

## *INTRODUCTION*

Annual reports on actual operations and operating plans for reservoir regulation activities were initiated in 1953. The Montana Area 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 streamflow conditions in the Upper Missouri River Basin during water year 2007, which are principal factors governing the pattern of reservoir operations. This report also describes operations during water year 2007 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 year 2008, 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 discussed, and the energy generated in 2007 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 2006 and 2007," compares the water storage available at the beginning of water year 2008 to that available at the beginning of water year 2007. Table CET7 is a summary of the end of month storage contents for each reservoir during water year 2007. 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 1 through September 30, unless specifically stated otherwise.

## **SUMMARY OF HYDROLOGIC CONDITIONS AND FLOOD CONTROL DURING 2007**

### **Antecedent Conditions:**

The conditions that existed following the 2006 water year indicated that the drought conditions remain prominent in many of the Montana basins east of the Continental Divide, where reclamation facilities are located. Conditions for the Upper Missouri River basin were showing moderate improvement overall, but conditions in the Bighorn Basin in Wyoming headed more toward the side of drought. The temperatures and precipitation for water year 2006 varied significantly between seasons. The mountain and valley precipitation for most basins in Montana east of the Continental Divide and the Bighorn basin in Wyoming were near to above normal during early fall until April. This again reversed and from May until the end of August the precipitation dropped to near record lows throughout most of the basins. By mid summer extremely hot and dry conditions returned to the Upper Missouri and Bighorn basins. Near normal precipitation throughout September brought a glimmer of light to the situation as most basins finished out the year with precipitation levels near 90 percent of normal.

The 2006 snowpack as of April 1 was below normal in the river basins in Montana and Wyoming. It ranged from 42 percent of normal in the Upper Missouri River basin above Lima Reservoir to 80 percent of normal in the St. Mary River Basin above Lake Sherburne. The conditions improved during April and precipitation was near to above average for most of Montana. Conversely, precipitation in the Bighorn basin in Wyoming was much below average during April. Overall, April mountain and valley precipitation across Montana was 133 percent of average. April temperatures were generally 2 to 5 degrees above average producing increased snowmelt rates and above average streamflows in many basins. Continued warm temperatures in May combined with much below average precipitation did not help with the problem.

Inflows for water year 2006 were generally above average during the beginning of the year due to early fall storms with good precipitation; however the flows through the rest of the year were below normal. Total inflows for most of the basins continued to reflect the cumulative drought conditions experienced in the Upper Missouri and Bighorn basins since water year 2000.

The 2006 water year storage began with Reclamation reservoirs ranging from above to much below average storage. At two major Reclamation projects, Yellowtail and Canyon Ferry releases were below the minimum desired for the fishery as recommended by the Montana Fish, Wildlife, and Parks (MFWP) through most of the 2006 water year.

### **October through December:**

Precipitation for the 2007 water year began with normal to much above normal precipitation after a Pacific system brought moist and cooler weather to the area. Precipitation overall was much above normal during October and November. The exception was in the Bighorn Basin which fell below normal during this time period. During December dry conditions returned to many basins in Montana. However on the bright side the Bighorn, Gallatin, and Madison basins came through with near average precipitation. The total precipitation for these areas, during October through December, ranged from near normal to much above normal. For some basins, the early precipitation patterns indicated there may be some reprieve from the drought conditions. However other areas such as the Beaverhead, Jefferson, and Bighorn basins, the beginning of water year 2007 did not provide any indication the drought conditions were improving, Tables MTT3A and MTT3B.

October through December inflows were below normal at all Reclamation reservoirs in Montana east of the Continental divide with the exception of Lake Sherburne, and Lake Elwell. During November the inflow to Lake Sherburne was the sixth highest of record and inflow to Lake Elwell was the seventh highest of record.

### **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 73 percent of normal in the Gallatin Basin to 93 percent of normal in the basin above Gibson Reservoir, Table MTT1. The mountain snowpack was 84 percent of normal in the Bighorn River Basin in Wyoming. Mountain snow water content statewide was 82 percent of average and 84 percent of last year. West of the Continental Divide, mountain snow water content was 85 percent of average and 99 percent of last year. East of the Continental Divide, mountain snow water content was 79 percent of average and 76 percent of last year. Mountain precipitation during January ranged between 42 percent of average above Lima Reservoir to 78 percent of normal in both the basin above Lake Elwell and the basin above Lake Sherburne. The valley precipitation during January was much more varied between basins ranging from 3 percent of average in the Sun-Teton basin to 98 percent of average in the Bighorn basin. Overall, January precipitation across the state was 63 percent of average and 50 percent of the previous year.

In February, precipitation around the state gave us a glimmer of hope as mountain precipitation fell between 70 and 130 percent of average, and valley precipitation ranged as wide as 96 to 282 percent of average across the basins. By March 1, mountain snow water content for the state was 87 percent of average and 84 percent of last year, while east of the Continental Divide snow water content was 84 percent of average and 85 percent of last year. Precipitation during March for mountain and valley areas east of the Continental Divide was 70 percent of average and 84 percent of last year, respectively. The dry conditions during March again resulted in below average snowpack accumulations leading into the final month of the snowfall period.

January through March inflows were below normal to much below normal, with Clark Canyon and Bighorn Lake recording the lowest. Inflows for January through March were 72 percent of average for Clark Canyon, and only 57 percent of average for Bighorn Lake.

**TABLE MTT3A  
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE  
2007 VALLEY PRECIPITATION**

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.	%
<b>Beaverhead</b>																								
Monthly Precip Average	0.89		0.43		0.39		0.39		0.28		0.65		1.16		2.20		1.92		1.37		1.28		1.09	
Monthly Precip and % of Average	1.66	188	0.07	16	0.12	31	0.17	42	0.36	129	0.52	81	1.56	134	1.57	71	1.67	87	0.77	66	1.04	81	1.05	96
<u>Year-to-Date Precip and % of Average</u>	<u>1.66</u>	<u>188</u>	<u>1.73</u>	<u>132</u>	<u>1.85</u>	<u>109</u>	<u>2.01</u>	<u>96</u>	<u>2.37</u>	<u>100</u>	<u>2.89</u>	<u>96</u>	<u>4.45</u>	<u>106</u>	<u>6.02</u>	<u>94</u>	<u>7.68</u>	<u>93</u>	<u>8.45</u>	<u>88</u>	<u>9.49</u>	<u>87</u>	<u>10.53</u>	<u>88</u>
<b>Jefferson</b>																								
Monthly Precip Average	0.80		0.58		0.47		0.48		0.35		0.71		1.13		2.14		2.12		1.47		1.36		1.13	
Monthly Precip and % of Average	2.06	258	0.27	46	0.21	44	0.16	33	0.57	160	0.60	86	1.36	120	2.16	101	1.67	79	0.80	64	0.90	66	1.38	122
<u>Year-to-Date Precip and % of Average</u>	<u>2.06</u>	<u>268</u>	<u>2.32</u>	<u>169</u>	<u>2.63</u>	<u>137</u>	<u>2.69</u>	<u>116</u>	<u>3.25</u>	<u>121</u>	<u>3.85</u>	<u>114</u>	<u>5.21</u>	<u>115</u>	<u>7.37</u>	<u>111</u>	<u>9.04</u>	<u>103</u>	<u>9.84</u>	<u>96</u>	<u>10.74</u>	<u>93</u>	<u>12.11</u>	<u>96</u>
<b>Madison</b>																								
Monthly Precip Average	1.49		1.77		2.04		1.87		1.55		1.88		1.70		2.78		2.71		1.81		1.61		1.67	
Monthly Precip and % of Average	3.47	233	1.71	96	1.82	89	0.72	39	2.38	163	0.85	46	1.58	93	3.11	112	2.15	79	0.83	46	0.63	39	1.83	110
<u>Year-to-Date Precip and % of Average</u>	<u>3.47</u>	<u>233</u>	<u>6.17</u>	<u>169</u>	<u>6.99</u>	<u>132</u>	<u>7.71</u>	<u>108</u>	<u>10.08</u>	<u>116</u>	<u>10.93</u>	<u>103</u>	<u>12.51</u>	<u>102</u>	<u>15.63</u>	<u>104</u>	<u>17.78</u>	<u>100</u>	<u>18.61</u>	<u>95</u>	<u>19.23</u>	<u>91</u>	<u>21.07</u>	<u>92</u>
<b>Gallatin</b>																								
Monthly Precip Average	1.61		1.10		0.79		0.84		0.70		1.40		2.06		3.22		2.85		1.44		1.48		1.79	
Monthly Precip and % of Average	4.31	268	0.83	75	1.46	185	0.72	86	1.87	267	1.06	76	2.96	143	6.50	171	3.07	108	0.66	46	0.96	66	1.69	94
<u>Year-to-Date Precip and % of Average</u>	<u>4.31</u>	<u>268</u>	<u>5.14</u>	<u>190</u>	<u>6.60</u>	<u>189</u>	<u>7.32</u>	<u>169</u>	<u>9.19</u>	<u>182</u>	<u>10.25</u>	<u>169</u>	<u>13.20</u>	<u>166</u>	<u>18.70</u>	<u>160</u>	<u>21.77</u>	<u>149</u>	<u>22.42</u>	<u>140</u>	<u>23.38</u>	<u>134</u>	<u>26.07</u>	<u>130</u>
<b>Missouri Above Toston</b>																								
Monthly Precip Average	1.06		1.01		1.02		0.97		0.78		1.16		1.38		2.44		2.37		1.57		1.46		1.37	
Monthly Precip and % of Average	2.70	254	0.79	78	0.88	87	0.40	41	1.35	174	0.70	61	1.65	113	2.96	121	1.87	79	0.73	47	0.81	se	1.49	109
<u>Year-to-Date Precip and % of Average</u>	<u>2.70</u>	<u>264</u>	<u>3.49</u>	<u>168</u>	<u>4.37</u>	<u>142</u>	<u>4.77</u>	<u>118</u>	<u>6.12</u>	<u>127</u>	<u>6.82</u>	<u>114</u>	<u>8.37</u>	<u>114</u>	<u>11.34</u>	<u>116</u>	<u>13.20</u>	<u>108</u>	<u>13.93</u>	<u>101</u>	<u>14.76</u>	<u>97</u>	<u>16.24</u>	<u>85</u>
<b>Sun-Teton</b>																								
Monthly Precip Average	1.17		1.29		1.22		1.33		1.09		1.12		1.41		2.63		2.56		1.64		1.67		1.43	
Monthly Precip and % of Average	1.22	106	2.29	177	0.73	60	0.46	3	1.04	96	0.83	74	1.85	131	2.76	104	0.77	30	0.11	7	0.27	16	1.82	128
<u>Year-to-Date Precip and % of Average</u>	<u>1.22</u>	<u>105</u>	<u>3.51</u>	<u>143</u>	<u>4.24</u>	<u>115</u>	<u>4.70</u>	<u>94</u>	<u>5.73</u>	<u>94</u>	<u>6.56</u>	<u>91</u>	<u>8.41</u>	<u>97</u>	<u>11.16</u>	<u>99</u>	<u>11.92</u>	<u>86</u>	<u>12.04</u>	<u>78</u>	<u>12.30</u>	<u>72</u>	<u>14.13</u>	<u>77</u>
<b>Marias</b>																								
Monthly Precip Average	0.57		0.43		0.38		0.39		0.28		0.59		0.93		2.11		2.43		1.41		1.56		1.13	
Monthly Precip and % of Average	0.74	128	0.45	106	0.32	86	0.36	94	0.80	282	0.11	18	1.76	188	1.41	67	1.11	45	0.24	17	0.64	41	2.43	216
<u>Year-to-Date Precip and % of Average</u>	<u>0.74</u>	<u>128</u>	<u>1.19</u>	<u>119</u>	<u>1.61</u>	<u>110</u>	<u>1.87</u>	<u>108</u>	<u>2.67</u>	<u>130</u>	<u>2.78</u>	<u>106</u>	<u>4.63</u>	<u>127</u>	<u>5.94</u>	<u>106</u>	<u>7.05</u>	<u>87</u>	<u>7.29</u>	<u>77</u>	<u>7.93</u>	<u>72</u>	<u>10.36</u>	<u>85</u>
<b>Milk</b>																								
Monthly Precip Average	0.60		0.43		0.42		0.41		0.30		0.62		0.86		2.01		2.23		1.58		1.18		1.20	
Monthly Precip and % of Average	1.09	181	0.34	80	0.18	42	0.28	68	0.44	145	0.56	106	1.80	210	2.96	148	1.91	86	0.72	46	0.48	ao	1.35	113
<u>Year-to-Date Precip and % of Average</u>	<u>1.09</u>	<u>181</u>	<u>1.44</u>	<u>139</u>	<u>1.62</u>	<u>111</u>	<u>1.90</u>	<u>102</u>	<u>2.34</u>	<u>108</u>	<u>2.89</u>	<u>107</u>	<u>4.70</u>	<u>132</u>	<u>7.66</u>	<u>138</u>	<u>9.57</u>	<u>123</u>	<u>10.29</u>	<u>110</u>	<u>10.77</u>	<u>102</u>	<u>12.12</u>	<u>103</u>
<b>St. Mary</b>																								
Monthly Precip Average	1.47		1.98		1.94		1.86		1.36		1.49		1.62		2.82		2.97		1.86		2.00		1.76	
Monthly Precip and % of Average	1.87	127	3.35	169	0.79	40	1.13	61	1.45	107	0.94	63	1.05	69	2.41	86	0.78	26	0.38	20	0.48	24	3.15	180
<u>Year-to-Date Precip and % of Average</u>	<u>1.87</u>	<u>127</u>	<u>5.22</u>	<u>161</u>	<u>6.01</u>	<u>111</u>	<u>7.13</u>	<u>98</u>	<u>8.58</u>	<u>100</u>	<u>9.62</u>	<u>94</u>	<u>10.67</u>	<u>91</u>	<u>12.98</u>	<u>90</u>	<u>13.76</u>	<u>79</u>	<u>14.14</u>	<u>73</u>	<u>14.61</u>	<u>69</u>	<u>17.76</u>	<u>77</u>
<b>Bighorn Above Yellowtail</b>																								
Monthly Precip Average	0.82		0.47		0.33		0.34		0.29		0.61		1.17		1.96		1.36		0.97		0.73		1.05	
Monthly Precip and % of Average	0.97	118	0.24	60	0.29	87	0.33	98	0.34	116	0.77	126	0.78	67	1.16	60	0.99	74	1.27	130	0.96	131	0.53	50
<u>Year-to-Date Precip and % of Average</u>	<u>0.97</u>	<u>118</u>	<u>1.20</u>	<u>93</u>	<u>1.49</u>	<u>92</u>	<u>1.83</u>	<u>93</u>	<u>2.16</u>	<u>96</u>	<u>2.94</u>	<u>102</u>	<u>3.72</u>	<u>92</u>	<u>4.88</u>	<u>82</u>	<u>5.87</u>	<u>80</u>	<u>7.14</u>	<u>86</u>	<u>8.10</u>	<u>90</u>	<u>8.63</u>	<u>86</u>

A composite of the following National Weather Service stations was used to determine monthly valley precipitation and percent of average for the drainage basins:

- Beaverhead** ..... Lima and Dillon
- Jefferson** ..... Lima, Dillon, Virginia City, and Boulder
- Madison.** ..... Hebgen, West Yellowstone, and Norris Madison
- Gallatin.** ..... Bozeman
- Missouri Above Toston** ..... Townsend, Lima, Dillon, Virginia City, Boulder, Hebgen, West Yellowstone, Norris Madison, and Bozeman
- Sun-Teton** ..... Summit, Choteau, Fairfield, Augusta, and Gibson
- Marias.** ..... Cut Bank, Conrad, Valier, Gold Butte, and Chester
- Milk** ..... Havre, Chinook, Harlem, Malta, and Rudyard
- St. Mary.** ..... Babb and East Glacier
- Bighorn Above Yellowtail** ..... Buffalo Bill, Sunshine, Boysen Darn, Dubois, Gas Hills, Lander, Riverton, Basin, Lovell, Thermopolis, and Worland

# TABLE MTT3B PRECIPITATION IN INCHES AND PERCENT OF AVERAGE 2007 MOUNTAIN PRECIPITATION

BASIN	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	
<b>Lima Reservoir</b>																									
Monthly Precip Average	8.70		12.60		14.20		14.20		13.10		15.70		13.00		16.00		14.20		8.70		8.40		9.40		
Monthly Precip and % of Average	13.80	159	11.10	88	11.50	81	5.90	42	13.20	101	4.10	26	10.40	80	6.00	38	3.80	27	5.10	69	8.90	106	12.50	133	
Year-to-Date Precip and % of Average	13.80	169	24.90	117	36.40	103	42.30	86	65.50	88	55.50	76	70.00	77	76.00	71	79.80	66	84.90	65	93.80	68	106.30	72	
<b>Clark Canyon Reservoir</b>																									
Monthly Precip Average	13.50		20.20		21.40		20.30		17.10		22.00		21.30		27.00		21.20		12.40		11.70		12.90		
Monthly Precip and % of Average	22.10	164	19.60	97	16.90	79	10.00	49	19.10	112	9.00	41	18.10	85	15.10	66	13.90	66	6.30	51	8.90	76	19.60	152	
Year-to-Date Precip and % of Average	22.10	164	41.70	124	58.60	106	68.60	91	87.70	96	96.70	84	114.80	86	129.90	80	143.80	78	150.10	76	159.00	78	178.60	81	
<b>Jefferson Drainage</b>																									
Monthly Precip Average	31.40		46.80		48.90																				
Monthly Precip and % of Average	48.70	165	44.50	97	37.80	77	24.60	52	44.90	114	25.70	54	40.20	82	44.00	76	32.40	71	15.40	55	19.70	74	40.50	140	
Year-to-Date Precip and % of Average	48.70	166	93.20	121	131.00	104	166.60	90	200.50	94	226.20	87	266.40	86	310.40	84	342.80	83	358.20	81	377.90	81	418.40	84	
<b>Madison Drainage</b>																									
Monthly Precip Average	21.30		33.10		35.30		35.90		30.90		36.40		30.20		32.90		26.00		15.90		14.90		17.90		
Monthly Precip and % of Average	31.80	149	31.00	94	26.00	74	26.00	43	35.90	116	14.10	39	25.80	86	13.60	41	10.90	42	11.30	71	16.20	109	19.30	108	
Year-to-Date Precip and % of Average	31.80	149	62.80	116	88.80	99	88.80	83	140.30	90	154.40	80	180.20	81	193.80	76	204.70	73	216.00	73	232.20	74	261.50	76	
<b>Gallatin Drainage</b>																									
Monthly Precip Average	9.40		11.20		11.30		11.40		9.90		14.90		14.40		16.90		13.10		7.20		6.70		8.20		
Monthly Precip and % of Average	15.30	163	9.90	88	8.40	74	7.00	61	12.90	130	7.40	60	13.40	93	13.60	86	7.60	68	4.30	60	5.60	84	6.60	80	
Year-to-Date Precip and % of Average	15.30	163	25.20	122	33.60	105	40.60	94	60.90	101	60.90	89	74.30	90	87.90	89	95.50	86	99.80	84	106.40	84	112.00	84	
<b>Canyon Ferry Reservoir</b>																									
Monthly Precip Average	51.80		75.90		80.70		80.40		67.80		82.40		77.60		89.30		70.60		42.20		40.20		46.80		
Monthly Precip and % of Average	78.30	161	73.40	97	61.60	76	39.80	60	78.50	116	39.10	47	65.40	84	61.60	69	42.90	61	24.70	69	33.20	83	55.60	121	
Year-to-Date Precip and % of Average	78.30	161	151.70	102	213.20	102	253.00	88	331.50	93	370.60	84	436.00	84	497.60	82	540.50	80	565.20	79	598.40	79	664.00	81	
<b>Gibson Reservoir</b>																									
Monthly Precip Average	9.70		13.60		13.90		13.40		11.00		11.40		11.00		14.80		15.00		7.70		9.10		8.70		
Monthly Precip and % of Average	9.00	93	25.60	188	9.10	65	10.00	75	10.00	91	6.20	54	7.30	66	15.80	107	5.60	37	1.30	17	3.00	33	9.00	103	
Year-to-Date Precip and % of Average	9.00	93	34.60	117	43.70	117	53.70	106	63.70	103	69.90	96	77.20	92	93.00	94	98.50	87	99.80	82	102.80	79	111.80	80	
<b>Lake Elwell Reservoir</b>																									
Monthly Precip Average	14.70		22.30		23.70		25.20		19.50		19.80		17.30		20.70		19.80		10.50		12.80		12.80		
Monthly Precip and % of Average	12.80	87	41.30	185	16.40	65	19.60	78	15.70	81	11.80	60	13.50	78	20.30	98	8.50	43	1.90	18	4.70	37	12.40	97	
Year-to-Date Precip and % of Average	12.80	87	54.10	114	69.50	114	89.10	104	104.80	99	116.60	93	130.10	91	150.40	92	158.90	87	160.80	83	166.50	80	177.90	81	
<b>Sherburne Reservoir</b>																									
Monthly Precip Average	9.80		16.50		16.20		15.70		12.10		11.20		9.60		10.00		10.30		6.00		5.10		6.80		
Monthly Precip and % of Average	5.10	52	34.60	210	13.50	83	13.50	78	8.50	70	16.80	150	7.10	74	9.40	94	7.80	78	0.40	7	1.30	26	5.40	79	
Year-to-Date Precip and % of Average	5.10	52	39.70	151	53.20	126	55.50	113	74.00	105	90.80	111	97.90	107	107.30	106	115.10	103	116.60		116.80	96	122.20	96	
<b>Bighorn Lake</b>																									
Monthly Precip Average	42.30		48.80		43.20		42.20		34.80		50.10		63.00		69.70		55.60		37.70		26.10		42.20		
Monthly Precip and % of Average	46.80	111	36.60	76	31.30	72	31.70	75	43.10	124	52.30	104	64.40	86	62.70	90	30.70	55	40.10	108	28.70	110	35.90	SS	
Year-to-Date Precip and % of Average	46.80	111	83.40	92	114.70	86	146.40	83	189.50	90	241.80	93	296.20	91	358.90	91	389.60	87	429.70	88	458.40	89	494.30	89	

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:

- Lima Reservoir ..... Crab Creek, Island Park, Tepee Creek, Divide, and Lakeview Ridge
- Clark Canyon Reservoir ..... Beagle Springs, Darkhorse Lake, Lemhi Ridge, Tepee Creek, Divide, Bloody Dick, and Lakeview Ridge
- Jefferson Drainage ..... Beagle Springs, Clover Meadow, Darkhorse Lake, Mule Creek, Lemhi Ridge, Rocker Peak, Tepee Creek, Clavert Creek, Saddle Mountain, Lower Twin, Divide, Bloody Dick, Lakeview Ridge, Short Creek, Frohner Meadow, and Moose Creek
- Madison Drainage ..... Carrot Basin, Clover Meadow, Tepee Creek, Black Bear, Lower Twin, Beaver Creek, Madison Plateau, and Whiskey Creek
- Gallatin Drainage ..... Carrot Basin, Shower Falls, and Lick Creek
- Canyon Ferry Reservoir ..... Beagle Springs, Darkhorse Lake, Carrot Basin, Clover Meadow, Shower Falls, Mule Creek, Rocker Peak, Black Bear, Saddle Mountain, Lower Twin, Beaver Creek, Madison Plateau, Short Creek, Lick Creek, Whiskey Creek, Frohner Meadow, Clavert Creek, Moose Creek, Lemhi Ridge, Tepee Creek, Divide, Bloody Dick, and Lakeview Ridge
- Gibson Reservoir ..... Mount Lockhart, Wood Creek, Dupuyer Creek, and Waldron
- Lake Elwell Reservoir ..... Mount Lockhart, Badger Pass, Pike Creek, Dupuyer Creek, and Waldron
- Sherburne Reservoir ..... Flattop Mountain and Many Glacier
- Bighorn Lake ..... Kirwin, Blackwater, Evening Star, Shell Creek, Powder River, Bald Mountain, Bone Springs Divide, Owl Creek, Sucker Creek, Dome Lake, Hansen Sawmill, Timber Creek, Bear Trap Meadow, Burgess Junction, Middle Powder, Marquette, Sylvan Lake, Younts Peak, and Sylvan Road

### April through June:

As of April 1, mountain snow water contents statewide were 70 percent of average and 70 percent of last year. West of the Continental Divide snowpack was 75 percent of average and 75 percent of last year. East of the Continental Divide snowpack was 68 percent of average and 70 percent of last year. Slight improvements were noticed in water supply conditions during February and March as reflected in the Natural Resources Conservation Service's Surface Water Supply Index map. The conditions held steady during April; precipitation was 66 to 93 percent of average in the mountains, and 69 to 210 percent of average in the valleys throughout Montana. Conversely, precipitation in the Bighorn basin in Wyoming was much below average during April falling in at 86 percent of average in the mountains and only 67 percent of average in the valleys. Overall, April mountain and valley precipitation across Montana was 93 percent of average and 71 percent of last year. April temperatures were above average across Montana producing increased snowmelt rates and above average streamflows in many basins.

The precipitation across Montana during May improved significantly from the previous month. Mountain and valley precipitation across the state was 116 percent of average and 172 percent of last year, while east of the Continental Divide, mountain and valley precipitation was 121 percent of average and 188 percent of last year. In general, many basins above Reclamation projects in Montana received precipitation rates much above average during May. Consequently, the warm temperatures in May combined with precipitation on top of snow did not provide good prospects for a slow gradual snow melt. A storm system moved through the area near the end of May producing heavy amounts of precipitation in the form of rain and snow. The picture below shows Phillipsburg, Montana on May 22 after the storm cleared.



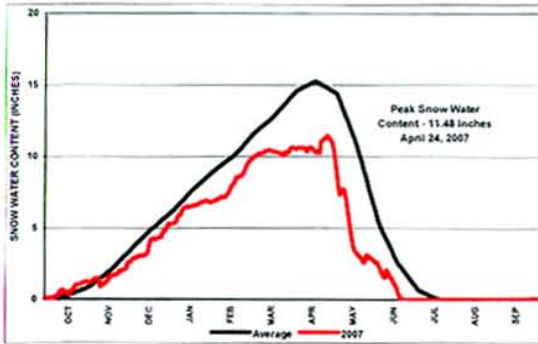
As of June 1, remaining mountain snow water content was generally much below average. The peak snowpack for the Wind, Shoshone, and Bighorn River basins in Wyoming were below normal and much below that from the previous year. The peak snowpack for Reclamation reservoirs occurred between April 4 and April 24, except in the Sun River basin where the peak occurred on March 5. The peak generally occurs

around April 15 for mountain locations, Figure MTG1.

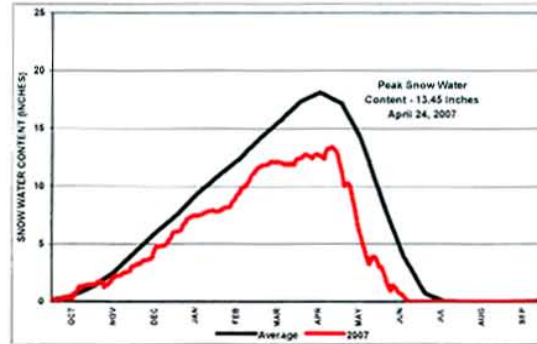


# Figure MTG1 WATER YEAR 2007 SNOW WATER CONTENT

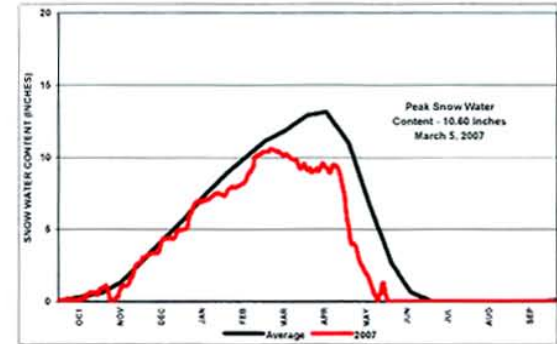
Clark Canyon Reservoir



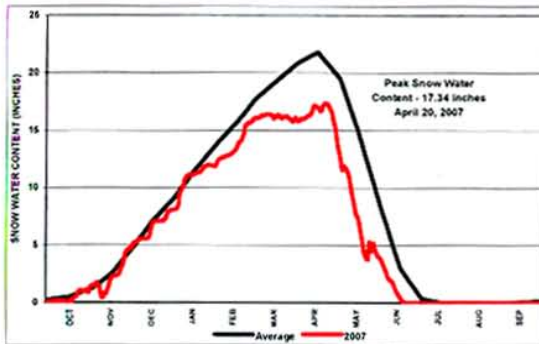
Canyon Ferry Reservoir



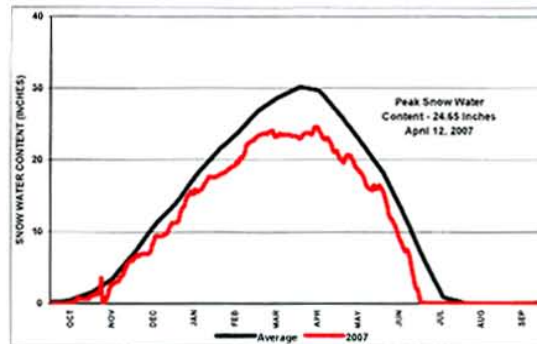
Gibson Reservoir



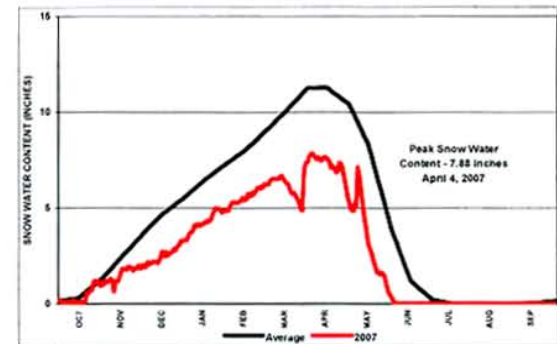
Lake Elwell



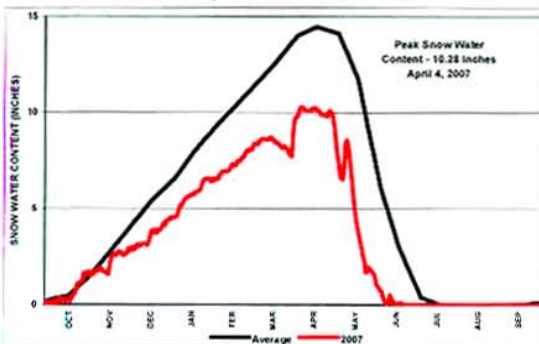
Lake Sherburne



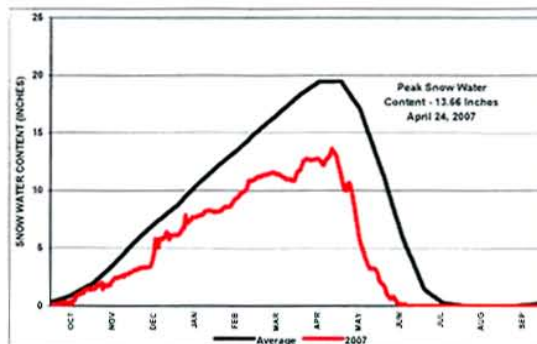
Bull Lake Reservoir



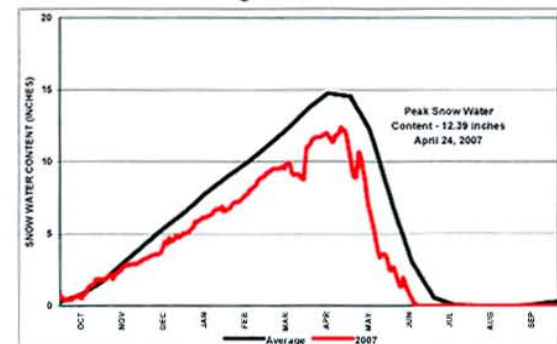
Boysen Reservoir



Buffalo Bill Reservoir



Bighorn Lake



July through September:

During July, temperatures were much above average, producing the warmest summer temperatures on record across most of Montana. Precipitation was also much below average across Montana causing a dangerous problem throughout the state as the May rains had produced bumper grass crops that all dried up. Dry lightning storms started many fires across the state that totaled in excess of 600,000 acres throughout the mountains and the prairies. The bright spot was the rains brought



*Pictures show fires from around the state as more than 600,000 acres of forest and grassland in Montana burned in the summer of 2007.*



by the storms in the Gulf of Mexico spreading scattered rain events across the Bighorn Basin in Wyoming. There was some relief by the end of July due to a low pressure system that moved in from the Gulf of Mexico, remnants of a tropical storm. August temperatures were near average while precipitation was much below average in Montana, but precipitation again fell above average across the Bighorn basin of Wyoming. September temperatures and precipitation were varied; early in the month conditions were warm and dry, while in the latter part of the month weather systems moved in bringing much needed precipitation to Montana. Overall Montana finished out the month of September at 106 percent of average for precipitation. Dry areas included the eastern edge of the state, and the northwest corner west of the continental Divide. Reclamation Storage facilities had basin precipitations between 109 percent in the Missouri River basin to 129 percent of average on the Milk river basin. The Bighorn Basin in Wyoming had the lowest precipitation total falling in at 77 percent of average.

The inflow conditions for August through September ranged from below average to much below average. The total inflows for the water year ranged from 50 percent of normal at Lake Elwell to 98 percent of normal at Lake Sherburne. Leading into water year 2008 the drought remained prominent in several Montana basins east of the Continental Divide, where Reclamation facilities are located. At the start of water year 2008, the early indications showed there was a moderate improvement in drought conditions for the Missouri River Basin, but conditions are showing no sign of improvement throughout the Bighorn Basin in Wyoming.

