

RECLAMATION

Managing Water in the West

Nebraska-Kansas Area Office

Report

To The

Republican River

Compact Administration

Burlington, CO



U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region
Nebraska-Kansas Area Office

August 22, 2017

REPUBLICAN RIVER COMPACT MEETING

August 22, 2017
Burlington, Colorado

2016 Operations

As shown on the attached Table 1, precipitation in the Republican River Basin varied from 122 percent of normal at Harlan County Dam to 90 percent of normal at Norton Dam. Total precipitation at Reclamation project dams ranged from 18.81 inches at Red Willow Dam to 33.30 inches at Lovewell Dam.

Inflows varied from 51 percent of the most probable forecast at Bonny Reservoir and Hugh Butler Lake to 154 percent of the most probable forecast at Harry Strunk Lake. Inflows into Bonny Reservoir totaled 4,398 AF while inflows at Harlan County Lake totaled 126,679 AF.

Average farm delivery values for total irrigable acres were as follows:

| <u>District</u> | <u>Farm Delivery</u> |
|---------------------|----------------------|
| Frenchman Valley | 0.6 inches |
| H&RW | 0.0 inches |
| Frenchman-Cambridge | 4.8 inches |
| Almena | 0.0 inches |
| Bostwick in NE | 5.7 inches |
| Kansas-Bostwick | 6.6 inches |

2016 Operation Notes

Bonny Reservoir – Remained empty at elevation 3638.00 feet, 34.0 feet below the top of conservation. The annual computed inflow totaled 4,398 AF. Reservoir inflows were bypassed the entire year as ordered by the State of Colorado. A total of 691 AF was bypassed into Hale Ditch from April 1st through September 14th.

Enders Reservoir – Started the year at elevation 3084.28 feet, 28.0 feet below the top of conservation. This was the second lowest level ever recorded on the first of January since initial filling. The reservoir level increased gradually during the spring to a peak elevation of 3086.30 feet on June 15, 2016. Evaporation decreased the reservoir level from June through mid-November reaching elevation 3084.06 feet on November 15th. The 2016 computed inflow totaled 4,683 AF. No water was released from Enders Reservoir for irrigation. This was the fifteenth consecutive year that H&RW Irrigation District did not divert water. It was also the thirteenth consecutive year that storage releases were not made for Frenchman Valley Irrigation District. The end of the year reservoir level was 27.9 feet (3084.41 feet) below the top of conservation.

Swanson Lake – Started the year at elevation 2734.84 feet, 17.2 feet below the top of conservation. The annual computed inflow totaled 31,055 AF (includes water pumped from Colorado’s Compact Compliance Pipeline). The lake gradually increased throughout the winter and spring. The peak elevation on June 3rd was 2741.72 feet (10.3 feet below the top of conservation). The reservoir level decreased throughout the irrigation season and reached an elevation of 2734.86 feet on November 14th. The district diverted 17,458 AF into Meeker-Driftwood Canal from June 20th through September 2nd. At the end of the year, the reservoir level was 16.4 feet below the top of conservation at 2735.63 feet.

Hugh Butler Lake – Started the year at elevation 2562.97 feet, 18.8 feet below the top of conservation. The 2016 computed inflow was 6,493 AF. Late winter and spring inflows gradually increased the lake level but summer evaporation slowed reservoir gains and the lake level peaked at 2566.78 feet on June 7th. No irrigation releases were made from Hugh Butler Lake in 2016. The reservoir elevation at the end of year was 2564.94 feet, 16.9 feet below the top of conservation.

Harry Strunk Lake – Started the year at elevation 2365.60 feet, 0.5 foot below the top of conservation. The annual computed inflow totaled 59,716 AF (includes water pumped from the Nebraska Cooperative Republican Platte Enhancement Project N-CORPE). The reservoir level was maintained near this level through the late winter and early spring months with inflows passed through the outlet works. Additional releases were started from the river outlet works on June 17th to meet increasing irrigation demands. Irrigation releases continued through September 5th reducing the reservoir level to 2355.92 feet. The district diverted 30,337 AF into Cambridge Canal. Late fall and early winter inflows (including water pumped from N-CORPE) increased the level of Harry Strunk Lake to elevation 2363.00 feet at the end of the year (3.1 feet below the top of conservation).

Keith Sebelius Lake – Started the year at elevation 2287.74 feet, 16.6 feet below the top of conservation. The total 2016 computed inflow was 8,285 AF. The reservoir level slowly increased to elevation 2289.68 feet on May 31st. No irrigation releases were made from Keith Sebelius Lake in 2016. The reservoir level gradually decreased during the summer and fall reaching elevation 2287.88 feet on August 26th. Runoff from a large precipitation event in September over Labor Day weekend increased the reservoir level 2.4 feet in two days with inflows peaking at approximately 1,750 cfs on September 4, 2016. Keith Sebelius Lake ended the year at elevation 2291.25 feet (13.0 feet below the top of conservation).

