is subject to the Belle Fourche River Compact, and the inflows and storage in the reservoir are allocated 10 percent to Wyoming users and 90 percent to South Dakota users, subject to prior rights. On January 3, 1963, the Belle Fourche Irrigation District executed a long-term contract for the use of 7.7 percent of active storage space in the reservoir. This space will be used to store water belonging to the irrigation district under its prior water right along with the District's pro rata share of storable inflows to Keyhole Reservoir. On January 1, 198$, the Crook County Irrigation District's contract for 18,080 acre-feet of space in Keyhole Reservoir became effective. The allocated space is used by each organization to store its pro rata share of inflows to Keyhole Reservoir. The flood control space at Keyhole Reservoir is all located above an ungated spillway. The spillway capacity is 11,000 cfs at maximum water surface elevation. The downstream safe channel capacity is 3,000 cfs. Formulas for forecasting inflows have not been developed. Research by the Soil Conservation Service during water years 1992 through 1994 show that inflow forecasting to Keyhole Reservoir is not reliable since there is no consistent snow pack and precipitation is highly cyclical. No further efforts to develop forecast models are planned.

### WATER YEAR 2003 OPERATIONS SUMMARY

Keyhole reservoir started the water year with an elevation of 4089.39 and storage of 116,993 acre-feet. Inflows for water year 2003 totaled 10,823 acre-feet. Average inflows for a water year are 16,918 acre-feet. On July 1, 2003 Keyhole reached its peak elevation for the water year of 2003 at elevation 4092.32, 6.98 feet below top of conservation.

Keyhole ended the water year at an elevation of 4088.45 ft, with storage of 111,347 acre-feet, 10.85 feet and 82,406 acre-feet below top of conservation.

Annual Emergency Management/Security orientation was April 9, 2003.

Irrigation releases occurred during July, August, and September with Crook County Irrigation District taking 651 acre-feet and the Belle Fourche Irrigation District ordering 15,744 acre-feet.

The Annual Facility Review was done on October 15, 2003 by personnel from the Rapid City Field Office.

MONTHLY STATISTICS FOR WATER YEAR 2003

October inflow at Keyhole Reservoir was below average. October EOM elev. was above average. Keyhole finished the month 10.1 feet from full.

November inflow at Keyhole Reservoir was near average. November EOM elev. was above average. Keyhole finished the month 10.2 feet from full.

December inflow at Keyhole Reservoir was below average. December EOM elev. was above average. Keyhole finished the month 10.1 feet from full.

January inflow at Keyhole Reservoir was 8th highest in 51 years of record. January EOM elevation was above average. Keyhole finished the month 10.0 feet from full.

February inflow at Keyhole Reservoir was below average. February EOM elevation was above average. Keyhole finished the month 9.9 feet from full.

March inflow at Keyhole Reservoir was much above average. March EOM elevation was above average. Keyhole finished the month 7.7 feet from full.

April inflow at Keyhole Reservoir was below average. April EOM elevation was above average. Keyhole finished the month 7.9 feet from full.

May inflow at Keyhole Reservoir was below average. May EOM elevation was above average. Keyhole finished the month 7.7 feet from full.

June inflow at Keyhole Reservoir was above average. June EOM elevation was above average. Keyhole finished the month 7.0 feet from full.

July inflow at Keyhole Reservoir was much below average. July EOM elevation was above average. Keyhole finished the month 8.6 feet from full. Irrigation release began July 2", currently at 140 cfs.

August inflow, at Keyhole Reservoir, was 8th lowest in 51 years of record. August EOM elevation was below average. Keyhole finished the month 10.5 feet from full. Irrigation release began July 2nd, currently at 101 cfs.

September EOM elevation was above average at Keyhole Reservoir. September inflow was above average. Keyhole finished the month 10.9 feet from full. Irrigation releases ended September 8.

Additional statistical information on Keyhole Reservoir and its operations during 2003 can be found on Table DKT9 and Figure DKG8.

TABLE DKT9
HYDROLOGIC DATA FOR 2003
KEYHOLE RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 4,051.00 | 7,952 | 7,952 |
| TOP OF ACTIVE CONSERVATION | 4,099.30 | 193,753 | 185,801 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | 4,111.50 | 334,215 | 140,462 |

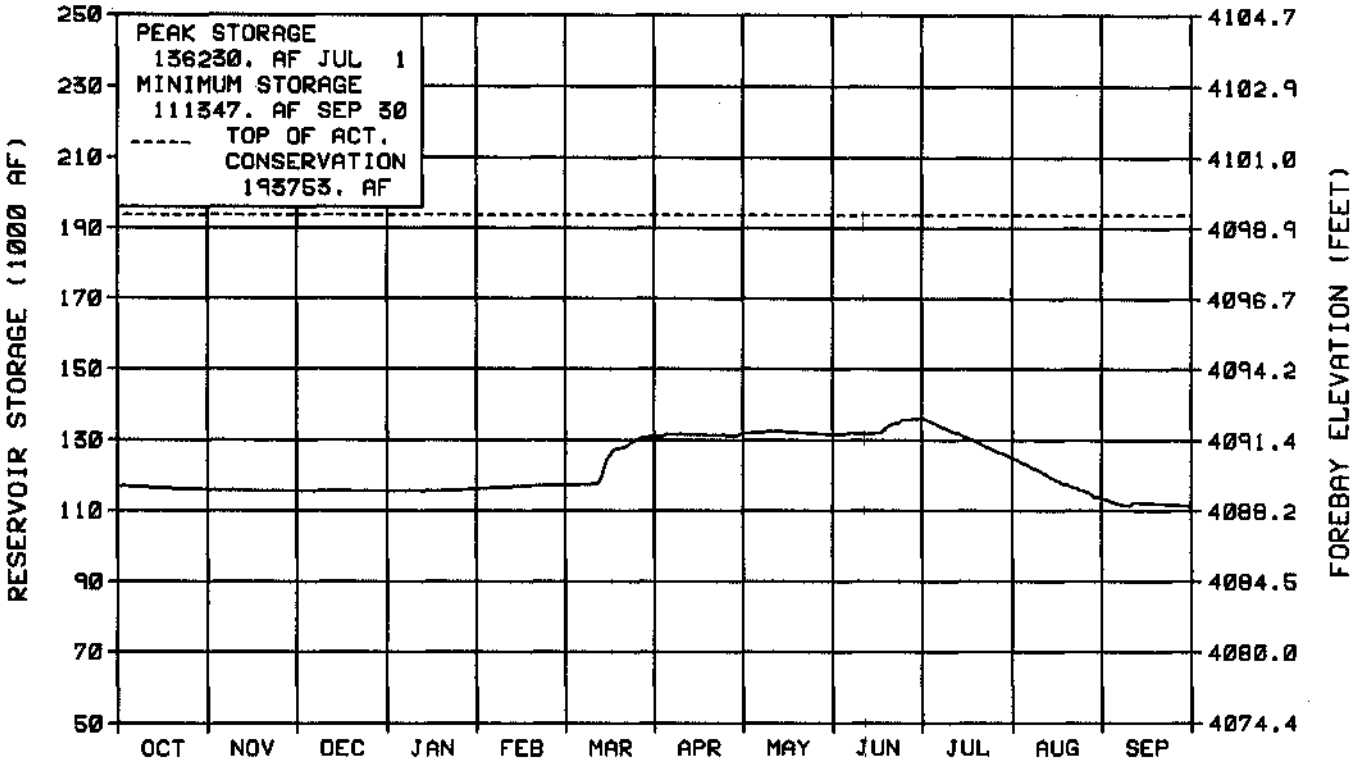
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 4,089.39 | 116,993 | OCT 01, 2002 |
| END OF YEAR | 4,088.45 | 111,347 | SEP 30, 2003 |
| ANNUAL LOW | 4,088.45 | 111,347 | SEP 30, 2003 |
| ANNUAL HIGH | 4,092.32 | 136,230 | JUL 01, 2003 |
| HISTORIC HIGH | 4,100.38 | 210,222 | MAY 21, 1978 |

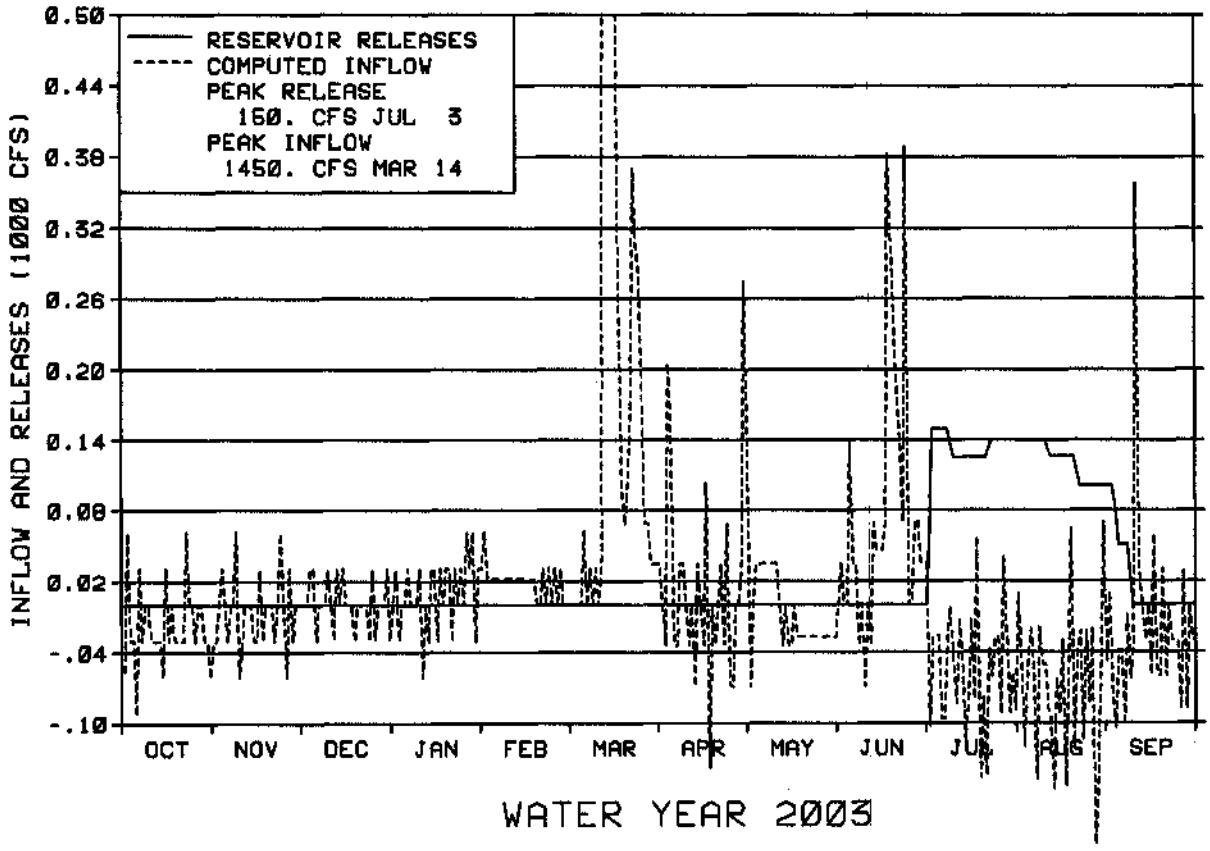
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 10,823 | OCT 02-SEP 03 | 16,469 | OCT 02 SEP 03 |
| DAILY PEAK (CFS) | 1,450 | MAR 14, 2003 | 150 | JUL 3-8, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |
| PEAK SPILL (CFS) | | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | -1158 | NA | 0 | NA | 115,835 | 132 |
| NOVEMBER | -304 | NA | 0 | NA | 115,531 | 133 |
| DECEMBER | 61 | 54 | 0 | NA | 115,592 | 133 |
| JANUARY | 730 | 161 | 0 | NA | 116,322 | 133 |
| FEBRUARY | 977 | 33 | 0 | NA | 117,299 | 130 |
| MARCH | 13,733 | 196 | 0 | NA | 131,032 | 136 |
| APRIL | 818 | 31 | 0 | NA | 131,850 | 136 |
| MAY | -274 | NA | 0 | NA | 131,576 | 132 |
| JUNE | 4,584 | 120 | 0 | NA | 136,160 | 135 |
| JULY | -3234 | NA | 7,944 | 199 | 124,9821 | 130 |
| AUGUST | -4039 | NA | 7,518 | 200 | 13,425 | 125 |
| SEPTEMBER | -1071 | NA | 1,007 | 127 | 111,347 | 126 |
| ANNUAL | 10,823 | 64 | 16,469 | 111 | | |
| APRIL-JULY | 9,264 | 89 | | | | |

* Frequently observed during fall and winter months

# DKG8
## KEYHOLE RESERVOIR




WATER YEAR 2003

## SHADEHILL RESERVOIR

### BACKGROUND

Shadehill Reservoir, a feature of the Shadehill Unit (P-S MBP), is located on the Grand River near Shadehill, South Dakota, and was constructed for irrigation of 9,700 acres, and for flood control, recreation, and fish and wildlife purposes. The reservoir has a dead and conservation capacity totaling 120,172 acre-feet with an additional exclusive flood control capacity of 230,004 acre-feet and a surcharge capacity of 119,560 acre-feet. Flood control space is all located above the crest of an un-gated glory-hole spillway. Because of the questionable quality of water, it was decided to postpone construction of distribution works for irrigation.