Reservoir Storage, Releases and Inflows: The 2007 water year storage began with Reclamation reservoirs ranging from average to below average storage. October 1 storage in the Upper Missouri Basin was 2,752,940 acre-feet, 100 percent of average. Storage for the

Milk River Project was 99,100 acre-feet, 93 percent of normal. Storage in Bighorn Lake was 762,470 acre-feet, 75 percent of normal. Due to the ongoing drought, and the inflow predictions for the upcoming spring inflows, storage in the reservoirs were increased through the winter in hopes of being able to fill to full pool.

The January through March storage in Reclamation reservoirs east of the Continental Divide ranged from below average to much above average. For example, the end of March storage ranged from 85 percent of normal at Clark Canyon to 147 percent of normal at Sherburne Reservoir.

Due to the good spring precipitation during April the inflows improved in many basins located in northcentral and southwest Montana to near average levels. Therefore, storage conditions improved slightly leading into May. The early precipitation patterns in conjunction with the near average snowpack indicated that drought conditions may be improving in Montana. However, dry conditions and warm weather returned during the middle of June. This warm weather lead to an early runoff from the snowpack, and caused the irrigators to start demanding water earlier than normal. In the Bighorn River basin in Wyoming dry conditions dominated throughout this period. Due to the continued drought in 2006, releases were maintained at 1,500 cfs through the spring and into July. In July the reservoir looked to have strong enough inflows that even with the irrigation demands the releases to the river could be increased to 1,750 cfs while still reaching full pool in the reservoir.

The only Reclamation reservoirs in Montana that did not fill to normal full capacity were Bighorn Lake, Clark Canyon Reservoir, and Tiber Reservoir.

There was approximately \$8,517,600 in flood damages prevented during water year 2007 by Reclamation facilities in Montana east of the Continental Divide. The total flood damage prevented by these facilities since 1950 is approximately \$366,108,800.

June through August storage ranged from much below average to above average. Storage in Clark Canyon Reservoir, and Lake Elwell remained much below normal throughout this period. June precipitation was average to above average during the first two weeks, and then the hot temperatures started to take hold. However July and August precipitation was below average resulting in significant irrigation demands from storage. By the end of August, Fresno Reservoir contained an above normal pool. The inflows to Bighorn Lake during June through August were much below average principally due to the lack of precipitation and subsequent irrigation demand. The storage in Bighorn Lake ended the month of August at 95 percent of average due to the conservative releases during the water year.

Water year 2007 ended with storage ranging from above average to much below average. The Reclamation reservoirs with the least amount of carryover storage were Clark Canyon and Gibson Reservoirs.

Releases at the Reclamation facilities including Clark Canyon, Gibson and Bighorn Lake were very conservative for most of the water year because of continued drought conditions.

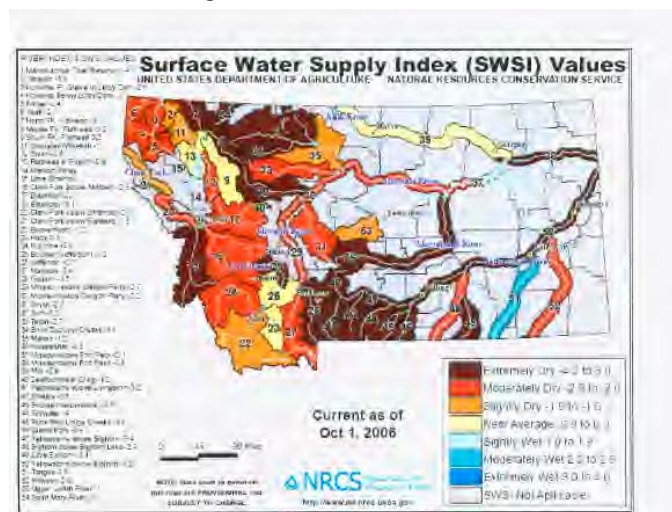
Releases were only increased when necessary to control the spring runoff and irrigation demands. This was a result of extremely hot and dry summer conditions in the basins, which reduced inflows significantly. Consequently releases were held at baseline minimums at most facilities to control the rate of decline in reservoir storage. In early October, releases from Clark Canyon Dam were set at approximately 40 cfs, below the desired minimum fishery flow, for the winter. Entering into water year 2008 releases from all Reclamation facilities in Montana are near the recommended minimum fishery flow.

**Water Supply and Runoff:**

The January 1 forecasted April-July runoff volumes ranged from 40 to 94 percent of average among Reclamation reservoirs east of the Continental Divide, MTT2. This indicated that the drought may be continuing for most of Montana and Northwest Wyoming. There were some improvements in the snowpack in the Milk and Bighorn River basins by March 1. However, the overall snowpack conditions and water supply forecasts remained constant and indications were there could potentially be water shortages if the spring precipitation did not materialize. The April 1 snowpack ranged from 84 percent of average in the Bighorn River basin in Wyoming to 47 percent of average in the Milk River basin, Table MTT1. The resulting April-July forecasted runoff volumes ranged from 34 to 92 percent of average. In the end, due to below average spring precipitation, the actual runoff volumes for water year 2007 ranged from 36 to 77 percent of average, Table MTT2. In some areas of Montana water shortages were experienced during the irrigation season, but overall irrigation demands were satisfied. Water users in the Beaverhead River Basin successfully implemented a Drought Management Plan in 2007, which helped to mitigate impacts of the drought conditions.

During water year 2007 the peak release at Clark Canyon was approximately 413 cfs greater than peak inflow. **Peak** release was 880 cfs on July 14, while the inflow peaked at 467 cfs on June 6, which was much below average. Canyon Ferry's peak inflow was 9,969 cfs on June 8, while the peak release was 5,477 cfs on Jan 11. In the Sun River Basin, Gibson Reservoir inflow peaked at 3,380 cfs on May 13, while the release peaked at 2,899 cfs on May 20. The peak inflow for **Pishkun and Willow Creek** Reservoirs were 1,844 cfs on March 30 and 100 cfs on Sept 23, respectively.

Inflow to Lake Elwell peaked at 2,243 cfs on Nov 10 and releases peaked at 1,082 cfs on Feb 22. In the Milk River Basin, Lake Sherburne peak inflow was 3,617 on Nov 7 and releases peaked at 623 cfs on July 28. The peak inflow for Fresno Reservoir was 1,682 cfs on Mar 12 while the release peaked at 904 cfs on July 18. Peak inflow at Nelson Reservoir was 430 cfs on Apr 26 while the release peaked at 334 on Aug 6. In the Bighorn River Basin, Bighorn Lake peak inflow was 8,827 cfs on June 7 and the peak release was 2,235 cfs on July 14.



Inflows to Reclamation facilities in Montana east of the Continental Divide were all much below average with the exception of the Milk River basin reservoirs. Inflows in the Milk River basin were near average for 2007.

TABLE MTT1  
2007 MOUNTAIN SNOW WATER CONTENT  
AS A PERCENT OF NORMAL

DRAINAGE BASIN	JAN 1	FEB 1	MAR 1	APR 1	MAY 1
Beaverhead	84	73	84	65	63
Jefferson	81	74	83	67	66
Madison	78	68	79	64	58
Gallatin	73	65	79	67	62
Missouri Headwaters above Toston	80	71	82	66	62
Sun	93	90	91	58	54
Marias	85	90	88	71	65
Milk River	91	73	115	47	173
St. Mary	80	83	87	65	75
Wind	71	70	71	65	47
Shoshone	71	66	72	62	56
Bighorn (Boysen-Bighorn)	84	68	83	84	79

TABLE MTT2  
2007 WATER SUPPLY FORECASTS

RESERVOIR	JAN 1 <sup>1/</sup>		FEB 1 <sup>1/</sup>		MAR 1 <sup>1/</sup>		APR 1 <sup>2/</sup>		MAY 1 <sup>3/</sup>		JUN 1 <sup>4/</sup>		ACTUAL APRIL-JULY <sup>5/</sup>		% OF APRIL FORECAST REC'D
	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	
Clark Canyon	44.6	40	39.5	35	59.0	52	38.8	34	25.0	28	15.0	24	40.2	36	104
Canyon Ferry	1,605.0	79	1,274.0	63	1,442.0	71	1,205.0	59	799.0	48	578.0	52	1,091.1	54	91
Gibson	436.0	91	407.8	85	424.0	89	373.7	78	320.0	73	167.0	63	296.9	62	79
Tiber	395.0	81	406.0	84	399.0	82	334.0	69	286.0	68	133.0	52	188.3	39	56
Sherburne	99.0	95	99.0	95	98.0	94	90.0	86	80.0	84	49.0	78	80.6	77	90
Fresno	69.0	83	60.0	72	80.0	96	56.0	92	43.0	103	15.0	77	56.5	57	71
Yellowtail	675.0	57	670.0	56	746.0	63	727.0	61	559.5	55	358.9	47	613.9	51	84

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.

## 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 five reservoirs provided flood relief during water year 2007. They were: Clark Canyon on the Beaverhead River near Dillon; Canyon Ferry on the Missouri River near Helena; Lake Elwell on the Marias River near Chester; Lake Sherburne on Swiftcurrent Creek near Babb; and Bighorn Lake on the Bighorn River near Fort Smith. Canyon Ferry Reservoir and Lake Sherburne played the most important role in preventing flood damages during the 2007 runoff season. The most notable examples of peak flows regulated by Bureau reservoirs during the spring runoff are as follows:

<u>Reservoir</u>	Peak Inflow (cfs)	River Discharge (cfs)	Date
Canyon Ferry	9,969	3,846	06/08/07
Lake Elwell	2,243	519	11/10/06
	2,010	514	05/14/07
Lake Sherburne	3,617	0	11/07/06
	895	36	06/06/07
Bighorn Lake	8,827	1,500	06/07/07

The Corps estimated these three Bureau reservoirs in Montana reduced flood damages by \$8,517,600 in 2007. Some of these benefits were derived by reducing local damages and other 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 within the jurisdiction of the Montana Area Office, refer to the individual "Summary of Operations for 2007" 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)

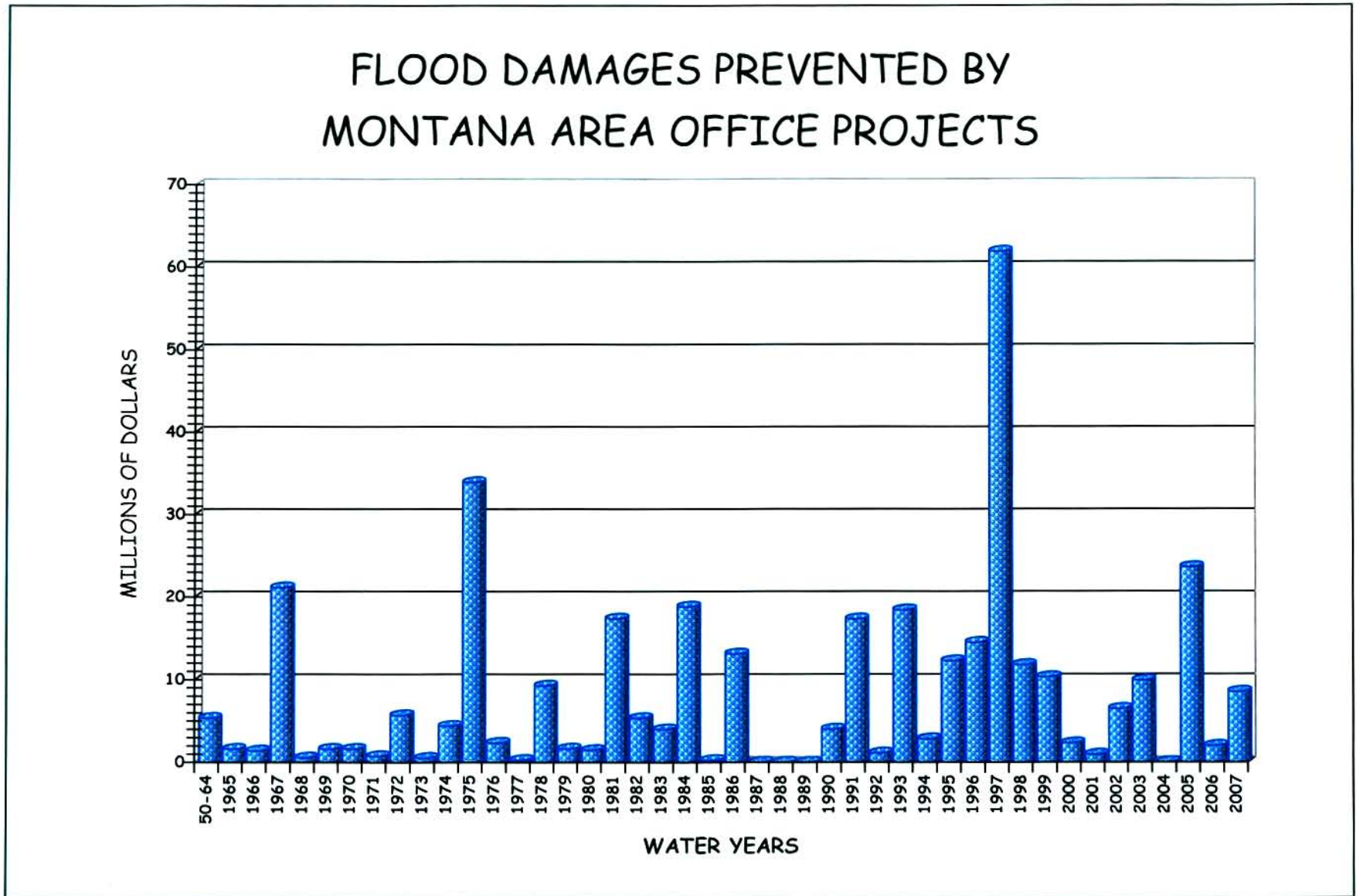
<u>Reservoir</u>	<u>Local</u>	Main <u>Stem</u>	2007 <u>Total</u>	Prey. <u>Accum.</u>	1950-2007 <u>Accum. Total</u>
Clark Canyon	\$ 0.0	\$ 364.3	\$ 364.3	\$ 12,503.5	\$ 12,867.8
Canyon Ferry	0.0	2,787.2	2,787.2	150,774.2	153,561.4
Gibson <sup>1</sup>	0.0	0.0	0.0	3,044.5	3,044.5
Lake Elwell	0.0	1,365.7	1,365.7	60,900.4	62,266.1
Lake Sherburne <sup>2</sup>	2,348.1	0.0	2,348.1	5,537.22	7,885.3
Fresno	0.0	0.0	0.0	13,085.5	13,085.5
Bighorn Lake	<u>0.0</u>	<u>1,652.3</u>	1,652.3	<u>111,745.9</u>	113,398.2
Total	\$2,348.1	\$ 6,169.5	\$ 8,517.6	\$357,591.2	\$366,108.8

<sup>1</sup> No space allocated to flood control, but some flood protection provided by operation for other purposes.

<sup>2</sup> Now includes historical flood damages prevented by Lake Sherburne since 1950 based on estimates provided by the Corps of Engineers.



FIGURE MTG2



## UNIT OPERATIONAL SUMMARIES FOR WATER YEAR 2007

### 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.

Entering water year 2007 the hydrologic conditions in the Beaverhead basin remained dry and did not indicate any definite improvements from the previous seven years. Valley precipitation, during August and September, was below average at 54 and 45 percent of average while the mountain precipitation varied from 38 and 104 percent of average, respectively. Although there was not an overall significant change in the streamflows above Clark Canyon Reservoir, the improved mountain precipitation during September, as well as irrigation return flows, did help to somewhat recover inflow. Inflow to Clark Canyon during August and September were 67 and 80 percent of average, respectively. Large irrigation demands during water year 2006 once again placed a heavy demand on storage in Clark Canyon Reservoir. Following the conclusion of the irrigation season, releases from Clark Canyon were gradually reduced to the fall and winter flow rate of about 40 cfs during September 19-October 6, which is much below the minimum recommended fishery flow between 100-200 cfs. Beginning in early September, storage in Clark Canyon began to steadily increase and entered water year 2007 with a content of 64,402 acre-feet at elevation 5519.31. At 52 percent of average, this was 11<sup>th</sup> lowest level of record for this time of year for the period of 1964-2006. This storage was also 20,411 acre-feet or 7.99 feet higher than at the beginning of water year 2006.

The 2007 water year began with some storm activity, resulting in valley and mountain precipitation during October being above average. The valley and mountain precipitation during October was 188 and 164 percent of average respectively. Weather conditions changed drastically in November as the valley and mountain precipitation respectively declined to 15 and

97 percent of average. The below average precipitation conditions would continue through January.

On January 1, the Natural Resources Conservation Service (NRCS) measured snowpack in the Beaverhead River basin at 84 percent of average. This was a decrease of 30 percent from the snowpack experienced on January 1, 2006. Snow fell in the Beaverhead River Basin at below average rates and by February 1, the snowpack was measured at 73 percent of average. This was a 44 percent decrease below the snowpack measured on February 1, 2006. Precipitation conditions improved slightly during February and on March 1, the measured snowpack in the Beaverhead basin had improved to 84 percent of average. However during March mountain precipitation was much below average, which indicated that another year of drought may likely occur. Inflow for October through March was 76,689 acre-feet, or 68 percent of normal. This was 3,962 acre-feet or 5 percent higher than the inflows experienced in 2006.

On April 1, the NRCS measured the mountain snowpack to be 65 percent of average. Some spring storm activity occurred in the Beaverhead valley during April, contributing to the cumulative valley precipitation increasing to 106 percent of average by the beginning of May. Conversely, the mountain precipitation was below average during April resulting in continued low snowpack conditions. In 2007, the mountain snowpack peaked on April 24 at 75 percent of average. This was near the normal time, but nearly 3.8 inches below the average peak content of 15.3 inches. The mountain snowmelt in the Beaverhead River basin normally begins in late April or early May. By May 1, the snowpack remained below normal at 63 percent of average.

While there was slightly improved moisture by the end of 2006, drought conditions would once again appear in water year 2007. Thus soil moisture deficits were still very severe in many locations throughout the basin. Weather conditions remained dry during May; valley precipitation was 71 percent of average while the mountain precipitation was only 56 percent of average. Even though the cumulative valley precipitation through the end of May was near average, the much below average mountain precipitation resulted in inflows continuing to remain at near record low levels.

Based on the mountain snowpack, the water supply forecast prepared on April 1, indicated the April-July runoff into Clark Canyon would be only 34 percent of normal, totaling approximately 38,800 acre-feet. This was a decrease of 37 percent or 41,500 acre-feet less than at this same time in 2006. Conference calls were held with the Clark Canyon Joint Board in both March and April to discuss the water supply outlook for the 2007 irrigation season. The Joint Board, which consists of three representatives from each water user entity, decided in early April to begin the season with reduced allotments in accordance with the newly adopted Drought Management Plan. The plan was incorporated into the water service contracts that were signed and enacted during water year 2007. The allotment for East Bench Irrigation District (EBID) was set at 2.7 acre-feet per acre, while the allotment for the Clark Canyon Water Supply Company (CCWSC) was set at 3.5 acre-feet per acre.

Snowmelt runoff during April through July was well below normal at only 36 percent of average. Daily inflows into Clark Canyon Reservoir averaged 114 cfs during April, 121 cfs during May,

189 cfs during June and 241 cfs during July. These resulted in respective monthly total inflows of 6,773 acre-feet, 7,436 acre-feet, 11,246 acre-feet and 14,804 acre-feet. The total April through July inflow decreased 23,745 acre-feet less than experienced in 2006. Releases during this time averaged 40 cfs during April, 342 cfs during May, 490 cfs during June and 737 cfs during July. As a result, storage slowly increased to a peak for the year of 131,421 acre-feet at elevation 5537.32 on May 7, before irrigation demands in 2007 required storage to begin drafting. This was 82 percent of normal and 75 percent of full capacity. This was also 7,569 acre-feet or 1.69 feet higher than the 2006 peak storage. The peak inflow for the year was recorded on June 6 at 467 cfs. This was also the 9th lowest peak daily inflow for the period of 1965 through 2007. The total April-July inflow to Clark Canyon was 36 percent of average totaling 40,259 acre-feet and was the 8th lowest April-July inflow of record for the period of 1965 through 2007.

Precipitation during the summer months remained below average in both valley and mountain areas. The mountain precipitation, which is factored into the snowmelt runoff volume, was only 66, 51 and 76 percent of average for June, July and August respectively. The valley precipitation reflected a similar distribution the same months with the precipitation totaling 87, 56 and 81 percent of average respectively. During September, valley precipitation improved to 96 percent of average, while a few fall storms brought above normal precipitation to the higher elevations.

By the end of September the total cumulative valley precipitation for the year was 88 percent of average while the total cumulative mountain precipitation for the Beaverhead basin was 81 percent of average. Unfortunately, the lack of valley precipitation during July through early September produced heavy demands on storage out of Clark Canyon to meet the downstream irrigation requirements. Storage in Clark Canyon was quickly depleted until reaching a low content for the year of 58,398 acre-feet at elevation 5517.17 on September 12. Releases out of Clark Canyon were gradually reduced throughout September, as irrigation demands decreased, to the fall and winter rate of about 30 cfs by September 28.

The majority of the storage water released from Clark Canyon Reservoir during water year 2007 to meet the downstream irrigation demands was released during May 1 through September 27. During this time, releases reached a peak for the year of 880 cfs on July 14 to satisfy the downstream water needs. Beginning in early May, storage in Clark Canyon declined from a peak of 131,421 acre-feet at elevation 5537.32 on May 7 to 58,398 acre-feet at elevation 5517.17 on September 12, at which time inflows exceeded releases and storage began to increase. Storage in Clark Canyon Reservoir increased beginning in mid-September and ended the water year at 62,052 acre-feet at elevation 5518.49. This was 50 percent of average and 2,350 acre-feet or 0.82 feet less than at the end of water year 2006. This was the 11th lowest end of water year storage level during the 1965 through 2007 period. This storage level was about 2,000 acre-feet above the desired minimum 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. Beginning about September 4 and continuing through September 27 the releases were gradually reduced to a fall and winter flow of about 30 cfs in an effort to conserve storage for the next season. This release was again much below the minimum recommended fishery flow of between 100-200 cfs.

EBID water users received approximately 61,800 acre-feet and CCWSC received approximately 76,800 acre-feet during water year 2007. The court appointed river commissioner as well as the East Bench Canal ended the 2007 season on September 14. The total diversion recorded by the river commission for the "non-signer" users on the Beaverhead River was approximately 24,200 acre-feet. The total annual inflow to Clark Canyon Reservoir during 2007 was 52 percent of average, totaling 138,194 acre-feet, the 9th lowest annual inflow for the period of 1965 through 2007. By comparison, this was 27,680 acre-feet less than the total annual inflow of water year 2006. The total annual release to the Beaverhead River from Clark Canyon was 140,544 acre-feet or 54 percent of normal and was also the 9th lowest annual release for the period of 1965 through 2007. This release was 4,919 acre-feet less than what was released during the drought of 2006.

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 filled to the top of the conservation pool in water year 2007 and peaked at 80,946 acre-feet, which was 96 percent of full capacity on May 16. 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 904 cfs on July 15 due to irrigation releases from storage, but the streamflow would have peaked at 698 cfs on June 7 if Clark Canyon Reservoir would not have been controlling the releases.

The Corps of Engineers determined that during 2007, Clark Canyon did not prevent any local flood damages, but there was \$364,300 flood damages prevented on mainstem Missouri. Since construction of the Clark Canyon Dam in 1965, Clark Canyon Reservoir has reduced flood damages by a total of \$12,867,800.

### **Important Events - 2007**

October 1, 2006: Clark Canyon Reservoir enters water year with 64,402 acre-feet of storage at elevation 5519.31.

October 6, 2006: Following the 2006 irrigation season, releases from Clark Canyon to the Beaverhead River were reduced to approximately 40 cfs to conserve storage and allow Clark Canyon Reservoir to gradually increase throughout the fall and winter.

April 3: A conference call was held with the Joint Board and allotments were set for EBID and CCWSC at 2.7 and 3.5 acre-feet per acre, respectively.

May 1: This marked the beginning of when releases from Clark Canyon were increased to meet downstream irrigation demands.

May 7: Clark Canyon Reservoir reached a peak storage content of 131,421 acre-feet at elevation 5537.32. This was 75 percent of full capacity and 42,946 acre-feet or 8.78 feet below the top of the joint-use pool.

June 6: Inflow to Clark Canyon reached a peak for the year at 467 cfs.

July 14: Releases from Clark Canyon Reservoir reached a peak of 880 cfs to meet downstream water demands from the Beaverhead River.

September 12: Storage in Clark Canyon Reservoir was drafted to a content of 58,398 acre-feet at elevation 5517.17. This was 33 percent of full capacity and 115,969 acre-feet or 28.93 feet below the top of the joint-use pool. After this time the reservoir began to refill due to the decrease in downstream irrigation demands.

September 14: East Bench Canal discontinues diversions.

September 27: Releases from Clark Canyon Dam to the Beaverhead River are reduced to the winter flow rate of approximately 30 cfs.

September 30: Clark Canyon Reservoir ends the water year with 62,052 acre-feet at elevation 5518.49, which is the 11th lowest storage on record.

Additional hydrologic and statistical information pertaining to the operation of Clark Canyon Reservoir during 2006 can be found in Table MTT5 and Figure MTG3.

TABLE MTT5  
 HYDROLOGIC DATA FOR 2007  
 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

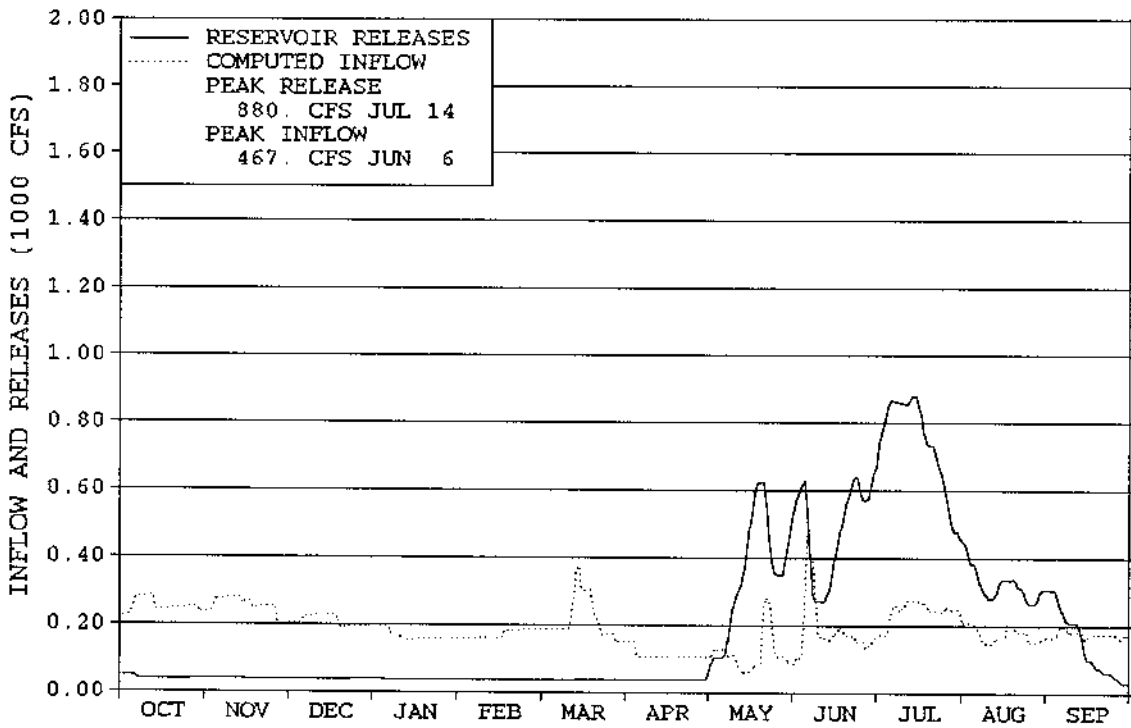
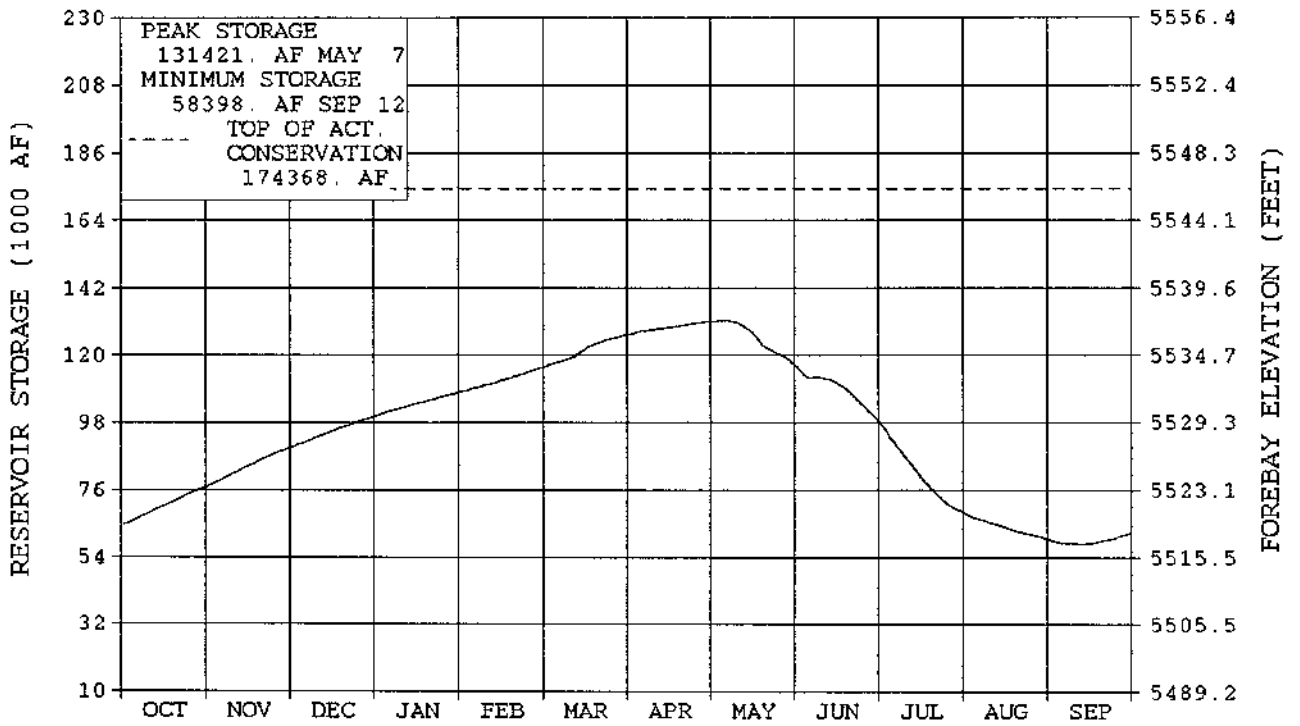
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5519.31	64,402	OCT 01, 2006
END OF YEAR	5518.49	62,052	SEP 30, 2007
ANNUAL LOW	5517.17	58,398	SEP 12, 2007
ANNUAL HIGH	5537.32	131,421	MAY 07, 2007
HISTORIC HIGH	5564.70	283,073	JUN 25, 1984

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	138,194	OCT 06-SEP 07	140,544	OCT 06-SEP 07
DAILY PEAK (CFS)	467	JUNE 06, 2007	880	JUL 14, 2007
DAILY MINIMUM (CFS)	60	MAY 14, 2007	30	SEP 28, 2007
DAILY FLOW AT BARRETTS (CFS)			904	JUL 15, 2007
DAILY FLOW AT BARRETTS W/O CLARK CANYON RESERVOIR (CFS)			698	JUN 07, 2007
PEAK SPILL (CFS)			0	NONE
TOTAL SPILL (AF)			0	NONE

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	15.5	67	2.6	18	77.3	62
NOVEMBER	15.1	68	2.4	18	89.9	68
DECEMBER	12.9	68	2.5	19	100.3	73
JANUARY	10.3	64	2.4	22	108.3	78
FEBRUARY	9.6	66	2.1	22	115.8	82
MARCH	13.3	71	2.4	23	126.6	85
APRIL	6.8	31	2.4	18	131.1	82
MAY	7.4	27	21.1	72	117.4	71
JUNE	11.2	31	29.2	72	99.5	60
JULY	14.8	54	45.3	97	69.0	46
AUGUST	10.8	56	19.8	51	60.0	47
SEPTEMBER	10.5	52	8.4	42	62.1	50
ANNUAL	138.2	52	140.5	54		
APRIL-JULY	40.3	36				

\* Average for the 1965-2007 period.

**FIGURE MTG3**  
**CLARK CANYON RESERVOIR**

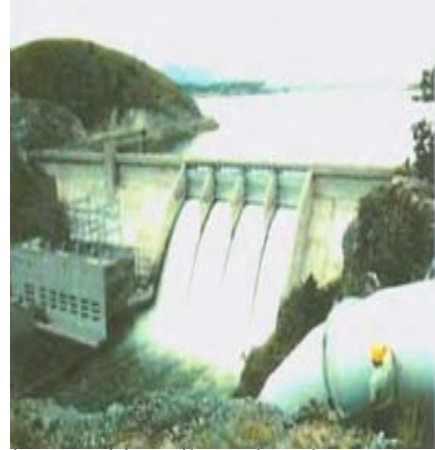


WATER YEAR 2007



## Canyon Ferry Lake and Powerplant

Canyon Ferry Lake (P-S MBP), formed by Canyon Ferry Dam, 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 28,000 acres on the East Bench Unit (P-S MBP). In addition, about 5,200 acres in the 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 33,700 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 persistent drought since 2001 has had lingering effects on streamflows into Canyon Ferry Lake over the past several years. Since March 2000 through December 2005, the inflow to Canyon Ferry has been below average for 70 consecutive months. This marks the longest period of record that the monthly inflows to Canyon Ferry Lake were below average.