Harlan County Lake – Started the year at elevation 1932.86, 12.9 feet below the top of conservation pool. The 2016 computed inflow totaled 126,679 AF (includes augmentation water that passed through Harry Strunk Lake). The lake level peaked at elevation 1940.71 feet on June 10th. Irrigation releases began on June 10th and continued through September 9th decreasing the pool level to elevation 1935.44 feet. Bostwick in Nebraska Irrigation District diverted 27,500 AF in 2016. Irrigation releases from Harlan County Lake totaled 63,972 AF in 2016. The reservoir elevation was 1935.58 feet (10.2 feet below the top of conservation) on December 31st. A ten year summary of Harlan County Lake operations is shown on Table 3.

Kansas Bostwick Irrigation District entered into an Excess Capacity Contract (Warren Act

Authority) with Reclamation for the use of compact compliance water stored in Harlan County Lake in 2014. An amendment to this contract in December 2014 provided for 14,100 AF of water to be carried over into 2015. No water was released under this contract during the 2015 irrigation season. Losses due to evaporation resulted in 10,900 AF remaining in this pool to be carried over into 2016. Prior to the 2016 irrigation season, the NDNR ordered an additional 28,000 AF of inflow resulting from augmentation pumping be stored for exclusive use by KBID. This additional water was included in the compact compliance pool for KBID use. A total of 466 AF was released under the Excess Capacity Contract during the 2016 irrigation season. An amendment to the contract between the KBID and Reclamation in December of 2016 provided for 15,000 AF of water to be carried over into 2017.

Lovewell Reservoir – Started the year at elevation 1582.13 feet, 0.5 foot below the top of conservation. The annual computed inflow total for 2016 was 46,529 AF. Republican River diversions were made via the Courtland Canal into Lovewell Reservoir during April. Lovewell Dam recorded 6.53 inches of precipitation during April and 8.39 inches during May. The reservoir pool reached a target level of 2.0 feet above top of conservation at the end of April. A river release was started on May 9th to maintain the pool level until irrigation releases began. The reservoir level peaked at elevation 1585.30 feet (2.7 feet above the top of conservation) on May 29th, and was at the target elevation when irrigation releases began on June 6th. Approximately 6,270 AF was released to the river.

Releases to the canal began on May 2nd and continued through September 9th. The reservoir elevation at the end of the irrigation season was 1581.39 feet. Republican River flow was not diverted via Courtland Canal into Lovewell Reservoir after the irrigation season. The Kansas Bostwick Irrigation District diverted a total of 48,633 AF in 2016, including 28,871 AF from Lovewell Reservoir. The reservoir level at the end of the year was 1582.51 feet (0.1 foot below top of conservation).

Current Operations (As of 7/31/17)

Bonny Reservoir – The reservoir is currently empty. Inflows continue to be bypassed through the reservoir as ordered by the State of Colorado. Approximately 1,057 AF has been released into Hale Ditch in 2017. Bonny Dam has recorded 19.96 inches of precipitation during the first seven months of the year (169% of average).

Enders Reservoir - The reservoir level is currently 30.0 feet below full and 3.0 feet below last year at this time. Enders Dam recorded 10.22 inches of precipitation during the first seven months of the year (77% of normal). Due to the water supply shortage, H&RW Irrigation District is not irrigating for the sixteenth year in a row. This is also the fourteenth consecutive year that Frenchman Valley Irrigation District has not received storage water for irrigation. On January 18, 2017 the Frenchman Valley and H&RW Irrigation Districts entered into an agreement with the Middle Republican Natural Resources District to release 2,000 AF of storage water from Enders Reservoir for compact compliance. This release began on April 5th and was completed by April 12th.

Swanson Lake – The lake level is currently 13.6 feet from full and is 0.1 foot above last year at this time. Precipitation for the year is at 110% of normal (14.89 inches). Irrigation releases began on June 22nd.

Hugh Butler Lake – The lake level is currently 16.3 feet below full and is 0.2 foot below last year at this time. The precipitation total so far this year is 10.50 inches (81% of normal). Irrigation releases began on July 24th.

Harry Strunk Lake – The lake level is currently 9.2 feet below the top of conservation. Precipitation at the dam during the first seven months of the year was 10.35 inches (73% of normal). Irrigation releases began on June 5th. The lake level is currently 5.6 feet below last year at this time.

Keith Sebelius Lake – Currently 12.4 feet below full. Lake level is 3.5 feet above last year at this time. Irrigation releases began July 10th. Precipitation at the dam during the first seven months of the year was 18.61 inches (117% of normal).