After further study, it was concluded that water from Shadehill Reservoir can be used for sustained irrigation if certain limitations of soils, leaching water, soil amendments, and drainage are met. A definite plan report covering 6,700 acres which meets these limitations has been completed, approved by the Commissioner, and released for distribution. On December 17, 1963, landowners within the area voted 24 to 21 against formation of an irrigation district. Further action on development of the area was deferred until the attitude of the landowners was more favorable. Pending more extensive irrigation development, an additional 51,500 acre-feet of space between elevations 2260 and 2272 was allocated to flood control. Allocations and evacuation of this space was made possible by modification of the outlet works in 1969 to permit a discharge of 600 cfs to the river. In June of 1975, the West River Conservancy Sub-District was formed combining all but one of the old individual contracts for water supply from the reservoir into one. Acreage contracted for by the District was 5,000 acres; however, only 3,064 acres were developed. On March 18, 1986, the contract between Reclamation and the West River Conservancy Sub-District was assigned to the Shadehill Water User District, an organization, which succeeded the Sub-District under South Dakota law. This contract has expired and presently conservation releases are meeting irrigation demands. Should irrigation releases be required a temporary water service contract will need toy be executed with the Shadehill Water User District.

Because certain release criteria reduced the effectiveness of flood control operations in the zone between elevation 2260 and 2272, and because the Corps of Engineers has constructed Bowman Haley Reservoir upstream from Shadehill Reservoir with 53,800 acre-feet of flood control space, the Corps requested that the interim flood control agreement be terMinated and that responsibility for the operations of Shadehill Reservoir when the pool is between elevations 2260 and 2272 revert to Reclamation. By a revised field working agreement dated May 15, 1972, it was agreed that the space between elevation 2260 and 2272 (51,500 acre-feet) be reallocated to conservation use. However, space below elevation 2272 will continue to be evacuated before the start of the spring runoff, but to a lesser extent than in the past.

### WATER YEAR 2003 OPERATIONS SUMMARY

Shadehill Reservoir began the water year at elevation 2263.19 ft with storage of 81,212 acre-feet. The peak reservoir water elevation occurred on May 18 with an elevation of 2264.21 ft.

Inflows for the water year were 11,929 acre-feet (17% of average) and the ninth lowest in the 52 year period of record. Shadehill ended the water year at elevation 2262.31 ft with storage of 77,934 acre-feet.

All project irrigation demands were met from river maintenance releases. There were no storage releases for irrigation needed during water year 2003.

Annual Emergency Management/Security orientation was conducted March 27 th, 2003.

The Annual Facility Review was done on September 24, 2003 by personnel from the Rapid City Field Office.

MONTHLY STATISTICS FOR WATER YEAR 2003

October inflow and October EOM elev. at Shadehill were below average. Winter/controlled release at 21 cfs. Shadehill finished the month 9.3 feet below top of conservation.

November inflow at Shadehill was much below average. November EOM elev. was 7th lowest in 51 years of record. Winter/controlled release at 20 cfs. Shadehill finished the month 9.7 feet below top of conservation.

December inflow at Shadehill was 2nd lowest and December EOM elev. was 6th lowest in 51 years of record. Winter/controlled release at 20 cfs. Shadehill finished the month 10.3 feet below top of conservation.

January inflow at Shadehill was below average and January EOM elevation 7th lowest in 51 years of record. Winter/controlled release at 20 cfs. Shadehill finished the month 10.6 feet below top of conservation.

February inflow at Shadehill was below average. February EOM elevation was 6th lowest in 51 years of record. Winter/controlled release at 20 cfs. Shadehill finished the month 10.7 feet below top of conservation.

March inflow at Shadehill was below average. March EOM elevation was much below average. Winter/controlled release at 20 cfs. Shadehill finished the month 8.2 feet below top of conservation.

April inflow at Shadehill was 7 th lowest and April EOM elevation was 5 th lowest in 51 years of record. Controlled release at 20 cfs. Shadehill finished the month 8.1 feet below top of conservation.

May inflow at Shadehill Reservoir was below average. May EOM elevation was fifth lowest in 51 years of record. Controlled releases are at 22 cfs. Shadehill finished the month 7.9 feet below top of conservation.

June inflow at Shadehill Reservoir was the seventh lowest in 51 years of record and June EOM

elevation was the fourth lowest in 51 years of record. Controlled releases are at 22 cfs. Shadehill finished the month 8.1 feet below top of conservation.

July EOM elevation and July inflow were 5 th lowest in 51 years of record. Controlled releases are at 22 cfs. Shadehill finished the month 8.9 feet below top of conservation.

August inflow and August EOM elevation, at Shadehill Reservoir, were 4 th lowest in 51 years of record. Controlled releases are at 20 cfs. Shadehill finished the month 9.9 feet below top of conservation.

September EOM elevation was 5 th lowest and September inflow was 3 rd highest in 51 years of record. Controlled releases are at 20 cfs. Shadehill finished the month 9.7 feet below top of conservation. Stilling basin dewatered and inspected September 24.

Additional statistical information on Shadehill Reservoir and its operations during 2003 can be found on Table DKT10 and Figure DKG9.

TABLE DKT10
HYDROLOGIC DATA FOR 2003
SHADEHILL RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2,250.80 | 43,869 | 43,869 |
| TOP OF ACTIVE CONSERVATION | 2,272.00 | 120,172 | 76,303 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | 2,302.00 | 350,176 | 230,004 |

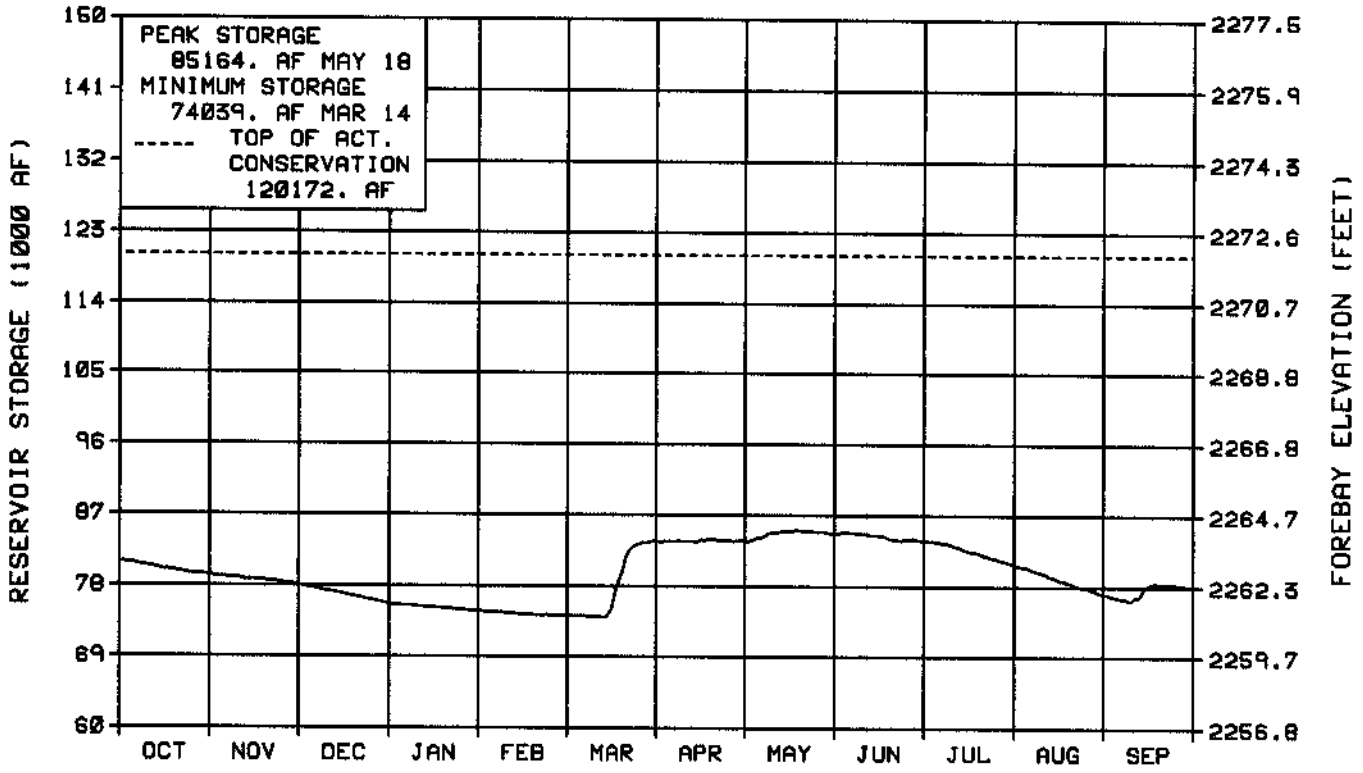
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2,263.19 | 81,212 | OCT 01, 2002 |
| END OF YEAR | 2,262.31 | 77,934 | SEP 30, 2003 |
| ANNUAL LOW | 2,261.22 | 74,039 | MAR 14, 2003 |
| ANNUAL HIGH | 2,264.21 | 85,164 | MAY 18, 2003 |
| HISTORIC HIGH | 2,297.90 | 318,438 | APR 10, 1952 |

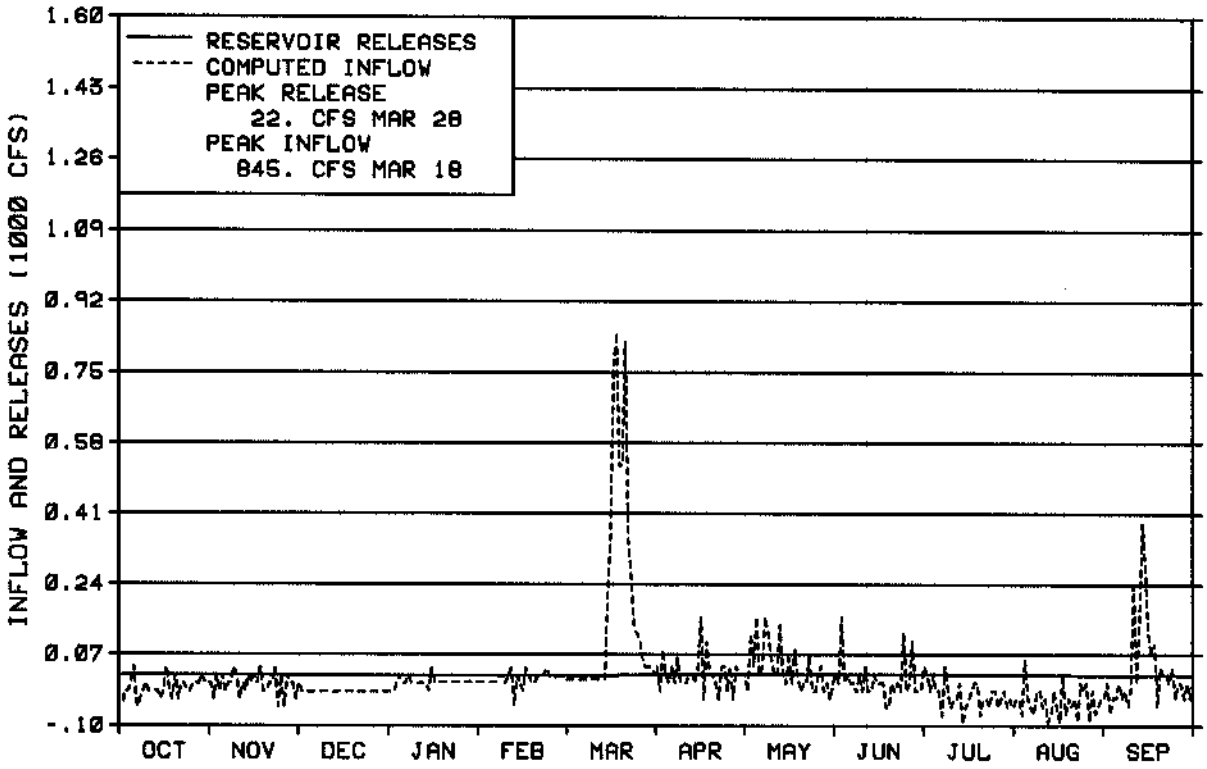
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 11,929 | OCT 02-SEP 03 | 15,207 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 845 | MAR 18, 2003 | 22 | MAR 03-JUL 03 |
| DAILY MINIMUM (CFS) | 0 | * | 20 | * |
| PEAK SPILL (CFS) | | | 0 | |
| TOTAL SPILL (AF) | | | 0 | |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | -581 | NA | 1,296 | 38 | 79,335 | 69 |
| NOVEMBER | -18 | NA | 1,237 | 45 | 78,080 | 69 |
| DECEMBER | -1164 | NA | 1,250 | 49 | 75,666 | 68 |
| JANUARY | 271 | 26 | 1,220 | 49 | 74,717 | 68 |
| FEBRUARY | 669 | 21 | 1,102 | 50 | 74,284 | 67 |
| MARCH | 10,663 | 50 | 1,273 | 14 | 83,674 | 68 |
| APRIL | 1,436 | 7 | 1,319 | 8 | 83,791 | 66 |
| MAY | 2,263 | 20 | 1,363 | 14 | 84,691 | 66 |
| JUNE | 496 | 5 | 1,319 | 15 | 83,868 | 65 |
| JULY | -1,657 | NA | 1,339 | 24 | 80,872 | 64 |
| AUGUST | -2,534 | NA | 1,277 | 28 | 77,061 | 63 |
| SEPTEMBER | 2,086 | NA | 1,213 | 32 | 77,934 | 66 |
| ANNUAL | 11,929 | 17 | 15,207 | 21 | | |
| APRIL-JULY | 2,538 | 6 | | | | |

* Frequently observed during fall and winter months

# DKG9
## SHADEHILL RESERVOIR




WATER YEAR 2003

## BELLE FOURCHE RESERVOIR

BACKGROUND

Belle Fourche Reservoir, located near Belle Fourche, South Dakota, is formed by Belle Fourche Dam on Owl Creek, a tributary of the Belle Fourche River. It has a total capacity of 192,077 acre-feet (185,277 acre-feet active). The reservoir is filled by diverting water from the Belle Fourche River through the Inlet Canal, which has a capacity of 1,300 cfs. The reservoir is used for irrigation of 57,000 acres in the Belle Fourche Project, which also receives a supplemental supply from Keyhole Reservoir. From November 1965 through May 1977, the active capacity of the reservoir was temporarily limited to 160,300 acre-feet at elevation 2981.8 feet until the damaged spillway was replaced.