The National Weather Service reported the valley precipitation during August and September 2006 was 54 and 72 percent of average, respectively, while the mountain precipitation was 45 and 91 percent of average, respectively. This contributed to well below normal inflows into Canyon Ferry during August and September. With inflows to Canyon Ferry Lake at only 54 percent of average during these months, conservative releases were maintained at rates that provided river flows downstream of Holter Dam at 3,500 cfs. As a result, Canyon Ferry Lake slowly declined and entered water year 2007 with a storage content of 1,526,128 acre-feet at elevation 3785.63. This was 89 percent of average and 24,468 acre-feet and 0.79 feet lower than at the beginning of water-year 2006.

Precipitation in the Missouri River Basin above Canyon Ferry Lake was well above average during October and then dropped to well below average during November through January. Valley precipitation during October was 254 percent of average, while the mountain precipitation was 151 percent of average. During November and January the valley precipitation dropped to 69 percent of average while the mountain precipitation dropped to 74 percent of average. This low precipitation contributed to the unseasonably low inflow to Canyon Ferry Lake. During October through January the inflow averaged 79 percent of normal.

At the beginning of the year with storage nearly 1 foot lower than a year ago and inflows to Canyon Ferry Lake well below normal, plans were made to maintain river flows downstream of Holter Dam no lower than 3,500 cfs to protect the downstream river fishery. This was about 600 cfs less than MFWP's recommended desired minimum river flow of 4,100 cfs. Maintaining releases at or above this rate allowed storage in Canyon Ferry Lake to slowly increase to 1,559,626 acre-feet at elevation 3786.71 by November 25. This was 68,751 acre-feet or 2.23 feet higher than on November 25, 2005.

On January 1, the Natural Resources Conservation Service (NRCS) measured the mountain snowpack in the Missouri River Basin above Canyon Ferry to be 80 percent of average, about 30 percent lower than a year ago. Snowpack in the Jefferson, Madison, and Gallatin River Basins, major tributaries of the Missouri River Basin was 81, 78 and 73 percent of normal, respectively. As the winter proceeded, snow continued to accumulate in the mountains, but at well below normal rates. According to the National Weather Service precipitation recordings, valley precipitation during January through March was 84 percent of average, while the mountain precipitation was only 68 percent of average. By April 1, mountain snowpack in the Missouri River Basin had declined to 66 percent of average. This was 32 percent lower than that experienced a year ago. Snowpack in the tributaries of the Jefferson, Madison, and Gallatin River Basins reported 67, 64, and 67 percent of normal respectively, as compared to 103, 105, and 105 percent of normal a year ago.

The water supply forecast prepared on April 1, indicated the April-July runoff into Canyon Ferry Lake was expected to be 59 percent of average, totaling 1,205,000 acre-feet. With storage at 108 percent of average, projected operations indicated the release out of Canyon Ferry to the Missouri River could continue to be maintained at rates that would provide flows in the Missouri River downstream of Holter Dam at or above 3,500 cfs during April and later increased to 4,100 cfs during May and June and still allow Canyon Ferry Lake to fill to the top of the joint-use pool at elevation 3797 near the end of June.

Precipitation in the Missouri River Basin varied during April through June. Valley precipitation above Canyon Ferry Lake during April, May, and June was respectively 113, 121, and 79 percent of average, while the mountain precipitation was 84, 69, and 61 percent of average, respectively. The effects of the persistent drought kept inflow to Canyon Ferry Lake well below normal during April through July. Unseasonably warm temperatures were experienced during April through June. However, it was not until early May that the snowmelt runoff actually began to flow into Canyon Ferry Lake. Inflows to Canyon Ferry gradually increased from about 3,880 cfs the middle of April to the peak for the year of 9,969 cfs on June 8.

On May 1, storage in Canyon Ferry Lake was recorded at 1,605,471 acre-feet at elevation 3788.17. As the inflows steadily increased, storage also increased in Canyon Ferry Lake, as releases to the Missouri River were maintained at about 3,500-3,600 cfs downstream of Holter Dam. As storage approached the top of the joint-use pool, releases from Canyon Ferry Lake were increased to control the rate of fill. On June 11, a peak discharge during spring runoff from Canyon Ferry Lake to the Missouri River was recorded at 4,973 cfs. With most of the high elevation snow above Canyon Ferry Lake melted out by the middle of June, inflow to Canyon Ferry Lake began to quickly recede. In response and better assure Canyon Ferry Lake of filling to the top of the joint-use pool, releases from Canyon Ferry Lake to the Missouri River were gradually reduced to rates that would maintain river flows below Holter Dam at or above 3,500 cfs. On June 21, Canyon Ferry Lake had reached a peak storage content of 1,885,225 acre-feet at elevation 3796.80, about 6,663 acre-feet or 0.20 feet below the top of the joint-use pool.

Valley precipitation in the Missouri River Basin during July was only 47 percent of average while the mountain precipitation was 59 percent of average. With essentially no precipitation falling during July, irrigation demands upstream of Canyon Ferry Lake remained high. As a result, the inflow to Canyon Ferry continued to drop from 43 percent of average in June to only 30 percent of average during July. The April-July runoff into Canyon Ferry totaled 1,091,127 acre-feet. This was 58 percent of average and 596,165 acre-feet lower than the inflow experienced in 2006.

Precipitation improved slightly during August but remained below average. Valley precipitation was 56 percent of average while the mountain precipitation was 83 percent of average. Generous rains finally began to fall during September, enabling valley precipitation to increase to 109 percent of average and the mountain precipitation to 121 percent of average. By year-end the total annual valley precipitation in the Missouri River Basin was 98 percent of average while the total annual mountain precipitation was only 81 percent of average. With releases continuing to be maintained at rates that maintained river flows downstream of Holter Dam at or above 3,500 cfs, storage in Canyon Ferry Lake slowly receded from the peak storage recorded on June 21 to a content of 1,500,636 acre-feet at elevation 3784.80 on September 30. This was 88 percent of average and about 25,492 acre-feet or 0.83 feet lower than at the end of water year 2006. The annual inflow to Canyon Ferry Lake was 65 percent of average, totaling 2,577,152 acre-feet. This was 559,448 acre-feet lower than the total annual inflow experienced in water-year 2006. Since March 2000 through December 2005, the inflow to Canyon Ferry has been below average for 70 consecutive months. This marked the longest period of record that the monthly inflows to Canyon Ferry Lake were below average.

During 2007, Canyon Ferry powerplant generated 294,510,000 kilowatt-hours, 76 percent of the long-term average. This was 65,339 kilowatt-hours more than generated during the record low year of 2002 and 51,770,000 kilowatt-hours less than generated in 2006. The plant used 92 percent of the water released from the dam in 2007 (2,402,258 acre-feet). The remainder of the water was released to meet the irrigation needs of the Helena Valley Irrigation District (200,386 acre-feet).

The Corps of Engineers estimated that during 2007, Canyon Ferry did not prevent any local flood damages but did prevent \$2,787,200 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 \$153,561,400.

### Important Events - Water Year 2007

September 28: All irrigation deliveries to the Helena Valley Unit were discontinued for the 2006 irrigation season. To continue conserving storage in Canyon Ferry, total release was decreased to 3,440 cfs (z, 3,440 cfs through the powerplant and 0 cfs for the Helena Valley Project) a rate that would maintain river flows downstream of Holter Dam at or above 3,500 cfs. River flows of 3,500 cfs is about 600 cfs below the desired minimum flow that sustains a healthy trout fishery in the Missouri River.

January 9-12: The National Weather Service forecasted a severe cold front to move into Montana. At the request of PPL-MT, the total release from Canyon Ferry to the Missouri River was increased to about 5,435 cfs to allow the river to freeze over at a higher level and reduce the potential for ice jam flooding from occurring. Approximately 30 hours later, turbine releases were gradually reduced to 3,935 cfs, a rate that would maintain river flows below Holter Dam at 4,000 cfs or higher.

January 19: Based on the January water supply forecast and continue conserving storage in Canyon Ferry, turbine releases were reduced to 3,450 cfs, a rate that would maintain river flows below Holter Dam at 3,500 cfs or higher.

February 1-4: The National Weather Service forecasted a severe cold front to move into Montana. At the request of PPL-MT, the total release from Canyon Ferry to the Missouri River was increased to about 4,450 cfs to allow the river to freeze over at a higher level and reduce the potential for ice jam flooding from occurring. Approximately 3 days later, turbine releases were gradually reduced to 3,450 cfs, a rate that would maintain river flows below Holter Dam at 3,500 cfs or higher.

February 20-March 15: Triennial maintenance was scheduled on Unit No. 3 of the powerplant. To allow for the maintenance and continue evacuating storage from Canyon Ferry Lake as projected, turbine releases were restricted to 2-unit capacity. The turbine releases from Canyon Ferry were maintained at 3,400 cfs.

February 9: Mountain snowpack in the Missouri River Basin upstream of Canyon Ferry was 70 percent of average. To conserve storage and better assure Canyon Ferry Lake of filling to the top of the joint-use pool, turbine releases were reduced to 3,300 cfs, a rate that would maintain river flows below Holter Dam near 3,500 cfs.

March 27: Irrigation deliveries to Helena Valley Unit were initiated on March 27 and adjusted periodically throughout the irrigation season to meet the irrigation demands. Based on the revised water supply outlook, turbine releases from Canyon Ferry powerplant were also adjusted

proportionately to maintain the total release from Canyon Ferry at 3,640 cfs (z 3,330 cfs through the powerplant and 310 cfs for the Helena Valley Project).

April 4-5: A maintenance outage was scheduled on Unit No. 2 of the powerplant to allow for inspection of the turbine wicket gates and perform minor maintenance. In response, turbine releases were restricted to 2-unit capacity and maintained at 3,365 cfs. Total release was maintained at 3,675 cfs 3,365 cfs through the powerplant and 310 cfs for the Helena Valley Project)

April 4: Helena Valley Reservoir was approaching full pool. In response, total release from Canyon Ferry was gradually decreased to 3,570 cfs 3,365 cfs through the powerplant and 205 cfs for the Helena Valley Project).

April 12: Reclamation attended and participated in the Upper Missouri River Advisory Group meeting held in the Director's Conference Room at Montana Fish, Wildlife, and Parks Building in Helena, Montana. 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 2007.

April 26: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 3,700 cfs 3,385 cfs through the powerplant and 145 cfs for the Helena Valley Project).

May 1: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 3,800 cfs ("z 3,385 cfs through the powerplant and 190 cfs for the Helena Valley Project).

May 4: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 3,935 cfs 3,385 cfs through the powerplant and 550 cfs for the Helena Valley Project).

May 8: A maintenance outage was scheduled on Unit No. 3 of the powerplant to allow for inspection and maintenance of the buss work in the electrical panel. In response, turbine releases were restricted to 2-unit capacity and maintained at 3,385 cfs. Total release was maintained at 3,935 cfs 3,385 cfs through the powerplant and 550 cfs for the Helena Valley Project)

May 10: Following maintenance of the buss work and based on the May 1 water supply outlook, total release from Canyon Ferry Dam was maintained at 3,745 cfs (z 3,230 cfs through the powerplant and 515 cfs for the Helena Valley Project)

May 11: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 3,845 cfs (z 3,230 cfs through the powerplant and 615 cfs for the Helena Valley Project).

May 16: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 4,010 cfs (z 3,230 cfs through the powerplant and 780 cfs for the Helena Valley Project).

May 23: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,990 cfs (z 3,230 cfs through the powerplant and 760 cfs for the Helena Valley Project).

May 31: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,780 cfs (z, 3,230 cfs through the powerplant and 550 cfs for the Helena Valley Project).

June 6-7: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 3,850 cfs (z 3,230 cfs through the powerplant and 620 cfs for the Helena Valley Project) on June 6. To better assure Canyon Ferry Lake of filling to the top of the joint-use pool, total release was reduced to 3,450 cfs 2,830 cfs through the powerplant and 620 cfs for the Helena Valley Project) on June 7.

June 8-11: A storm system moved across much of Wyoming and southern Montana, bringing large amounts of precipitation. Inflow to Canyon Ferry were increasing. With Canyon Ferry Lake nearly 3 feet from the top of the joint-use pool, total release was gradually increased to 5,350 cfs 4,750 cfs through the powerplant and 600 cfs for the Helena Valley Project) to slow the rate of fill in Canyon Ferry Lake.

June 12: Following the storm, streamflows were now declining. To better assure Canyon Ferry of filling to the top of the joint-use pool, total release was reduced. Helena Valley Irrigation District also decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 4,765 cfs ("=, 4,250 cfs through the powerplant and 515 cfs for the Helena Valley Project).

June 15: Streamflows to Canyon Ferry Lake continued to decline faster than anticipated. To better assure Canyon Ferry of filling to the top of the joint-use pool, total release was reduced to 4,285 cfs 3,750 cfs through the powerplant and 535 cfs for the Helena Valley Project).

June 19: Streamflows to Canyon Ferry Lake continued to decline faster than anticipated. To better assure Canyon Ferry of filling to the top of the joint-use pool, total release was reduced to 3,890 cfs ("z 3,350 cfs through the powerplant and 540 cfs for the Helena Valley Project).

July 2: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 3,955 cfs 3,350 cfs through the powerplant and 605 cfs for the Helena Valley Project).

July 5: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 4,045 cfs 3,350 cfs through the powerplant and 695 cfs for the Helena Valley Project).

July 10: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry was increased to 4,065 cfs (3,325 cfs through the powerplant and 740 cfs for the Helena Valley Project).

July 18-19: Inflow to Canyon Ferry Lake during July is the 3rd lowest of record at only 25 percent of average. To conserve storage and slow the evacuation rate of storage in Canyon Ferry Lake, total release from Canyon Ferry was gradually reduced to 3,620 cfs (2,850 cfs through the powerplant and 770 cfs for the Helena Valley Project).

August 21: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,505 cfs (2,850 cfs through the powerplant and 655 cfs for the Helena Valley Project).

August 24: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,425 cfs (2,850 cfs through the powerplant and 575 cfs for the Helena Valley Project).

August 24-30: Mechanical problems were encountered with Unit #3. During maintenance of the unit, turbine releases were limited and restricted to 2-unit capacity.

August 30: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,320 cfs (2,850 cfs through the powerplant and 470 cfs for the Helena Valley Project).

September 18: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,230 cfs (2,850 cfs through the powerplant and 380 cfs for the Helena Valley Project).

September 20: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry was decreased to 3,160 cfs (2,850 cfs through the powerplant and 310 cfs for the Helena Valley Project).

October 1: All irrigation deliveries to the Helena Valley Unit were discontinued for the 2007 irrigation season. To continue conserving storage in Canyon Ferry, total release was decreased to 3,100 cfs (3,100 cfs through the powerplant and 0 cfs for the Helena Valley Project) at a rate that would maintain river flows downstream of Holter Dam at or above 3,300 cfs. River flows of 3,300 cfs is about 800 cfs below the desired minimum flow that sustains a healthy trout fishery in the Missouri River.

Additional statistical information of Canyon Ferry Reservoir and its operations during 2007 can be found on Table MTT6 and Figure MTG4.

TABLE MTT6  
HYDROLOGIC DATA FOR 2007  
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	3785.63	1,526,128	OCT 01, 2006
END OF YEAR	3784.80	1,500,636	SEP 30, 2007
ANNUAL LOW	3784.21	1,482,675	FEB 05, 2007
ANNUAL HIGH	3796.80	1,885,225	JUN 21, 2007
HISTORIC HIGH	3800.00	2,050,900	JUN 23, 1964

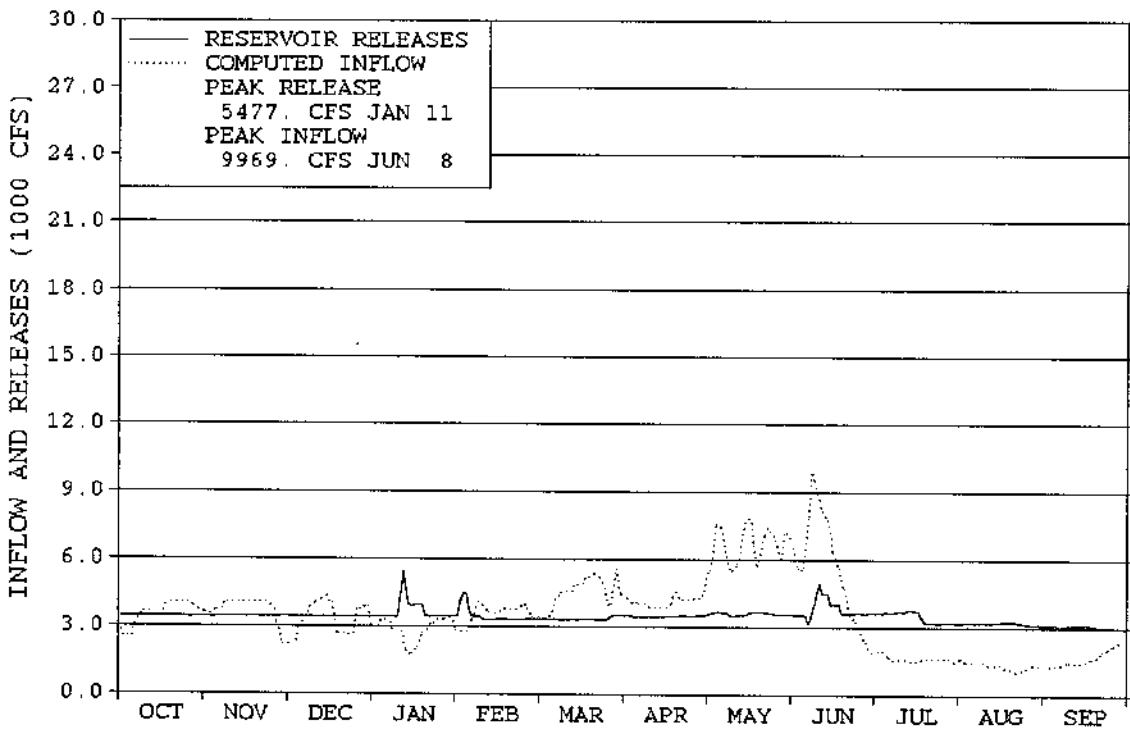
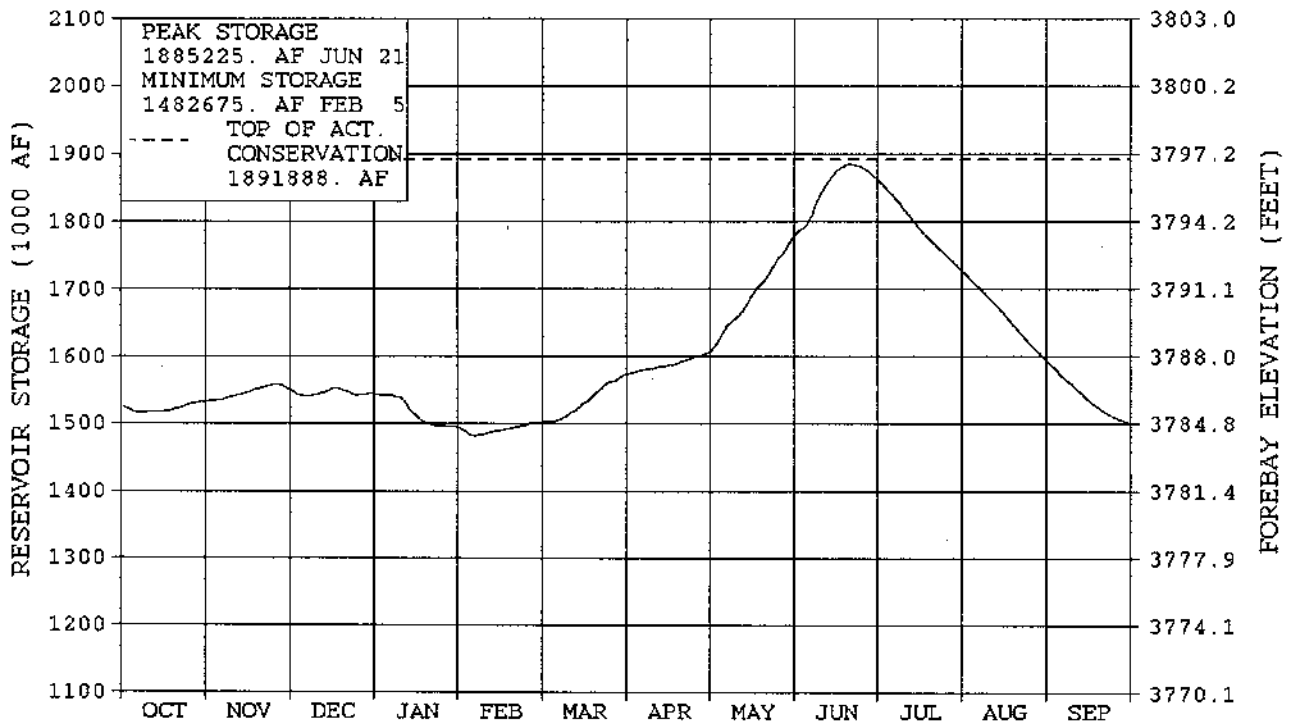
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	2,577,152	OCT 06-SEP 07	2,505,424	OCT 06-SEP 07
DAILY PEAK (CFS)	9,969	JUN 08, 2007	5,477	JAN 11, 2007
DAILY MINIMUM (CFS)	1,012	AUG 21, 2007	2,981	SEP 29, 2007
PEAK SPILL (CFS)			0	NONE
TOTAL SPILL (AF)			0	NONE

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	PUMPED TO HELENA VALLEY (KAF)	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	219.8	77	0	---	212.4	81	1,533.5	89
NOVEMBER	221.8	75	0	---	205.1	76	1,550.3	89
DECEMBER	205.7	85	0	---	211.6	71	1,544.4	92
JANUARY	176.5	80	0	---	227.0	76	1,493.9	95
FEBRUARY	200.7	91	0	---	192.4	72	1,502.2	99
MARCH	278.4	103	1.4	504	206.1	69	1,573.1	108
APRIL	246.9	71	6.8	121	207.8	68	1,605.5	110
MAY	409.2	71	18.5	144	221.6	61	1,774.6	109
JUNE	334.7	43	16.8	110	227.2	48	1,865.3	99
JULY	100.3	30	22.2	132	214.5	61	1,728.8	95
AUGUST	81.7	48	20.7	133	197.0	78	1,592.8	92
SEPTEMBER	101.4	47	10.8	139	182.8	79	1,500.6	88
ANNUAL	2,577.2	65	97.2	129	2,505.4	68		
APRIL-JULY	1,091.1	58						

\* Average for the 1955-2007 period.



**FIGURE MTG4  
CANYON FERRY LAKE**



WATER YEAR 2007

## 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 10,209 acre-feet at an elevation of 3819.60 feet. Helena Valley Reservoir reached a low for the year of 7,480 acre-feet at an elevation of 3813.65 feet on September 30, 2007. With new operating criteria in place, goals were to fill Helena Valley Reservoir by April 1 and maintain it nearly full through June. In response, diversions to the Helena Valley Unit from Canyon Ferry Reservoir were started on March 27. Storage in Helena Valley Reservoir then steadily increased to a spring peak of 10,378 acre-feet at an elevation of 3819.03 feet on May 7, 2007. Normal irrigation and municipal demands slowly drafted storage to 9,156 acre-feet at an elevation of 3817.46 on May 20, 2007, before filling to a peak for the year of 10,430 at an elevation of 3820.03 on June 1, 2007. By the end of water year 2007, Helena Valley reservoir ended with a storage content of 7,480 acre-feet at elevation 3813.65. During 2007, 97,220 acre-feet of water was pumped to Helena Valley from Canyon Ferry Reservoir. Helena Valley Irrigation District released 70,886 acre-feet for irrigation. All irrigation deliveries were discontinued for the 2007 season on October 1.

The reservoir provided an adequate water supply to satisfy all irrigation requirements for the Helena Valley Unit in 2007 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 2007

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	RESERVOIR STORAGE (AF)	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
Beginning of Year	3819.60	10,209	10/01/06
End of Year	3813.65	7,480	09/30/07
Annual Low	3813.65	7,480	09/30/07
Annual High	3820.03	10,430	06/01/07
Historic High	3820.60	10,738	6/02/75
INFLOW-OUTFLOW DATA			ANNUAL
Pumped from Canyon Ferry to Helena Valley Unit			97,220 AC-FT
Inflow to Helena Valley Reservoir			72,947 AC-FT
Released from reservoir for irrigation			70,886 AC-FT
Delivered to the City of Helena for municipal use			1,938 AC-FT

MONTH	RESERVOIR		PUMPED TO HELENA VALLEY (KAF)
	FOREBAY ELEVATION (FEET)	STORAGE CONTENT (KAF)	
OCTOBER	3818.38	9.6	0
NOVEMBER	3817.53	9.2	0
DECEMBER	3816.82	8.9	0
JANUARY	3816.00	8.5	0
FEBRUARY	3815.37	8.2	0
MARCH	3817.18	9.0	1.4
APRIL	3819.41	10.1	6.8
MAY	3820.02	10.4	18.5
JUNE	3819.58	10.2	16.8
JULY	3814.59	7.9	22.2
AUGUST	3819.22	10.0	20.7
SEPTEMBER	3813.65	7.5	10.8
ANNUAL			97.2

## 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 2006 provided some relief to the water users but the cumulative effects of below average water supply in the Sun River basin were reflected in the Gibson Reservoir inflows heading into water year 2007. The August through September inflow to Gibson Reservoir was 65 percent of average, totaling 29,742 acre-feet at the end of water year 2006. With the inflows averaging 189 cfs and releases averaging 132 cfs during September, storage in Gibson Reservoir increased slowly and entered water year 2007 with a storage content of 10,545 acre-feet at elevation 4623.56. This was 38

percent of average and only 11 percent of full capacity. This was also 85,932 acre-feet or 100.44 feet below the top of the conservation pool and was 5,469 acre-feet or 14.35 feet more than at the beginning of water year 2006.

At the conclusion of the 2006 irrigation season, fall and winter releases from Gibson Reservoir to the Sun River were reduced in mid-September and maintained between 70-80 cfs with the expectation that with normal snowpack they could be increased later. In early November a large precipitation event caused inflows to increase to approximately 156 percent of average and storage by the end of November had increased to approximately 31,200 acre-feet. By early December, snowpack as well as storage was near normal, which allowed releases to be increased to about 100 cfs. Storage in Gibson Reservoir continued to increase and by the end of December storage reached 39,337 acre-feet at elevation 4671.06.

Precipitation in the Sun River basin varied from much above average to much below average during water year 2007. Cumulative precipitation for October through December was above average for valley and mountain areas in the Sun River basin, principally due to the early November storm event. By January 1, the Natural Resources Conservation Service (NRCS) measured the mountain snowpack in the Sun-Teton River Basins at 93 percent of average, which was a 25 percent increase from a year ago. During January, precipitation was below average in both valley and mountain areas resulting in a decreased snowpack of 90 percent of average by February 1. During February precipitation was near normal in the Sun River basin, consequently snowpack accumulated at near average rates. By March 1 snowpack had improved to 91 percent of average. March precipitation was below average in valley areas, while much below average in the mountains. The cumulative precipitation through the end of March was 91 and 96 percent of average for the valley and mountain areas, respectively.

On April 1, the NRCS measured the snowpack at only 58 percent of average. In 2007 the snowpack in the Sun River basin reached its peak accumulation in early March and was 80 percent of the average peak. Snowmelt runoff began entering Gibson Reservoir in mid-March and storage began to increase dramatically. Releases to the Pishkun Reservoir were initiated on March 26 and Gibson Reservoir storage drafted until April 8 when inflows increased above releases. By May 1, storage in Gibson Reservoir had reached 76,676 acre-feet at elevation 4708.23, 19,801 acre-feet or 15.77 feet below the top of the conservation pool. As the temperatures increased in early May, streamflows increased to the peak inflow for the year of 3,380 cfs on May 13.

During April and May, precipitation in valley areas was near average, while precipitation in mountain areas ranged between much below average to average conditions. Precipitation conditions in June did not improve. Valley and mountain precipitation during June were 30 and 37 percent of average, respectively. The cumulative effect of the below average precipitation in the mountains resulted in much below average spring runoff into Gibson Reservoir. The inflows during April, May and June were 109, 81, and 44 percent of average, respectively.

Releases during late April were kept at a reduced rate to ensure filling of Gibson Reservoir and beginning in early May release were increased quickly to control the rate of fill. On May 19, Gibson Reservoir reached a peak storage content for the year of 96,477 acre-feet at elevation 4724.00, which is the top of the active conservation pool. The peak discharge to the Sun River over the Sun River Diversion Dam was recorded on June 3 at 2,025 cfs, while the peak discharge from Gibson Reservoir was recorded on May 19 at 2,910 cfs. The snowmelt runoff peaked quickly and began to recede by the end of May. Early June precipitation temporarily increased inflows to the reservoir, but by June 6 the inflow quickly declined again indicating that the snowmelt runoff was complete. The early snowmelt resulted in the inflow to Gibson Reservoir during July being only 41 percent of average. The actual April-July inflow totaled 296,902 acre-feet, approximately 67 percent of average and 63,022 acre-feet or 18 percent less than the previous year.

Weather conditions became extremely hot and dry in July when precipitations in both the valley and mountain areas were only 7 and 17 percent of average, respectively. The drought conditions continued during August resulting in the cumulative water year precipitation through August for valley and mountain areas totaling 72 and 79 percent of average, respectively. Concluding the water year conditions improved slightly during September when valley and mountain precipitation were 128 and 103 percent of average, respectively. The August-September inflow to Gibson Reservoir totaled 22,897 acre-feet, only 50 percent of average. Beginning August 1, releases from Gibson Dam were reduced from approximately 1,440 cfs to about 200 cfs by the 4th of the month. During September the average inflow was approximately 168 cfs, while releases in the latter part of the month were reduced to approximately 100 cfs allowing storage in Gibson Reservoir to gradually increase. During late September, releases over the Sun River Diversion Dam were reduced to rates below the recommended minimum fishery flow. Gibson Reservoir ended the water year with a content of 6,233 acre-feet of storage at elevation 4612.77 on September 30. This was 22 percent of average and 6 percent of normal full capacity or 90,244 acre-feet or 111.23 feet below the top of the conservation pool. This was 4,312 acre-feet or 10.80 feet less than at the end of water year 2006.

Total annual inflow for water year 2007 was 68 percent of average, totaling 417,094 acre-feet. This was 26,914 acre-feet or 6 percent less than the inflow experienced during water year 2006.

Diversions to the Pishkun Supply Canal were started on March 26 for both Willow Creek and Pishkun Reservoirs. Maintenance on Pishkun Reservoir outlet works required the reservoir to essentially be empty during the winter of 2007. During late March and early April storage was moved from Gibson Reservoir to refill Pishkun Reservoir. The early spring diversion was temporarily discontinued on April 9 to allow Gibson Reservoir to fill. The total net inflow to Pishkun Reservoir during water year 2007 was 234,815 acre-feet, 103 percent of average. Early spring diversions to Willow Creek Reservoir were discontinued on April 9. However when Pishkun Reservoir was filled in early May, diversions to Willow Creek began again as excess water was released from Gibson Dam.

This allowed storage in Willow Creek to increase until June 2, when the reservoir reached a peak content. Diversions to Willow Creek Reservoir were discontinued in late May as the reservoir approached normal full pool. Diversions were reinitiated for a brief period in mid-August, but then discontinued until mid-September when they were reinitiated and were still be made through December 31. The net inflow for the water year to Willow Creek Reservoir was 9,578 acre-feet, 66 percent of average.

Greenfields Irrigation District discontinued water delivery on August 17. Supplemental water contracts served by Greenfields were satisfied May 14 through June 15 while Gibson Reservoir releases were in excess of senior irrigation demands. Based on average diversions to Pishkun Reservoir and supplemental water delivered, Greenfields delivered approximately 75 percent of normal allotment to their water users. The total diversion for Fort Shaw Irrigation District was above average during 2007. The total water diverted during April 17 through October 12 was approximately 52,099 acre-feet, which is 124 percent of average.

Even though there is no space allocated to flood control, the Corps of Engineers still estimates flood damages that may be prevented by Gibson Reservoir. During 2007 Gibson Reservoir did not contribute to the reduction of flood damages locally or downstream on the Missouri River below Fort Peck Reservoir. Since 1950 Gibson Reservoir has prevented \$3,044,500 in flood damages.

### **2007 Fires in the Sun River Basin**

Fires during the summer of 2007 burned in excess of 52,000 acres in the Sun River Basin above Gibson Reservoir in northcentral Montana. A final tally of the number of acres burned in the basin has not been compiled. Due to the fires, a SNOTEL site was affected, and others had equipment removed before the fire was in the area.

The fire damage poses many concerns for the years to come; accelerated snow melt due to loss of canopy, new snow melt patterns for the basin, accumulations of burned timber in the reservoir, as well as siltation problems resulting from the loss of vegetation and root systems. With these new concerns and patterns, operation procedures and forecasts may have to change in order for the basin, and its storage facilities to continue to provide the same benefits as in years past. At this time it is difficult to accurately predict the cumulative affect these fires will have on the water supply and operations of the Sun River Project, but Reclamation and Greenfields Irrigation District will be monitoring impacts closely.

