

## KEY STORAGE FACILITIES

**Reservoir:** KEYHOLE

**Date:** 12 Feb. 2001

**Location:** NWNW 27,T51N,R66W

**Owner:** United States Bureau of Reclamation

**Year of Construction:** 1952

**Total Storage:** 634,639 acre-feet

**Active Storage:** 185,801 acre-feet

**Inactive Storage:** 7,226 acre-feet

**Dead Storage:** 726 acre-feet

**Inviolate Flood Control Storage:** 140,462 acre-feet

**Dam Construction Type:** Zoned earth fill



**Area/Capacity Table:** *(Source: 1978 Area Capacity Tables, computed 3/3/81, U.S. Bureau of Reclamation, Rapid City, South Dakota.)*

Area Table (acres, elevations in 1-ft. increments)

	0	1	2	3	4	5	6	7	8	9
	0	0	0	1	1	1	9	17	25	33
	41	61	81	102	122	142	180	218	255	293
	331	372	413	454	495	536	581	627	672	718
	763	815	868	920	973	1,025	1,130	1,236	1,341	1,447
	1,552	1,632	1,712	1,793	1,873	1,953	2,044	2,134	2,225	2,315
	2,406	2,570	2,734	2,899	3,063	3,227	3,378	3,529	3,680	3,831
	3,982	4,198	4,414	4,630	4,846	5,062	5,303	5,544	5,785	6,026
	6,267	6,608	6,950	7,291	7,633	7,974	8,308	8,642	8,977	9,311
	9,645	9,982	10,319	10,655	10,992	11,329	11,693	12,057	12,422	12,786
	13,150	13,537	13,924	14,311	14,698	15,085	15,461	15,837	16,213	16,589
	16,965	17,383	17,801	18,219	18,637	19,055	19,505	19,955	20,406	20,856

Volume Table (acre-feet, elevations in 1-ft. increments)

	0	1	2	3	4	5	6	7	8	9
	0	0	0	1	2	2	7	20	41	70
4,030	107	169	230	321	433	565	726	926	1,161	1,435
4,040	1,747	2,099	2,491	2,925	3,399	3,915	4,474	5,078	5,727	6,422
4,050	7,162	7,952	8,793	9,687	10,634	11,632	12,710	13,899	15,182	16,576
4,060	18,075	19,667	21,339	23,092	24,925	26,837	28,836	30,925	33,104	35,374
4,070	37,735	40,223	42,875	45,692	48,673	51,817	55,120	58,573	62,178	65,933
4,080	69,840	73,930	78,236	82,758	87,496	92,450	97,632	103,056	108,720	114,626
4,090	120,772	127,210	133,989	141,110	148,572	156,375	164,516	172,991	181,801	190,945
4,100	200,422	210,236	220,386	230,873	241,697	252,857	264,369	276,244	288,483	301,087
4,110	314,055	327,398	341,129	355,246	369,751	384,642	399,915	415,564	431,589	447,990
4,120	461,767	481,941	499,533	517,543	535,971	554,817	574,098	593,828	614,009	634,639

From permit map:

*Approximately 70,000 acre-feet of the original 200,000 acre-feet of Normal Water Surface elevation may ultimately be filled with sediment.*

*Storage capacity above elevation 4099.3 is for flood control and super storage.*

*Normal water surface is at top of controlled storage capacity.*

**Outlet:** Concrete-lined, horseshoe-shaped tunnel, 9.5 feet x 8.25 feet high through the left abutment. Release capacities of about 1,480 cubic feet per second are controlled by two vertical lift, high-pressure hydraulic slide gates.

**Spillway:** Uncontrolled concrete crest and concrete-lined open channel at the right abutment at 4099.3 feet, 19.25 feet wide, with a capacity of 11,000 cfs.

**End-of-Month Storage Records:** Yes

**Water Rights:** (Source: Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999)

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Keyhole Res	5707R	D,I,S,Min,Mun,Ind	09-10-1949	190000	28-51-066

Ninety percent of conservation storage (193,753 acre-feet) is reserved for South Dakota. This services approximately 57,200 irrigable acres in the vicinity of Belle Fourche and Newell, South Dakota. A portion of South Dakota's allocation currently has no contract and is maintained in the U.S. (federal) account.

Of Wyoming's portion (10 percent of active storage), 18,080 acre-feet have been purchased by the Crook County Irrigation District. The remaining 500 acre-feet were purchased by Shattuck Hills. Wyoming's 10 percent of active storage is reserved in the Belle Fourche Compact.

**Designated Use:** Flood control, irrigation, stock and fire protection, and other uses

**Recreational Use:** Fishing, boating, camping, swimming

**Associated Irrigation Diversions:** All irrigation diversions downstream of Keyhole Reservoir on the Belle Fourche are affected. Eighteen Wyoming irrigators are members of the Crook County Irrigation District, which owns the majority of the 10 percent share of the conservation pool discussed above.

**Associated Industrial Diversions:** None

**Operational Discussion:**

From the U.S. Bureau of Reclamation web page  
<http://gphyd0.gp.usbr.gov/aop/um/97/KEYRUS97.HTM>

*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 snowpack and precipitation is highly cyclical. No further efforts to develop forecast models are planned.*

Releases are made upon requests from the Crook County Irrigation District in Wyoming and the Belle Fourche Irrigation District in South Dakota.