When the Belle Fourche Reservoir storage right was satisfied by the reservoir filling, the South Dakota Department of Environment and Natural Resources provided guidelines for complying with water rights on the Belle Fourche River. The District was required to continue to bypass 5 cfs for domestic use prior to diverting the Johnson Lateral water right for up to 40 cfs. If flows into the diversion dam were greater than 45 cfs, the District was required to bypass up to 60 cfs for downstream irrigation rights. Any flows in excess of these amounts could be diverted into the reservoir and stored. If all of these rights were not needed, the District could divert flows into the reservoir.

WATER YEAR 2003 OPERATIONS SUMMARY

Belle Fourche Reservoir began the Water Year with an elevation of 2952.28 ft and storage of 56,009 acre-feet.

Significant Canal Operations:

The Inlet Canal remained open all winter. North and South Canal were turned on May 27 and South Canal was shut off September 15 with North Canal being shut off September 19.

Inflows peaked in March with a total of 23,641acre-feet for the month which is 141 percent of average. Inflows for the water year were 96% of average.

The reservoir ended the water year at elevation 2952.34 ft with storage of 56,237 acre-feet. The reservoir finished the year 22.66 feet from full.

Annual Emergency Management/Security orientation was conducted on March 25, 2003.

The annual settlement survey was completed. This survey is done approximately one month after the peak elevation for the year has occurred in the reservoir. Inclinometers readings were taken quarterly as required by the periodic monitoring schedule.

The Annual Facility Review was done on October 22, 2003 by personnel from the Rapid City Field Office and the Belle Fourche Irrigation District.

MONTHLY STATISTICS FOR WATER YEAR 2003

October inflow at Belle Fourche was slightly below average. October EOM elev. was near average. Belle Fourche ended the month 20.3 feet from full.

November inflow at Belle Fourche was slightly above average. November EOM elev. was near average. Belle Fourche ended the month 17.9 feet from full.

December inflow at Belle Fourche was slightly above average. December EOM elev. was near average. Belle Fourche ended the month 15.9 feet from full.

January inflow at Belle Fourche was slightly above average. January EOM elevation was near average. Belle Fourche ended the month 14.0 feet from full.

February inflow at Belle Fourche was slightly above average. February EOM elevation was slightly below average. Belle Fourche ended the month 12.2 feet from full.

March inflow at Belle Fourche was above average. March EOM elevation was slightly above average. Belle Fourche ended the month 8.3 feet from full.

April inflow at Belle Fourche was slightly below average. April EOM elevation was slightly above average. Belle Fourche ended the month 6.6 feet from full.

May inflow at Belle Fourche Reservoir was below average . May EOM elevation was above average. Belle Fourche ended the month 5.3 feet from full. The District began filling the canals on May 27, 2003.

June inflow at Belle Fourche Reservoir was below average. June EOM elevation was slightly below average. Belle Fourche ended the month 6.8 feet from full.

Inflow at Belle Fourche Reservoir was 3 $^{rd}$ lowest in 51 years of record. July EOM elevation was below average. Belle Fourche ended the month 13.7 feet from full.

August inflow and August end-of-month (EOM) elevation, at Belle Fourche Reservoir, were below average. Belle Fourche ended the month 22.4 feet from full.

September EOM elevation at Belle Fourche Reservoir was above average. September inflow was the 7$^{th}$ highest in 51 years of record. Belle Fourche ended the month 22.7 feet from full. Irrigation releases at South Canal ended on September 15, North Canal on September 19.

Additional statistical information on Belle Fourche reservoir and its operations during 2003 can be found on Table DKT11 and Figure DKG10.

TABLE DKT II
HYDROLOGIC DATA FOR 2003
BELLE FOURCHE RESERVOIR

| RESERVOIR ALLOCATIONS | ELEVATION (FEET) | TOTAL RESERVOIR STORAGE (AF) | STORAGE ALLOCATION (AF) |
|---|---|---|---|
| TOP OF INACTIVE AND DEAD | 2,927.00 | 6,800 | 6,800 |
| TOP OF ACTIVE CONSERVATION | 2,975.00 | 192,077 | 185,277 |
| TOP OF JOINT USE | | | |
| TOP OF EXCLUSIVE FLOOD CONTROL | | | |

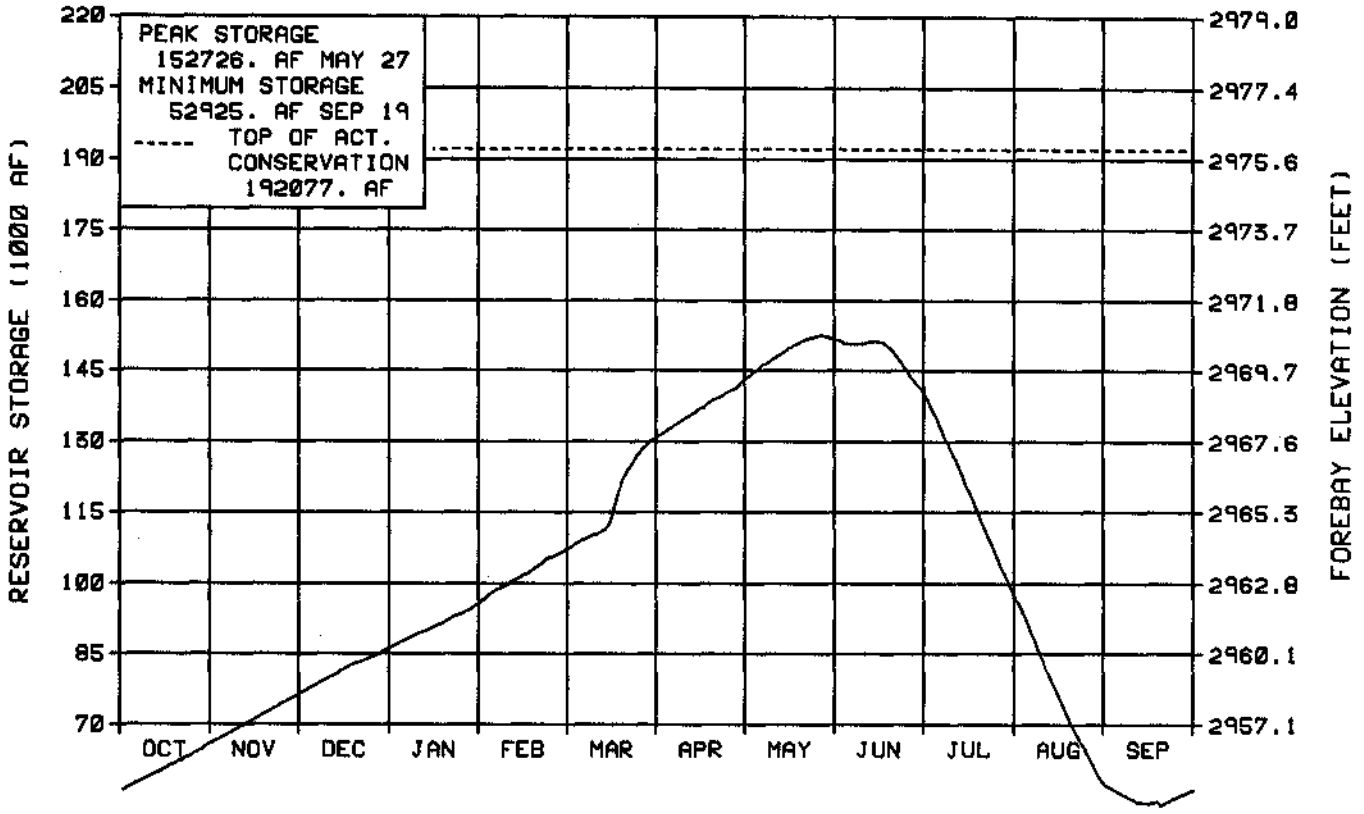
| STORAGE-ELEVATION DATA | ELEVATION (FT) | STORAGE (AF) | DATE |
|---|---|---|---|
| BEGINNING OF YEAR | 2,952.28 | 56,009 | OCT 01, 2002 |
| END OF YEAR | 2,952.34 | 56,237 | SEP 30, 2003 |
| ANNUAL LOW | 2,951.45 | 52,925 | SEP 19, 2003 |
| ANNUAL HIGH | 2,969.85 | 152,726 | MAY 27, 2003 |
| HISTORIC HIGH | 2,975.80 | 198,455 | MAY 12, 1978 |

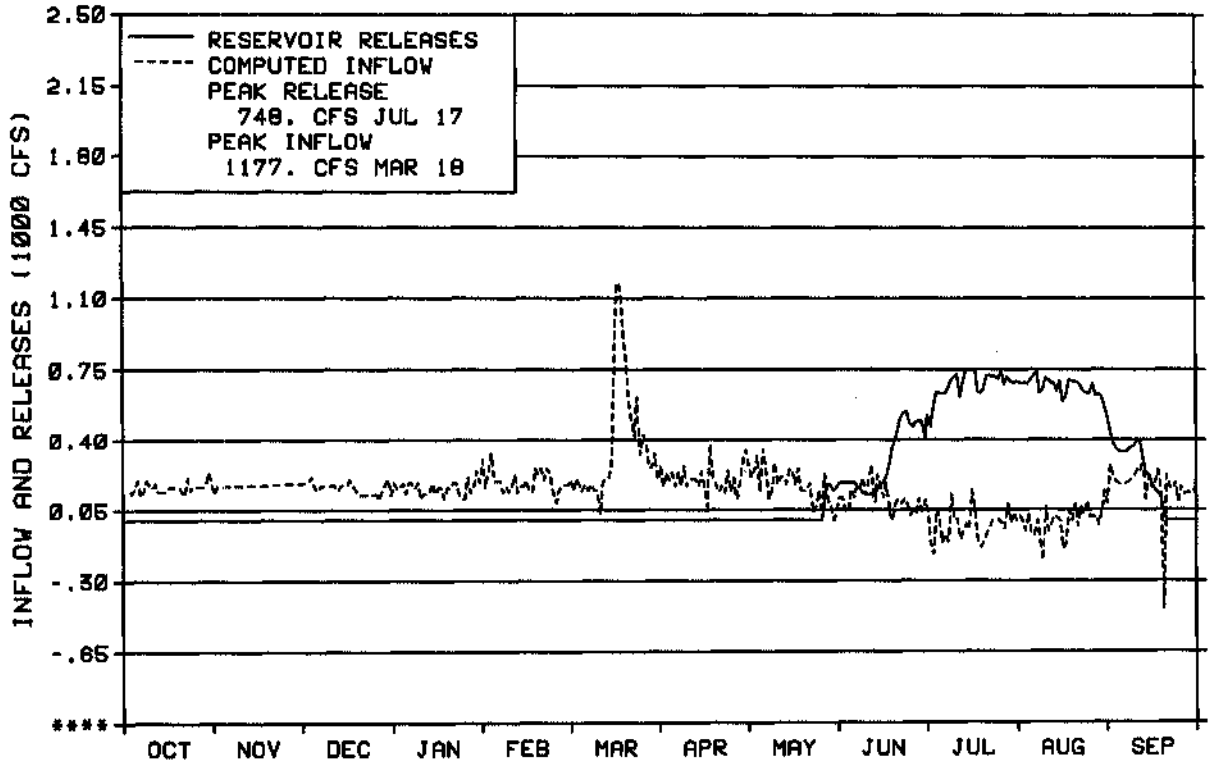
| INFLOW-OUTFLOW DATA | INFLOW | DATE | OUTFLOW | DATE |
|---|---|---|---|---|
| ANNUAL TOTAL (AF) | 111,844 | OCT 02-SEP 03 | 111,617 | OCT 02-SEP 03 |
| DAILY PEAK (CFS) | 1,177 | MAR 18, 2003 | 748 | JUL 17, 2003 |
| DAILY MINIMUM (CFS) | 0 | * | 0 | * |
| PEAK SPILL (CFS) | 0 | | 0 | NONE |
| TOTAL SPILL (AF) | | | 0 | NONE |

| MONTH | INFLOW | | OUTFLOW | | CONTENT | |
|---|---|---|---|---|---|---|
| | AF | % OF AVG | AF | % OF AVG | AF | % OF AVG |
| OCTOBER | 10,023 | 95 | 0 | NA | 66,032 | 92 |
| NOVEMBER | 10,526 | 106 | 0 | NA | 76,558 | 94 |
| DECEMBER | 9,862 | 106 | 0 | NA | 86,420 | 96 |
| JANUARY | 10,014 | 104 | 0 | NA | 96,434 | 97 |
| FEBRUARY | 10,519 | 101 | 0 | NA | 106,953 | 98 |
| MARCH | 23,641 | 142 | 0 | NA | 130,594 | 104 |
| APRIL | 12,053 | 86 | 0 | NA | 142,647 | 102 |
| MAY | 10,754 | 76 | 1,542 | 19 | 151,860 | 104 |
| JUNE | 6,550 | 55 | 17,354 | 103 | 141,0569 | 100 |
| JULY | -1,632 | NA | 41,344 | 111 | 8,079 | 91 |
| AUGUST | -202 | NA | 40,605 | 113 | 57,272 | 78 |
| SEPTEMBER | 9,737 | 201 | 10,771 | 62 | 56,237 | 92 |
| ANNUAL | 111,844 | 96 | 111,617 | 96 | | |
| APRIL-JULY | 27,725 | 64 | | | | |