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 Reservoir during the 2006 irrigation season were discontinued on August 13, 2006. Reservoir content in Pishkun at the beginning of water year 2007 was 16,008 acre-feet at elevation 4342.00. This was 49 percent of average and 34 percent of normal full capacity and 19,666 acre-feet or 20.2 feet less than at the beginning of water year 2006.

Storage during the fall and winter of 2007 was held at the bottom of the Active Conservation pool for maintenance work being performed on the river outlet works. Diversion to refill the reservoir began in late March and by early May storage had reached the top of active conservation pool. Once irrigation releases began, storage fluctuated based on meeting irrigation demands. Due to the precipitation in late May, demands decreased allowing storage to increase to a peak content for the year of 47,820 acre-feet at elevation 4370.73 on May 28. Irrigation releases from Pishkun Reservoir were started on May 9 with a maximum release of 1,734 cfs recorded on June 16. The maximum inflow was 1,848 cfs on March 29, 2007. All diversions from the Sun River to Pishkun Reservoir were discontinued on August 13. All irrigation releases from Pishkun Reservoir were discontinued on August 17, which is much earlier than normal. Approximately 234,814 acre-feet of water, 114 percent of average, was released from Pishkun Reservoir during May 9 through August 17 to help meet the irrigation demands on the Sun River Project. By the end of the water year, the reservoir storage was 16,008 acre-feet at elevation 4342.20. This was 49 percent of average and 34 percent of full capacity. This was also the same elevation as the end of water year 2006.



Additional hydrologic and statistical data pertaining to Pishkun Reservoir can be found in Table MTT8-B and Figure MTG6.

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 be diverted for irrigation at the Fort Shaw Diversion Dam, the Floweree Canal of the Broken O Ranch, and other downstream senior water users.



All diversions from the Sun River to Willow Creek during the 2006 irrigation season were discontinued on December 1, 2006. Reservoir content in Willow Creek at the beginning of water year 2007 was 22,035 acre-feet at elevation 4134.90. This was 126 percent of average and 69 percent of full capacity and 4,473 acre-feet or 3.71 feet more than at the beginning of water year 2006.

Storage in Willow Creek Reservoir remained fairly stable throughout the winter. Diversions from the Sun River to Willow Creek Reservoir during 2007 were initiated on March 26 at a rate of approximately 25 cfs. The diversions began to reach Willow Creek Reservoir on March 29 and storage increased through April and May to a peak storage content for the year of 31,570 acre-feet at elevation 4141.81 on June 2. This storage level was 113 percent of average and was at 99 percent of full capacity. Due to the reservoir approaching normal full pool, diversions from the Sun River to Willow Creek were discontinued late May, with the total inflow from March 29 through June 2 totaling approximately 2,600 acre-feet. The peak inflow during this time period was 66 cfs.

To help meet irrigation demands within the Sun River Irrigation Projects a release of 130 cfs was initiated from Willow Creek Reservoir on June 25 and steadily increased to 200 cfs by the end of the month. Releases were held steady during July and then decreased in August as a result of decreased downstream irrigation demands. Releases were discontinued on August 14. Approximately 17,395 acre-feet of storage was released from Willow Creek Reservoir during June 25 through August 14 to help meet the irrigation demands in 2007. As a result, storage was drafted to a content of 13,024 acre-feet at elevation 4126.72 on August 29. Diversions to Willow Creek Reservoir were reinitiated on September 17, allowing storage to slowly increase through the remainder of the year. Willow Creek Reservoir ended the water year with a storage content of 14,218 acre-feet at elevation 4127.97. This was 81 percent of average and 45 percent of nominal full capacity. This was also 7,817 acre-feet or 6.93 feet lower than at the end of water year 2006. Diversions to Willow Creek Reservoir were still being made through December 31.

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

### Important Events — 2007

December 1: Diversions to Willow Creek Feeder Canal were discontinued for the winter.

March 26: Diversions to Willow Creek and Pishkun Reservoirs were initiated.

March 29: Inflows into Pishkun Reservoir peak at approximately 1,848 cfs.

April 9: Diversions to Willow Creek and Pishkun Reservoirs were discontinued.

May 4: Diversions to Willow Creek and Pishkun Reservoirs were initiated again as runoff increases.

May 13: Inflows into Gibson Reservoir peak at approximately 3,380 cfs.

May 19: Gibson Reservoir reaches peak for year at elevation 4724.00.

May 27: Inflows into Willow Creek Reservoir peak at approximately 66 cfs.

May 28: Pishkun Reservoir reaches peak for year at elevation 4370.73.

June 2: Willow Creek Reservoir reaches peak for year at elevation 4141.81.

August 13: Diversions to Pishkun Reservoir discontinued for the year.

August 17: Greenfields Irrigation District discontinued water delivery from Pishkun Reservoir.

September 17: Diversion to Willow Creek Reservoir reinitiated to provide increased winter carry-over storage.

TABLE MTT8-A  
HYDROLOGIC DATA FOR 2007  
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

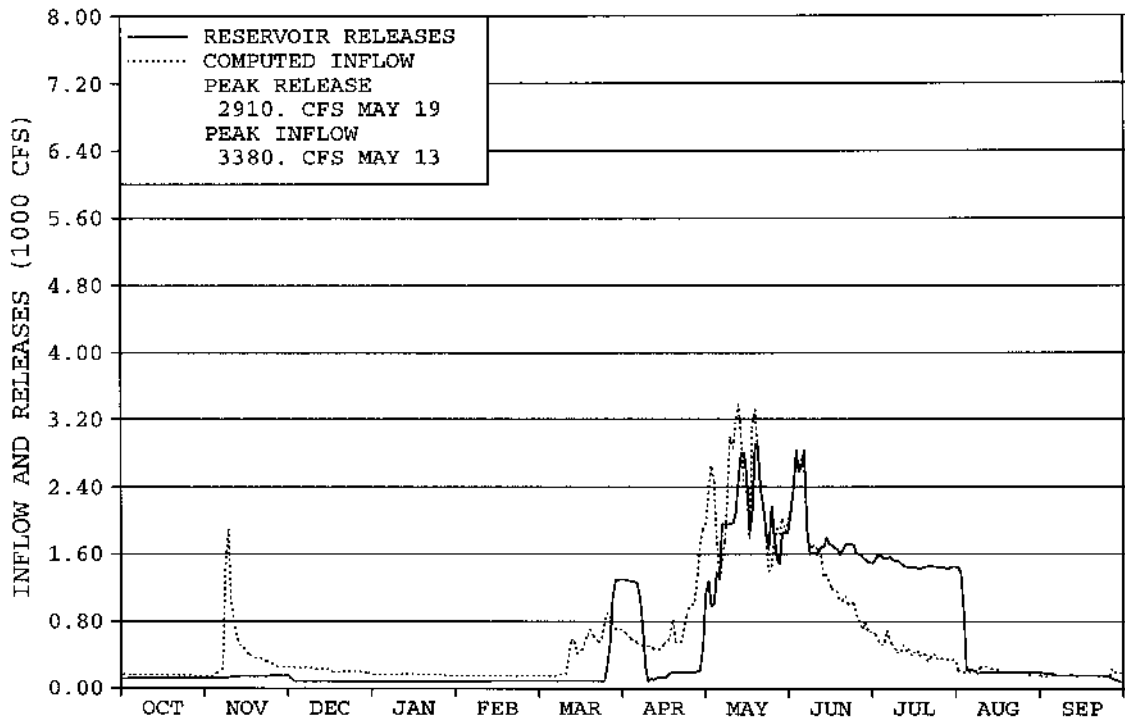
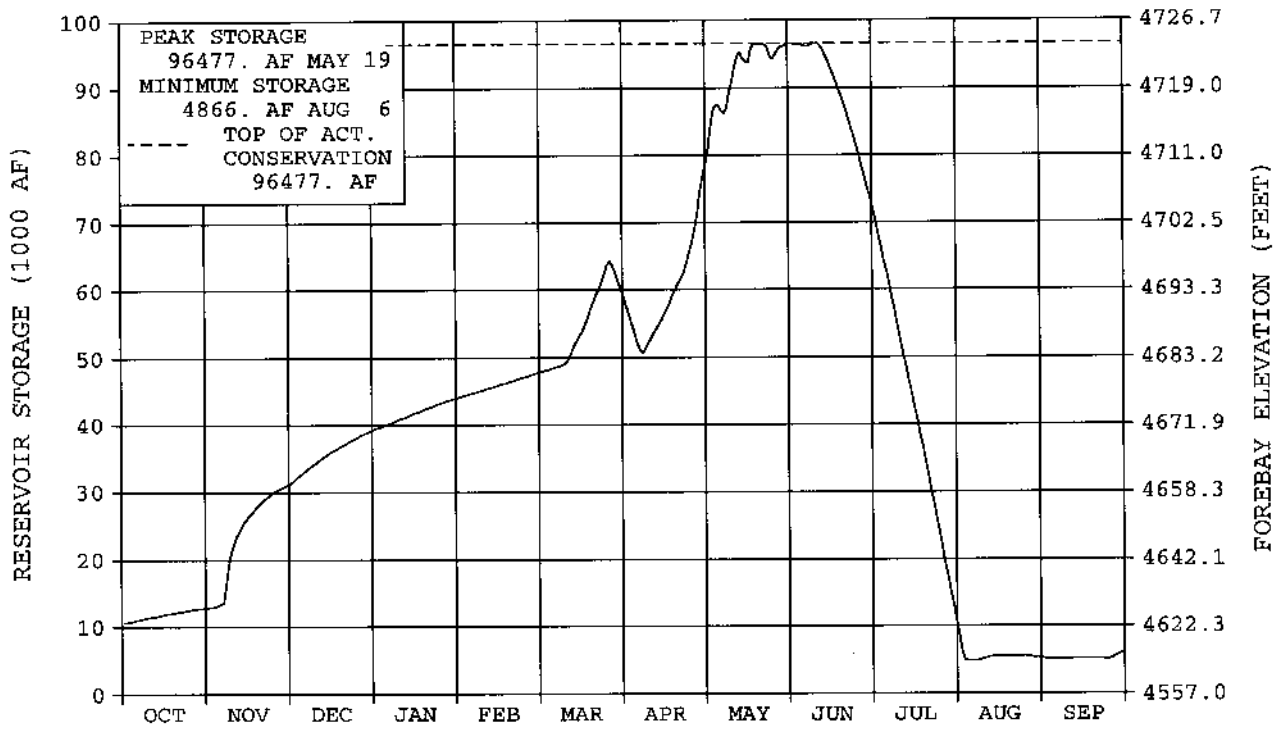
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4623.56	10,545	OCT 01, 2006
END OF YEAR	4612.77	6,233	SEP 30, 2007
ANNUAL LOW	4608.50	4,866	AUG 06, 2007
ANNUAL HIGH	4724.00	96,477	MAY 19, 2007
HISTORIC HIGH	4732.23	116,400	JUN 08, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	417,094	OCT 06-SEP 07	421,410	OCT 06-SEP 07
DAILY PEAK (CFS)	3,380	MAY 13, 2007	2,910	MAY 19, 2007
DAILY MINIMUM (CFS)	142	SEP 23, 2007	81	SEP 30, 2007

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	TOTAL CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	9.7	52	4.6	139	4.7	47	12.8	43
NOVEMBER	26.8	156	74.5	365	5.2	47	31.2	91
DECEMBER	13.4	86	0.1	58	6.1	55	39.3	103
JANUARY	10.2	74	0	---	6.1	62	44.1	106
FEBRUARY	8.5	70	0	---	5.6	68	47.7	106
MARCH	28.5	197	10.4	1104	8.2	84	60.2	126
APRIL	43.7	109	17.5	202	14.4	65	76.7	143
MAY	138.7	81	52.2	133	84.5	87	96.4	113
JUNE	86.4	44	77.4	136	35.9	27	73.8	83
JULY	28.0	41	85.4	119	7.8	30	11.0	19
AUGUST	12.9	49	11.3	28	10.4	79	5.3	16
SEPTEMBER	10.0	52	1.2	11	10.0	98	6.2	22
ANNUAL	417.1	68	264.5	113	198.7	55		
APRIL-JULY	296.9	62						

\* Average for the 1931-2007 period.

# FIGURE MTG5 GIBSON RESERVOIR



WATER YEAR 2007

TABLE MTT8-B  
HYDROLOGIC DATA FOR 2007  
PISHKUN RESERVOIR (SUN RIVER PROJECT)  
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4342.00	16,008	16,008
TOP OF ACTIVE CONSERVATION	4370.00	46,694	30,686

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4342.00	16,008	OCT 01, 2006
END OF YEAR	4342.00	16,008	SEP 30, 2007
ANNUAL LOW	4342.00	16,008	OCT 01, 2006
ANNUAL HIGH	4370.73	47,820	MAY 28, 2007
HISTORIC HIGH	4371.40	48,950	JUL 04, 1953

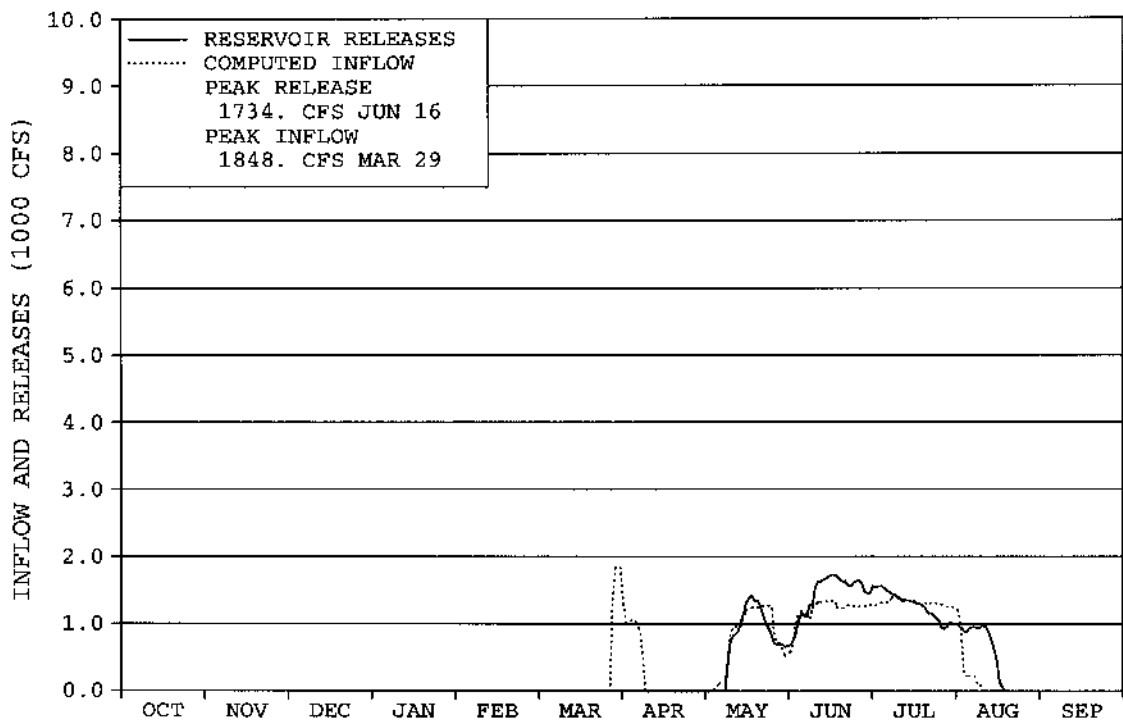
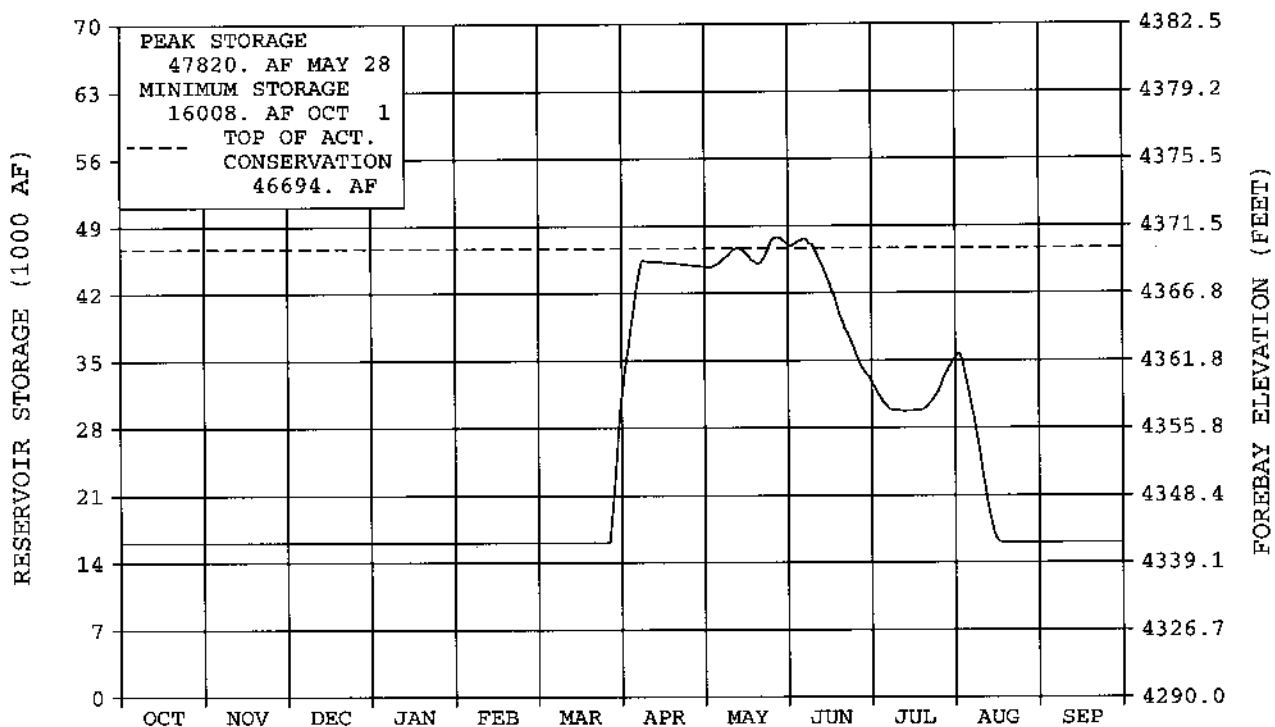
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	234,815	OCT 06-SEP 07	234,815	OCT 06-SEP 07
DAILY PEAK (CFS)	1,848	MAR 29, 2007	1,734	JUN 16, 2007
DAILY MINIMUM (CFS)	0	*	0	*

\* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	0.0	---	0	---	16.0	47
NOVEMBER	0.0	---	0	---	16.0	46
DECEMBER	0.0	---	0	---	16.0	47
JANUARY	0.0	---	0	---	16.0	47
FEBRUARY	0.0	---	0	---	16.0	47
MARCH	13.6	2883	0	---	29.6	87
APRIL	15.2	219	0	---	44.8	110
MAY	45.9	127	43.6	142	47.2	103
JUNE	72.1	124	86.1	140	33.2	78
JULY	80.8	116	78.8	106	35.2	95
AUGUST	7.1	17	26.3	62	16.0	46
SEPTEMBER	0.0	---	0	---	16.0	49
ANNUAL	234.8	103	234.8	104		
APRIL-JULY	214.1	126				

\* Average for the 1947-2007 period.

**FIGURE MTG6**  
**PISHKUN RESERVOIR NEAR AUGUSTA**



WATER YEAR 2007

TABLE MTT8-C  
HYDROLOGIC DATA FOR 2007  
WILLOW CREEK RESERVOIR (SUN RIVER PROJECT)  
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4085.28	1	1
TOP OF ACTIVE CONSERVATION	4142.00	31,848	31,847

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4134.90	22,035	OCT 01, 2006
END OF YEAR	4127.97	14,218	SEP 30, 2007
ANNUAL LOW	4126.58	12,894	AUG 14, 2007
ANNUAL HIGH	4141.81	31,570	JUN 02, 2007
HISTORIC HIGH	4144.00	35,300	JUN 22, 1975

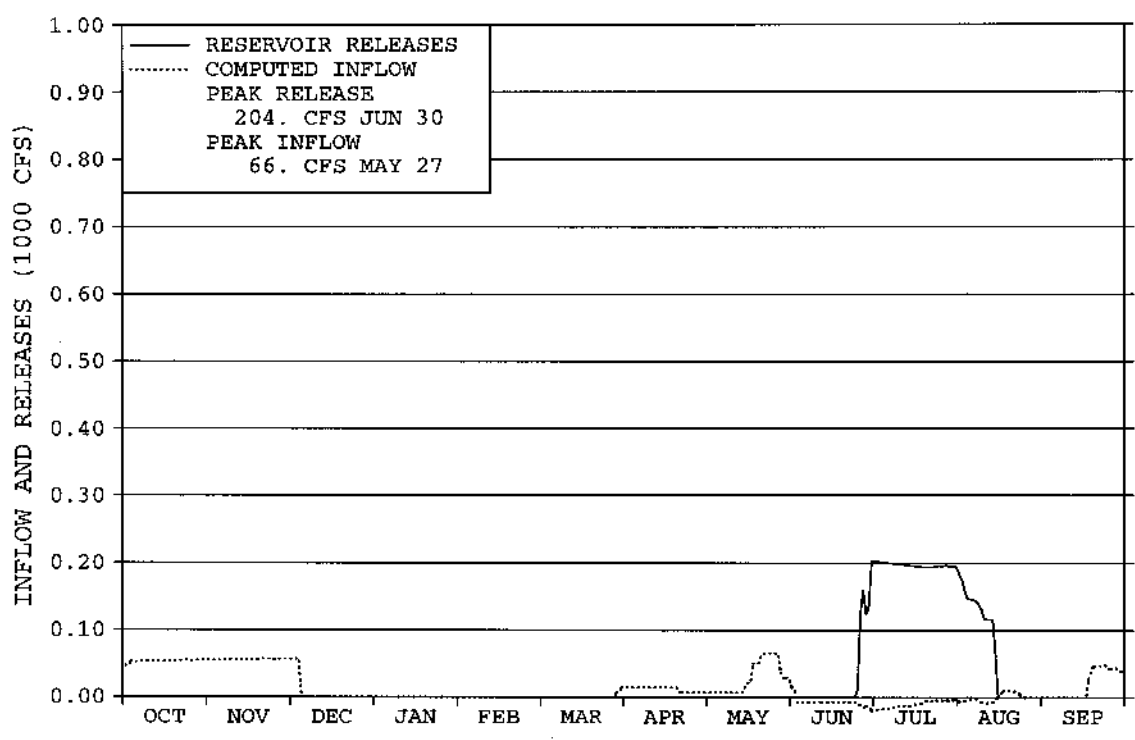
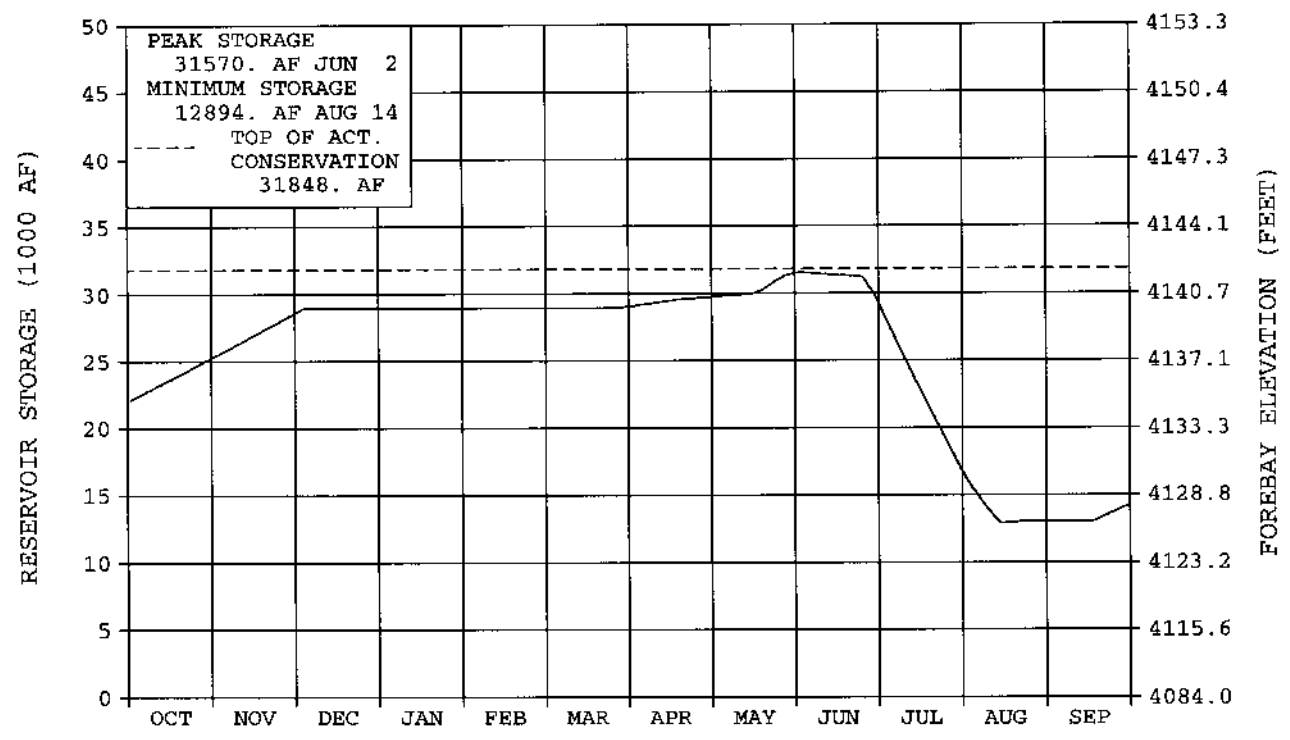
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	9,578	OCT 06-SEP 07	17,395	OCT 06-SEP 07
DAILY PEAK (CFS)	66	MAY 27, 2007	204	JUN 30, 2007
DAILY MINIMUM (CFS)	0	*	0	*

\* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	3.3	407	0	---	25.3	133
NOVEMBER	3.3	457	0	---	28.6	146
DECEMBER	0.3	83	0	---	29.0	146
JANUARY	0.0	---	0	---	29.0	143
FEBRUARY	0.0	---	0	---	29.0	140
MARCH	0.1	6	0	---	29.0	133
APRIL	0.7	35	0	---	29.7	120
MAY	1.8	44	0	---	31.5	114
JUNE	-0.4	---	1.5	47	29.6	99
JULY	-0.6	---	12.1	220	16.8	72
AUGUST	0.0	---	3.8	102	13.0	70
SEPTEMBER	1.2	256	0.0	---	14.2	81
ANNUAL	9.6	66	17.4	120		
APRIL-JULY	1.4	13				

\* Average for the 1952-2007 period.

# FIGURE MTG7 WILLOW CREEK RESERVOIR



WATER YEAR 2007



## **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 Lower Marias Unit and for flood control. The crest section of Tiber Dam 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 be 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 initiated 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 started 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.

In 2002, Reclamation surveyed Lake Elwell 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 October of 1957. The 2002 survey determined that Lake Elwell has a storage capacity of 925,649 acre-feet and a surface area of 18,275 acres at a reservoir elevation of 2993.00. Since closure in 1957, the reservoir has accumulated a sediment volume of 42,179 acre-feet below elevation 2993.00. This volume represents a 4.4 percent change in total capacity at this elevation. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

In September of 2003, construction of a Federal Energy Regulatory Commission (FERC) permitted powerplant began. The river outlet works underwent extensive modification to incorporate the addition of a 7.5 MW powerplant, privately owned by Tiber Montana, LLC. A

bifurcation pipe was installed in the river outlet works tunnel at the downstream end to divert flow from the existing 72-inch outlet pipe through a bifurcation and 96-inch butterfly valve to the powerplant. Construction of the powerplant was completed and brought on-line in June 2004.

Precipitation in the Marias River Basin above Lake Elwell was well below normal during July and August of 2006. Valley precipitation was recorded at 42 and 40 percent of average, respectively, while mountain precipitation was 33 and 57 percent of average, respectively. Inflow to Lake Elwell during July of 2006 was only 24 percent of average and the tenth lowest July inflow ever recorded. To slow the rate of decline, releases from Lake Elwell to the Marias River were decreased to 525 cfs on August 3. Inflow to Lake Elwell during August was only 12 percent of average and the sixth lowest August inflow ever recorded. To conserve storage in Lake Elwell, releases from Lake Elwell to the Marias River were decreased to 500 cfs on September 8. Inflow into Lake Elwell during July-September totaled 22,955 acre-feet which was only 23 percent of normal and the eighth lowest inflow ever recorded during this time. The total annual runoff into Lake Elwell during 2006 was 406,655 acre-feet, 61 percent of normal and 67,543 acre-feet more than experienced in 2005. This was the 14th lowest annual inflow ever recorded into Lake Elwell. As a result, Lake Elwell slowly declined and entered water year 2007 with a storage content of 769,201 acre-feet at an elevation of 2983.47 feet. This was 98 percent of normal and 1.25 feet higher than at the beginning of water year 2006.

During October and November valley precipitation in the Marias River Basin above Lake Elwell was above average and then dropped to below average during December and January. Mountain precipitation during October was below average but was well above average during November and then dropped to below average for the remainder of the year.

During the winter of 2006-2007, mountain snowpack in the Marias Basin above Lake Elwell began accumulating at near normal rates. On December 1, the Natural Resources Conservation Service (NRCS) measured the mountain snowpack in the Marias River Basin above Lake Elwell to be 110 percent of average. Inflow into Lake Elwell during October through December totaled 65,455 acre-feet and was 104 percent of normal. On January 1, the NRCS measured the mountain snowpack in the Marias River Basin above Lake Elwell to be 85 percent of average. The January 1 water supply forecast, based on mountain snowpack, indicated the April-July runoff into Lake Elwell would be 395,000 acre-feet, which was 81 percent of normal. By January 15, the NRCS reported the mountain snowpack in the Marias River Basin above Lake Elwell had improved to 102 percent of average. With storage at 105 percent of average, the January 1 water supply forecast indicated flows needed to be increased to reach target objectives. On March 1, the NRCS reported snowpack in the Marias River Basin upstream of Lake Elwell was at 88 percent of average. Storage in Lake Elwell had reached the desired minimum target level of elevation 2976.00. To maintain the lake elevation near this level, releases to the Marias River were decreased.

As the winter progressed, mountain snowfall accumulated at lower than near normal rates and by April 1, mountain snowpack in the Marias River Basin had declined to 71 percent of normal. Mountain snowpack peaked on April 20 at 82 percent of normal. The April 1 water supply

forecast indicated the April-July runoff into Lake Elwell would be 334,000 acre-feet or 69 percent of normal. Storage in Lake Elwell slowly drafted to a low content for the year of 665,309 acre-feet at elevation 2975.85 on March 17.

Precipitation in the Marias River Basin varied from much above average to much below average during April through June. Valley precipitation above Lake Elwell during April, May and June was 188, 67 and 45 percent of average, respectively, while the mountain precipitation 78, 98, and 43 percent of average, respectively.

The May 1 water supply forecast indicated the May-July runoff into Lake Elwell would be 286,000 acre-feet or 68 percent of normal. Inflow to Lake Elwell during May was only 51 percent of average, leaving lots of room for improvement.

The June inflow to Lake Elwell continued to remain well below normal at only 27 percent of average. Storage steadily increased until reaching a peak content for the summer of 763,518 acre-feet at elevation 2983.08 on June 21, 2007. Actual April-July runoff into Lake Elwell totaled 188,038 acre-feet, the fifth lowest of record, 39 percent of normal, and 109,616 acre-feet less than in 2006. To slow the rate of decline, releases from Lake Elwell to the Marias River were decreased to 400 cfs on June 28.

Precipitation in the Marias River Basin above Lake Elwell was well below normal during July and August. Valley precipitation was recorded at 17 and 41 percent of average, respectively, while mountain precipitation was 18 and 37 percent of average, respectively. Inflow to Lake Elwell during July was only 6 percent of average and the second lowest July inflow ever recorded. Inflow to Lake Elwell during August was the fifth lowest August inflow ever recorded. To conserve storage in Lake Elwell, releases from Lake Elwell to the Marias River were decreased to 350 cfs on September 17.

Inflow into Lake Elwell during July-September totaled 3,609 acre-feet which was only 4 percent of normal and the third lowest inflow ever recorded during this time. The total annual runoff into Lake Elwell during 2007 was 334,760 acre-feet, 50 percent of normal and 71,895 acre-feet less than experienced in 2006. This was the eighth lowest annual inflow ever recorded into Lake Elwell.

By the end of the year, normal operations Lake Elwell drafted storage to 691,869 acre-feet at an elevation of 2977.91 feet. This was 88 percent of normal and 5.56 feet lower than reported on September 30, 2006.

The Corps of Engineers determined that during 2007, Lake Elwell did not prevent any local flood damages but did prevent \$1,365,700 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 \$62,266,100.00.

### Important Events — 2007

October 31, 2006: To allow Tiber Montana to change oil in the generator bearings, flows were switched from the powerplant to the river outlet works and maintained at 515 cfs for approximately 6 hours. After completion of the maintenance, flows were switched back to the powerplant.

January 1, 2007: Natural Resources Conservation Service reported snowpack conditions in the watershed above Lake Elwell had deteriorated to about 85 percent of normal.