**References:**

U.S. Bureau of Reclamation web page  
<http://gphyd0.gp.usbr.gov/aop/um/97/KEYRUS97.HTM>

*Map to Accompany Application, Keyhole Reservoir, United States of America Department of the Interior Bureau of Reclamation, Billings, Montana, 18 Aug. 1965.*

**Net evaporative loss for Keyhole Reservoir:**

*Historical End of Month Contents:*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	121,365	123,588	126,445	131,275	138,859	138,375	130,281	121,048	118,763	120,984	120,413	120,413
1971	117,730	122,889	137,754	161,420	168,271	173,321	165,512	156,038	153,367	117,304	117,000	117,061
1972	157,052	176,613	179,144	178,301	180,197	183,794	180,373	176,528	170,543	157,130	156,818	156,818
1973	167,297	167,459	168,514	172,646	172,815	171,465	164,781	157,754	157,286	167,540	167,216	167,297
1974	162,122	167,297	168,271	167,946	166,323	161,966	151,344	142,333	139,342	157,286	156,272	156,584
1975	137,892	137,892	144,203	151,568	156,974	158,378	151,344	141,037	136,097	138,514	137,961	137,823
1976	134,094	138,030	139,688	140,606	141,325	151,643	147,297	140,821	133,749	134,508	133,610	133,818
1977	131,407	131,937	135,820	144,059	142,908	140,102	129,221	115,359	113,503	131,606	131,407	131,010
1978	112,281	112,689	152,093	153,142	189,922	172,731	172,140	165,187	158,768	114,143	112,049	112,223
1979	157,130	157,598	168,109	171,380	167,054	162,122	157,832	152,692	147,822	157,208	155,882	156,662
1980	143,196	147,597	149,096	148,871	143,700	139,549	128,029	107,769	106,044	145,355	143,772	143,484
1981	102,176	102,176	103,595	94,799	74,774	62,473	55,188	47,192	42,657	102,983	101,644	102,016
1982	41,688	45,345	46,687	47,162	56,759	62,621	60,573	56,828	55,935	42,062	41,662	41,608
1983	61,299	66,857	68,063	68,573	68,456	66,741	56,828	51,399	50,508	58,221	59,496	59,890
1984	51,271	53,351	65,513	66,896	79,346	90,492	85,718	82,481	80,425	51,143	51,048	51,207
1985	79,302	79,257	82,434	82,481	77,489	73,386	62,954	57,487	56,003	79,346	79,391	79,391
1986	55,940	56,828	64,379	67,674	74,313	74,695	68,065	62,327	63,963	55,462	55,359	55,769
1987	66,513	69,091	84,445	87,741	92,604	90,247	83,741	79,442	78,639	66,088	66,513	66,552
1988	77,233	79,800	83,413	83,507	81,064	71,777	63,219	55,666	53,417	77,756	77,364	77,233
1989	52,732	53,090	58,224	59,002	61,486	57,561	48,922	41,033	40,511	52,960	52,601	52,699
1990	40,667	46,103	50,132	51,435	53,385	48,492	40,458	32,950	31,510	40,071	40,096	40,380
1991	30,862	31,442	31,680	32,752	46,780	48,461	40,876	32,884	30,376	31,119	30,883	30,904
1992	30,059	30,249	30,692	30,482	27,035	25,701	25,001	19,619	18,990	29,786	30,038	30,017
1993	18,672	18,704	25,190	32,025	50,894	67,752	69,485	70,364	68,184	18,594	18,578	18,594
1994	69,761	81,064	102,593	103,840	105,409	101,411	94,389	87,011	85,432	68,184	68,302	68,933
1995	93,059	93,159	96,156	96,734	109,998	111,524	110,818	107,855	105,971	92,196	92,703	92,601
1996	108,488	119,212	147,732	149,183	153,369	151,650	146,976	144,126	141,694	107,109	107,740	108,026
1997	148,381	162,861	181,888	186,602	183,966	182,067	180,995	178,414	175,336	141,036	140,817	142,378
1998	173,421	175,772	183,061	180,995	178,769	179,210	181,712	181,620	178,323	173,595	172,560	173,075
1999	177,353	178,591	182,160	185,875	179,923	186,241	179,923	177,267	174,727	184,870	177,616	176,851
Historical Ave. Vol. (af)	100,681	104,218	111,906	114,299	117,472	116,865	111,133	104,751	102,263	100,472	99,894	100,044
Corresponding Area (acres)	5,303	5,544	5,785	5,785	6,026	6,026	5,785	5,544	5,303	5,303	5,303	5,303

*Net evaporative loss (continued):*

Lewis Annual Evap. (in.)                      43  
 Total Storage (af)                              634,639

**Calculations:**

Monthly Lewis Evap. (in.)	1.161	1.075	1.677	3.44	4.945	5.633	7.353	6.708	4.945	3.268	1.677	1.118
Monthly Precipitation (in.)	0.25	0.25	0.75	1.75	2.75	2.75	1.75	1.25	1.25	1.25	0.75	0.75
Net Evaporation (in.)	0.911	0.825	0.927	1.69	2.195	2.883	5.603	5.458	3.695	2.018	0.927	0.368
Total Net Evaporation (af)	403	381	447	815	1,102	1,448	2,701	2,522	1,633	892	410	163
												<b>TOTAL</b>
												<b>12,915</b>