* Frequently observed during fall and winter months

# DKG10
## BELLE FOURCHE RESERVOIR




WATER YEAR 2003

## CORPS OF ENGINEERS MAIN STEM RESERVOIRS

The Missouri River main stem reservoir system consists of six reservoirs located on the Missouri River in Montana, North Dakota, South Dakota, and Nebraska. This reservoir system serves flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Based on information from the Corps' 2003 AOP, the capacity and storage allocations of the main stem system were updated to current values and are shown in downstream order as follows:

**Reservoir Storage Allocation (1,000 Acre-Feet)**

| Dam | Permanent | Carryover Multiple Use | Annual Flood Control and Multiple Use | Exclusive Flood Control | Total Storage |
|---|---|---|---|---|---|
| Fort Peck | 4,211 | 10,785 | 2,717 | 975 | 18,688 |
| Garrison | 4,980 | 13,130 | 4,222 | 1,489 | 23,821 |
| Oahe | 5,373 | 13,461 | 3,201 | 1,102 | 23,137 |
| Big Bend | 1,682 | 0 | 117 | 60 | 1,859 |
| Fort Randall | 1,517 | 1,607 | 1,309 | 985 | 5,418 |
| Gavins Point | 321 | 0 | 90 | 59 | 470 |
| Totals | 18,084 | 38,983 | 11,656 | 4,670 | 73,393 |

Each main stem facility serves a powerplant. The number of generating units and total nameplate capabilities are shown below:

| Powerplant | Units | Capacity (Kilowatts) |
|---|---|---|
| Fort Peck | 5 | 185,250 |
| Garrison | 5 | 517,750 |
| Oahe | 7 | 786,030 |
| Big Bend | 8 | 494,320 |
| Fort Randall | 8 | 320,000 |
| Gavins Point | 3 | 132,300 |
| Totals | 36 | 2,435,650 |

Main stem system releases are regulated to support the multiple use purposes of the reservoirs. The navigation season on the Missouri River below the dams normally is from late March to late November. Generally, releases from the system for navigation are higher during late summer and fall lowering the system storage. During that time, much of the system's hydropower is generated from the lower most projects. During closure of the navigation season, higher releases are made and more power is generated from the upstream Fort Peck and Garrison Reservoirs. This offsets the reduced release and generation from the downstream projects during winter closure of the river for navigation. The desired annual target system storage level is 57.1 million acre-feet on the first of March.

The regulation of Missouri River flows by the main stem storage provided benefits to nine water resource-related functions, including flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Table CETI presents the regulation benefit for most of those functions as recorded in 2002-2003, 2001-2002, and the average. Benefits are defined as the tons of produce shipped, dollars of damages prevented, kilowatt hours of electricity produced, and reservoir elevation and river stages maintained. For the shipping information, estimates also were provided this year which included the sand, gravel, and waterway material shipped.

**TABLE CETI**
**Main Stem Reservoir Water Regulation**
**Comparison with Past Regulations**

| Use of Regulated Water | Period of Use or Season | Totals | Totals | Long-Term |
|---|---|---|---|---|
| Navigation* | Mar. - Dec. | 1.0 million tons (2003) | 1.0 million tons (2002) | 2.1 million tons' |
| Flood Damages Prevented | Jan. - Dec. | $49.7 million (2003) | $7.3 million (2002) | $18.2 billion2 |
| Energy | Aug. - Jul. | 7.8 billion KWH (Aug. 02-July 03) | 7 billion KWH (Aug. 01-July 02) | 10 billion KWH3 |

* Excludes sand, gravel, waterway material
2002/2003 - preliminary estimate
Including sand, gravel, waterway material
8.3 million tons (2002)
7.0 million tons (35-year long-term average)

The main stem reservoirs also provide supplemental water for irrigation and municipal uses and improves water quality in the river system.

'Average for 34 years 1968-2002 with the peak shipments in 1977 (2.1 million tons).
[2]Total damages prevented (1938-2003).
[3]Average Annual 1968-2003.

A detailed description of the main stem system operations during 2003 is presented in annual operating reports prepared by and available for distribution from the U.S. Missouri River Basin Water Management Division, U.S. Army Corps of Engineers, Northwestern Division, Omaha, Nebraska.

## ENERGY GENERATION

There are 14 Federal powerplants located in the Upper Missouri River Basin that are currently operating. Eight of the powerplants are operated and maintained by Reclamation and have a total capacity of 348,100 kilowatts. The other six have a total capacity of 2,435,650 kilowatts and are operated and maintained by the Corps. The Corps' powerplants are located on the main stem of the Missouri River. Generation from the 14 powerplants is marketed by the Department of Energy.

Total generation in the combined system in WY 2003 was 8,540.496 million kilowatt hours, 559.9 million kilowatt hours more than in WY 2002. A summary of the past 10 years of energy generation within the Upper Missouri River Basin is shown below.

USBR and COE Energy Generation
Million KiloWatt Hours

| Year | USSR | COE | TOTAL |
|---|---|---|---|
| 2003 | 757.118 | 7783.378 | 8540.496 |
| 2002 | 708.594 | 7271.994 | 7980.588 |
| 2001 | 905.528 | 6521.944 | 7427.472 |
| 2000 | 1240.802 | 10363.931 | 11604.733 |
| 1999 | 2017.536 | 11073.228 | 13090.764 |
| 1998 | 1822.698 | 11435.586 | 13258.284 |
| 1997 | 2016.989 | 13942.025 | 15959.014 |
| 1996 | 1837.954 | 13788.867 | 15626.821 |
| 1995 | 1433.794 | 8883.983 | 10317.777 |
| 1994 | 1268.360 | 8171.693 | 9440.053 |

A comparison of 2002 and 2003 generation and other data from Missouri Basin Region powerplants is shown on Table CET2. Tables CET3, 4, and 5 show the monthly generation, power releases, and total downstream releases, respectively, for all Federal plants in the Missouri Basin Region. The annual energy generation for each of the last several years for all Reclamation, Corps, and combined plants is shown graphically on Figures CEG1, 3, and 5, respectively, Monthly generation for each month during the past several years is shown graphically on Figures CEG2, 4, and 6.

For a more detailed account of powerplants operation at Reclamation facilities during the year, refer to the 2003 operation summaries. Information on the Corps' powerplants operations can be obtained from the annual operating reports prepared by and available for distribution from the Reservoir Control Center, U.S. Army Corps of Engineers, Omaha, Nebraska.

# TABLE CET2

## ANNUAL ENERGY PRODUCTION DATA
## WATER YEAR 2003

| BUREAU PLANTS | INSTALLED CAPACITY (KW) | MILLION KILOWATT-HOURS GENERATED 2002 | MILLION KILOWATT-HOURS GENERATED 2003 | WATER USED FOR GENERATION IN 2003 1,000 AF | WATER USED FOR GENERATION IN 2003 PERCENT OF TOTAL RELEASE | WATER USED FOR GENERATION IN 2003 KW-HOURS PER AF | RIVER RELEASE 1,000 AF | TOTAL RELEASE 1,000 AF |
|---|---|---|---|---|---|---|---|---|
| Canyon Ferry | 50,000 | 229.171 | 322.771 | 2,564.559 | 94.72 | 125.86 | 2,707.570 | 2,707.568 |
| Pilot Butte[1] | 1,600 | 3.976 | 2.258 | 24.822 | 14.35 | 90.97 | 172.945 | 172.944 |
| Boysen | 15,000 | 26.201 | 25.560 | 418.787 | 96.21 | 61.03 | 432.274 | 435.275 |
| | | | | | | | | |
| Buffalo Bill Reservoir Units | | | | | | | | |
| Shoshone | 3,000 | 15.004 | 15.271 | 96.147 | 14.23 | 158.83 | See below for | total. |
| Buffalo Bill | 18,000 | 38.521 | 44.438 | 167.610 | 24.81 | 265.13 | See below for | total. |
| Heart Mountain | 6,000 | 17.267 | 18.170 | 82.384 | 12.19 | 220.55 | See below for | total. |
| Spirit Mountain [2] | 4,500 | 12.793 | 14.923 | 144.352 | 21.36 | 103.38 | See below for | total. |
| Total for Buffalo Bill Reservoir[3] | 31,500 | 83.585 | 92.802 | 490.493 | 72.59 | 189.20 | 456.386 | 675.671 |
| | | | | | | | | |
| Yellowtail | 250,000 | 365.661 | 313.727 | 1,057.379 | 100.00 | 296.70 | 1,004.901 | 1,057.379 |
| **Subtotal** | **348,100** | **708.594** | **757.118** | **4,556.040** | **90.24** | **166.18** | **4,774.076** | **5,048.837** |
| CORPS PLANTS | | | | | | | | |
| Fort Peck | 185,250 | 691.452 | 839.431 | 5,508.00 | 100.04 | 152.40 | 5,506.000 | 5,506.000 |
| Garrison | 517,750 | 1,464.465 | 1,862.752 | 13,712.00 | 100.00 | 135.85 | 13,712.000 | 13,712.000 |
| Oahe | 786,030 | 2,083.279 | 2,018.595 | 15,185.00 | 100.00 | 132.93 | 15,185.000 | 15,185.000 |
| Big Bend | 494,320 | 819.321 | 846.207 | 14,101.00 | 100.00 | 60.01 | 14,101.000 | 14,101.000 |
| Fort Randall | 320,000 | 1,503.217 | 1,502.469 | 15,108.00 | 100.00 | 99.45 | 15,108.000 | 15,108.000 |
| Gavins Point | 132,300 | 710.260 | 713.924 | 16,209.00 | 100.00 | 44.04 | 16,209.000 | 16,209.000 |
| **Subtotal** | **2,435,650** | **7,271.994** | **7,783.378** | **79,823.00** | **100.00** | **97.51** | **79,821.000** | **79,821.000** |
| **TOTAL MISSOURI BASIN** | **2,783,750** | **7,980.588** | **8,540.496** | **84,379.04** | **99.42** | **101.22** | **84,595.076** | **84,869.837** |

[1] River Release and Total Release at Pilot Butte Reservoir is Computed Inflow to Pilot Butte Reservoir due to the location of the powerplant at inlet of supply canal.

[2] Spirit Mountain Powerplant is used to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow section of the conduit. Water used for generation at Spirit Mountain Powerplant is then routed to Heart Mountain Canal or used for generation at Heart Mountain Powerplant.

[3] This represents the total for the four separate powerplants at Buffalo Bill Dam..