January 10, 2007: To allow Reclamation to replace a faulty valve in the river outlet works gate house, flows were switched to the auxiliary outlet works for approximately 4 hours and increased to 600 cfs. The January 1 water supply forecast indicated flows needed to be increased to reach target objectives. After completion of the maintenance, flows were reinitiated through the powerplant and increased to 700 cfs.

January 16, 2007: Natural Resources Conservation Service reported snowpack in the Marias River Basin upstream of Lake Elwell is 102 percent of average. With the slightly above normal snowpack and reservoir storage at 105 percent of average, the January water supply forecast indicates releases to the Marias River need to be increased to 900 cfs in order to reach our target objectives.

February 15, 2007: Natural Resources Conservation Service reported snowpack in the Marias River Basin upstream of Lake Elwell is 85 percent of average. The February water supply forecast indicates releases to the Marias River need to be increased to 1,100 cfs in order to reach our target objectives.

February 21, 2007: Natural Resources Conservation Service reported snowpack in the Marias River Basin upstream of Lake Elwell is 93 percent of average. The February water supply forecast indicates releases to the Marias River need to be increased to 1,150 cfs in order to reach our target objectives.

March 5, 2007: Natural Resources Conservation Service reported snowpack in the Marias River Basin upstream of Lake Elwell is 90 percent of average. Storage in Lake Elwell has reached the desired minimum target level of elevation 2976.00. To maintain the lake elevation near this level, releases to the Marias River will be decreased to 900 cfs.

March 29-30, 2007: Natural Resources Conservation Service reported snowpack in the Marias River Basin upstream of Lake Elwell is 77 percent of average. With work on the lower end of the boat ramp and breakwater near completion, releases to the Marias River will be reduced to 500 cfs to allow storage in Lake Elwell to begin refilling.

April 1, 2007: Natural Resources Conservation Service reported snowpack conditions in the watershed above Lake Elwell were 71 percent of normal. Water supply forecast indicated the April-July runoff into Lake Elwell would be 334,000 acre-feet or 69 percent of normal.

April 11, 2007: Marias Management Committee met for annual spring meeting.

April 26, 2007: To allow for a 3-year periodic review and inspection of the river outlet works and gates, flows were discontinued through the powerplant and initiated through the auxiliary outlet works for approximately 8 hours. After completion of the inspection, flows were discontinued through the auxiliary outlet works and reinitiated through the powerplant at the current rate of 500 cfs.

June 21, 2007: Lake Elwell reaches a peak elevation for the summer of 2983.08 feet, 9.92 feet below the top of the joint use pool.

June 28, 2007: Inflows to Lake Elwell are occurring less than forecast. In an effort to conserve storage in Lake Elwell, releases from Lake Elwell to the Marias River were decreased to 400 cfs.

September 4, 2007: To allow Tiber Montana to conduct an efficiency test of their turbine unit, releases from Lake Elwell were increased from 400 cfs to 450 cfs and held for 30 minutes; then increased to 500 cfs and held at that rate for 30 minutes before returning flows back to the current rate of 400 cfs.

September 17, 2007: Inflow into Lake Elwell during August was the fifth lowest on record. To conserve storage, releases from Lake Elwell to the Marias River were decreased to 350 cfs.

Additional hydrologic and statistical information pertaining to the operation of Lake Elwell during 2007 can be found in Table MTT9 and Figure MTG8.

TABLE MTT9  
HYDROLOGIC DATA FOR 2007  
LAKE ELWELL (TIBER DAM)  
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2966.40	554,330	554,330
TOP OF ACTIVE CONSERVATION	2976.00	667,213	112,883
TOP OF JOINT USE	2993.00	925,649	258,436
TOP OF EXCLUSIVE FLOOD CONTROL	3012.50	1,328,723	403,074

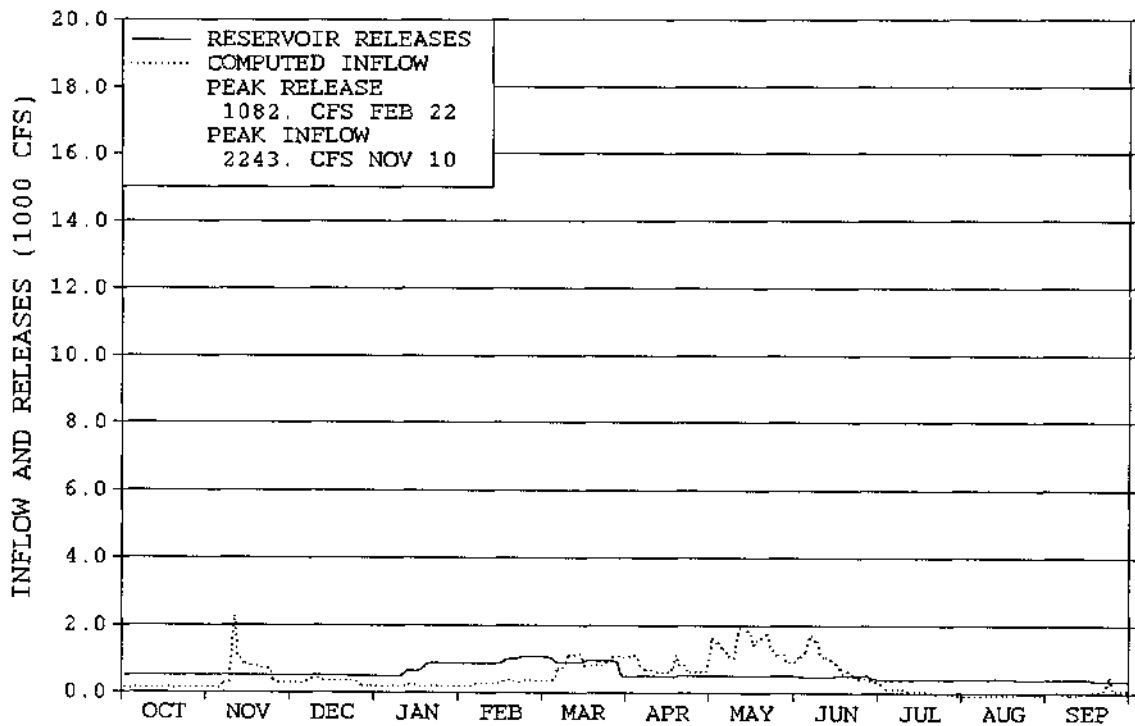
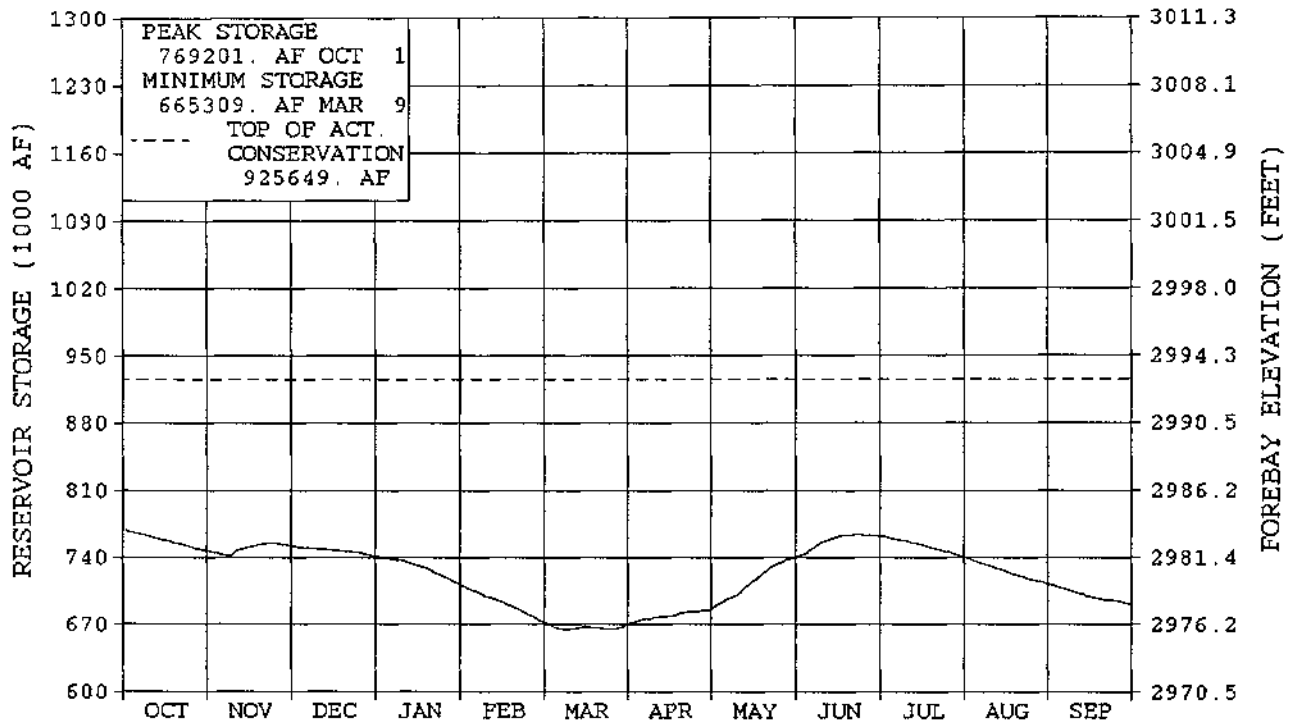
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2983.47	769,201	OCT 01, 2006
END OF YEAR	2977.91	691,869	SEP 30, 2007
ANNUAL LOW	2975.85	665,309	MAR 17, 2006
ANNUAL HIGH	2983.47	769,201	OCT 01, 2006
HISTORIC HIGH	3005.59	1,214,417	JUL 12, 1965

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	334,760	OCT 06-SEP 07	412,092	OCT 06-SEP 07
DAILY PEAK (CFS)	2,243	NOV 10, 2006	1,082	FEB 22, 2007
DAILY MINIMUM (CFS)	-82	JUL 31, 2007	355	SEP 26, 2007
PEAK SPILL (CFS)			0	NONE
TOTAL SPILL (AF)			0	NONE

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	9.3	42	31.7	70	746.8	100
NOVEMBER	36.0	163	30.6	86	752.3	103
DECEMBER	20.1	108	31.0	112	741.4	105
JANUARY	12.8	79	44.0	170	710.2	104
FEBRUARY	17.4	80	53.2	210	674.4	101
MARCH	51.4	103	56.8	161	669.0	99
APRIL	46.0	73	29.9	66	685.1	98
MAY	86.2	51	31.5	47	739.8	93
JUNE	51.9	27	29.2	30	762.5	82
JULY	3.9	6	25.6	34	740.8	82
AUGUST	-2.9	---	25.7	44	712.2	84
SEPTEMBER	2.5	16	22.9	45	691.9	88
ANNUAL	334.8	50	412.1	70		
APRIL-JULY	188.0	39				

\* Average for the 1957-2007 period.

FIGURE MTG8  
LAKE ELWELL



WATER YEAR 2007

## 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 5,000 and 6,000 acres are served supplemental water by the Ft. Belknap Indian Irrigation Project.

Lake Sherburne 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 66,147 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.



In 2002, Reclamation surveyed Lake Sherburne 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 1919. The 2002 survey determined that Lake Sherburne has a storage capacity of 66,147 acre-feet and a surface area of 1,719 acres at a reservoir elevation of 4788.00. Since Lake Sherburne closure in 1919, the measured total volume change at reservoir elevation 4788.00 was estimated to be 343 acre-feet between the 1948 and 2002 surveys and 1,707 acre-feet between the 1983 and 2002 surveys. Due to the upstream lakes, the loss due to sediment deposition in Lake Sherburne should be minimal so it is assumed the volume differences between the surveys are due to the different survey methods and the differences in the vertical datum. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

Water year 2006 provided precipitation extremes in both valley and mountain areas of the St. Mary River basin. The latter part of the year produced mostly dry conditions in both the mountain and valley areas. Valley areas for August and September were 55 and 104 percent of average respectively, while mountain areas were 33 and 71 percent of average respectively. Due to these dry conditions inflow to Lake Sherburne was 4,869 acre-feet, only 76 percent of average during September. Although the inflow was much below



average, the storage in Lake Sherburne did increase to 7,652 acre-feet, 111 percent of average and 12 percent of normal full capacity, at elevation 4738.85 by the beginning of water year 2007. Releases from Lake Sherburne were discontinued on September 23 and subsequently the St. Mary Canal was shutdown on September 25, 2006 until spring of 2007.

Although October precipitation in the valley areas was above normal, the precipitation in mountain areas was much below average. Conditions reversed dramatically in November with both valley and mountain areas receiving much above average precipitation. Cumulative valley precipitation from October to the end of December was 111 percent of average. During the same period cumulative mountain precipitation was 125 percent of average. Inflows during October through December varied from below, above, to much above average; the inflows were 43, 456, and 92 percent of average, respectively. This resulted in storage at the end of December of 39,309 acre-feet, 225 percent of average.

On January 1, the Natural Resources Conservation Service (NRCS) reported that mountain snowpack in the St. Mary basin was 80 percent of normal. Even though total precipitation during November and December was above average the unusually large and relatively warm precipitation event in early November melted the snowpack that had accumulated to that point. As a result, the cumulative mountain precipitation was 125 percent of average through the end of December; however the snowpack remaining was below average. Precipitation in both valley and mountain areas was below average during January which resulted in the February 1 snowpack for the St. Mary basin being only 83 percent of average. Storm patterns in low elevation areas improved slightly in February with above normal precipitation, but precipitation in mountain areas that drain into Lake Sherburne was 70 percent of average. Overall the snowpack did improve for the St. Mary basin and on March 1 snowpack for the St. Mary basin was reported at 87 percent of average. Total inflow during January through March was 18,844 acre-feet, 228 percent of normal and the 2<sup>nd</sup> highest inflow since 1974.

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. In 2007, the prospect of continued drought in the St. Mary and Milk River basin indicated that irrigation water would possibly be needed very early in the season; therefore diversions to the St. Mary Canal were initiated on March 8. Releases from Lake Sherburne preceded the canal diversion on March 5. With above average mountain precipitation during March snowpack would normally be expected to accumulate at near to above average rates. This was not the case. Due to warm precipitation events, even at high elevations, the snowpack accumulation was actually at below average rates. The snow pack peaked on April 12, near the normal time at 82 percent of average. The April 1 water supply forecast for April through July runoff indicated that the runoff would be 90,000 acre-feet, 87 percent of normal

Once releases were started, storage decreased until April 28 when warm weather began to increase streamflows and thus beginning the snowmelt runoff season for 2007. Diversion to the St. Mary Canal averaged 553 cfs during April and 578 cfs during May. Releases

from Lake Sherburne were adjusted during April and late May to maintain diversion rates for the St. Mary Canal. Releases were then reduced to between 35-65 cfs in early May; in conjunction with canal diversions to store the United States portion of the natural St. Mary flow because Fresno Reservoir was at full capacity and making spillway releases. Canal diversions were increased back to usual rates May 11, while Lake Sherburne releases were kept at reduced rates. It appeared that the snowmelt runoff for the St. Mary River was receding in late May, therefore release from Lake Sherburne were once again increased. However, due to precipitation early in June, releases from Lake Sherburne were once again reduced to approximately 40 cfs from June 5 through June 15. Overall valley and mountain precipitation for April were both below average; conversely, precipitation in both areas was near normal during May.

The snowmelt runoff was essentially melted out by the end of June which is approximately three weeks earlier than normal. Lake Sherburne storage peaked on June 28 at 54,556 acre-feet, at elevation 4780.98, which was 11,591 acre-feet and 7.02 feet below the top of normal full capacity. The actual April through July runoff was approximately 80,594 acre-feet, 77 percent of normal.

Precipitation during June, July and August was much below average in both the valley and mountain areas. Consequently, the cumulative water year precipitation through the end of August for valley and mountain areas was decreased 69 and 95 percent of average, respectively. Inflows during these months were 62, 62 and 69 percent of average, respectively. Inflow for the water year totaled 140,322 acre-feet, 98 percent of average. This was 17,243 acre-feet or 11 percent less than the inflow experienced during water year 2006. Storage on September 30, 2007, was 7,025 acre-feet, 84 percent of normal.

According to preliminary data, diversions from the St. Mary River to the Milk River totaled 196,200 acre-feet, 130 percent of the long-term average. The long-term average annual diversion is 150,500 acre-feet and the 1972-2002 average is 168,900 acre-feet. The largest diversion previously recorded was 277,500 acre-feet during 1989. Canal diversions as well as releases from Lake Sherburne were discontinued for water year 2007 on September 4.

In August, a conference call was held with the International Joint Commission Field Representatives to discuss accumulated deficits by the US and Alberta on the St. Mary and Milk Rivers, respectively. It was concluded that since the measured water consumption by Alberta was greater than the currently approved method, which only estimates consumption based on general conditions (wet, normal, dry), then Canada would not request repayment of any deficit by the US on the St. Mary. It was also discussed that due to construction on Lake Sherburne outlet conduits the US would be unable to make any deficit repayment releases prior to the end of the accounting year. Both the US and Canada agreed that any deficit would likely be refunded anyway after October with natural flow of the main-stem St. Mary River.

The Corps of Engineers estimates that during 2007, Lake Sherburne did prevent local flood damages. The flood damages prevented equal approximately \$2,348,100, which was principally due to November precipitation event as previously discussed. In 2007, the Corps of Engineers estimated the historical local flood damages prevented by Lake Sherburne, since 1950, is equal to approximately \$7,885,300.

### **Flood Event: Glacier National Park, November 2006**

In November a record precipitation and runoff event occurred. From November 3-15 approximately 15 inches of rain fell in the basin above Lake Sherburne with the majority of the precipitation in the first few days of the month. It is estimated that this event was larger than the **100-yr** storm depth of a four-day duration. The U.S. Geological Survey (USGS) estimates that an additional 18,400 acre-feet of water flow went past the Swiftcurrent at Many Glacier, MT streamgaging site from approximately November 4 through December 9. This volume is above the base flow that would have normally occurred. Lake Sherburne during this same time period increased nearly 26,400 acre-feet or 25.8 feet in elevation. The flooding caused severe damage to roads and drainage structures in Glacier Park. The event was also covered by national media after the release of the photos shown below.



Looking South at Swiftcurrent Creek with Many Glacier Lodge in the background.



Swiftcurrent Creek at Many Glacier, Montana.

Additional hydrologic and statistical information pertaining to the operation of Sherburne Reservoir during 2007 can be found in Table MTT10-A and Figure MTG9.

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 32,534 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 suitable water for municipal use. The city of Harlem and the Hill County Water District have also contracted for municipal use.

During water year 2006 there was some relief to the drought conditions in the Milk River basin. Cumulative precipitation was 93 percent of normal at the end of September.

Inflow into Fresno Reservoir during September was 26,200 acre-feet, 100 percent of normal. Consequently, with reduced irrigation demands, Fresno Reservoir filled to a storage content of 46,134 acre-feet, 116 percent of normal and 50 percent of full capacity to begin water year 2007. During September 2006 releases were made from Fresno Reservoir to transfer water to Nelson Reservoir. After the first week of September irrigation diversions for the Milk River Project were discontinued, but storage for the Ft. Belknap Indian Irrigation Project (FBIIP) was still needed, therefore Fresno Reservoir releases were maintained between 100-200 cfs to satisfy the FBIIP demand and to move water for Nelson Reservoir. Releases were reduced to winter levels of approximately 44 cfs on September 28 near the end of water year 2006.

Precipitation during the start of water year 2007 remained near average; the accumulated precipitation from October through December was 111 percent of normal. Reservoir inflow was below average in October but improved slightly during November and December. However inflows during these months are a relatively small volume, which resulted in storage decreasing by the end of December. The end of December storage was 41,754 acre-feet, 112 percent of average and 45 percent of normal full capacity.

By January 1, the NRCS reported the snowpack in the Milk River basin was 91 percent of average, coinciding with the near average cumulative precipitation. Precipitation conditions would worsen during January with a monthly total of only 68 percent of average. This resulted in a snowpack on February 1 measuring 73 percent of average thus producing a March through July runoff forecast for Fresno Reservoir to 60,000 acre-feet, 72 percent of average.

Storage at the end of February was 40,444 acre-feet, 114 percent of average. In the Milk River basin the spring runoff season generally occurs from March through June. Therefore, the peak snowpack and most reliable water supply runoff forecast for the Milk River basin is generally at the beginning of March. During 2007, the precipitation in February was above average, consequently the snowpack in the Milk River basin increased at above average rates. On March 1 the snowpack was reported at 115 percent of average. The March 1 water supply forecast indicated that 80,000 acre-feet of runoff could be expected, which was 96 percent of normal. Based upon this forecast, Fresno Reservoir was expected to fill to the top of the conservation pool. Also in March, Reclamation and the Milk River irrigation districts began to discuss water supply, but no allotments were set. Fortunately, the precipitation during February, March, and April was above average, which postponed any early irrigation demands.

When the runoff below Fresno Reservoir began in late March, diversions to Nelson Reservoir were initiated. Diversion into Dodson South Canal began on March 12. Approximately 30,700 acre-feet of Fresno releases and natural runoff below Fresno Dam were delivered to Nelson Reservoir during March 8 through April 30. This time period was before releases were adjusted from Fresno Reservoir for irrigation demands. Inflows to Nelson were maintained at or above 70 cfs until mid-June when irrigation demands on the Dodson South Canal exceeded capacity.

The initial meeting with the Milk River Joint Board of Control (MRJBC) regarding water supply was during a conference call on April 3. Potential irrigation allotments were discussed, it was decided to wait until the April 17 meeting to set the initial allotment. The

initial allotment was set at 1.75 acre-feet per acre. Then on June 19, there was a meeting with MRJBC to reassess allotments. Based on storage conditions the MRJBC elected to increase the irrigation allotment to 2.75 acre-feet per acre. At this meeting it was decided that this would be the final allotment for the season. During the August 21 meeting the MRJBC designated September 10 as the end of the irrigation season. Releases were continued from Fresno Reservoir after September 10 to satisfy the FBIIP irrigation demand from their storage, but at a much reduced rate.

By May 1, cumulative valley precipitation was 132 percent of normal. The above average precipitation in March and April resulted in reservoir storage not being required to meet early irrigation demands. Fresno Reservoir reached normal full pool on April 24 and remained at or above this storage content until irrigation demands increased above the combined spillway and river outlet discharge on June 26. From late April through June both facilities on the Milk River were at or above normal full pool. During much of this time spillway releases from Fresno Reservoir were not being utilized for irrigation and went directly to the Missouri. Moreover, the irrigation demand was so small from Nelson Reservoir that water diverted into the reservoir from Dodson Diversion Dam was simply released back to the Milk River through the Nelson North Canal. This situation is very rare and resulted in above average allotments for the irrigation season. The storage peaked at 94,256 acre-feet at elevation 2575.28 or 0.28 feet above the spillway crest on May 31.

The average releases for June and July were 512 cfs and 818 cfs, which were 63 and 90 percent of average, respectively. Releases from Fresno Reservoir peaked at 904 cfs on July 18. The actual March through July inflow for Fresno Reservoir, excluding St. Mary canal water, was approximately 55,200 acre-feet, 57 percent of average based on the USGS computation for natural flow at the Milk River at Eastern Crossing gaging station. Inflow to Fresno Reservoir peaked during this time at 1,692 cfs, on March 12.

Even though the June through August valley precipitation was below average, the cumulative water year precipitation was still 103 percent of average. Total inflow for the year was 218,707 acre-feet, 81 percent of average. This was 39,937 acre-feet or 15 percent less than the inflow experienced during water year 2006. Diversions from the St. Mary River basin to the Milk River basin accounted for about 75 percent of the inflow to Fresno Reservoir during 2007. Storage on September 30, 2007 was 40,352 acre-feet, 101 percent of average and 43 percent of normal full capacity.

The Corps of Engineers estimated that during 2007 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 1950 Fresno Dam and reservoir has reduced flood damages by a total of \$13,085,500.

Additional hydrologic and statistical information pertaining to the operation of Fresno Reservoir during 2007 can be found in Table MTT10-B and Figure MTG10.

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.

At the end of water year 2006 releases from Fresno Reservoir to satisfy the FBIIP irrigation demand were made during September. Release were increased above the irrigation demand transfer water to Nelson Reservoir to ensure that Malta and Glasgow Irrigation Districts would have sufficient water for the beginning of the 2007 irrigation season and provide additional storage space in Fresno Reservoir. Therefore storage increased during September and Nelson Reservoir began the 2007 water year with a storage content of 48,814 acre-feet, at elevation 2213.68, 86 percent of average and 62 percent of normal full capacity. Storage slowly increased until October 19 when diversions were discontinued. This resulted in storage decreasing through the winter until early March.

Diversions to Nelson Reservoir began in early March. The total inflow prior to irrigation season, March 8 through April 30, was approximately 30,700 acre-feet. Irrigation releases from Nelson Reservoir began on April 29 through the Nelson South Canal and continued through September 10. Since much of the demand from Malta Irrigation District is for early irrigation, releases are generally discontinued in mid-June for harvest. This was the case once again when releases from Nelson South Canal were discontinued from June 7-30.

From early March, storage steadily increased until early May when irrigation release began. Beginning in May, storage oscillated until early July when once again irrigation demands increased and storage decreased through mid-September. Storage in Nelson Reservoir peaked at 79,297 acre-feet at elevation 2221.68 on June 1, which was a new record high storage.

No piping plover were observed during 2007 nesting on the shores of Nelson Reservoir. Inflows to Nelson Reservoir during May through July totaled 16,800 acre-feet. Releases to the Milk River were made for use by Glasgow Irrigation District during May through September. The total storage released for Glasgow was approximately 17,900 acre-feet. In September irrigation releases were discontinued and inflows to the reservoir increased thus allowing some storage to be recovered through the end of the water year. Water that was diverted into Nelson Reservoir during August through October totaled approximately 12,800 acre-feet. Total net inflow to Nelson Reservoir during water year 2007 was 53,847 acre-feet. Storage on September 30, 2007 was 53,097 acre-feet at elevation 2214.95, 94 percent of average and 67 percent of normal full capacity.

Additional hydrologic and statistical information pertaining to the operation of Nelson Reservoir during 2007 can be found in Table MTT10-C and Figure MTG11.

### Important Events - 2007

November 7: Inflow to Lake Sherburne peaked for the year at 3,617 cfs.

March 1: Milk River runoff forecast indicates 96 percent of normal runoff.

March 5: Releases begin from Lake Sherburne.

March 8: St. Mary Canal begins to divert.

March 12: Inflow to Fresno Reservoir peaked at 1,692 cfs.

March 21: Releases from Fresno Reservoir were increased to transfer water to Nelson Reservoir and provide storage space to Lake Sherburne storage as well as natural inflow.

April 1: Lake Sherburne runoff forecast indicates 87 percent of normal runoff.

April 17: MRJBC sets the irrigation allotment to 1.75 acre-feet per acre.

April 29: Irrigation releases are initiated from Nelson Reservoir.

May 31: Fresno Reservoir storage peaks for the year at 94,256 acre-feet at elevation 2575.28, 0.28 feet above normal full pool.

June 1: Nelson Reservoir storage peaks for the year at 79,297 acre-feet at elevation 2221.68, 0.8 feet above normal full pool.

June 19: The MRJBC increases the irrigation allotment to 2.75 acre-feet per acre and designates that as the final allotment for season.

June 28: Lake Sherburne storage peaks for the year at 54,556 acre-feet, at elevation 4780.98, which is 7.02 feet below normal full pool.

August 10: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River deficit repayments. It was concluded that the US would not refund any deficit due to additional water used by Alberta on the Milk during the irrigation season and because the Lake Sherburne outlet conduits being repaired.

August 21: The MRJBC sets September 10 as the end of irrigation season.

September 4: Lake Sherburne releases and St. Mary Canal diversions are discontinued.

September 10: Releases from Nelson Reservoir are discontinued.

September 28: Releases from Fresno Reservoir are set at approximately 40 cfs for the duration of the winter.



TABLE MTT10-A  
 HYDROLOGIC DATA FOR 2007  
 SHERBURNE RESERVOIR (MILK RIVER PROJECT)  
 NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4729.30	1,899	1,899
TOP OF ACTIVE CONSERVATION	4788.00	66,147	64,248

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4738.85	7,652	OCT 01, 2006
END OF YEAR	4737.97	7,025	SEP 30, 2007
ANNUAL LOW	4734.46	4,689	SEP 03, 2007
ANNUAL HIGH	4780.98	54,556	JUN 28, 2007
HISTORIC HIGH	4788.30	68,371	JUN 30, 1986

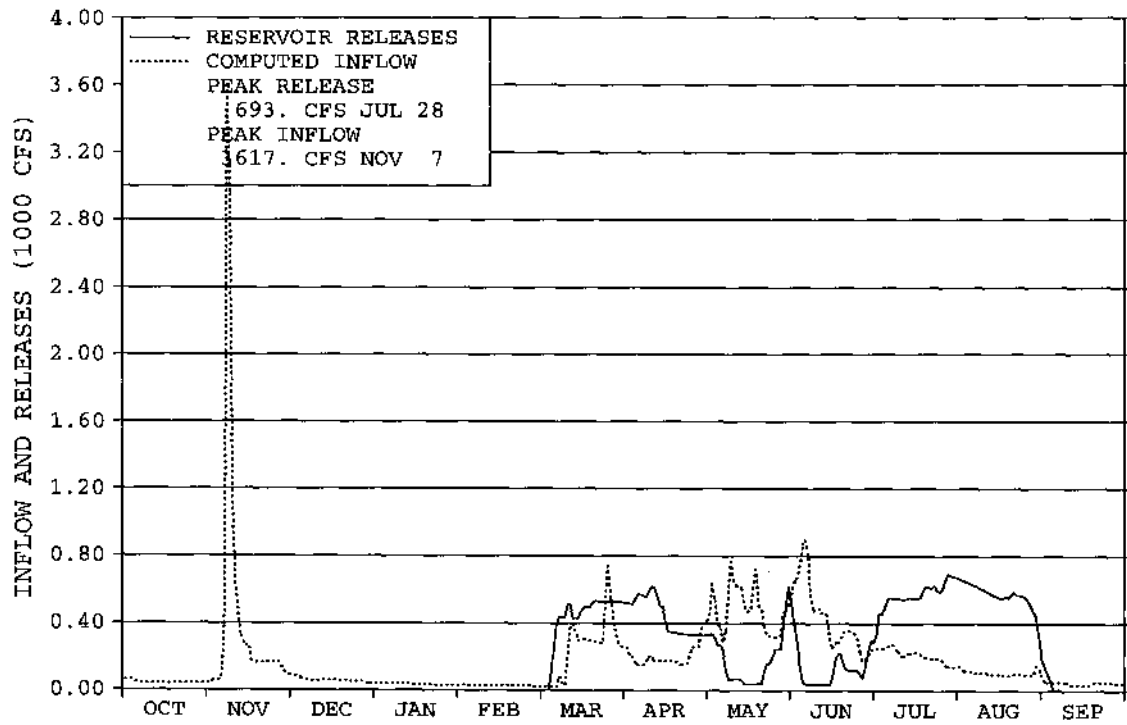
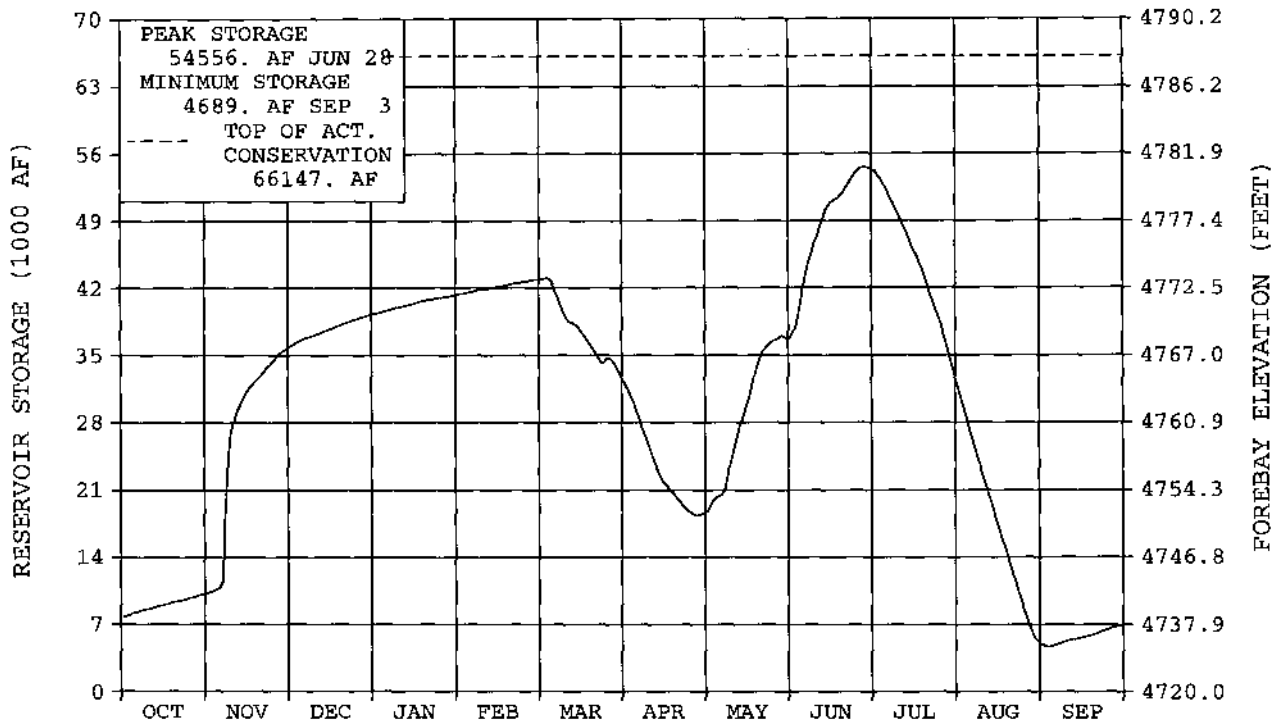
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	140,322	OCT 06-SEP 07	140,949	OCT 06-SEP 07
DAILY PEAK (CFS)	3,617	NOV 07, 2006	693	JUL 28, 2007
DAILY MINIMUM (CFS)	21	FEB 28, 2007	0	*

\* During nonirrigation season

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	2.6	43	0.0	---	10.3	109
NOVEMBER	25.6	456	0.0	---	35.8	263
DECEMBER	3.5	92	0.0	---	39.3	225
JANUARY	2.1	73	0.0	---	41.4	205
FEBRUARY	1.5	63	0.0	---	42.9	190
MARCH	15.3	510	25.1	552	33.0	147
APRIL	12.1	135	26.6	186	18.5	98
MAY	29.5	91	11.4	57	36.7	126
JUNE	26.0	62	8.2	43	54.4	103
JULY	13.0	62	34.6	138	32.8	68
AUGUST	6.5	69	34.4	106	5.0	21
SEPTEMBER	2.7	42	0.7	3	7.0	84
ANNUAL	140.3	98	140.9	99		
APRIL-JULY	80.6	77				

\* Average for the 1955-2007 period.