Harlan County Lake – The current water surface level is approximately 5.8 feet below full. The lake level is 2.5 feet above last year at this time. Harlan County Dam has recorded 19.83 inches of precipitation so far this year (131% of normal). Irrigation releases began on June 12th. The available irrigation supply from Harlan County Lake on June 30, 2017 was 111,600 AF.

Lovewell Reservoir – The reservoir level is currently 2.6 feet below the top of conservation and approximately 1.4 feet below last year's elevation at this time. Lovewell Dam recorded 13.84 inches of precipitation during the first seven months of the year (79% of average). Canal releases began on May 1st.

A summary of data for the first seven months of 2017 is shown on Table 2.

Other Items

Excess Capacity Contract – Harlan County Lake – An Excess Capacity Contract (Contract) was executed with Kansas Bostwick Irrigation District (KBID) to temporarily store inflows into Harlan County Lake under the State of Nebraska's Compact Call water right administration. This Contract allowed water to be temporarily stored for KBID's use during the 2014 irrigation season. The contract was extended and amended into 2015, 2016, and 2017 to allow for carryover of the temporary storage.

WaterSMART Basin Study Program - The States of Colorado, Nebraska, and Kansas and the U.S. Department of the Interior, Bureau of Reclamation completed the Republican River Basin Study in early 2016. The Republican River Basin Study area covers the entire Republican River Basin in eastern Colorado, southern Nebraska, and northern Kansas down to the Clay Center gauging station in Kansas. The Basin Study represented an extensive collaborative effort among the states of Colorado, Kansas, and Nebraska to identify adaptation

strategies that address current and future water management challenges in the basin.

The Basin Study found that climate change may have a pronounced impact on future supplies and demands across the basin. The modeling tools developed under the study were used to evaluate alternatives to improve the supply reliability at the Frenchman-Cambridge Irrigation District in Nebraska, as well as the Bostwick Irrigation Districts in Nebraska and Kansas.

Nebraska focused on augmenting the supply of Swanson Lake and creating new surface water storage on Thompson Creek, a tributary of the Republican River. Kansas evaluated alternatives that increase the storage volume at Lovewell Reservoir.

The newly developed ground and surface water modeling tools will help inform future water management decisions that help build resiliency against future climate change, while also maintaining compliance with the Republican River Compact.

The Republican River Basin Study is a part of Reclamation's WaterSMART Program. The report is available online at www.usbr.gov/watersmart/bsp.

TABLE 1
NEBRASKA-KANSAS PROJECTS
Summary of Precipitation, Reservoir Storage and Inflows
CALENDAR YEAR 2016

| Reservoir | Total Precip. Inches | Percent Of Average % | Storage 12-31-15 | | Storage 12-31-16 | Gain or Loss | | Maximum Storage | | Minimum Storage | | Total Inflow AF | Percent Of Most Probable % |
|----------------|----------------------|----------------------|------------------|---------|------------------|--------------|---------|-----------------|---------|-----------------|---------|-----------------|----------------------------|
| | | | AF | AF | | AF | AF | Content | Date | Content | Date | | |
| Box Butte | 16.68 | 98 | 17,339 | 14,789 | 14,789 | -2,550 | 25,737 | MAY 18 | 11,599 | SEP 15 | 16,590 | 108 | |
| Merritt | 30.10 | 147 | 61,100 | 61,913 | 61,913 | 813 | 68,191 | MAY 4 | 42,181 | SEP 3 | 205,133 | 110 | |
| Calamus | 30.03 | 124 | 102,456 | 101,203 | 101,203 | -1,253 | 122,331 | MAY 1 | 68,603 | SEP 20 | 253,166 | 93 | |
| Davis Creek | 24.51 | 99 | 9,849 | 14,300 | 14,300 | 4,451 | 31,581 | JUL 7 | 9,102 | APR 13 | 58,536 | 130 | |
| Bonny | 19.41 | 113 | 0 | 0 | 0 | 0 | 0 | N/A | 0 | N/A | 4,398 | 51 | |
| Enders | 21.29 | 112 | 10,178 | 10,264 | 10,264 | 86 | 11,602 | JUN 15 | 10,027 | SEP 27 | 4,683 | 62 | |
| Swanson | 21.65 | 108 | 43,591 | 45,972 | 45,972 | 2,381 | 66,449 | JUN 3 | 43,644 | JAN 1 | 31,055 | 114 | |
| Hugh Butler | 18.81 | 96 | 12,879 | 14,669 | 14,669 | 1,790 | 16,457 | JUN 7 | 12,884 | JAN 1 | 6,493 | 51 | |
| Harry Strunk | 23.14 | 112 | 33,773 | 29,393 | 29,393 | -4,380 | 38,820 | JUN 1 | 19,880 | SEP 5 | 59,716 | 154 | |
| Keith Sebelius | 22.04 | 90 | 9,422 | 13,039 | 13,039 | 3,617 | 13,109 | SEP 21 | 9,422 | JAN 1 | 8,285 | 115 | |
| Harlan County | 27.82 | 122 | 167,416 | 194,203 | 194,203 | 26,787 | 250,967 | JUN 10 | 167,230 | JAN 1 | 126,679 | 112 | |
| Lovewell | 33.30 | 121 | 34,279 | 35,398 | 35,398 | 1,119 | 44,282 | MAY 29 | 29,806 | AUG 8 | 46,529 | 78 | |
| Kirwin | 30.59 | 130 | 35,389 | 77,029 | 77,029 | 41,640 | 77,029 | DEC 31 | 29,815 | AUG 26 | 68,124 | 274 | |
| Webster | 30.59 | 129 | 17,305 | 67,864 | 67,864 | 50,559 | 67,864 | DEC 31 | 17,305 | JAN 1 | 58,446 | 356 | |
| Waconda | 27.46 | 108 | 213,417 | 216,908 | 216,908 | 3,491 | 256,082 | SEP 7 | 200,897 | APR 16 | 191,173 | 154 | |
| Cedar Bluff | 27.66 | 132 | 55,681 | 54,285 | 54,285 | -1,396 | 59,749 | JUL 12 | 54,083 | DEC 23 | 11,201 | 75 | |