# TABLE CET3

## MONTHLY ENERGY GENERATION (MILLION KILOWATT-HOURS)

## WATER YEAR 2003

| | BUREAU OF RECLAMATION PLANTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BUFFALO BILL PLANTS | | | | | |
| MONTH | CANYON FERRY | PILOT BUTTE | BOYSEN | HEART MOUNTAIN | SPIRIT MOUNTAIN | BUFFALO BILL | SHOSHONE | YELLOWTAIL | TOTAL |
| October | 22.625 | 0.487 | 0.306 | 0.822 | 0.787 | 0.681 | 0.640 | 16.957 | **43.305** |
| November | 25.222 | 0.144 | 0.554 | 0.000 | 0.000 | 0.000 | 0.877 | 20.229 | **47.026** |
| December | 26.763 | 0.000 | 0.777 | 0.000 | 0.000 | 0.000 | 0.000 | 24.290 | **51.830** |
| January | 26.852 | 0.000 | 0.789 | 0.000 | 0.000 | 0.000 | 0.115 | 26.086 | **53.842** |
| February | 24.037 | 0.000 | 0.743 | 0.000 | 0.000 | 0.000 | 0.747 | 24.064 | **49.591** |
| March | 26.206 | 0.000 | 0.865 | 0.000 | 0.000 | 0.001 | 0.988 | 25.456 | **53.516** |
| April | 25.863 | 0.000 | 1.841 | 1.417 | 0.000 | 1.592 | 1.428 | 21.953 | **54.094** |
| May | 37.054 | 0.000 | 3.347 | 3.580 | 1.376 | 4.666 | 2.008 | 20.005 | **72.036** |
| June | 40.361 | 0.000 | 5.007 | 3.165 | 3.155 | 10.685 | 2.166 | 31.542 | **96.081** |
| July | 28.315 | 0.429 | 5.149 | 3.218 | 3.317 | 11.869 | 2.224 | 41.571 | **96.092** |
| August | 20.089 | 0.965 | 3.837 | 2.964 | 3.243 | 9.545 | 2.143 | 35.343 | **78.129** |
| September | 19.384 | 0.233 | 2.345 | 3.004 | 3.045 | 5.399 | 1.935 | 26.231 | **61.576** |
| TOTAL | **322.771** | **2.258** | **25.560** | **18.170** | **14.923** | **44.438** | **15.271** | **313.727** | **757.118** |

| | CORPS OF ENGINEERS PLANTS | | | | | | | MISSOURI BASIN |
|---|---|---|---|---|---|---|---|---|
| MONTH | FORT PECK | GARRISON | OAHE | BIG BEND | FORT RANDALL | GAVINS POINT | TOTAL | TOTAL |
| October | 45.982 | 118.357 | 140.763 | 62.572 | 165.580 | 80.726 | **613.980** | **657.285** |
| November | 52.745 | 146.246 | 181.488 | 77.320 | 120.421 | 65.106 | **643.326** | **690.352** |
| December | 92.690 | 162.429 | 109.636 | 47.829 | 62.166 | 37.711 | **512.461** | **564.291** |
| January | 92.468 | 150.925 | 128.010 | 56.763 | 76.168 | 39.181 | **543.515** | **597.357** |
| February | 84.683 | 164.934 | 111.447 | 48.560 | 61.143 | 34.777 | **505.544** | **555.135** |
| March | 49.221 | 142.549 | 162.094 | 65.687 | 96.034 | 48.171 | **563.756** | **617.272** |
| April | 62.553 | 150.091 | 178.711 | 75.217 | 139.578 | 63.031 | **669.181** | **723.275** |
| May | 84.046 | 155.550 | 154.020 | 64.876 | 149.479 | 69.113 | **677.084** | **749.120** |
| June | 79.015 | 174.755 | 207.139 | 84.402 | 147.994 | 66.953 | **760.258** | **856.339** |
| July | 74.925 | 183.761 | 210.875 | 86.983 | 154.857 | 68.973 | **780.374** | **876.466** |
| August | 65.283 | 177.311 | 214.384 | 83.939 | 156.391 | 66.081 | **763.389** | **841.518** |
| September | 55.820 | 135.844 | 220.028 | 92.059 | 172.658 | 74.101 | **750.510** | **812.086** |
| TOTAL | **839.431** | **1,862.752** | **2,018.595** | **846.207** | **1,502.469** | **713.924** | **7,783.378** | **8,540.496** |

# TABLE CET4

**WATER USED FOR POWER GENERATION (1,000 ACRE-FEET)**
**WATER YEAR 2003**

| MONTH | CANYON FERRY | BOYSEN | PILOT BUTTE | BUFFALO BILL RESERVOIR UNITS | | | | YELLOWTAIL | FORT PECK | GARRISON | OAHE | BIG BEND | FORT RANDALL | GAVINS POINT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SHOSHONE | BUFF. BILL | HEART MTN. | SPIRIT MTN.[1] | | | | | | | |
| October | 181.894 | 10.159 | 5.372 | 4.532 | 3.219 | 3.864 | 8.753 | 88.353 | 287.000 | 852.000 | 1,064.000 | 1,018.000 | 1,808.000 | 1,845.000 |
| November | 200.075 | 14.696 | 1.636 | 3.749 | 0.000 | 0.000 | 0.000 | 72.514 | 336.000 | 1,071.000 | 1,395.000 | 1,262.000 | 1,363.000 | 1,452.000 |
| December | 212.495 | 18.717 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 75.171 | 606.000 | 1,207.000 | 847.000 | 774.000 | 662.000 | 776.000 |
| January | 214.450 | 18.412 | 0.000 | 0.733 | 0.000 | 0.000 | 0.000 | 76.661 | 602.000 | 1,133.000 | 986.000 | 928.000 | 792.000 | 839.000 |
| February | 194.134 | 16.541 | 0.000 | 4.935 | 0.000 | 0.000 | 0.000 | 68.117 | 563.000 | 1,240.000 | 855.000 | 796.000 | 611.000 | 732.000 |
| March | 215.746 | 18.672 | 0.000 | 6.214 | 0.000 | 0.000 | 0.000 | 80.144 | 315.000 | 1,066.000 | 1,210.000 | 1,109.000 | 931.000 | 1,067.000 |
| April | 208.473 | 28.910 | 0.000 | 9.171 | 5.480 | 6.591 | 0.000 | 76.140 | 417.000 | 1,109.000 | 1,343.000 | 1,269.000 | 1,355.000 | 1,470.000 |
| May | 293.592 | 51.353 | 0.000 | 12.882 | 20.436 | 16.200 | 15.492 | 76.324 | 557.000 | 1,151.000 | 1,140.000 | 1,089.000 | 1,464.000 | 1,599.000 |
| June | 306.709 | 72.141 | 0.000 | 13.896 | 39.805 | 14.547 | 30.132 | 103.386 | 518.000 | 1,265.000 | 1,524.000 | 1,408.000 | 1,453.000 | 1,581.000 |
| July | 219.161 | 67.323 | 4.727 | 14.242 | 45.523 | 14.092 | 30.066 | 119.354 | 497.000 | 1,319.000 | 1,560.000 | 1,462.000 | 1,494.000 | 1,571.000 |
| August | 160.580 | 57.495 | 10.552 | 13.554 | 31.248 | 13.425 | 30.905 | 115.809 | 436.000 | 1,296.000 | 1,592.000 | 1,428.000 | 1,504.000 | 1,545.000 |
| September | 157.250 | 44.368 | 2.535 | 12.239 | 21.899 | 13.665 | 29.004 | 105.406 | 374.000 | 1,003.000 | 1,669.000 | 1,558.000 | 1,671.000 | 1,732.000 |
| **TOTAL** | **2,564.559** | **418.787** | **24.822** | **96.147** | **167.610** | **82.384** | **144.352** | **1,057.379** | **5,508.000** | **13,712.000** | **15,185.000** | **14,101.000** | **15,108.000** | **16,209.000** |

[1] Spirit Mountain Powerplant is used to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow section of the conduit. Water used for generation at Spirit Mountain Powerplant is then routed to Heart Mountain Canal or used for generation at Heart Mountain Powerplant

# TABLE CET5

**TOTAL RELEASE (1,000 ACRE-FEET)**
**WATER YEAR 2003**

| MONTH | CANYON FERRY | BOYSEN | PILOT BUTTE | BUFFALO BILL | YELLOWTAIL | FORT PECK | GARRISON | OAHE | BIG BEND | FORT RANDALL | GAVINS POINT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| October | 182.028 | 18.756 | 0.000 | 23.735 | 88.353 | 287.000 | 852.000 | 1,064.000 | 1,018.000 | 1,808.000 | 1,845.000 |
| November | 200.075 | 18.105 | 0.000 | 6.248 | 72.514 | 336.000 | 1,071.000 | 1,395.000 | 1,262.000 | 1,363.000 | 1,452.000 |
| December | 212.931 | 18.717 | 0.000 | 6.431 | 75.171 | 606.000 | 1,207.000 | 847.000 | 774.000 | 662.000 | 776.000 |
| January | 214.450 | 18.412 | 0.000 | 6.420 | 76.661 | 602.000 | 1,133.000 | 986.000 | 928.000 | 792.000 | 839.000 |
| February | 194.134 | 16.541 | 0.000 | 5.792 | 68.117 | 563.000 | 1,240.000 | 855.000 | 796.000 | 611.000 | 732.000 |
| March | 215.746 | 18.728 | 0.000 | 6.443 | 80.144 | 313.000 | 1,066.000 | 1,210.000 | 1,109.000 | 931.000 | 1,067.000 |
| April | 216.503 | 28.962 | 8.444 | 33.247 | 76.140 | 417.000 | 1,109.000 | 1,343.000 | 1,269.000 | 1,355.000 | 1,470.000 |
| May | 317.522 | 51.536 | 30.880 | 89.801 | 76.324 | 557.000 | 1,151.000 | 1,140.000 | 1,089.000 | 1,464.000 | 1,599.000 |
| June | 362.427 | 72.141 | 32.899 | 175.190 | 103.386 | 518.000 | 1,265.000 | 1,524.000 | 1,408.000 | 1,453.000 | 1,581.000 |
| July | 241.311 | 67.323 | 42.039 | 139.245 | 119.354 | 497.000 | 1,319.000 | 1,560.000 | 1,462.000 | 1,494.000 | 1,571.000 |
| August | 183.710 | 61.686 | 37.345 | 104.027 | 115.809 | 436.000 | 1,296.000 | 1,592.000 | 1,428.000 | 1,504.000 | 1,545.000 |
| September | 166.731 | 44.368 | 21.337 | 79.092 | 105.406 | 374.000 | 1,003.000 | 1,669.000 | 1,558.000 | 1,671.000 | 1,732.000 |
| **TOTAL** | **2,707.568** | **435.275** | **172.944** | **675.671** | **1,057.379** | **5,506.000** | **13,712.000** | **15,185.000** | **14,101.000** | **15,108.000** | **16,209.000** |

# TABLE CET6

**TOTAL RESERVOIR STORAGE CONTENTS (1,000 ACRE-FEET)**
**WATER YEARS 2002 AND 2003**

| BUREAU RESERVOIRS | TOP OF CONSERVATION CAPACITY [3] | DEAD AND INACTIVE CAPACITY | TOTAL STORAGE SEPTEMBER 30 | | END OF SEPTEMBER PERCENT OF AVERAGE | |
|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2002 | 2003 |
| Clark Canyon | 178.1 | 1.5 | 16.9 | 15.8 | 16 | 15 |
| Canyon Ferry | 1,891.9 | 396.0 | 1,687.6 | 1,547.2 | 101 | 93 |
| Helena Valley | 10.5 | 4.6 | 8.0 | 4.0 | 116 | 57 |
| Gibson | 96.5 | 0.0 | 26.2 | 6.2 | 91 | 22 |
| Willow Creek | 32.3 | 0.1 | 27.7 | 19.7 | 134 | 95 |
| Pishkun | 46.7 | 16.3 | 36.8 | 33.5 | 112 | 102 |
| Lake Elwell | 967.3 | 577.6 | 862.4 | 857.2 | 116 | 115 |
| Sherburne | 67.9 | 3.1 | 11.4 | 7.8 | 78 | 53 |
| Fresno | 92.9 | 0.4 | 44.3 | 27.8 | 86 | 54 |
| Nelson | 79.0 | 18.1 | 54.2 | 50.2 | 103 | 95 |
| Bull Lake | 152.5 | 0.7 | 40.9 | 56.3 | 53 | 73 |
| Pilot Butte | 33.7 | 3.8 | 6.1 | 12.4 | 31 | 64 |
| Boysen | 741.6 | 219.2 | 239.0 | 351.9 | 38 | 56 |
| Anchor[1] | 17.2 | 0.1 | 0.3 | 0.3 | 100 | 100 |
| Buffalo Bill[2] | 646.6 | 41.7 | 358.9 | 465.7 | 83 | 108 |
| Bighorn Lake | 1,070.0 | 493.6 | 635.0 | 785.9 | 65 | 81 |
| E. A. Patterson | 8.6 | 0.5 | 6.4 | 6.4 | 100 | 100 |
| Lake Tschida | 67.1 | 5.2 | 52.2 | 55.3 | 89 | 94 |
| Jamestown Reservoir | 31.5 | 0.8 | 29.8 | 29.8 | 103 | 103 |
| Shadehill Reservoir | 120.2 | 43.9 | 81.2 | 77.9 | 73 | 70 |
| Angostura Reservoir | 130.8 | 48.3 | 78.2 | 81.9 | 84 | 88 |
| Deerfield Reservoir | 15.7 | 0.2 | 15.1 | 15.2 | 112 | 112 |
| Pactola Reservoir | 56.0 | 1.0 | 46.2 | 48.1 | 96 | 100 |
| Keyhole Reservoir | 193.8 | 8.0 | 117.0 | 111.3 | 117 | 111 |
| Belle Fourche Reservoir | 192.1 | 6.8 | 56.0 | 56.2 | 83 | 83 |
| **Subtotal** | **6,124.4** | **1,776.8** | **4,055.7** | **4,242.0** | | |
| CORPS RESERVOIRS | | | | | | |
| Fort Peck | 17,713.0 | 4,211.0 | 11,854.0 | 10,492.0 | | |
| Garrison | 22,332.0 | 4,980.0 | 15,239.0 | 13,512.0 | | |
| Oahe | 22,035.0 | 5,373.0 | 13,112.0 | 11,932.0 | | |
| Big Bend | 1,799.0 | 1,682.0 | 1,727.0 | 1,693.0 | | |
| Fort Randall | 4,433.0 | 1,517.0 | 3,181.0 | 3,367.0 | | |
| Gavins Point | 411.0 | 321.0 | 386.0 | 373.0 | | |
| **Subtotal** | **68,723.0** | **18,084.0** | **45,499.0** | **41,369.0** | | |
| **TOTAL UPPER MISSOURI BASIN** | **74,847.4** | **19,860.8** | **49,554.7** | **45,611.0** | | |

[1] Percent of average content of Anchor Reservoir is based on an 11-year average, 1991-2002.