# FIGURE MTG9 LAKE SHERBURNE



WATER YEAR 2007

TABLE MTT10-B  
HYDROLOGIC DATA FOR 2007  
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

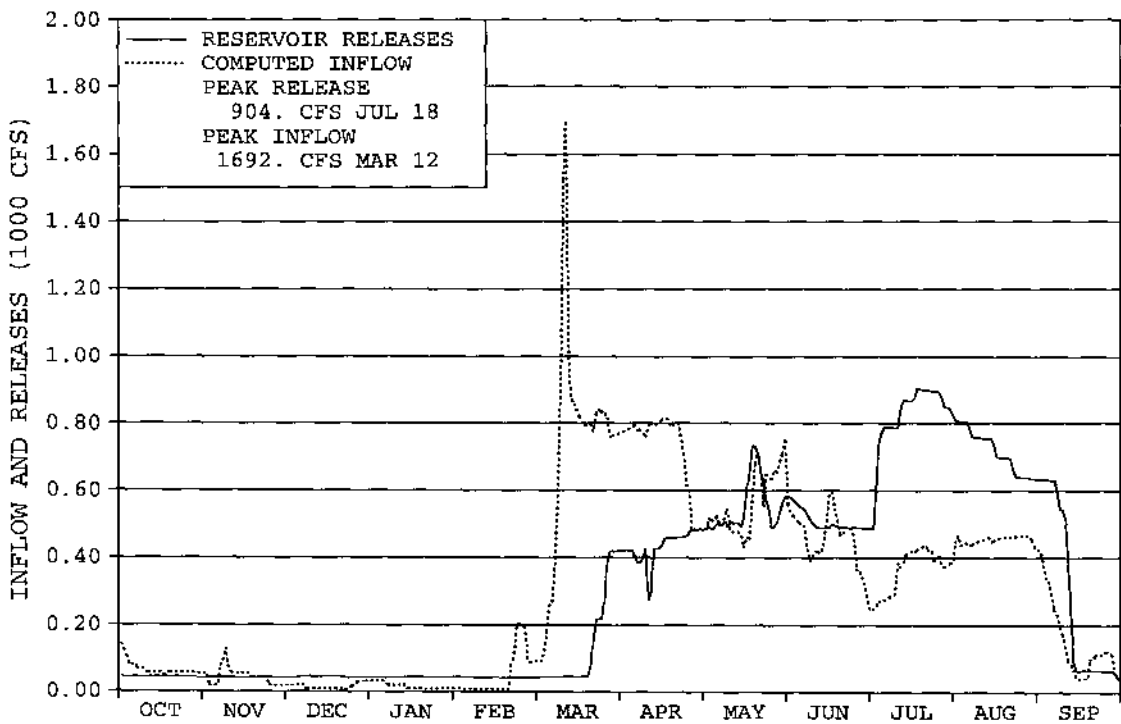
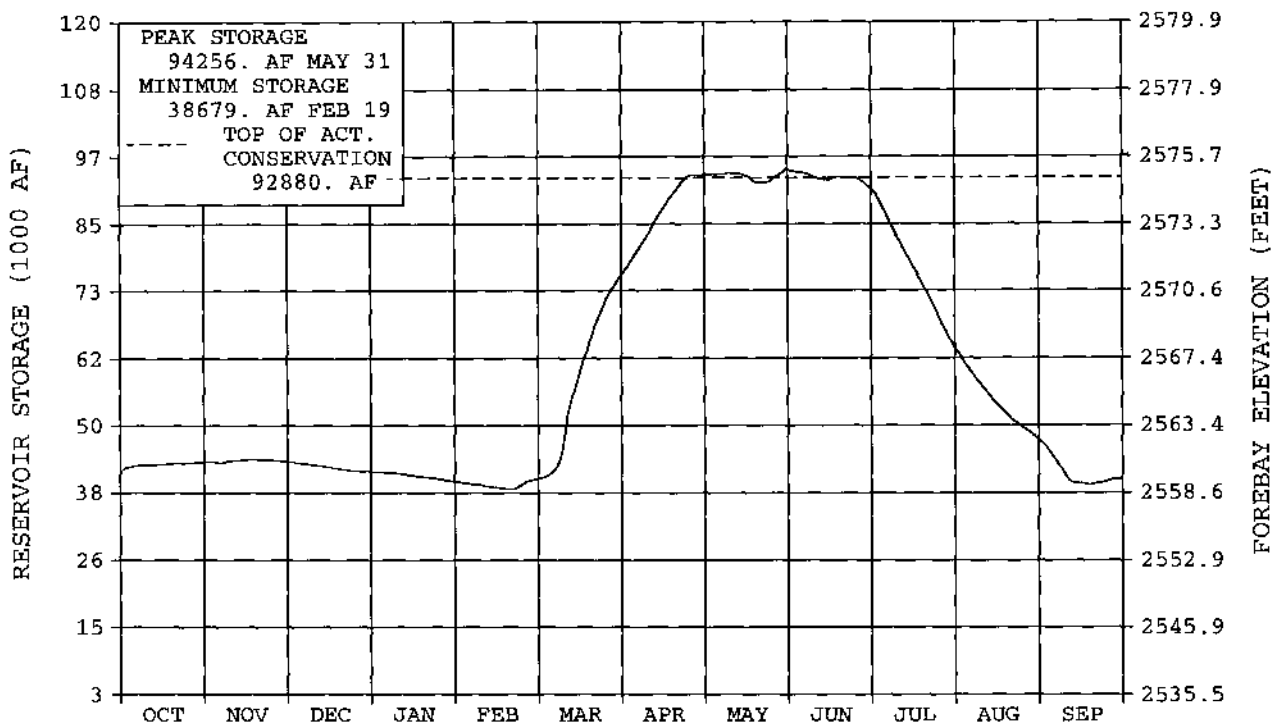
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2560.37	46,134	OCT 01, 2006
END OF YEAR	2559.61	40,352	SEP 30, 2007
ANNUAL LOW	2558.88	38,679	FEB 19, 2007
ANNUAL HIGH	2575.28	94,256	MAY 31, 2007
HISTORIC HIGH	2579.35	154,023	APR 03, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	218,707	OCT 06-SEP 07	220,489	OCT 06-SEP 07
DAILY PEAK (CFS)	1,692	MAR 12, 2007	904	JUL 18, 2007
DAILY MINIMUM (CFS)	6	DEC 22, 2006	41	FEB 18, 2007

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	4.1	54	2.7	36	43.5	111
NOVEMBER	2.5	121	2.5	81	43.5	112
DECEMBER	0.9	94	2.7	103	41.8	112
JANUARY	0.9	183	2.7	105	40.0	112
FEBRUARY	2.8	82	2.3	97	40.4	114
MARCH	43.2	142	8.2	124	75.4	144
APRIL	43.6	110	25.7	126	93.4	132
MAY	34.5	79	33.7	70	94.3	144
JUNE	27.4	60	30.4	63	91.3	147
JULY	22.2	63	50.2	90	63.3	143
AUGUST	27.9	85	44.0	97	47.1	126
SEPTEMBER	8.6	33	15.4	70	40.4	101
ANNUAL	218.7	81	220.5	83		
APRIL-JULY	127.8	78				

\* Average for the 1949-2007 period.

# FIGURE MTG10 FRESNO RESERVOIR



WATER YEAR 2007

TABLE MTT10-C  
HYDROLOGIC DATA FOR 2007  
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	2213.68	48,814	OCT 01, 2006
END OF YEAR	2214.95	53,097	SEP 30, 2007
ANNUAL LOW	2212.12	43,968	MAR 07, 2007
ANNUAL HIGH	2221.68	79,297	JUN 01, 2007
HISTORIC HIGH	2221.68	79,297	JUN 01, 2007

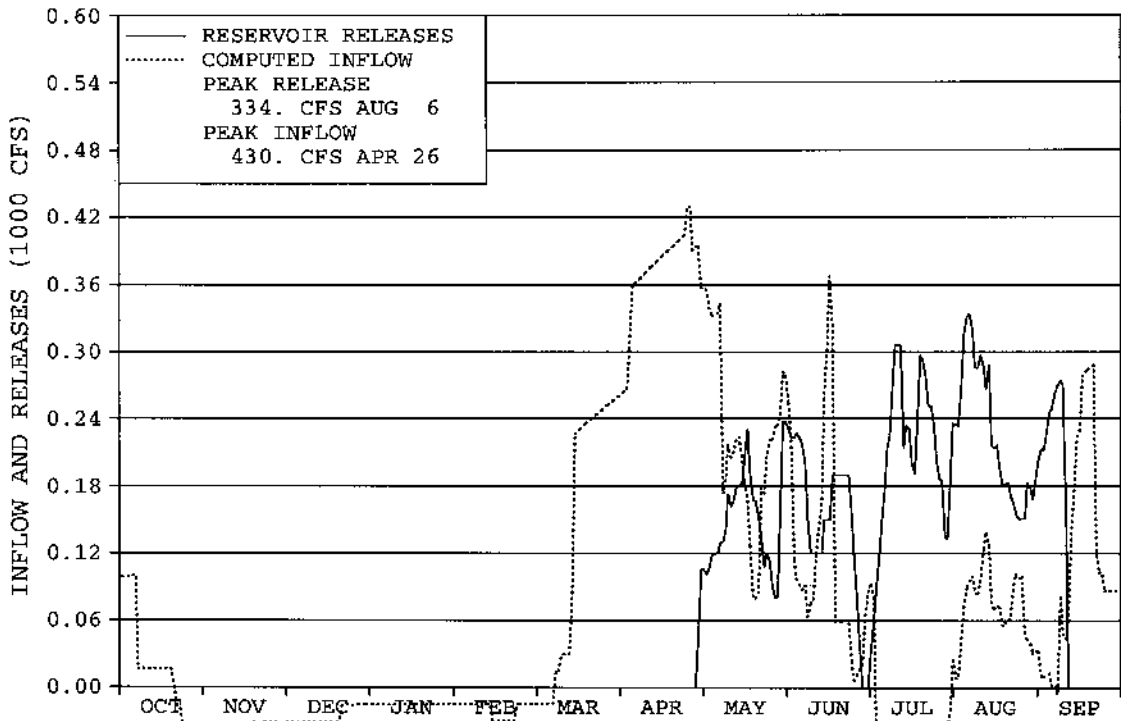
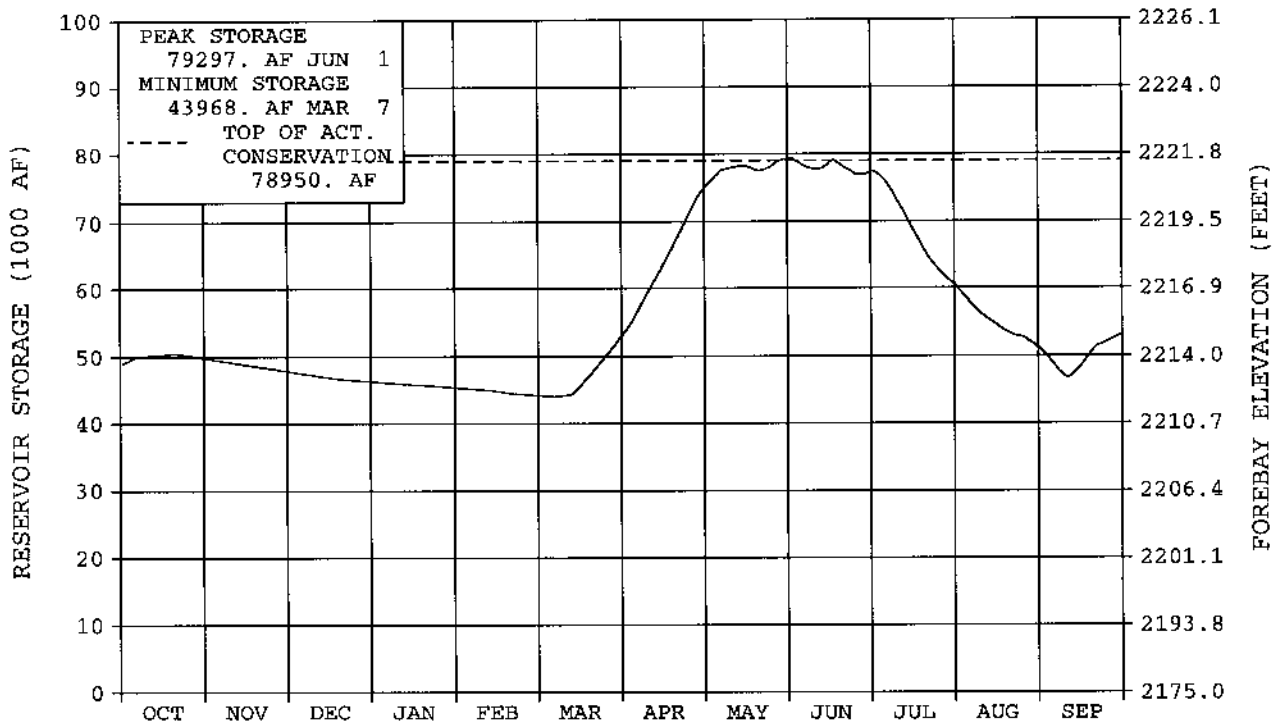
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	53,847	OCT 06-SEP 07	49,570	OCT 06-SEP 07
DAILY PEAK (CFS)	430	APR 26, 2007	334	AUG 06, 2007
DAILY MINIMUM (CFS)	0	*	0	*

\* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	1.0	24	0.0	---	49.8	84
NOVEMBER	-2.0	---	0.0	---	47.8	82
DECEMBER	-1.6	---	0.0	---	46.2	82
JANUARY	-1.0	---	0.0	---	45.3	82
FEBRUARY	-1.1	---	0.0	---	44.2	82
MARCH	8.5	588	0.0	---	52.6	97
APRIL	22.1	299	0.3	52	74.4	123
MAY	13.9	205	9.1	121	79.3	131
JUNE	6.8	89	8.8	120	77.2	129
JULY	-4.0	---	12.7	125	60.5	110
AUGUST	4.4	63	13.9	177	51.1	94
SEPTEMBER	6.7	113	4.7	133	53.1	94
ANNUAL	53.8	137	49.6	125		
APRIL-JULY	38.9	146				

\* Average for the 1947-2007 period.

**FIGURE MTG11**  
**NELSON RESERVOIR**



WATER YEAR 2007

## Bighorn Lake and Yellowtail 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 be 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.

During the fall of 2006, precipitation in the Bighorn Basin upstream of Bighorn Lake was well below average during July and August but improved to well above average during September and October. The September-October mountain precipitation was 120 percent of average while the valley precipitation was 113 percent of average. The generous precipitation that was received during September and October of 2006 helped reduce upstream irrigation demands, only to allow the inflows into Bighorn Lake to increase from 34 percent of average during June through August to 69 percent of average during September and October. With inflows averaging 2,140 cfs during September and maintaining releases from Bighorn Lake to the Bighorn River at 1,500 cfs, storage in Bighorn Lake gradually increased. By the beginning of water year 2007, storage in Bighorn Lake had increased to 761,787 acre-feet at elevation 3603.07. This was 308,242 acre-feet or 36.93 feet below the top of the joint-use pool and 238,719 acre-feet or 30.96 feet lower than at the beginning of water year 2006.

At the end of water year 2006, storages in Boysen and Buffalo Bill Reservoirs located on the Wind and Shoshone Rivers were drafted to 80 and 101 percent of average, respectively, to meet irrigation demands. As compared to a year ago, with year-end reservoir levels much worse at

Boysen and nearly the same at Buffalo Bill, the WYAO established the minimum winter releases out of these reservoirs at flow rates of 500 and 200 cfs.

During the fall of 2006, precipitation in the Bighorn River Basin was generally near to well above normal. During October, valley precipitation was 118 percent of average while the mountain precipitation was 111 percent of average. But by November, valley precipitation dropped to 50 percent of average while the mountain precipitation dropped to 75 percent of average. The generous early fall precipitation, caused the tributary flow between Boysen and Buffalo Bill Reservoirs to Bighorn Lake to be 97 percent of average during October and drop slightly to 88 percent of average during November. However, the releases out of Boysen and Buffalo Bill Reservoirs had a bigger effect on the inflow to Bighorn Lake. The lower than normal releases coupled with the dry soil conditions caused the inflow to Bighorn Lake to be only 66 percent of average during October and 61 percent of average during November. With inflows to Bighorn Lake averaging 1,855 cfs during October and November and releases to the Bighorn River maintained at 1,500 cfs, Bighorn Lake rose 13.36 feet beginning on September 2, 2006 to elevation 3611.79 feet with a storage content of 814,769 acre-feet on November 28, 2006.

The inflow to Bighorn Lake during December through March was 54 percent of average totaling 327,933 acre-feet. During this same period, releases were maintained at 1,500 cfs, causing storage to slowly and steadily decline. By February 21, storage had slowly declined to a low of 781,669 acre-feet at elevation 3606.49. This was about 92 percent of average for this time of year and 288,360 acre-feet or 33.51 feet below the top of the joint-use pool.

Weather conditions during the fall and winter of 2006-2007 for the Bighorn River Basin started out about normal. But by the middle of November, weather conditions began to change. Snows accumulated in the higher elevations at near normal rates during October and early November but quickly dropped to below normal rates about the middle of November and continued at below normal rates through the middle of March. Valley precipitation during November through January was 75 percent of average while the mountain precipitation was 74 percent of average.

On January 1, the Natural Resources Conservation Service (NRCS) measured mountain snowpack in the Bighorn Basin at about 84 percent of normal. The Wind and Shoshone River Basins, major tributaries of the Bighorn River, were both measured at 71 percent of average. This was 20 percent and 15 percent lower in the Wind River Basin and Shoshone River Basins and only 5 percent lower in the Bighorn River Basin as a whole than reported on January 1, 2006. By February 1, snowpack in the Wind River Basin declined to 70 percent while the Shoshone River Basin declined to 66 percent of average. The snowpack in Bighorn River Basin had declined to 68 percent of average, a decline of 16 percent from that recorded on January 1.

By February, weather conditions began to improve a bit. During February through March, valley precipitation improved to 123 percent of average while the mountain precipitation improved to 112 percent of average. By March 1 the snowpack in the Wind and Shoshone River Basins essentially remained unchanged at 71 and 72 percent of average respectively. However, for the Bighorn River Basin, the snowpack improved to 83 percent of average, due largely to the good winter storms that moved across the Bighorn Mountains dumping large accumulations of snow. At one point, the mountain snowpack began melting out early, dropping from 83 percent of average in early March to as low as 66 percent of average by March 28. This was alarming until a major storm system moved across southern Montana and northern Wyoming, dumping large



amounts of snow in the mountains. By April 5, the mountain snowpack had climbed to 83 percent of average. Normally mountain snowpack continues to accumulate through the middle of April, generally reaching a peak snow water content of around 14.75 inches on April 15. After that time, the snowmelt runoff begins and streamflows begin to increase. However, in 2007, the mountain snows began melting out quickly until another storm system moved across the Bighorn Mountains in late April, causing the snowpack to once again accumulate. Snowpack reached a peak water content of 12.39 inches or 85 percent of average on April 24. The normal water content of the snowpack on this date is 14.63 inches.

As the warmer temperatures returned the mountain snowpack once again began to quickly melt, dropping to 63 percent of average by May 4. However, another storm system brought more snow and the mountain snowpack increased to 79 percent of average. This was short lived as the mountain snow was now melting out at rates much faster than normal. By the middle of June, all of the mountain snow was essentially melted out, about 4-5 weeks earlier than normal.

On April 1, Bighorn Lake had a storage content of 798,825 acre-feet at elevation 3609.30. This was an increase of 2.21 feet from March 1 and 24,969 acre-feet or 3.84 feet less than a year ago. Water supply forecasts of April-July snowmelt runoff are prepared at the beginning of each month beginning in January and continuing through June. During January through March, the water supply forecasts indicated the spring runoff would be adequate to allow Bighorn Lake to fill to the top of the joint-use pool at elevation 3640 by the end of June or early July while maintaining river releases at a flow rate of 1,500 cfs. The water supply forecast prepared on April 1, indicated the spring runoff into Bighorn Lake was still adequate to maintain a river release of 1,500 cfs or higher through June and still allow Bighorn Lake to fill to the top of the joint-use pool at elevation 3640.

Cooler and drier than normal weather was experienced during April and May. Valley precipitation was only 62 percent of average, while the mountain precipitation was much better at 88 percent of average. This was due largely to the winter storms that had moved across the Bighorn Mountains, bringing with it good accumulations of snow. Unseasonably warm temperatures in early May finally began melting the higher elevation mountain snow. Accompanied by a minor storm system in early June, inflow to Bighorn Lake increased from about 1,540 cfs in late April to a peak for the year of 8,827 cfs on June 7. After that time, the inflows began to quickly recede. The inflow to Bighorn Lake during April through June was only 62 percent of average totaling 526,441 acre-feet, but was a significant improvement over the 453,536 acre-feet of inflow experienced in 2006.

With releases to the Bighorn River maintained at 1,500 cfs, storage in Bighorn Lake steadily increased from 813,848 acre-feet at elevation 3611.65 on May 1 to 971,155 acre-feet at elevation 3631.19 on June 7, the date the peak inflow of 8,827 cfs occurred. As the inflows now slowly declined, storage continued to increase but at a slower rate. By the middle of June, it appeared Bighorn Lake would soon reach the top of the joint-use pool. In response, releases from Bighorn Lake to the Bighorn River were increased to 1,750 cfs on June 15. On June 25, Bighorn Lake had reached a peak storage content of 1,048,112 acre-feet at elevation 3638.22. This was about 105 percent of average and 21,917 acre-feet or 1.78 feet below the top of the joint-use pool.

During July and August, numerous storm systems moved up from the south bringing good precipitation to the Bighorn River Basin. Valley precipitation during July and August was 131 percent of average while the mountain precipitation was 108 percent of average. This was

short lived as the valley precipitation dropped to 50 percent of average during September and the mountain precipitation dropped to 85 percent of average.

Even with the good precipitation that was received during July and August, it was not enough to offset the high irrigation demands. Because the irrigation demands in the Bighorn River Basin were unseasonably high, the inflow to Bighorn Lake remained well below average. Inflows to Bighorn Lake were only 28 percent of average during July, 54 percent of average during August, and 60 percent of average during September. The July-September inflow was the 6th lowest of record since construction of the dam, with the September inflow being the 311 lowest of record. With river releases maintained at a conservative rate of 1,750 cfs throughout the summer and observing near record low inflow during July through September, storage in Bighorn Lake slowly declined to 956,743 acre-feet at elevation 3629.71 by the end of the water year. This was 94 percent of average and 113,286 acre-feet or 10.29 feet below the top of the joint-use pool. This was also 194,956 acre-feet or 26.64 feet higher than the level experienced at the end of water year 2006.

The April-July runoff into Bighorn Lake during 2007 was 51 percent of average and totaled 613,901 acre-feet, about 85,702 acre-feet more than the inflow experienced in 2006. This made it the 9th lowest April-July inflow of record since construction of Yellowtail Dam. The annual runoff into Bighorn Lake totaled 1,364,195 acre-feet and will be recorded as the 5th lowest annual runoff of record. This was 54 percent of average and 5 percent or 68,665 acre-feet less than the total runoff experienced during water year 2006. The total amount of water released to the Bighorn River during 2007 was 1,139,824 acre-feet or 50 percent of average.

The persistent extended drought 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 conservative measures implemented early in the year, it was possible to provide good opportunities for lake recreation on Bighorn Lake, protect the lake fishery interests, and provide limited habitat for the renowned trout fishery downstream of Yellowtail Afterbay Dam. Throughout the fall, winter, and early spring, releases to the Bighorn River were maintained at 1,500 cfs, about 1,000 cfs lower than the desired minimum flow required to support a healthy river fishery. By maintaining these conservative releases, storage was able to recover favorably. With the increased storage levels, it became possible to increase the river releases to 1,750 cfs during in June and maintain them at that rate throughout the remainder of the year. The good water levels of Bighorn Lake during 2007 also allowed for full service recreation at all marinas around Bighorn Lake during the recreation season from Memorial Day Weekend through Labor Day Weekend.

The Corps of Engineers estimated that during 2007, Bighorn Lake did not prevent any local flood damages but did prevent \$1,652,300 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 \$113,398,200.

Total generation produced at Yellowtail Powerplant during 2007 was 365,409,000 kilowatt-hours, 42 percent of the long term average since construction of the powerplant in 1967. This was 51,682 kilowatt-hours more than generated during the record low year of 2003 and 209,687 kilowatt-hours less than generated in 2006. All of the water released from the dam was released through the powerplant.

## Important Events - Water Year 2007

October 2-3: With the 2006 irrigation season essentially over, the BIA requested all diversions to the Bighorn Canal be gradually discontinued by October 3. Turbine releases were gradually reduced to maintain a total release of 1,500 cfs (1,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

October 17-18: The Afterbay was nearly emptied and the river releases were gradually reduced from 1,500 cfs to 400 cfs. This release was maintained for approximately 5-6 hours to facilitate the measurement of discharge from springs and seepage located between Yellowtail Dam and Afterbay Dam. Following the measurements, the river releases were gradually increased to 1,500 cfs.

October 17: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

November 14: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

December 4-5: The Afterbay level was maintained no higher than elevation 3187.50 feet to allow for annual maintenance of the government camp sewage lagoon.

December 11: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

December 21: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

January 9: Streamflow measurements indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

January 16: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

January 31: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

February 15: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs. Also, due to mechanical problems with the Afterbay Dam's sluiceway gates, the level of the Afterbay was maintained no lower than elevation 3182 feet to continue releasing water to the Bighorn River at a rate of 1,500 cfs through the Afterbay Dam's spillway gates.

March 21: Montana Fish, Wildlife, & Parks hosted the annual Bighorn Interagency Coordination Meeting at the Montana State University-Billings to discuss the operations of Bighorn Lake and Bighorn River. Dan Jewell, Area Manager of the Montana Area Office and 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 spring and summer 2007 irrigation season.

March 21: The level of the tailwater was maintained no higher than elevation 3183 during 0700-1700 hour to allow for inspection of Yellowtail Dam's spillway tunnel.

April 3-13: The level of the tailwater was maintained no higher than elevation 3183 during 0700-1730 hour to allow for inspection of Yellowtail Dam's spillway tunnel.

April 5: Streamflow measurements indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain river releases at 1,500 cfs.

May 21-23: The BIA requested irrigation diversions to the Bighorn Canal be initiated and gradually increased to 250 cfs.

May 30: The BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release was reduced to 1,700 cfs (1,500 cfs to the Bighorn River and 200 cfs to the Bighorn Canal).

May 31: Due to heavy rains, the BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release was reduced to 1,650 cfs (1,500 cfs to the Bighorn River and 150 cfs to the Bighorn Canal).

June 6: Due to heavy rains, the BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release was reduced to 1,580 cfs (1,500 cfs to the Bighorn River and 80 cfs to the Bighorn Canal).

June 7: Due to heavy rains, the BIA requested all diversions to the Bighorn Canal be discontinued. In response, the total release was reduced to 1,500 cfs (1,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

June 15: Since the rains have diminished, the inflows to Bighorn Lake continue to decline. With Bighorn Lake filling at a rate of 0.4 feet per day, and the lake about 4 feet below the top of the joint-use pool, releases to the Bighorn River were increased to 1,750 cfs (1,750 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

June 19-21: Due to increased irrigation demands, the BIA requested a gradual increase in diversions to the Bighorn Canal. In response, the total release was increased to 2,000 cfs (1,750 cfs to the Bighorn River and 250 cfs to the Bighorn Canal).

June 26-28: Due to increased irrigation demands, the BIA requested a gradual increase in diversions to the Bighorn Canal. In response, the total release was increased to 2,200 cfs (1,750 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

July 5: Streamflow measurements indicated actual flows in the Bighorn Canal were lower than anticipated. Turbine releases were adjusted to maintain total release at 2,130 cfs (1,750 cfs to the Bighorn River and 380 cfs to the Bighorn Canal).

July 9-10: Warm weather has increased the algae growth in the Bighorn Canal considerably. To assist with the treatment of the algae and maintenance of the Bighorn Canal, turbine releases

were adjusted to maintain total release at 2,180 cfs (1,750 cfs to the Bighorn River and 430 cfs to the Bighorn Canal).

July 12: Due to increased irrigation demands, the BIA requested an increase in diversions to the Bighorn Canal. In response, the total release was increased to 2,230 cfs (1,750 cfs to the Bighorn River and 480 cfs to the Bighorn Canal).

July 16: Due to decreased irrigation demands, the BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release was decreased to 2,205 cfs (1,750 cfs to the Bighorn River and 455 cfs to the Bighorn Canal).

July 26: Due to increased irrigation demands, the BIA requested an increase in diversions to the Bighorn Canal. In response, the total release was increased to 2,150 cfs (1,750 cfs to the Bighorn River and 400 cfs to the Bighorn Canal).

July 27-28: Due to fluctuating irrigation demands, the BIA requested changes in diversions to the Bighorn Canal. In response, the total release was decreased to 2,100 cfs (1,750 cfs to the Bighorn River and 350 cfs to the Bighorn Canal).

August 1: Streamflow measurements indicated actual flows in the Bighorn River and Bighorn Canal were lower than anticipated. Turbine releases were adjusted to maintain total release at 2,125 cfs (1,750 cfs to the Bighorn River and 375 cfs to the Bighorn Canal).

August 13-16: To assist with the Comprehensive Facility Review and inspection of the physical features of Yellowtail Dam and Afterbay Dam, operating restrictions were placed on the tailwater and the Afterbay.

August 20-31: A 12-day maintenance outage was scheduled on the Afterbay Dam sluice gates. During this outage, the level of the Afterbay was maintained no lower than elevation 3182 to allow for the required river discharge to be released through the Afterbay spillway gates.

August 9: Due to increased irrigation demands, the BIA requested an increase in diversions to the Bighorn Canal. In response, the total release was increased to 2,200 cfs (1,750 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

September 5-6: Due to decreased irrigation demands, the BIA requested a gradual reduction in diversions to the Bighorn Canal. In response, the total release was decreased to 2,015 cfs (1,750 cfs to the Bighorn River and 265 cfs to the Bighorn Canal).

September 12-18: Due to decreased irrigation demands, the BIA requested a gradual reduction in diversions to the Bighorn Canal. In response, the total release was decreased to 1,950 cfs (1,750 cfs to the Bighorn River and 200 cfs to the Bighorn Canal).

September 20: Reclamation hosted the annual Bighorn Basin Water Supply Meeting at the Montana State University-Billings to discuss operations of Bighorn Lake and Bighorn River. Dan Jewell, Area Manager of the Montana Area Office and 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 fall and winter season of 2007-2008.

October 1-2: With the 2007 irrigation season essentially over, the BIA requested all diversions to the Bighorn Canal be gradually discontinued by October 2. In response, the total release was gradually reduced to 1,750 cfs (1,750 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

Additional hydrologic and statistical information pertaining to the operations of Bighorn Lake during 2007 can be found on Table MTT11 and MTG12.