TABLE 2
NEBRASKA-KANSAS AREA OFFICE
Summary of Precipitation, Reservoir Storage and Inflows

JANUARY - JULY 2017

| Reservoir | Precip. | Percent Of | Storage | Storage | Gain or | Inflow | Percent |
|----------------|---------|------------|-----------|-----------|---------|--------|----------|
| | Inches | Average | 7/31/2016 | 7/31/2017 | Loss | AF | Of Most |
| | | % | AF | AF | AF | AF | Probable |
| | | | | | | | % |
| Bonny | 19.96 | 169 | 0 | 0 | 0 | 3,881 | 69 |
| Enders | 10.22 | 77 | 10,861 | 8,854 | (2,007) | 3,237 | 77 |
| Swanson | 14.89 | 110 | 54,645 | 54,944 | 299 | 27,273 | 127 |
| Hugh Butler | 10.50 | 81 | 15,384 | 15,240 | (144) | 4,011 | 51 |
| Harry Strunk | 10.35 | 73 | 28,661 | 21,113 | (7,548) | 28,129 | 107 |
| Keith Sebelius | 18.61 | 117 | 10,040 | 13,797 | 3,757 | 5,320 | 102 |
| Harlan County | 19.83 | 131 | 214,164 | 241,369 | 27,205 | 95,643 | 123 |
| Lovewell | 13.84 | 79 | 32,246 | 28,462 | (3,784) | 32,582 | 120 |

Inflow at Swanson Lake and Harry Strunk Lake includes water from augmentation (pumping) projects.

**TABLE 3
HARLAN COUNTY LAKE**

| Year | Inflow (AF) | Outflow (AF) | Gross Evap. (AF) | Precip. (Inches) | Precipitation | | End of Year Content (AF) | Projected Irrig. Water Supply On June 30th (AF) |
|------|----------------|-----------------|------------------------|---------------------|---|--------------------------------------|-----------------------------------|--|
| | | | | | Harlan County Dam* (% of Average) | Rep. Basin Dams (% of Average) | | |
| 2007 | 198,528 | 21,237 | 38,197 | 26.92 | 118% | 114% | 255,393 | 111,700 |
| 2008 | 224,841 | 114,938 | 45,985 | 30.31 | 133% | 131% | 319,311 | 175,900 |
| 2009 | 136,747 | 94,079 | 41,721 | 24.50 | 108% | 128% | 320,258 | 156,000 |
| 2010 | 239,054 | 194,055 | 46,893 | 31.66 | 139% | 119% | 318,364 | 147,800 |
| 2011 | 174,830 | 120,989 | 49,241 | 30.69 | 135% | 115% | 322,964 | 157,700 |
| 2012 | 78,581 | 160,221 | 50,199 | 18.14 | 80% | 64% | 191,125 | 132,900 |
| 2013 | 48,794 | 75,355 | 40,042 | 17.46 | 77% | 83% | 124,522 | 81,400 |
| 2014 | 92,209 | 35,502 | 32,387 | 18.53 | 81% | 105% | 148,842 | 59,000 |
| 2015 | 106,728 | 54,502 | 33,652 | 28.85 | 127% | 115% | 167,416 | 79,600 |
| 2016 | 126,679 | 63,972 | 35,920 | 27.82 | 122% | 109% | 194,203 | 103,500 |

NOTE: On June 30, 2017 Projected Irrig. Water Supply was 111,600 AF.
* Average Annual Precipitation at Harlan County Dam is 22.76 inches