[2] Percent of average content of Buffalo Bill Reservoir is based on a 9-year average, 1993-2002; to reflect the operation of the reservoir since 19 when the dam was raised and the capacity of the reservoir was increased to 646,565 acre-feet.

[3] Includes joint-use space.

# TABLE CET7

**WATER YEAR 2003**
**End-of-Month Reservoir Contents**
**(1,000 Acre-Feet)**

| RECLAMATION RESERVOIRS | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLARK CANYON RESERVOIR | 25.0 | 34.7 | 43.1 | 50.6 | 57.3 | 66.6 | 71.4 | 64.9 | 40.6 | 15.6 | 11.2 | 15.8 |
| % of Average | 21 | 28 | 33 | 38 | 41 | 45 | 46 | 42 | 28 | 12 | 10 | 15 |
| CANYON FERRY RESERVOIR | 1,670.3 | 1,665.5 | 1,638.1 | 1,604.8 | 1,575.9 | 1,590.6 | 1,669.4 | 1,762.6 | 1,901.9 | 1,750.9 | 1,628.3 | 1,547.2 |
| % of Average | 98 | 97 | 99 | 102 | 104 | 108 | 112 | 106 | 101 | 97 | 96 | 93 |
| HELENA VALLEY RESERVOIR | 7.4 | 7.1 | 6.8 | 6.5 | 6.4 | 6.2 | 9.7 | 8.2 | 8.7 | 6.7 | 7.6 | 4.0 |
| % of Average | 114 | 115 | 113 | 116 | 121 | 123 | 110 | 90 | 97 | 87 | 95 | 57 |
| GIBSON RESERVOIR | 33.0 | 35.9 | 37.8 | 40.0 | 42.8 | 48.8 | 82.0 | 95.1 | 83.3 | 18.7 | 4.6 | 6.2 |
| % of Average | 96 | 95 | 91 | 89 | 89 | 94 | 130 | 107 | 92 | 33 | 14 | 22 |
| WILLOW CREEK | 27.5 | 27.5 | 27.5 | 27.5 | 27.6 | 28.3 | 28.9 | 32.4 | 32.0 | 24.2 | 19.9 | 19.7 |
| % of Average | 131 | 127 | 124 | 123 | 121 | 120 | 116 | 117 | 114 | 105 | 97 | 95 |
| PISHKUN RESERVOIR | 36.4 | 36.0 | 35.9 | 35.8 | 35.8 | 35.5 | 39.3 | 44.2 | 41.5 | 31.0 | 32.7 | 33.5 |
| % of Average | 108 | 104 | 104 | 106 | 105 | 102 | 95 | 96 | 101 | 85 | 91 | 102 |
| LAKE ELWELL (TIBER DAM) | 826.9 | 815.2 | 799.7 | 782.5 | 770.8 | 785.7 | 833.9 | 892.7 | 945.2 | 916.7 | 886.6 | 857.2 |
| % of Average | 116 | 116 | 115 | 115 | 114 | 115 | 119 | 115 | 111 | 112 | 114 | 115 |
| SHERBURNE LAKE | 6.3 | 8.9 | 11.3 | 13.6 | 15.8 | 21.0 | 19.2 | 33.3 | 59.8 | 40.5 | 13.5 | 7.8 |
| % of Average | 36 | 41 | 46 | 49 | 53 | 78 | 88 | 95 | 109 | 84 | 47 | 53 |
| FRESNO RESERVOIR | 48.3 | 51.0 | 51.3 | 49.8 | 48.5 | 76.3 | 87.4 | 85.2 | 67.4 | 37.4 | 20.6 | 27.8 |
| % of Average | 96 | 102 | 106 | 106 | 100 | 111 | 104 | 108 | 85 | 63 | 42 | 54 |
| NELSON RESERVOIR | 67.7 | 64.8 | 62.5 | 60.5 | 58.7 | 66.9 | 73.3 | 68.0 | 70.8 | 51.6 | 43.5 | 50.2 |
| % of Average | 123 | 121 | 120 | 119 | 118 | 128 | 123 | 118 | 124 | 101 | 86 | 95 |
| BULL LAKE | 43.2 | 44.0 | 44.0 | 43.9 | 44.1 | 44.6 | 40.6 | 50.7 | 96.5 | 104.2 | 65.6 | 56.3 |
| % of Average | 55 | 56 | 56 | 55 | 56 | 56 | 52 | 56 | 76 | 81 | 63 | 73 |
| PILOT BUTTE RESERVOIR | 18.8 | 28.3 | 28.2 | 28.1 | 28.2 | 28.1 | 27.0 | 20.5 | 30.9 | 18.1 | 15.9 | 12.4 |
| % of Average | 75 | 108 | 108 | 109 | 109 | 102 | 87 | 73 | 103 | 70 | 71 | 64 |
| BOYSEN RESERVOIR | 254.2 | 265.7 | 278.7 | 294.8 | 308.6 | 345.8 | 353.8 | 373.7 | 416.4 | 388.2 | 351.6 | 351.9 |
| % of Average | 40 | 43 | 47 | 52 | 56 | 64 | 68 | 68 | 62 | 58 | 55 | 56 |
| ANCHOR RESERVOIR | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 1.5 | 0.6 | 0.3 | 0.4 | 0.3 |
| % of Average[1] | 99 | 131 | 141 | 159 | 126 | 92 | 64 | 89 | 14 | 13 | 47 | 106 |
| BUFFALO BILL RESERVOIR | 350.7 | 357.1 | 361.9 | 368.4 | 373.3 | 384.1 | 399.6 | 503.0 | 619.6 | 614.2 | 530.5 | 465.7 |
| % of Average[2] | 86 | 88 | 90 | 92 | 95 | 101 | 115 | 130 | 114 | 111 | 108 | 108 |
| BIGHORN LAKE | 663.0 | 668.6 | 651.6 | 632.4 | 611.5 | 626.9 | 624.1 | 691.1 | 831.8 | 800.0 | 762.6 | 785.9 |
| % of Average | 67 | 70 | 72 | 74 | 74 | 77 | 78 | 79 | 82 | 79 | 79 | 81 |
| E. A. PATTERSON LAKE | 6.2 | 6.3 | 6.4 | 6.5 | 6.6 | 8.8 | 8.6 | 8.6 | 6.9 | 6.5 | 6.3 | 6.4 |
| % of Average | 100 | 101 | 103 | 104 | 99 | 113 | 111 | 114 | 94 | 92 | 95 | 100 |
| LAKE TSCHIDA | 53.3 | 54.0 | 54.8 | 55.1 | 55.4 | 71.5 | 68.4 | 68.4 | 68.2 | 61.0 | 55.7 | 55.3 |
| % of Average | 90 | 91 | 93 | 93 | 90 | 100 | 99 | 101 | 100 | 94 | 92 | 94 |
| JAMESTOWN RESERVOIR | 28.1 | 27.2 | 27.2 | 27.0 | 27.0 | 28.1 | 31.4 | 34.5 | 31.9 | 31.2 | 30.7 | 29.8 |
| % of Average | 105 | 103 | 103 | 102 | 101 | 82 | 65 | 80 | 85 | 89 | 93 | 103 |
| SHADEHILL RESERVOIR | 79.3 | 78.1 | 75.7 | 74.7 | 74.3 | 83.7 | 83.8 | 84.7 | 83.9 | 80.9 | 77.1 | 77.9 |
| % of Average | 72 | 72 | 70 | 70 | 69 | 69 | 68 | 68 | 68 | 67 | 66 | 70 |
| ANGOSTURA RESERVOIR | 78.8 | 81.0 | 83.3 | 85.7 | 88.5 | 105.4 | 108.9 | 110.6 | 115.1 | 99.3 | 84.2 | 81.9 |
| % of Average | 82 | 84 | 84 | 85 | 84 | 93 | 93 | 93 | 98 | 92 | 86 | 88 |
| DEERFIELD RESERVOIR | 14.9 | 14.8 | 14.6 | 14.3 | 14.1 | 15.0 | 15.4 | 15.4 | 15.5 | 15.3 | 15.2 | 15.2 |
| % of Average | 111 | 108 | 104 | 100 | 97 | 101 | 104 | 104 | 105 | 106 | 110 | 112 |
| PACTOLA RESERVOIR | 46.5 | 46.7 | 46.8 | 47.2 | 47.5 | 49.5 | 52.0 | 56.1 | 56.1 | 52.9 | 49.0 | 48.1 |
| % of Average | 95 | 96 | 96 | 97 | 98 | 100 | 102 | 108 | 107 | 105 | 101 | 100 |
| KEYHOLE RESERVOIR | 115.8 | 115.5 | 115.6 | 116.3 | 117.3 | 131.0 | 131.9 | 131.6 | 136.2 | 125.0 | 113.4 | 111.3 |
| % of Average | 114 | 114 | 114 | 114 | 112 | 116 | 116 | 113 | 118 | 114 | 110 | 111 |
| BELLE FOURCHE RESERVOIR | 66.0 | 76.6 | 86.4 | 96.4 | 107.0 | 130.6 | 142.6 | 151.9 | 141.1 | 98.1 | 57.3 | 56.2 |
| % of Average | 81 | 83 | 86 | 87 | 89 | 95 | 96 | 98 | 96 | 87 | 73 | 83 |
| **CORPS RESERVOIRS** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| FORT PECK RESERVOIR | 11,799.0 | 11,715.0 | 11,336.0 | 11,001.0 | 10,746.0 | 11,033.0 | 11,025.0 | 11,054.0 | 11,159.0 | 10,950.0 | 10,694.0 | 10,492.0 |
| GARRISON RESERVOIR | 14,988.0 | 14,442.0 | 13,917.0 | 13,553.0 | 13,182.0 | 13,858.0 | 13,695.0 | 13,914.0 | 15,101.0 | 14,857.0 | 14,042.0 | 13,512.0 |
| OAHE RESERVOIR | 12,844.0 | 12,495.0 | 12,790.0 | 12,887.0 | 13,304.0 | 13,558.0 | 13,364.0 | 13,660.0 | 13,437.0 | 13,137.0 | 12,691.0 | 11,932.0 |
| BIG BEND RESERVOIR | 1,689.0 | 1,712.0 | 1,722.0 | 1,701.0 | 1,700.0 | 1,721.0 | 1,703.0 | 1,681.0 | 1,705.0 | 1,682.0 | 1,707.0 | 1,693.0 |
| FORT RANDALL RESERVOIR | 2,334.0 | 2,375.0 | 2,577.0 | 2,780.0 | 3,105.0 | 3,417.0 | 3,486.0 | 3,278.0 | 3,359.0 | 3,434.0 | 3,434.0 | 3,367.0 |
| LEWIS AND CLARK LAKE | 405.0 | 412.0 | 384.0 | 376.0 | 366.0 | 355.0 | 357.0 | 349.0 | 374.0 | 368.0 | 368.0 | 373.0 |

[1] Percent of average content of Anchor Reservoir is based on a 12-year average, 1991-2002; this is due to the availability of data for Anchor Reservoir.

[2] Percent of average content of Buffalo Bill Reservoir is based on a 10-year average, 1993-2002; to reflect the operation of the reservoir since 1992 when the dam was raised and the capacity of the reservoir was increased to 646,565 acre-feet.