For more detailed information on the operations of Boysen and Buffalo Bill Reservoirs during 2007, 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 2007  
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	3603.07	761,787	OCT 01, 2006
END OF YEAR	3629.71	956,743	SEP 30, 2007
ANNUAL LOW	3603.07	761,787	OCT 01, 2006
ANNUAL HIGH	3638.22	1,048,112	JUN 25, 2007
HISTORIC HIGH	3656.43	1,365,198	JUL 06, 1967

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	1,364,195	OCT 06-SEP 07	1,139,824	OCT 06-SEP 07
DAILY PEAK (CFS)	8,827	JUN 07, 2007	1,764	JUN 16, 2007
DAILY MINIMUM (CFS)	673	JAN 15, 2007	1,050	OCT 18, 2006
PEAK SPILL (CFS)			0	NONE
TOTAL SPILL (AF)			0	NONE

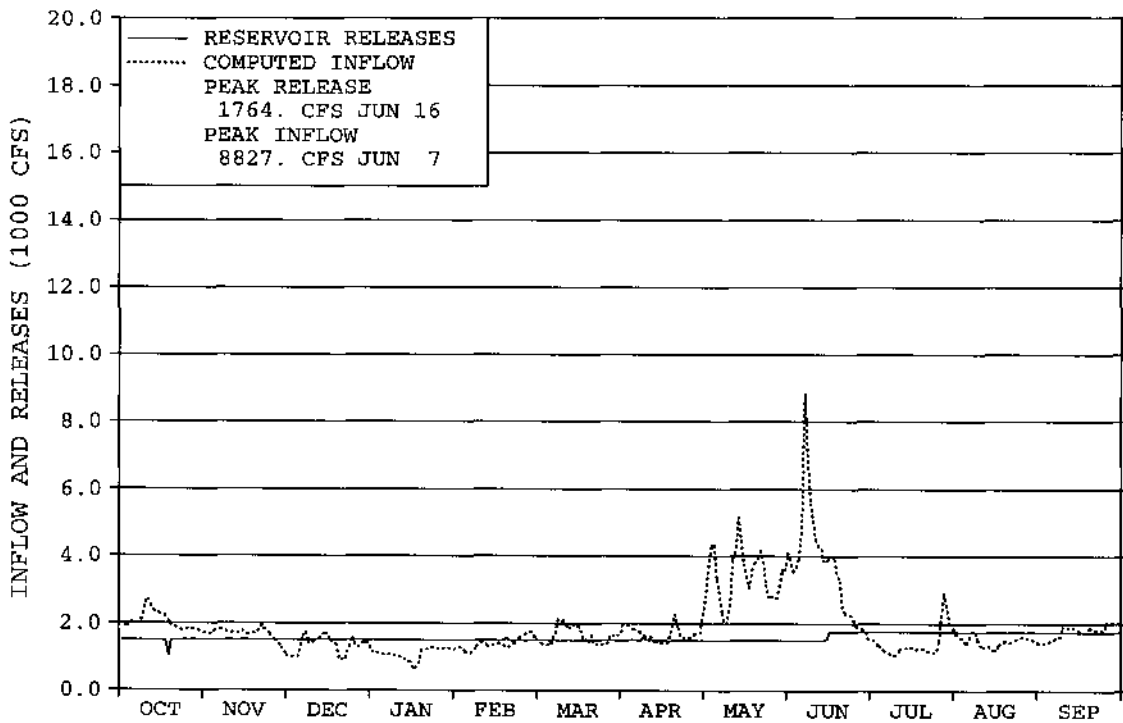
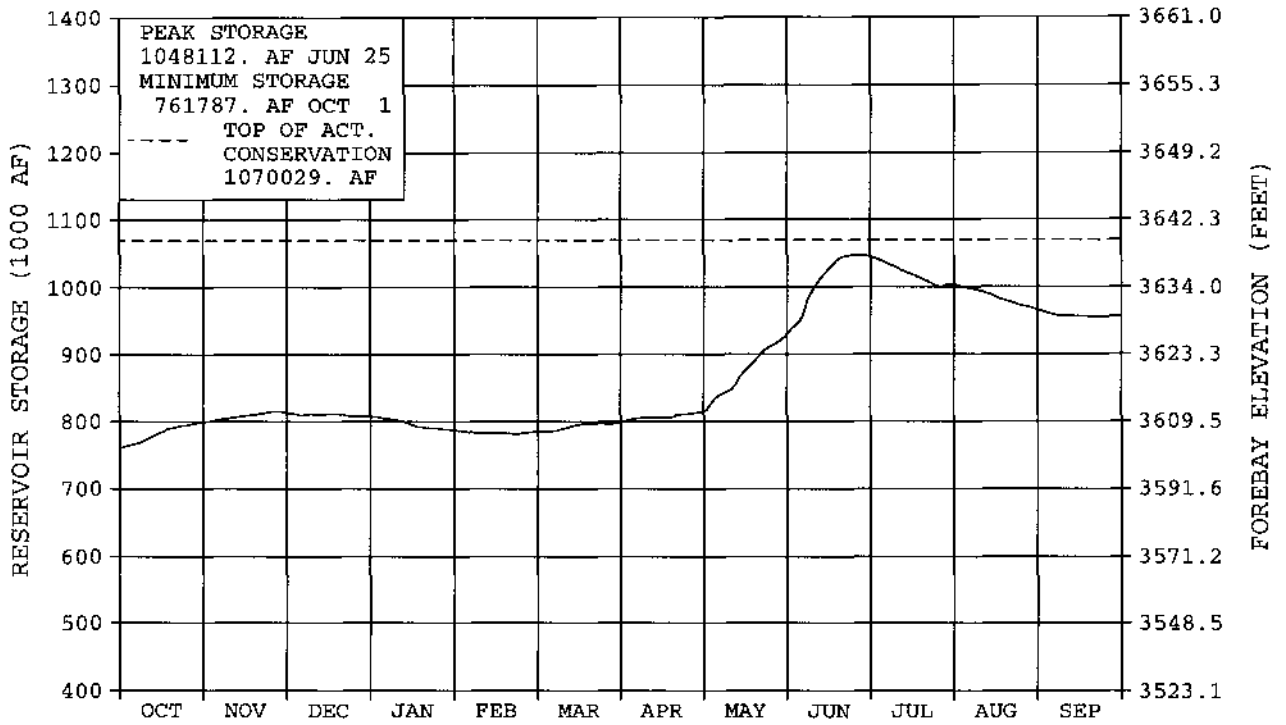
\*Discharge to the Bighorn River

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	125.6	66	0.7	18	91.4	53	799.6	79
NOVEMBER	98.7	61	0.0	---	89.7	50	813.1	83
DECEMBER	82.5	56	0.0	---	92.6	50	807.2	88
JANUARY	67.4	48	0.0	---	92.2	51	786.4	91
FEBRUARY	77.8	54	0.0	---	83.3	51	785.3	93
MARCH	100.2	56	0.0	---	92.0	50	798.2	96
APRIL	100.6	58	0.0	---	89.4	50	813.8	99
MAY	206.7	80	4.5	41	92.2	50	927.9	106
JUNE	219.2	49	8.7	41	97.1	38	1,045.8	102
JULY	87.5	28	25.7	93	108.3	40	1,003.1	97
AUGUST	3	54	26.0	97	107.6	63	965.1	95
SEPTEMBER	106.7	60	15.0	80	104.0	69	956.7	94
ANNUAL	1,364.2	54	80.7	73	1,139.8	50		
APRIL-JULY	613.9	51						

\* Average for the 1967-2007 period.

# FIGURE MTG12

## BIGHORN LAKE



WATER YEAR 2007



## **CLIMATE SUMMARY**

Water year 2007 represents the eighth year of extended drought over much of the Bighorn basin in Wyoming. Snowpack over the entire Bighorn basin was below average through the winter and remained fairly constant at about 70 percent of average from December through March. On the bright side, annual precipitation in both the Shoshone and Wind River basins was near average for water year 2007, which especially in the Wind River basin, was a big improvement over 2006. Major weather systems were few and far between during water year 2007, but the winter and spring storms that did pass through the Bighorn basin were timely. In water year 2007, temperatures were above average almost every month and the summer of 2007 was one of the warmest on record. At the end of the water year the majority of the Bighorn basin was considered to be in moderate to severe drought.

October was generally mild over the entire Bighorn basin with temperatures about five degrees above average. Precipitation was also above average, and the snowpack began to accumulate in the mountains following storms that passed through Wyoming around October 20th and 25th. On November 1st the snowpack in the Boysen drainage was right at the thirty year average while the snowpack above Buffalo Bill Reservoir was 72 percent of average. Little precipitation fell during the first week of November but during the period from November 8th through the 14th a series of upper level disturbances brought snow to the mountains of western Wyoming, with the southern Wind River Range receiving the greatest snowfall. Warm and dry conditions filled in behind the storms and remained for the rest of the month. November temperatures were five degrees above average in the Wind River basin with temperatures in Shoshone drainage about three degrees above average. Snowpack in both reservoir watersheds lost significantly to average, with the snowpack above Boysen and Buffalo Bill falling to 71 and 57 percent of average on December 1st, respectively. Above average temperatures continued in December as both the Shoshone and Wind River basins were about three degrees higher than normal. The most significant snowfall events during December occurred on the 14th and 28th, with the Shoshone watershed faring better than the Wind River mountains. Precipitation in the mountains above Buffalo Bill was slightly above average during December and the snowpack increased to 71 percent of average on January 1st. In the Boysen watershed, the snowpack remained the same as the previous month when compared to average as the mountains received 76 percent of average December precipitation.

January started out dry and mild, but beginning on January 10th an arctic cold front pushed into the state bringing snow to western and central Wyoming. As the front passed through and skies cleared, frigid cold moved into Wyoming, bringing the coldest temperatures of the winter. On January 12th the nighttime temperature dropped to more than 40 degrees below zero at locations inside Yellowstone National Park. Pahaska, on the North Fork of the Shoshone River, reported a low of 33 degrees below zero. Temperatures were not as severe in the Wind River basin but lows of -15 to -20 degrees were common. For the month, temperatures were about three degrees below average. The snowpack over the entire Bighorn basin remained fairly stable over the month when compared to average, and on February 1st, the snowpack stood at 70 and 67 percent of average in the Boysen and Buffalo Bill watersheds, respectively. Above average snow fell on the mountains and lower elevations of the Shoshone basin during February and the snowpack increased by six percent during the month to 73 percent of average on March 1st. In the Wind

River basin, precipitation at low elevation weather stations was well below average and temperatures in March were about five degrees warmer than normal. By mid-March, almost no precipitation had fallen and the snowpack began to decline. The snowpack continued to deteriorate until March 29th when much needed moisture moved through Wyoming and gave a thirteen percent boost to the basin snowpack. Even with the recovery from the end of March storm, the snowpack in the Wind River basin dropped three percent, to 70 percent of average on April 1st. Conditions were much the same in the Shoshone basin with the snowpack beginning to decline in mid-March. The end of March storm had less of an effect on the Shoshone watershed and a nine percent drop occurred during the month to 64 percent of average on April 1st. The mean monthly temperature was about two degrees below average during March in the Shoshone drainage.

Snow continued to fall in the mountains above Buffalo Bill during much of April with the majority of the precipitation falling on April 19th. During the month, the lower elevation weather stations received well above average precipitation while snowfall in the mountains was right on average. Temperatures in the Shoshone basin were slightly above average and increases in reservoir inflow due to snowmelt runoff occurred toward the end of the month. During April the snowpack in the mountains above Buffalo Bill Reservoir fell another six percent, down to 58 percent of average on May 1st. While the Shoshone drainage enjoyed above average precipitation during April, the Wind River basin only received 23 percent of average precipitation. The weather station at Lander recorded the second lowest April precipitation in 117 years of record and Riverton had the fourth lowest April since 1918. Temperatures in the Wind River basin were also slightly above average during April and the snowpack on May 1st was down to 53 percent of average, a 17 percent decrease for the month.

The month of May is normally the wettest month of the year in the Bighorn basin and May of 2007 got off to a good start as a powerful spring storm brought rain and snow to central and western Wyoming between the third and sixth of the month. The Wind River Range received the greatest benefit from this storm with the Hobbs Park SNOTEL receiving 33 inches of new snow and other sites in the basin reporting over two feet of snow. Aside from providing additional snow in the mountains, the rain that fell in the valley reduced the need to divert water from the Wind River for irrigation and allowed more water to reach Boysen Reservoir. The Shoshone basin was on the fringe of the storm and received lesser amounts of moisture. Unfortunately, this was the only noteworthy storm during the month and both the Wind and Shoshone basins ended up with below average precipitation at 87 and 35 percent of average, respectively. Temperatures over the entire Bighorn basin were about three degrees above normal. Warm and dry was bad news for the snowpack, which melted out rapidly during May. By June 1st the snowpack was gone at all but the highest elevation SNOTEL sites in both the Wind and Shoshone basins. In the Wind River basin the snowpack dropped 41 percent to 12 percent of average and the Shoshone basin stood at 16 percent of average on June 1st, a 42 percent decline during the month of May. Inflow to Buffalo Bill Reservoir from snowmelt runoff began to increase during the last few days of April and peaked at 4,693 cfs on May 13th• Boysen inflow began to increase during the first week of May, reaching a maximum for the month of 2,633 cfs on May 13th. June was very similar to May in that a strong system early in the month provided essentially the entire precipitation received during the month. Rainfall amounts on June 6th and 7th exceeded one inch at many locations in western and central Wyoming, with reports of over two inches falling in the area around Cody. Reservoir inflow spiked as a result of the storm and the maximum inflow to Boysen for 2007 of 2,716 cfs occurred on June 7th while Buffalo Bill inflow reached a peak of 4,625 cfs on June 6th. In spite of the good rainfall early in the month, both the Shoshone and

Wind River basins received less than average precipitation during June. Temperatures during June exceeded average by about four degrees. Precipitation in July and August was above average as were the temperatures. The Weather Service Office in Riverton reported that July 2007 was the warmest July of record going back to 1918 and Lander had the fourth warmest July since recordkeeping began in 1891.

The 2007 mountain snow water content for the drainage basins in Wyoming is shown on Table WYT1. The 2007 water supply forecasts are shown on Table WYT2 and the 2007 precipitation in inches and the percent of average is shown on Table WYT3.

**TABLE WYT1**  
**2007 MOUNTAIN SNOW WATER CONTENT <sup>1</sup>**  
**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	3.30	59	4.93	67	6.22	69	7.40	66	5.30	51
BOYSEN	4.57	70	6.58	70	8.37	73	9.78	70	7.43	53
BUFFALO BILL	6.20	71	8.27	67	11.14	73	11.79	64	11.40	58

<sup>1</sup> 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**  
**2007 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			
BULL LAKE	115	83	115	83	115	83	110	79	100	72	100	72	101.9	73	93
BOYSEN	350	63	350	63	350	63	300	54	250	45	225	41	211.0	38	70
BUFFALO BILL	500	78	500	78	525	82	425	66	425	66	410	64	426.5	67	100

Averages are based on the 1977-2006 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.	%	
<b>VALLEY PRECIPITATION<sup>1</sup></b>																									
BUFFALO BILL																									
MONTHLY PRECIP AND % OF AVERAGE		1.53	149	1.22	111	0.95	93	0.44	39	1.12	130	0.71	67	1.83	144	0.74	35	1.24	63	1.56	106	1.71	132	1.11	85
YEAR-TO-DATE PRECIP AND % OF AVERAGE		1.53	149	2.75	129	3.70	117	4.14	97	5.26	103	5.97	96	7.80	104	8.54	89	9.78	85	11.34	87	13.05	91	14.16	90
BOYSEN																									
MONTHLY PRECIP AND % OF AVERAGE		1.11	146	0.26	52	0.14	47	0.38	142	0.12	34	0.74	123	0.27	23	1.58	87	0.87	76	2.25	255	0.94	152	0.56	56
YEAR-TO-DATE PRECIP AND % OF AVERAGE		1.11	146	1.37	109	1.51	97	1.89	104	2.01	93	2.75	100	3.02	77	4.60	80	5.47	79	7.72	99	8.66	103	9.22	98
BULL LAKE																									
MONTHLY PRECIP AND % OF AVERAGE		1.01	167	0.23	53	0.10	45	0.26	130	0.07	24	0.51	111	0.25	22	1.39	78	0.54	47	2.14	219	1.40	201	0.65	62
YEAR-TO-DATE PRECIP AND % OF AVERAGE		1.01	167	1.24	119	1.34	106	1.60	110	1.67	96	2.18	99	2.43	73	3.82	75	4.36	70	6.50	90	7.90	99	8.55	95
<b>MOUNTAIN PRECIPITATION<sup>2</sup></b>																									
BUFFALO BILL																									
MONTHLY PRECIP AND % OF AVERAGE		3.10	129	2.90	78	3.20	103	2.20	73	2.90	116	1.80	64	3.40	100	2.20	58	1.50	50	2.00	91	2.40	150	2.10	95
YEAR-TO-DATE PRECIP AND % OF AVERAGE		3.10	129	6.00	98	9.20	100	11.40	93	14.30	97	16.10	92	19.50	93	21.70	88	23.20	84	25.20	84	27.60	88	29.70	88
BOYSEN																									
MONTHLY PRECIP AND % OF AVERAGE		2.60	124	1.80	60	1.90	76	2.00	80	1.80	82	2.40	83	2.10	60	3.00	88	1.20	50	1.90	112	2.40	171	1.80	90
YEAR-TO-DATE PRECIP AND % OF AVERAGE		2.60	124	4.40	86	6.30	83	8.30	82	10.10	82	12.50	82	14.60	78	17.60	80	18.80	77	20.70	79	23.10	84	24.90	84
BULL LAKE																									
MONTHLY PRECIP AND % OF AVERAGE		2.00	100	1.20	55	1.30	76	1.60	100	1.10	69	3.20	133	1.80	56	3.10	91	1.00	43	2.50	167	1.80	129	1.70	89
YEAR-TO-DATE PRECIP AND % OF AVERAGE		2.00	100	3.20	76	4.50	76	6.10	81	7.20	79	10.40	90	12.20	83	15.30	85	16.30	80	18.80	86	20.60	88	22.30	88

<sup>1</sup> A composite of the following National Weather Service stations was used to determine monthly valley precipitation and percent of average for the drainage basins:

- Bull Lake.....Burris, Diversion Dam, and Dubois;
- Boysen.....Boysen Dam, Burris, Diversion Dam, Dubois, Lander, and Riverton;
- Buffalo Bill.....Buffalo Bill Dam, Lake Yellowstone, and Tower Falls

<sup>2</sup> 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 1977-2006 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 <sup>1</sup>					
Reservoir	Local	Main Stem	2007 Total	Previous Accumulation	1950 - 2007 Accumulation Total
Bull Lake <sup>2</sup>	\$ 0	\$ 0	\$ 0	\$ 2,690,300	\$ 2,690,300
Boysen	\$ 0	\$ 4,400	\$ 69,400	\$88,256,300	\$88,325,700
Buffalo Bill <sup>2</sup>	\$ 0	\$ 0	\$ 0	\$10,989,400	\$10,989,400

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 2007.

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 51,258 AF of water at the start of water year 2007, which was 66 percent of the normal end of September content and 34 percent of capacity. Irrigation diversions into the Wyoming Canal ended in September and releases from Bull Lake were reduced at that time to conserve the remaining storage in Bull Lake.

During water year 2006, 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 the irrigation season ended, the Boysen water in Bull Lake was transferred back to Boysen at a rate of approximately 20 cfs to provide a winter flow in Bull Lake Creek. Inflow during October, November, and December exceeded the release and the content of Bull Lake began to increase as soon as irrigation releases ended. By the end of December, storage in Bull Lake had increased to 58,510 AF, which was 76 percent of average. On January 1, snowpack in the basin above Bull Lake was 59 percent of average. Water supply forecasts of the April-July snowmelt runoff were prepared each month, beginning in January and continuing through June. The January forecast indicated the April-July snowmelt runoff would be approximately 115,000 AF, which was 83 percent of average. Precipitation in the mountains above Bull Lake was right at average during January with the Wind River valley receiving above average precipitation. While the snowpack increased to 67 percent of average on February 1st, the April-July snowmelt runoff forecast remained at 115,000 AF. Inflow during January, February, and March basically matched outflow and at the end of March the reservoir held 58,465 AF. The snowpack held fairly constant, compared to average, through the period as near average precipitation fell in the mountains. On April 1st the snowpack above Bull Lake was 66 percent of average and the forecast prepared on April 1st was lowered to 110,000 AF.

Midvale began irrigation deliveries on April 23" utilizing water released from Bull Lake and the available natural flow in the Wind River. Releases from Bull Lake were increased as early season irrigation water was needed to supplement diversions from the Wind River prior to the start of runoff. April precipitation was well below average on the irrigated lands of the district and precipitation in the mountains above Bull Lake was about half of normal. The snowpack remained at about 65 percent of average through most of the month, but the last few days of April saw significant losses. By May 1st the snowpack in the Bull Lake drainage was down to 51 percent of average, resulting in a reduction in the May 1 forecast to 100,000 AF, 72 percent of average. An early May storm provided some relief and as Wind River flows increased in mid-

May, project demands were met with natural flow from the river and Bull Lake releases were cut back. Following the storm, temperatures warmed and snowmelt runoff got under way in the Wind River basin. Flows in Bull Lake Creek above Bull Lake were also increasing at this time and the peak inflow from the runoff of 1,002 cfs occurred on May 21st. The reservoir level rose more than ten feet during May, to 5778.74 feet on May 31st. By the first of June the snowpack was essentially gone, standing at only seven percent of average. Demand for Bull Lake water began to increase again during the last week of May but inflow exceeded releases through most of June. Another storm during the first week of June caused inflows to spike from the rain and the peak of 1,171 cfs on June 6th was the maximum inflow during the year. When Bull Lake reached a maximum content for the year of 96,337 AF on June 28th at elevation of 5785.77 feet, the reservoir was 56,122 AF and 19.23 feet below the top of the active conservation pool. Inflow to Bull Lake was 62 percent of average during June and the flow of the Wind River above Bull Lake Creek was only 33 percent of average. July inflows were also well below average as Bull Lake received only 55 percent of normal and the flow of the Wind River above Bull Lake Creek was 43 percent of average for July. With little natural flow available in the Wind River, more Bull Lake storage water was needed to satisfy the irrigation demand and releases in excess of 1,000 cfs were required for almost one half of July. By the end of July, storage in Bull Lake had fallen to 70,413 AF. August and September inflows continued to be below average and storage in Bull Lake continued to decline through the end of the irrigation season. Irrigation on the Riverton Unit ended on September 13th and Bull Lake storage for water year 2007 reached a low of 45,362 AF of water at elevation 5764.31 feet on September 16th. As the release from the dam was reduced, the lake level began to slowly increase and on September 30th the water surface elevation of Bull Lake was 5765.42 feet. The content of Bull Lake on September 30th was 47,673 AF of water.

Actual April-July inflows totaled 101,893 AF, 73 percent of average. Total inflow to Bull Lake for the water year was 143,398 AF, which was 77 percent of average. The flow of the Wind River above the mouth of Bull Lake Creek was estimated to be 48 percent of average, totaling 193,721 AF during the April-July period. The total diversion into the Wyoming Canal for the April-September period was 310,530 AF, 93 percent of average.

Additional hydrologic and statistical information pertaining to Bull Lake operations during 2007 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 Dam and the Wyoming Canal which supplies the reservoir are operated by Midvale under contract with Reclamation.

Pilot Butte Reservoir began water year 2007 with a total storage content of approximately 4,158 AF at elevation 5411.25 feet. Releases from Pilot Canal for the 2006 irrigation season ended on September 17, 2007. Repairs to the outlet works at Pilot Butte Dam were scheduled for the fall of 2006 and releases to Pilot Canal at the end of the irrigation season were used to draw the reservoir down to the lowest level possible in order to facilitate the work. The reservoir level continued to slowly drop through the fall due to evaporation, reaching a historic low content of 3,748 AF at elevation 5409.80 feet on December 1st. The reservoir remained at approximately this level for the first half of December. Upon completion of the outlet works repair, diversions into the Wyoming Canal were initiated on December 14th in order to refill Pilot Butte Reservoir.



By the end of December, storage in Pilot Butte had increased to 8,072 AF. Diversions into the reservoir continued at a rate of approximately 120 cfs through mid-March. When the diversion was ended on March 22nd, Pilot Butte held 28,652 AF of water. Releases from Pilot Butte began on April 9th to flush the canal and irrigation deliveries were initiated on April 23<sup>rd</sup>. Water year 2007 was hotter and drier than normal and Pilot Butte storage was drawn upon through the irrigation season, with releases to Pilot Canal ending on September 16th. At the end of the irrigation season, storage in the reservoir was 9,418 AF, with losses to evaporation drawing the reservoir down to 9,263 AF of water at the end of the water year. The end of year reservoir elevation was 5424.96 feet.

Total generation at the Pilot Butte Powerplant in water year 2007 was 3,204,000 kilowatt-hours (kWh). During water year 2007, 34,862 AF or 21 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 2007 can be found in Table WYT5 and Figure WYG2.

# TABLE WYT4

## HYDROLOGIC DATA FOR WATER YEAR 2007

### 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	5767.11	51,258	OCT 01, 2006
END OF YEAR	5765.42	47,673	SEP 30, 2007
ANNUAL LOW	5764.31	45,362	SEP 16, 2007
HISTORIC LOW*	5743.03	6,228	MAR 31, 1950
ANNUAL HIGH	5785.77	96,337	JUN 28, 2007
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.

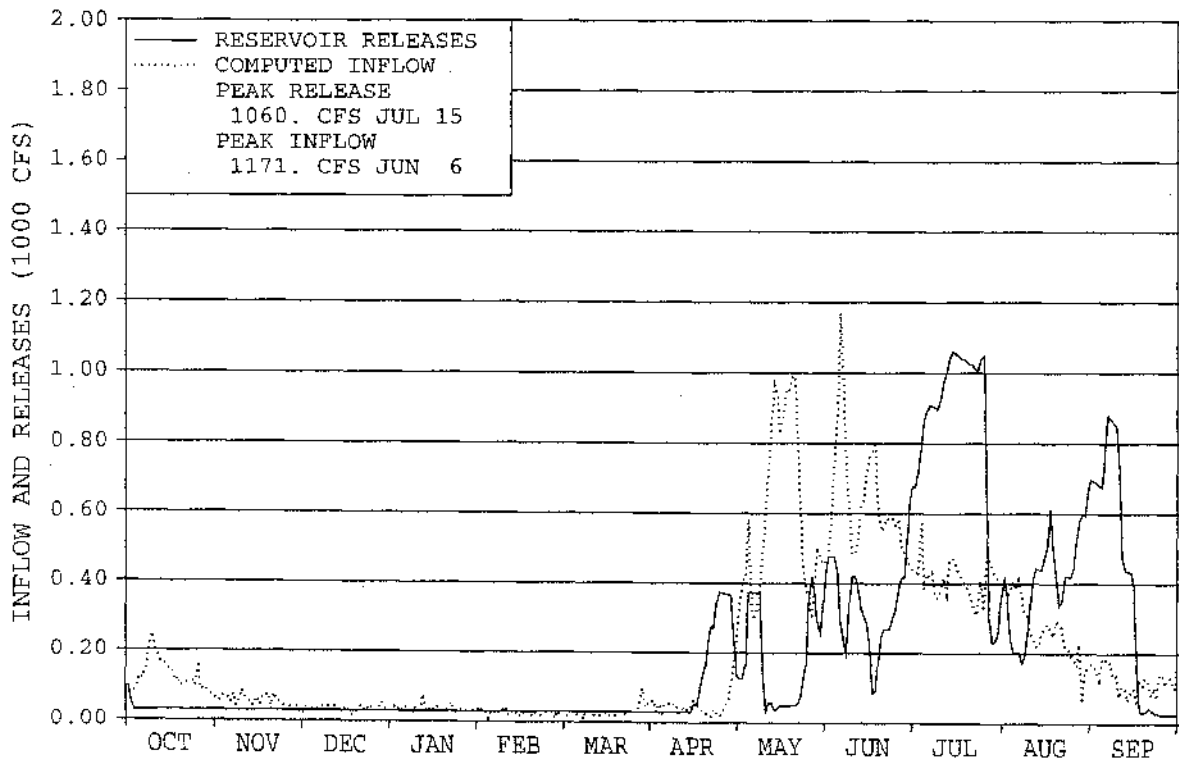
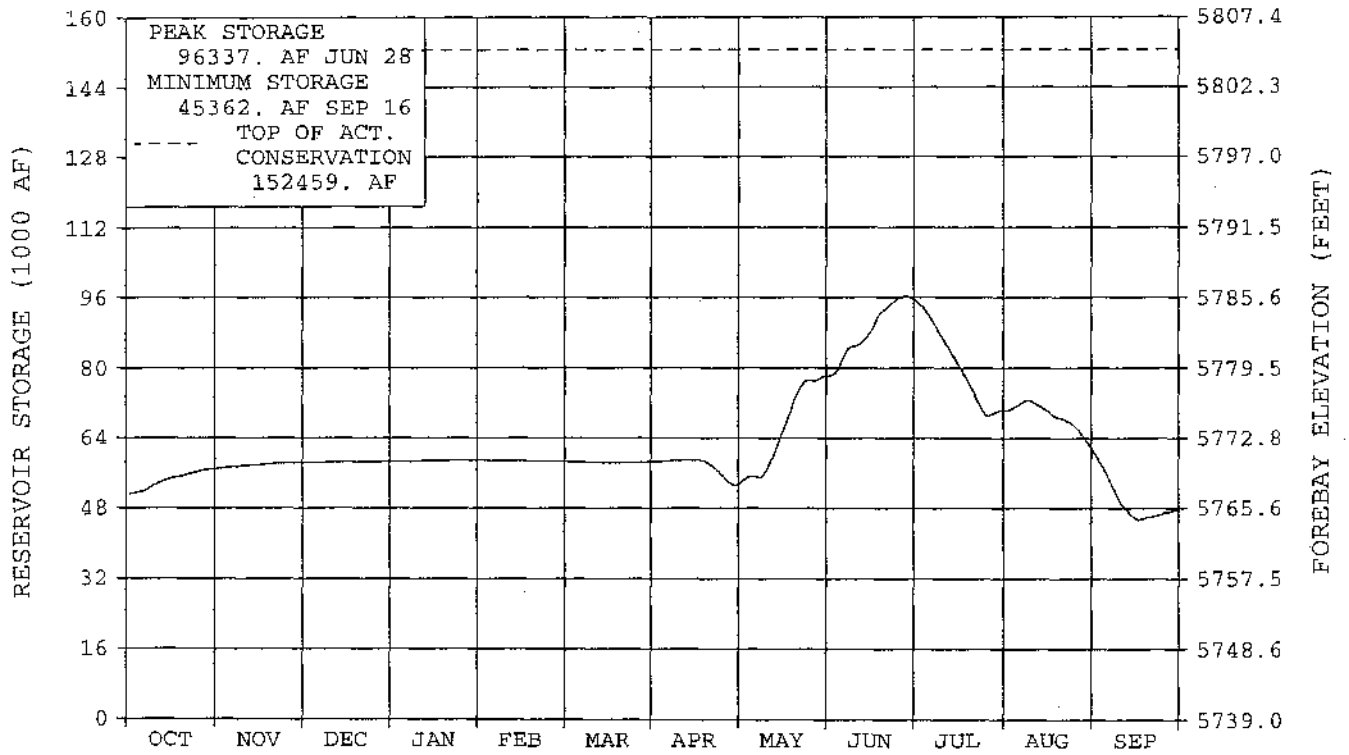
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	143,398	OCT 06-SEP 07	146,983	OCT 06-SEP 07
DAILY PEAK (cfs)	1,171	JUN 06, 2007	1,060	JUL 15, 2007
DAILY MINIMUM (cfs)	7	MAR 08, 2007	24	SEP 25, 2007
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	7.6	145	2.0	30	56.9	75
NOVEMBER	3.1	109	1.8	75	58.2	76
DECEMBER	2.1	87	1.8	90	58.5	76
JANUARY	2.1	98	1.8	95	58.8	76
FEBRUARY	1.4	86	1.6	100	58.5	76
MARCH	1.8	99	1.8	106	58.5	76
APRIL	2.8	80	8.1	238	53.1	69
MAY	36.1	130	11.0	74	78.2	87
JUNE	37.8	62	20.1	82	95.9	76
JULY	25.3	55	50.8	111	70.4	55
AUGUST	16.3	76	25.5	56	61.2	59
SEPTEMBER	7.1	75	20.6	58	47.7	62
<b>ANNUAL</b>	<b>143.5</b>	<b>77</b>	<b>146.9</b>	<b>79</b>		
		APRIL - JULY INFLOW (AF)				
		ACTUAL	AVERAGE			
		101,893	138,800			

\* Average for the 1977-2006 period

FIGURE WYG1

BULL LAKE RESERVOIR NEAR LENORE



WATER YEAR 2007

# TABLE WYT5 HYDROLOGIC DATA FOR WATER YEAR 2007 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	5411.25	4,158	OCT 01, 2006
END OF YEAR	5424.96	9,263	SEP 30, 2007
ANNUAL LOW	5409.80	3,748	DEC 01, 2006
HISTORIC LOW	5409.80	3,748	DEC 01, 2006
ANNUAL HIGH	5457.80	31,765	MAY 20, 2007
HISTORIC HIGH	5460.60	37,465	APR 20, 1988

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	168,150	OCT 06-SEP 07	162,934	OCT 06-SEP 07
DAILY PEAK (cfs)	1,144	JULY 26, 2007	752	JUL 19, 2007
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