# TABLE CET8

**WATER YEAR 2003**
**Monthly Inflow Amounts**
**(1,000 Acre-Feet)**

| RECLAMATION RESERVOIRS | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLARK CANYON RESERVOIR | 9.8 | 11.4 | 10.0 | 9.2 | 8.2 | 10.9 | 6.3 | 5.4 | 10.5 | 8.8 | 7.7 | 6.8 | 105.2 |
| % of Average | 41 | 50 | 53 | 59 | 59 | 59 | 30 | 19 | 29 | 30 | 37 | 33 | 39 |
| CANYON FERRY RESERVOIR | 164.9 | 195.3 | 185.5 | 181.2 | 165.2 | 230.5 | 302.6 | 422.3 | 523.9 | 112.5 | 82.8 | 93.6 | 2,660.2 |
| % of Average | 57 | 67 | 78 | 81 | 76 | 85 | 90 | 78 | 74 | 34 | 48 | 45 | 70 |
| HELENA VALLEY RESERVOIR | -0.6 | -0.3 | -0.3 | -0.3 | -0.1 | -0.2 | 6.1 | 12.0 | 20.9 | 19.4 | 20.8 | 6.6 | 84.0 |
| % of Average | N/A | N/A | N/A | N/A | N/A | N/A | 107 | 103 | 143 | 126 | 128 | 82 | 120 |
| GIBSON RESERVOIR | 11.0 | 7.7 | 8.1 | 8.3 | 7.6 | 11.4 | 53.6 | 114.6 | 109.0 | 29.9 | 14.3 | 11.1 | 386.7 |
| % of Average | 64 | 46 | 55 | 62 | 64 | 77 | 134 | 75 | 62 | 45 | 54 | 59 | 68 |
| WILLOW CREEK | -0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 0.6 | 3.4 | -0.3 | -0.4 | 0.2 | -0.3 | 3.9 |
| % of Average | N/A | N/A | N/A | N/A | 28 | 93 | 39 | 85 | N/A | N/A | 127 | N/A | 28 |
| PISHKUN RESERVOIR | -0.4 | -0.4 | -0.1 | -0.1 | -0.1 | -0.2 | 3.8 | 38.3 | 78.7 | 80.3 | 19.1 | 0.8 | 219.6 |
| % of Average | N/A | N/A | N/A | N/A | N/A | N/A | 47 | 104 | 123 | 113 | 50 | 7 | 95 |
| LAKE ELWELL (TIBER DAM) | 16.8 | 17.7 | 14.7 | 12.5 | 15.2 | 44.7 | 77.0 | 93.4 | 89.5 | 7.5 | 0.4 | 1.0 | 390.5 |
| % of Average | 91 | 85 | 79 | 77 | 68 | 97 | 132 | 67 | 58 | 15 | 3 | 8 | 68 |
| SHERBURNE LAKE | 3.9 | 2.6 | 2.5 | 2.2 | 2.2 | 5.2 | 15.0 | 27.7 | 32.3 | 15.5 | 7.9 | 4.0 | 121.1 |
| % of Average | 66 | 41 | 68 | 77 | 98 | 170 | 149 | 87 | 83 | 75 | 82 | 61 | 85 |
| FRESNO RESERVOIR | 18.8 | 5.2 | 3.0 | 1.1 | 1.1 | 30.5 | 27.9 | 34.0 | 39.6 | 34.7 | 31.7 | 12.2 | 239.8 |
| % of Average | 257 | 284 | 421 | 140 | 27 | 106 | 93 | 81 | 84 | 103 | 103 | 56 | 96 |
| NELSON RESERVOIR | 13.5 | -2.9 | -2.3 | -2.0 | -1.8 | 8.2 | 7.4 | 2.6 | 8.6 | -0.7 | 5.5 | 8.0 | 44.1 |
| % of Average | 337 | N/A | N/A | N/A | N/A | 318 | 95 | 33 | 100 | N/A | 78 | 147 | 99 |
| BULL LAKE | 4.0 | 2.1 | 1.3 | 1.1 | 1.4 | 1.7 | 2.4 | 27.8 | 47.6 | 32.4 | 14.5 | 6.3 | 142.6 |
| % of Average | 75 | 70 | 54 | 51 | 91 | 95 | 75 | 105 | 77 | 66 | 67 | 62 | 75 |
| PILOT BUTTE RESERVOIR[1] | 12.6 | 9.6 | -0.1 | -0.1 | 0.0 | -0.1 | 7.4 | 24.3 | 43.3 | 29.2 | 35.2 | 17.8 | 179.2 |
| % of Average | 158 | 692 | N/A | N/A | N/A | N/A | 82 | 109 | 112 | 68 | 109 | 75 | 99 |
| BOYSEN RESERVOIR | 34.0 | 29.6 | 31.7 | 34.5 | 30.3 | 56.0 | 37.0 | 71.4 | 114.8 | 39.1 | 25.1 | 44.7 | 548.2 |
| % of Average | 52 | 58 | 80 | 93 | 80 | 104 | 70 | 53 | 44 | 26 | 38 | 74 | 54 |
| ANCHOR RESERVOIR | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.7 | 3.6 | 5.4 | 2.6 | 0.6 | 0.7 | 13.8 |
| % of Average[2] | 19 | 7 | 2 | 6 | 4 | 148 | 84 | 83 | 73 | 100 | 95 | 94 | 78 |
| *BUFFALO BILL RESERVOIR | 15.6 | 12.6 | 11.2 | 13.0 | 10.6 | 17.2 | 48.8 | 193.4 | 291.9 | 133.8 | 20.3 | 14.3 | 782.7 |
| % of Average | 64 | 59 | 67 | 85 | 78 | 91 | 117 | 126 | 95 | 76 | 42 | 53 | 90 |
| BIGHORN LAKE | 116.3 | 78.2 | 58.1 | 57.5 | 47.2 | 95.6 | 73.3 | 143.4 | 244.1 | 87.5 | 78.4 | 128.8 | 1,208.3 |
| % of Average | 63 | 53 | 44 | 44 | 37 | 56 | 43 | 52 | 60 | 30 | 47 | 72 | 51 |
| E. A. PATTERSON LAKE | -0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 12.7 | 0.4 | 0.7 | 1.2 | -0.4 | -0.1 | 0.1 | 14.8 |
| % of Average | -48 | 34 | 60 | 32 | 8 | 185 | 9 | 45 | 58 | N/A | N/A | 39 | 77 |
| LAKE TSCHIDA | 1.1 | 0.7 | 1.1 | 0.9 | 0.9 | 54.3 | 3.0 | 3.7 | 1.8 | -1.5 | -1.4 | 0.0 | 64.6 |
| % of Average | 59 | 47 | 103 | 71 | 16 | 183 | 16 | 48 | 19 | N/A | N/A | 7 | 78 |
| JAMESTOWN RESERVOIR | 0.1 | -0.1 | 0.0 | -0.2 | -0.1 | 1.1 | 3.2 | 7.7 | 6.3 | 4.5 | 5.9 | 3.0 | 31.4 |
| % of Average | 6 | N/A | N/A | N/A | N/A | 13 | 13 | 79 | 184 | 101 | 136 | 233 | 52 |
| SHADEHILL RESERVOIR | -0.6 | 0.0 | -1.2 | 0.3 | 0.7 | 10.7 | 1.4 | 2.3 | 0.5 | -1.7 | -2.5 | 2.1 | 11.9 |
| % of Average | N/A | N/A | N/A | 16 | 15 | 47 | 9 | 17 | 7 | N/A | N/A | N/A | 16 |
| ANGOSTURA RESERVOIR | 0.5 | 2.2 | 2.3 | 2.4 | 2.8 | 16.9 | 3.5 | 3.2 | 9.6 | -0.7 | -0.6 | 0.8 | 42.8 |
| % of Average | 23 | 69 | 116 | 100 | 50 | 125 | 38 | 19 | 66 | N/A | N/A | 52 | 55 |
| DEERFIELD RESERVOIR | 0.6 | 0.6 | 0.6 | 0.4 | 0.5 | 1.5 | 1.6 | 1.2 | 1.1 | 0.5 | 0.5 | 0.5 | 9.7 |
| % of Average | 75 | 79 | 85 | 58 | 71 | 152 | 118 | 79 | 79 | 54 | 63 | 76 | 84 |
| PACTOLA RESERVOIR | 1.5 | 1.4 | 1.3 | 1.6 | 1.4 | 3.2 | 3.7 | 6.6 | 4.4 | 1.6 | 0.8 | 1.2 | 28.8 |
| % of Average | 66 | 80 | 88 | 110 | 94 | 118 | 79 | 93 | 66 | 44 | 25 | 52 | 74 |
| KEYHOLE RESERVOIR | -1.2 | -0.3 | 0.1 | 0.7 | 1.0 | 13.7 | 0.8 | -0.3 | 4.6 | -3.2 | -4.0 | -1.1 | 10.8 |
| % of Average | N/A | N/A | 39 | 123 | 36 | 186 | 34 | N/A | 316 | N/A | N/A | N/A | 74 |
| BELLE FOURCHE RESERVOIR | 10.0 | 10.5 | 9.9 | 10.0 | 10.5 | 23.6 | 12.1 | 10.8 | 6.6 | -1.6 | -0.2 | 9.7 | 111.8 |
| % of Average | 80 | 99 | 104 | 96 | 111 | 144 | 96 | 74 | 62 | N/A | N/A | 173 | 94 |

[1] Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.

[2] Percent of average inflow for Anchor Reservoir is based on a 12-year average, 1991-2002, this is due to the availability of data for Anchor Reservoir.

## FIGURE CEG1
## ANNUAL GENERATION AT USBR PLANTS

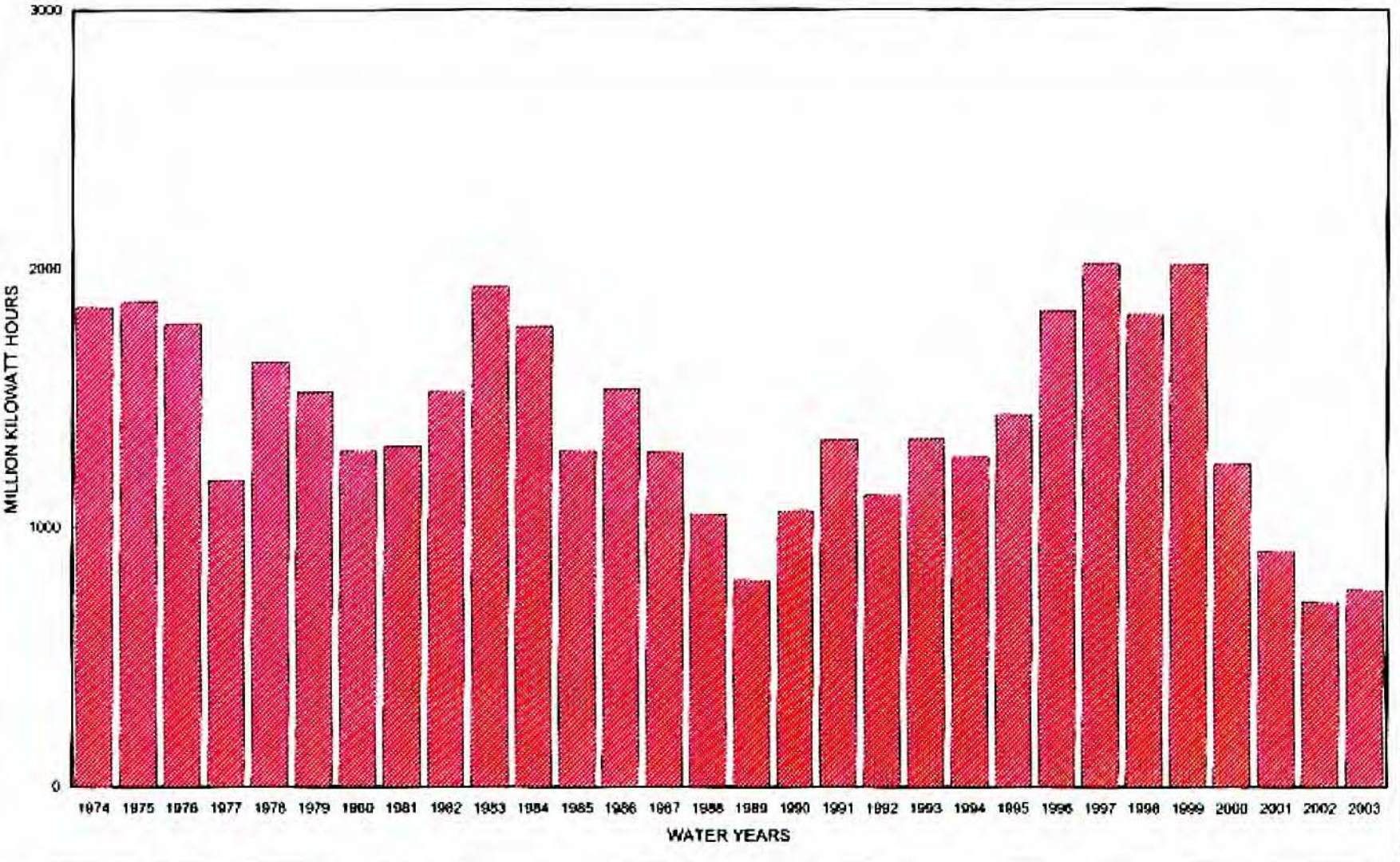


FIGURE CEG2

## MONTHLY GENERATION AT USBR PLANTS

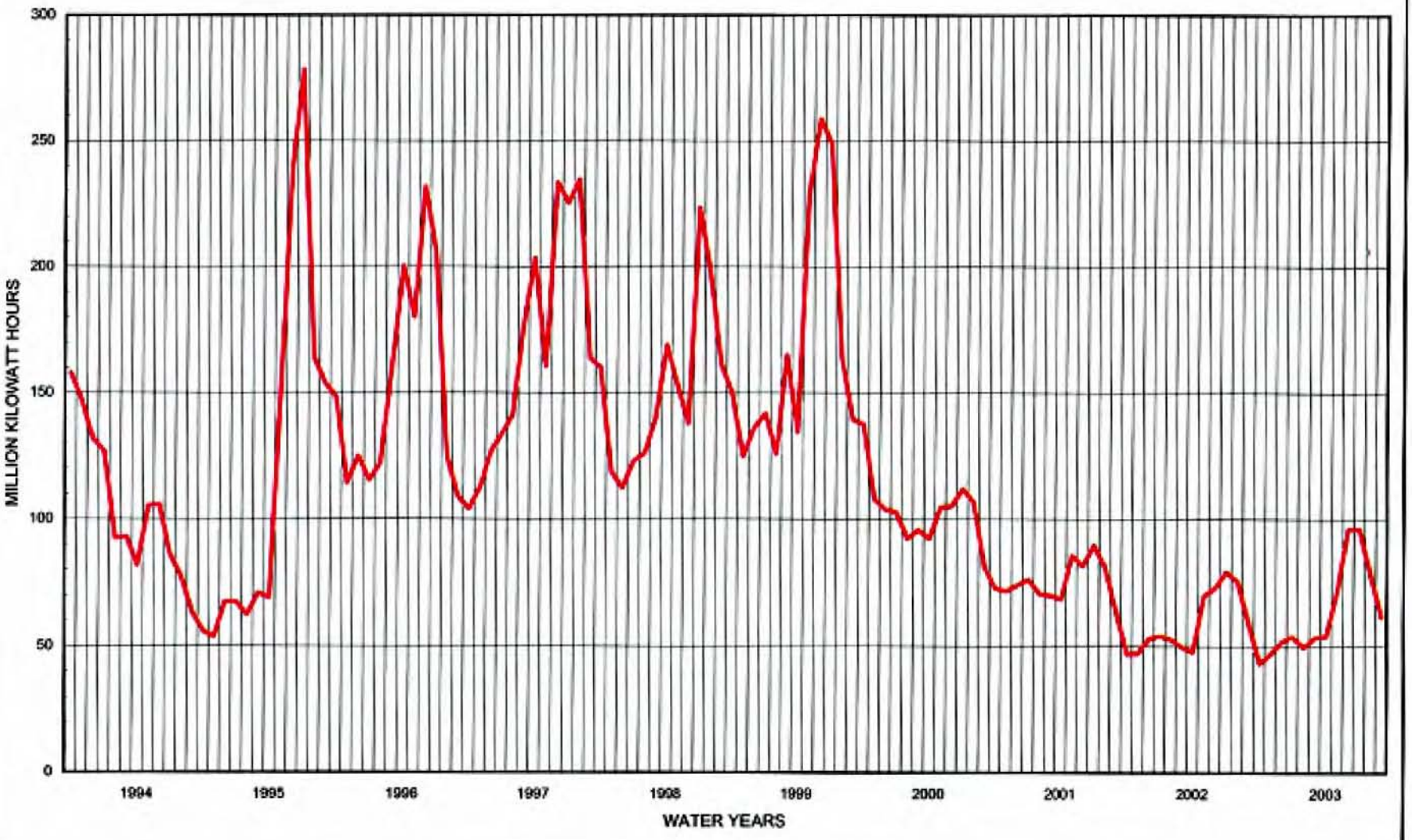


FIGURE CEG3

## ANNUAL GENERATION AT COE PLANTS

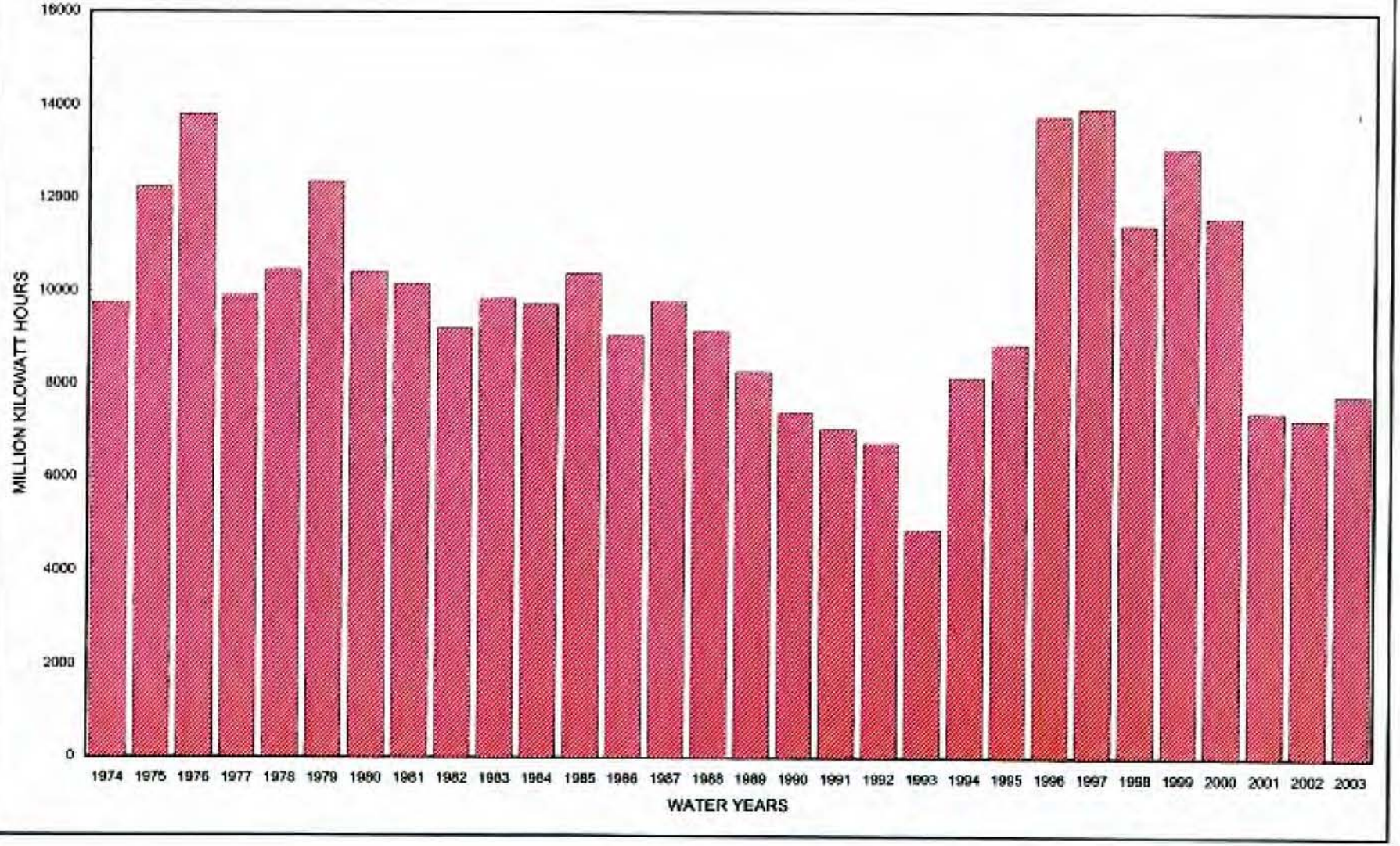


FIGURE CEG4

# MONTHLY GENERATION AT COE PLANTS

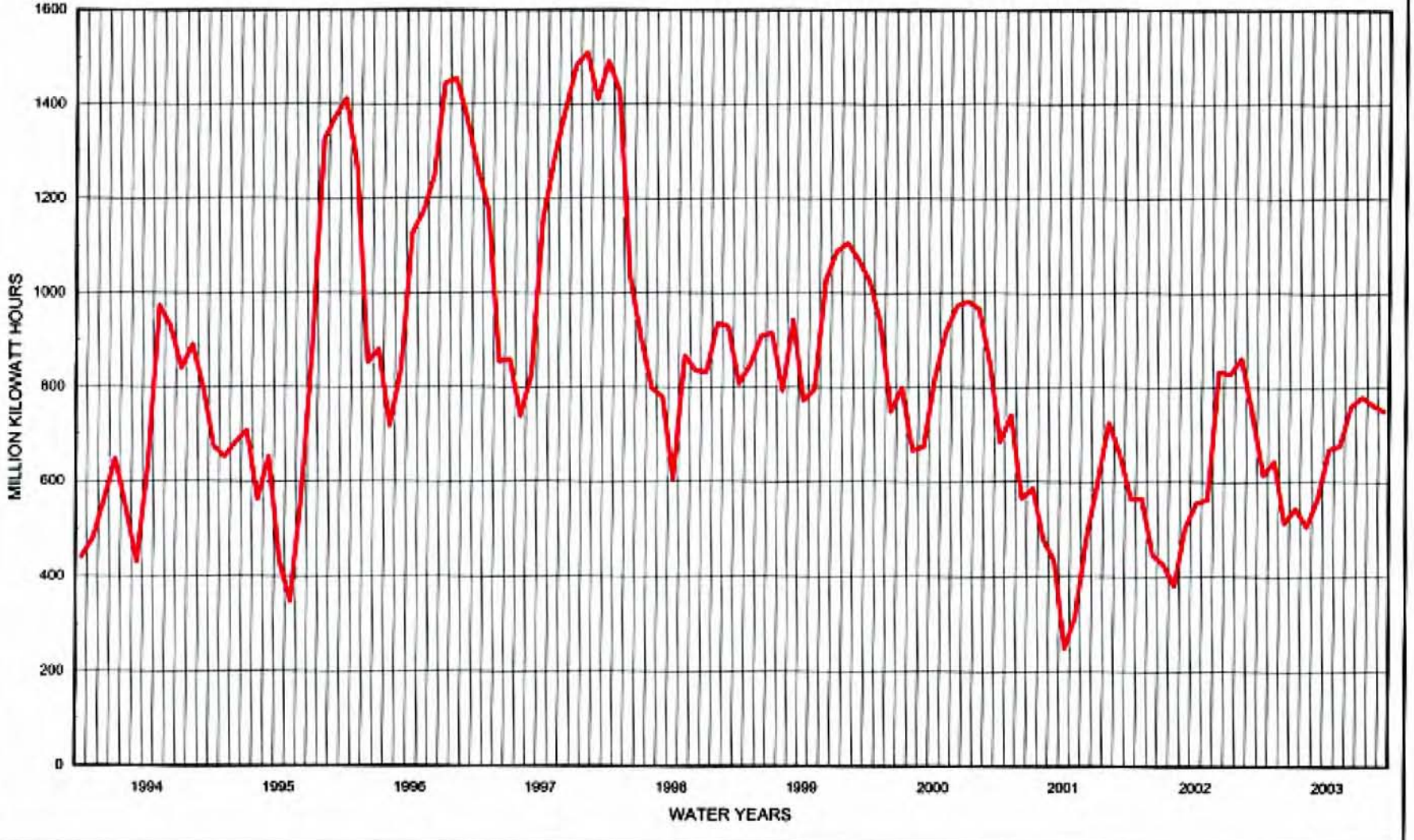


FIGURE CEG5

# ANNUAL GENERATION - USBR & COE PLANTS

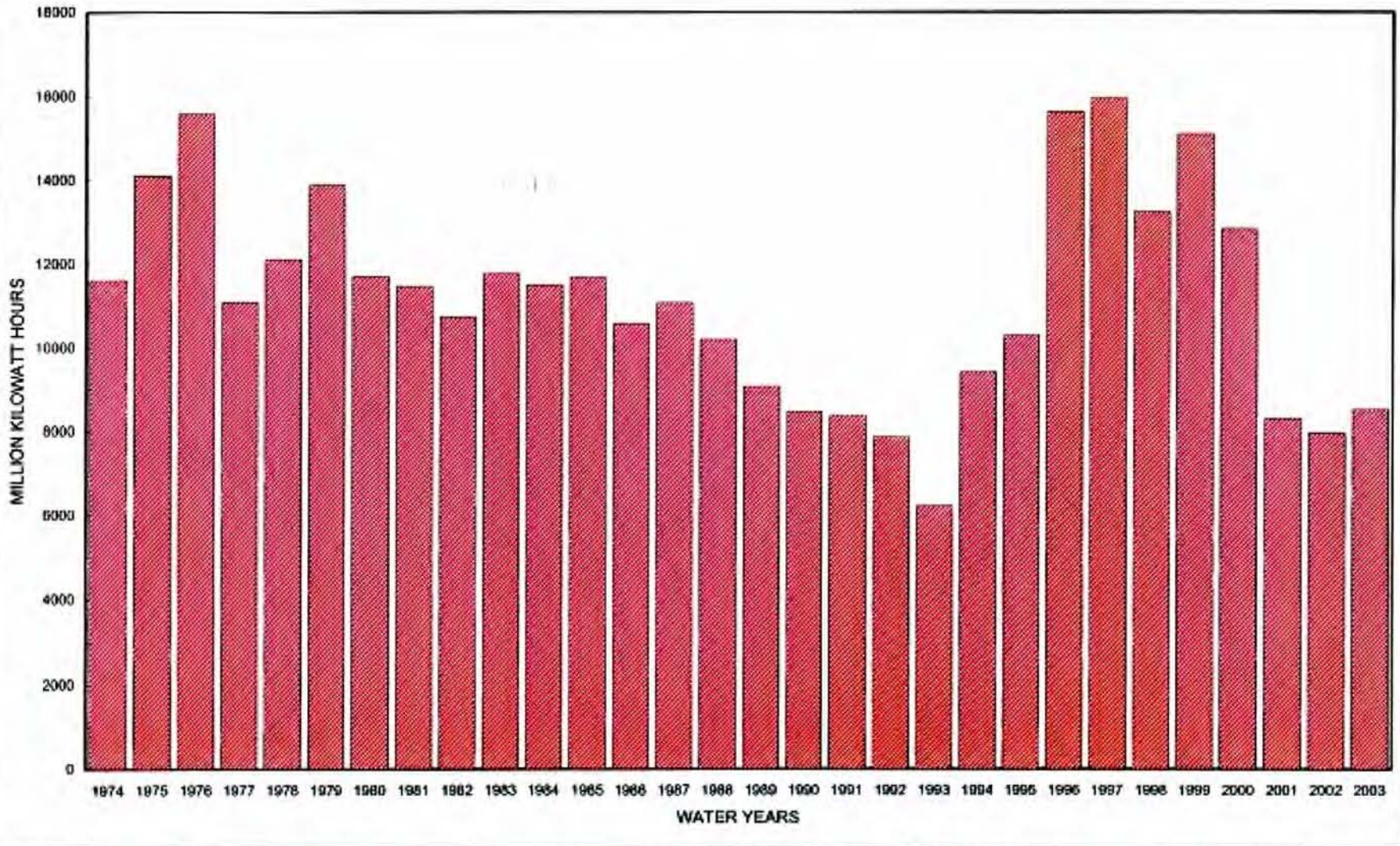


FIGURE CEG6

## MONTHLY GENERATION - USBR & COE PLANTS