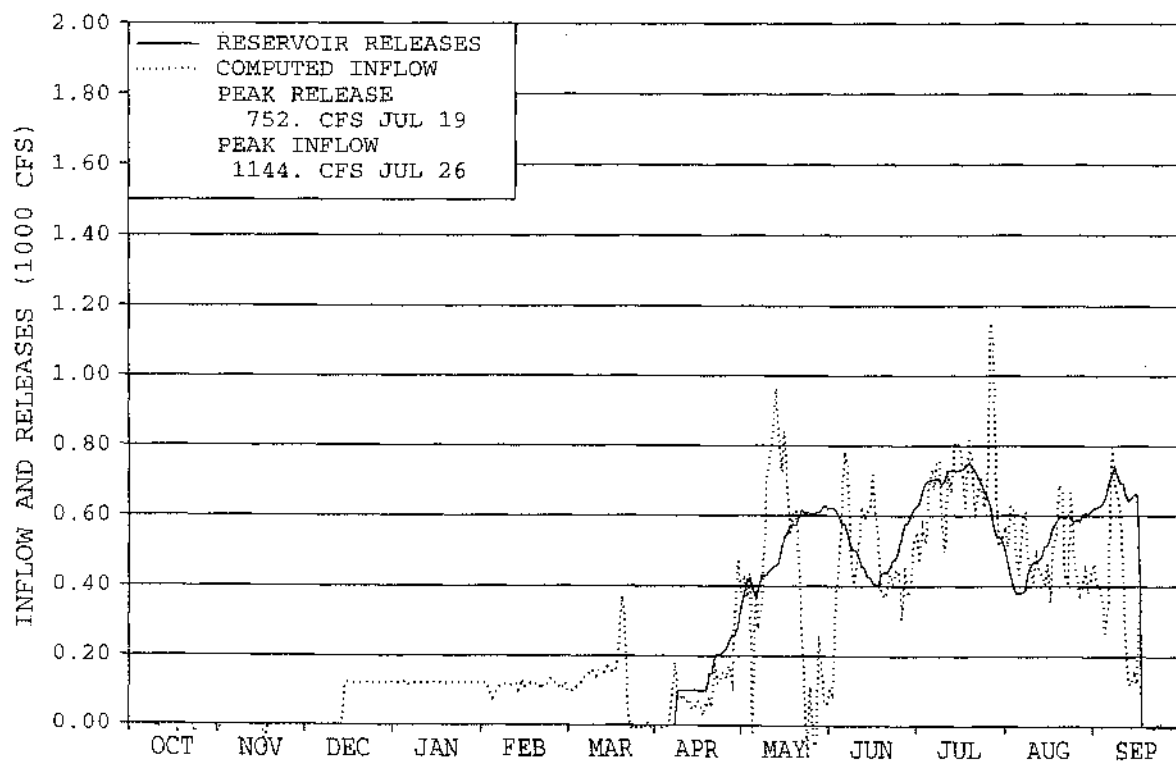
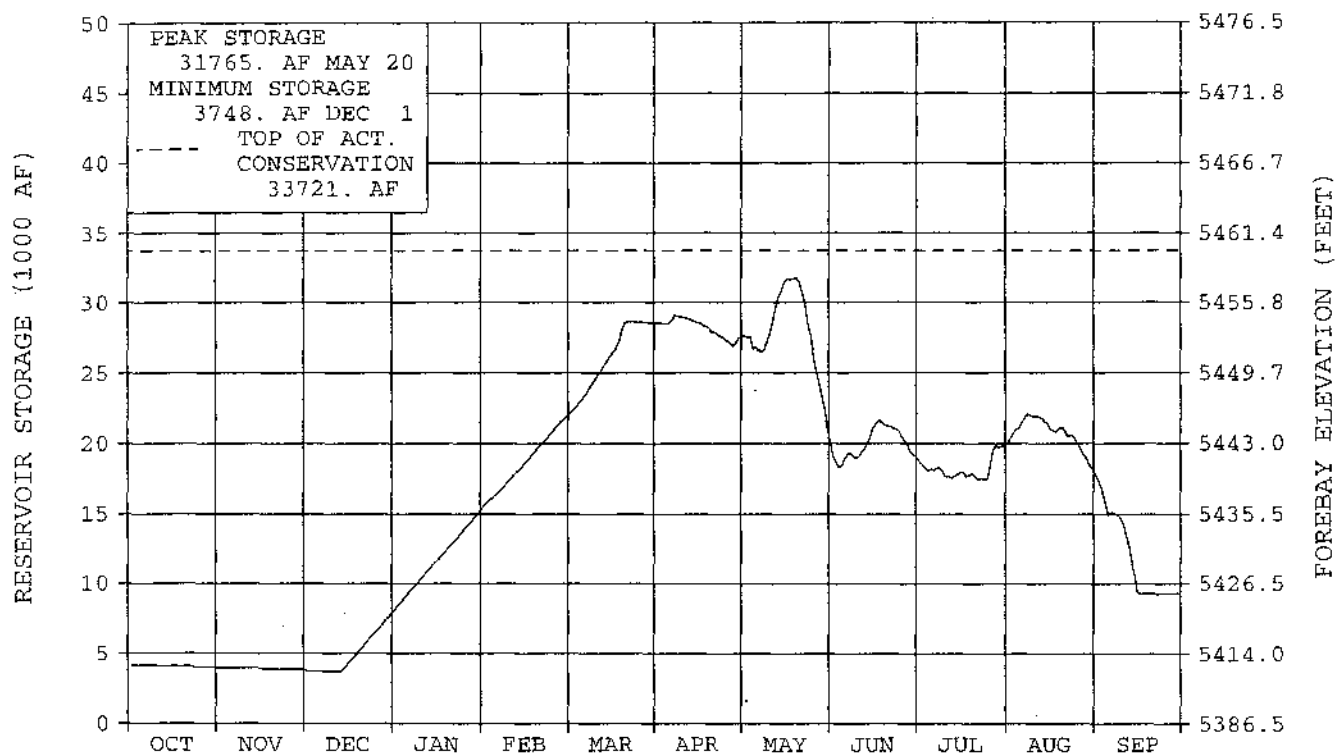
MONTH	INFLOW*		OUTFLOW		CONTENT	
	KAF	% of Avg**	KAF	% of Avg**	KAF	% of Avg**
OCTOBER	-0.2	N/A	0.0	N/A	4.0	15
NOVEMBER	-0.1	N/A	0.0	N/A	3.9	14
DECEMBER	4.3	N/A	0.0	N/A	8.1	30
JANUARY	7.4	N/A	0.0	N/A	15.5	58
FEBRUARY	6.3	N/A	0.0	N/A	21.8	82
MARCH	6.8	344	0.0	N/A	28.6	101
APRIL	5.8	72	6.9	125	27.4	89
MAY	25.2	111	31.4	121	21.2	77
JUNE	28.3	74	30.3	84	19.2	64
JULY	42.2	101	41.5	90	19.9	77
AUGUST	30.0	93	32.0	89	17.9	82
SEPTEMBER	12.2	52	20.8	78	9.3	50
ANNUAL	168.2	94	162.9	91		

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

\*\* Average for the 1977-2006 period.

FIGURE WYG2

PILOT BUTTE RESERVOIR



WATER YEAR 2007

## **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 2007 began with 447,786 AF of water stored in Boysen Reservoir, which was 80 percent of the 30 year average. The corresponding reservoir elevation of 4706.63 feet was 18.37 feet below the top of the joint use pool. The winter release was set at 500 cfs on September 22, 2006, when irrigation demands fell below the planned fall and winter release of 500 cfs. October precipitation in the Boysen watershed was above the thirty year average and reservoir inflow was 86 percent of average during the month. With releases held at 500 cfs, the reservoir level rose 1.63 feet to 4708.26 feet at the end of October. November precipitation was 52 percent of average and the snowpack stood at 71 percent of average on December 1st. Reservoir inflow was 84 percent of average during November and the reservoir level continued to rise until November 25th when the reservoir elevation was 4709.13 feet. In December, the snowpack remained at about 70 percent of average through the month while inflow to Boysen was 65 percent of average. Total precipitation for December at lower elevation weather stations was 47 percent of average. Storage in the reservoir declined through December and at the end of the month, Boysen held 474,573 AF at elevation 4708.67 feet.

Forecasts of April-July snowmelt runoff were prepared at the beginning of each month beginning in January and continuing through June. On January 1st the snowpack in the mountains above Boysen was 70 percent of average and the forecast indicated approximately 350,000 AF of water, 63 percent of average, would enter Boysen Reservoir during the April-July snowmelt runoff period. Precipitation during January was above average at lower elevations but

precipitation in the mountains was below average and temperatures were below normal. The snowpack remained fairly constant through the month and was 70 percent of average on February 1st. With the snowpack holding at about 70 percent of average through the winter, the February and March forecasts both indicated that about 350,000 AF of runoff could be expected to enter Boysen during the April-July runoff period. Reservoir inflow during January and February was well below average and the reservoir level continued to gradually decrease. At the end of February, Boysen held 459,452 AF of water at elevation 4707.53 feet and with the forecasted runoff, the reservoir level was projected to fall about ten feet short of filling. Storage in Boysen continued to fall during the first part of March but a storm on March 29th caused inflows to climb above 1000 cfs and the reservoir made a small gain. At the end of the month Boysen held 464,319 AF of water, with March inflow 68 percent of average. Precipitation during March was 123 percent of average and the snowpack changed little over the month, standing at 70 percent of average on April 1st. Based on conditions in the basin, the April 1 forecast was reduced by 50,000 AF to 300,000 AF of runoff for the April-July period.

Precipitation in the Wind River basin was well below average in April, with Lander receiving 0.19 inches of precipitation during the month. This was the second lowest April total in 116 years of record for Lander. Irrigation demands were satisfied by the 500 cfs winter release until April 23rd, when the Wyoming State Engineer's Office in Riverton requested an increase to satisfy downstream needs for irrigation water. When the increase above the winter release was made, Boysen storage use accounting was initiated and continued through the remainder of the irrigation season. The Boysen release was limited to the amount needed to meet the demands of downstream contractors, with changes coordinated by the Wyoming State Engineer's Office in Riverton. By the end of April the Boysen release was 800 cfs and with April inflow averaging about 530 cfs the reservoir level dropped 0.10 feet over the month to elevation 4707.80 feet. Below average April precipitation and above average temperature in the basin during the month resulted in a 17 percent drop in the snowpack. Even though the snowpack fell 17 percent compared to average during April, there was not a corresponding increase in streamflow during the month and the inflow to Boysen was 64 percent of average. The snowpack on May 1st was 53 percent of average and the May forecast of April-July snowmelt runoff was reduced to 250,000 AF, which was 45 percent of average. Much needed precipitation fell during the first week of May and reservoir inflow spiked above 2,300 cfs as a result. Unfortunately, little precipitation fell during the remainder of the month and Boysen storage was called on to satisfy irrigation demands. Reservoir inflow was 69 percent of average for May and at the end of the month Boysen held 482,958 AF of water at elevation 4709.29 feet. By the end of May, only the highest elevations in the Wind River Range still held snow and the basin-wide snowpack was only 12 percent of average on June 1st.

The poor snowpack and less than expected inflow during April and May resulted in the June forecast being reduced to 225,000 AF. Irrigation demands were reduced for a short time following widespread rainfall around June 6th. Inflow increased as a result of this storm and as the remaining mountain snowpack melted, the peak inflow to Boysen of 2,716 cfs occurred on June 7th. The snowmelt runoff was short lived and inflow exceeded outflow until June 16th when Boysen reached a maximum content of 493,384 AF at elevation 4710.05 feet. Inflow during June was only 25 percent of average. As warm and dry conditions returned to the basin, the demand for irrigation water increased and outflow from the Dam peaked on June 30th at 1,338

cfs. Releases during July averaged about 1,160 cfs while reservoir inflows averaged about 525 cfs. This was 24 percent of the July average and the reservoir level fell to 4705.98 feet on July 31<sup>st</sup>. Inflow continued to lag behind average during August and September with about 50 percent of average flowing in to Boysen and irrigation demands gradually decreased through the period. Because of the low reservoir content at the end of the water year and the ongoing drought conditions in the basin, it was determined that the Boysen release would be set at 400 cfs following the 2007 irrigation season. On October 1, 2007, the irrigation demand below Boysen fell below 400 cfs so the release from the Dam was set at the planned winter release of 400 cfs and Boysen storage water use accounting ended for the year.

Actual inflow for the April-July period totaled 211,045 AF, which was 38 percent of average. Total inflow to Boysen during water year 2007 was 468,365 AF, 50 percent of average. The reservoir ended the water year at 4701.87 feet with a content of 389,685 AF. This was 64 percent of the average end of September content. During water year 2007, Boysen Powerplant generated 38,982,000 kWh of electricity, about 57 percent of average and 18,574,000 kWh less than was generated in 2006. Of the 526,466 AF of water released from Boysen in water year 2007, 522,230 AF was discharged through the powerplant and 4,236 AF bypassed the powerplant.

### **Important Events - 2007**

September 22, 2006: Irrigation demand fell below the planned winter release of 500 cfs, ending storage use accounting for the year.

March 23, 2007: Boysen Reservoir spring water information meeting was held in Worland to discuss the water supply and proposed operation of Boysen Reservoir in 2007.

April 23, 2007: Releases greater than the 500 cfs winter release were required to meet irrigation demands and Boysen Reservoir storage water use accounting was initiated.

October 1, 2007: Irrigation demand fell below the planned winter release of 400 cfs, ending storage use accounting for the year.

November 14, 2007: Boysen Reservoir fall water information meeting was held in Worland to discuss 2007 water operations.

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



# TABLE WYT 6 HYDROLOGIC DATA FOR WATER YEAR 2007 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	4706.63	447,786	OCT 01, 2006
END OF YEAR	4701.87	389,685	SEP 30, 2007
ANNUAL LOW	4701.83	389,219	SEP 27, 2007
HISTORIC LOW ELEVATION *	4684.18		MAR 18, 1956
HISTORIC LOW CONTENT *		235,737	SEP 24, 2002
ANNUAL HIGH	4710.05	493,384	JUN 18, 2007
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)	468,365	OCT 06-SEP 07	526,466*	OCT 06-SEP 07
DAILY PEAK (cfs)	2,716	JUN 7, 2007	1,338	JUN 30, 2007
DAILY MINIMUM (cfs)	54	JUL 2, 2007	476	DEC 1, 2006
PEAK SPILLWAY FLOW (cfs)				
TOTAL SPILLWAY FLOW (AF)				

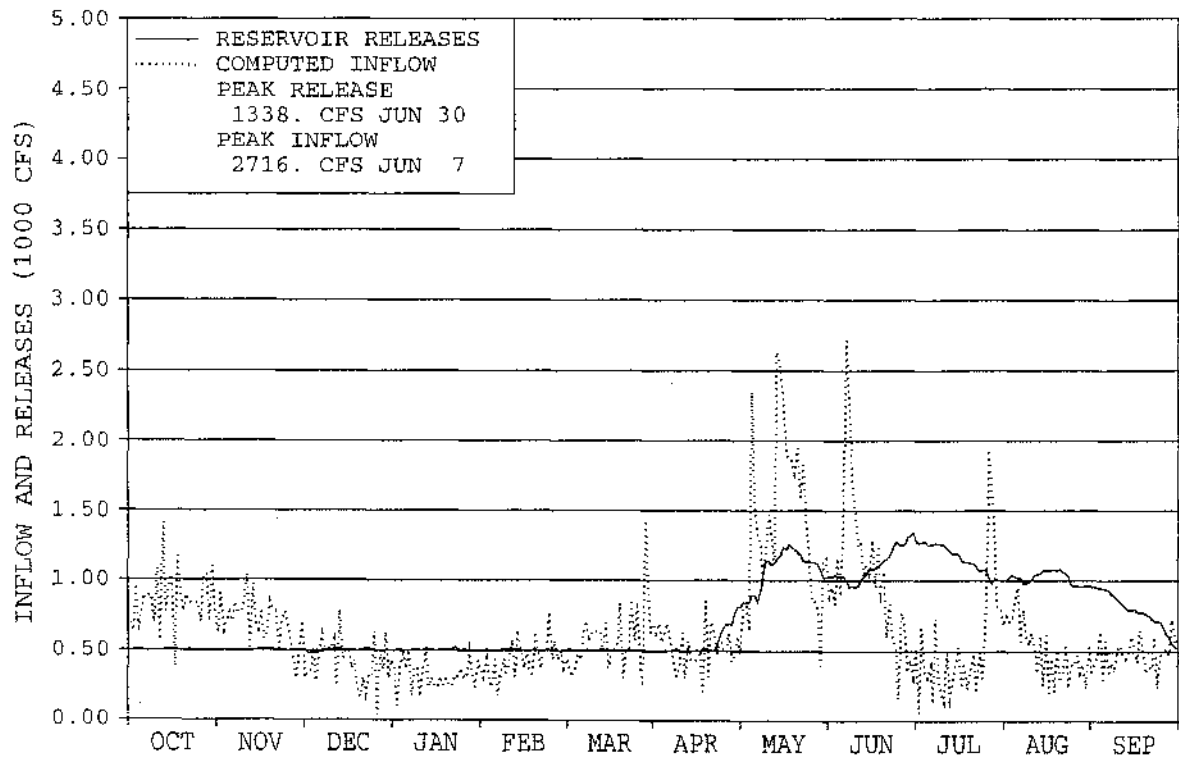
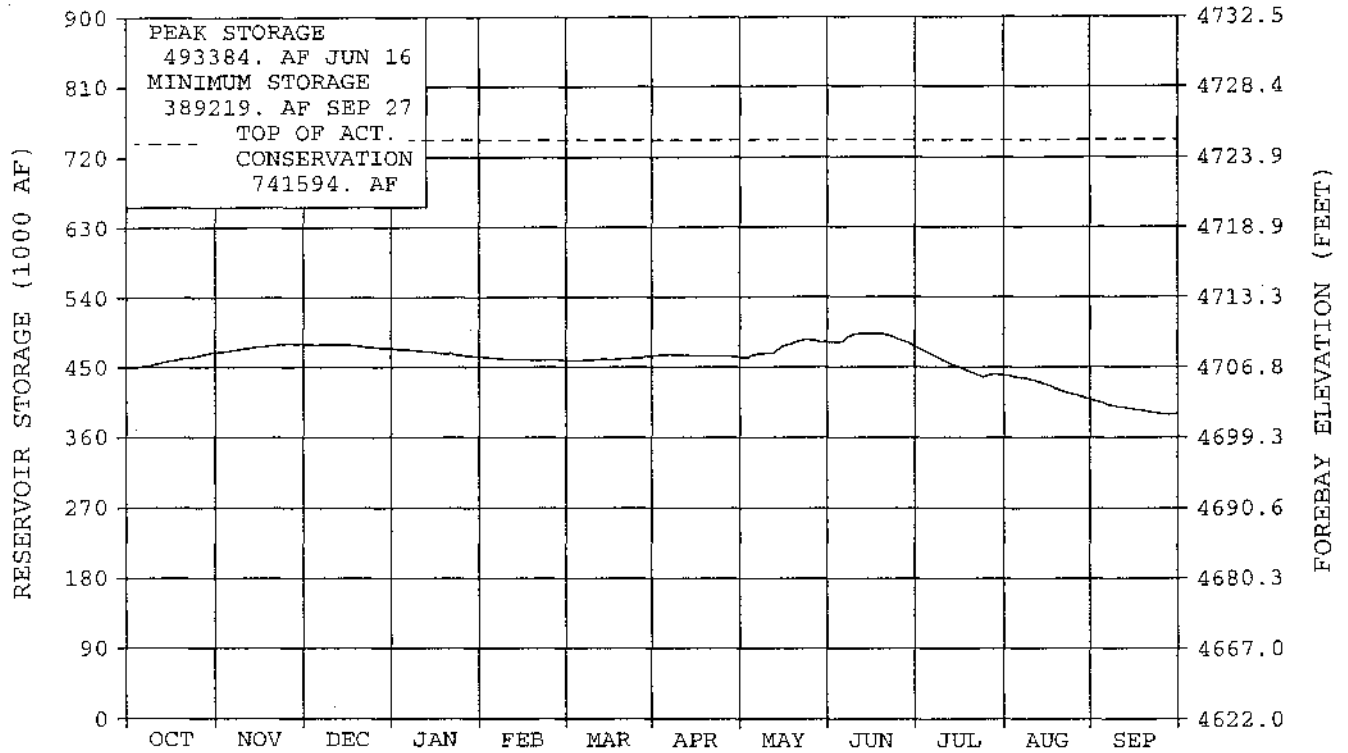
\* Of the 526,466 AF of water released from Boysen Reservoir, 4,236 AF bypassed the powerplant.

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	52.1	86	30.8	48	469.1	77
NOVEMBER	41.0	84	29.9	52	480.2	80
DECEMBER	25.1	65	30.8	52	474.6	82
JANUARY	19.6	53	31.1	56	463.1	82
FEBRUARY	24.4	64	28.0	57	459.5	83
MARCH	35.9	68	31.0	51	464.3	85
APRIL	31.4	64	32.7	48	463.0	88
MAY	85.9	69	65.9	71	483.0	87
JUNE	61.3	25	66.0	48	478.3	72
JULY	32.4	24	71.3	51	439.5	67
AUGUST	30.7	51	62.6	69	407.5	65
SEPTEMBER	28.5	53	46.3	64	389.7	64
ANNUAL	468.3	50	526.4	55		
		APRIL - JULY INFLOW (AF)				
		ACTUAL	AVERAGE			
		211,045	551,300			

\* Average for the 1977-2006 period

FIGURE WYG3

BOYSEN RESERVOIR



WATER YEAR 2007

## 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. 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. 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 2007 was 233 AF at elevation 6354.00 feet. The reservoir level increased slightly in October, reaching 254 AF by the end of the month. The reservoir level remained stable through most of the winter and at the end of February, held 314 AF at elevation 6357.00 feet. Inflows began to increase in the latter part of March and at the end of the month, Anchor held 444 AF of water. The reservoir continued to slowly rise through the spring and reached its maximum content for the year of 915 AF on May 16th. Inflow dropped off quickly and releases to help meet irrigation demands drafted the reservoir to 283 AF at the end of May. The reservoir remained at a fairly constant level for the remainder of the water year and held 254 AF at elevation 6355.00 feet on September 30th. The maximum daily inflow for the year of 107 cfs occurred on May 15th and the maximum release of 87 cfs was on May 4th.

Hydrologic and statistical data pertaining to Anchor Reservoir operations during 2007 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 2007 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	6354.00	233	OCT 01, 2006
END OF YEAR	6355.00	254	SEP 30, 2007
ANNUAL LOW	6354.00	233	OCT 01, 2006
HISTORIC LOW			
ANNUAL HIGH	6370.00	915	MAY 16, 2007
HISTORIC HIGH	6418.52	9,252	JUL 03, 1967

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	8,610	OCT 06-SEP 07	8,588	OCT 06-SEP 07
DAILY PEAK (cfs)	107	MAY 15, 2007	87	MAY 4, 2007
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

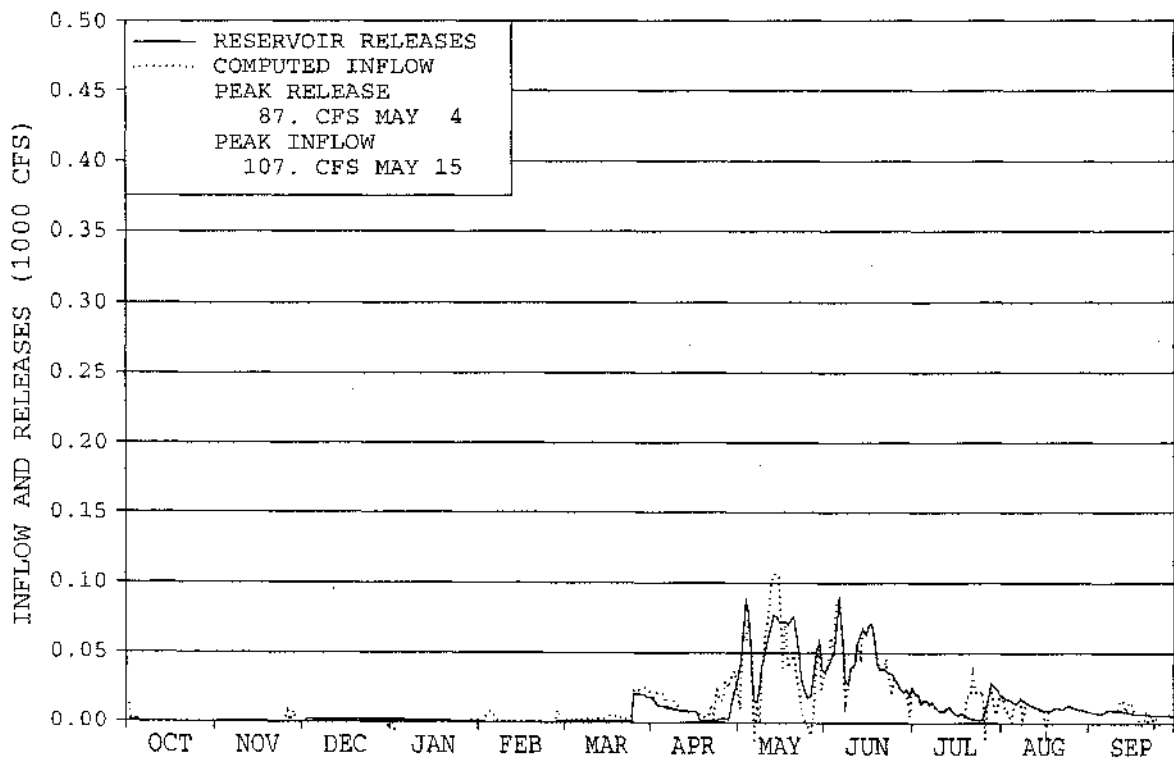
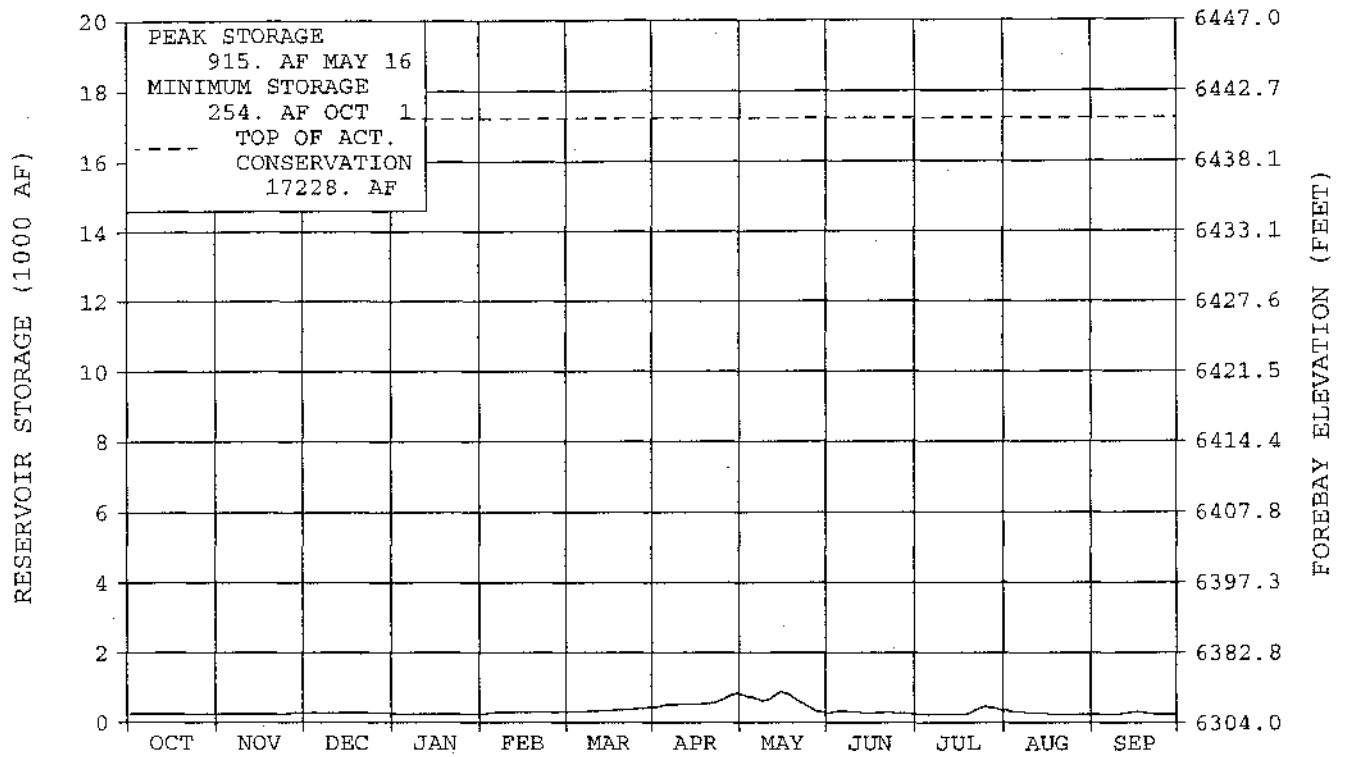
\* Outflow is water released from the Dam to Owl Creek. When the reservoir level rises above approximately 6412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. This water is neither measured nor accounted for. In 2007, no water flowed over the notch in the dike.

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	0.0	5	0.0	0	0.3	95
NOVEMBER	0.1	18	0.0	0	0.3	132
DECEMBER	0.1	40	0.1	46	0.3	131
JANUARY	0.1	65	0.1	70	0.3	132
FEBRUARY	0.1	47	0.0	0	0.3	142
MARCH	0.4	137	0.3	131	0.4	145
APRIL	0.9	130	0.4	93	0.9	176
MAY	2.6	60	3.1	101	0.3	17
JUNE	2.6	39	2.7	52	0.3	8
JULY	0.9	41	0.7	22	0.4	18
AUGUST	0.6	279	0.7	45	0.3	40
SEPTEMBER	0.4	67	0.4	45	0.3	78
ANNUAL	8.8	54	8.6	54		

\* Average is for the 1991-2006 period. This period was used because of the availability of data at Anchor Reservoir.

FIGURE WYG4

ANCHOR RESERVOIR



WATER YEAR 2007

## **Shoshone Project & Buffalo BM Unit**

The primary features of the original Shoshone Project included Buffalo Bill Dam 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 Dam 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 Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement, 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 BM 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 BM 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 2007 was 441,121 AF of water at elevation 5366.19 feet. The reservoir level continued to slowly fall during the first half of October as releases for irrigation continued to exceed inflow. By October 17th releases to the Shoshone River for irrigation were no longer required and the release to the Shoshone River was reduced to 200 cfs in accordance with the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement. Irrigation deliveries to the Heart Mountain Canal were discontinued on October 13th. Once releases to the canal and river for irrigation ended, the reservoir began to recover and at the end of October there were 433,451 AF of water in storage at elevation 5365.08 feet. Inflows during the October through December period were near average and by the end of December storage in the reservoir had increased to 447,191 AF. Precipitation was above average during the period, as were temperatures, and the snowpack in the Buffalo Bill watershed stood at 71 percent of average on January 1st.

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 1st indicated that 500,000 AF of runoff could be expected to flow into Buffalo Bill Reservoir during the April through July period, which was 78 percent of the 30 year average. January inflow to Buffalo Bill was below average and by the end of the month storage in the reservoir fell slightly to 445,330 AF of water. Precipitation in the mountains of the Buffalo Bill watershed was below average during January and the snowpack fell to 67 percent of average on February 1st. Overall conditions changed very little through the month and the forecast prepared on February 1st

remained at 500,000 AF. The snowpack regained losses to average that occurred during January, increasing six percent to 74 percent of average on March 1st. Precipitation was above average during February while Buffalo Bill inflow was 85 percent of average. The March 1 forecast was increased slightly to 525,000 AF. March precipitation was about 65 percent of average with most of the accumulation occurring during the last few days of the month. The snowpack continued to slowly fall further from average through the month. March inflow was above average and the content of the reservoir increased to 457,725 AF of water at elevation 5368.65 feet on March 31. With no major snowfall events until the end of the month, the snowpack dropped nine percent to 64 percent of average on April 1. With the snow season nearing an end, the outlook for good snowmelt runoff was diminishing and the April 1 forecast was reduced by 100,000 AF to 425,000 AF of inflow expected to enter Buffalo Bill during the April-July snowmelt runoff period.

As irrigation season approached, control of the release from the Dam was turned over to the Shoshone Irrigation District for irrigation on April 19th and preparations for delivery to Heart Mountain canal were also initiated. However, a timely snow storm blanketed the basin and it was the end of April before releases above the winter flow were needed to meet the irrigation demands of the downstream districts. Releases from the Dam were increased on April 30th to meet downstream irrigation needs and Heart Mountain Canal deliveries were initiated on May 1st. Mountain precipitation was right at the 30 year average, with well above average rainfall at lower elevation weather stations during April. When the snowpack in the Buffalo Bill watershed peaked on April 24th, it was at 70 percent of average. By May 1st, the snowpack had fallen to 58 percent of average and was dropping rapidly. Inflows did not begin to respond to the melting snowpack until the very end of April, but with irrigation releases starting about two weeks later than it normally would, Buffalo Bill continued to rise through the month. By the end of April, the content in Buffalo Bill Reservoir had increased to 485,597 AF. Conditions on May 1 indicated that the expected April-July snowmelt runoff would remain at 425,000 AF, which was 66 percent of the average. Snowmelt runoff got underway at the end of April, but snow and cold temperatures entered the basin around May 3rd and inflows declined. As temperatures warmed back up following the storm and reservoir inflow increased, the maximum inflow to Buffalo Bill of 4,693 cfs occurred on May 13th. Provisional data from the U S Geological Survey shows that the inflow on the North Fork of the Shoshone River peaked at 3,510 cfs on May 13th and the peak on the South Fork of 1,650 cfs also occurred on May 13th. Snowmelt continued through May as the snowpack fell to 16 percent of average on June 1st. The early melt of the snowpack resulted in May inflow being 115 percent of average. By the end of May, Buffalo Bill Reservoir had risen to 5382.79 feet, with a content of 562,453 AF. Outflow was just beginning to exceed inflow when another weather system brought over two inches of rain to the Cody area during the first week of June. Inflows reacted to the rainfall event and a second peak of 4,625 cfs occurred on June 6th. Demand dropped off, thanks to the rain and the reservoir continued to rise until June 26th. The maximum content for the year was 623,630 AF at elevation 5390.66 feet, 22,935 AF and 2.84 feet below the top of the active conservation pool. Releases from the dam in excess of irrigation demand were not required to control the rate of fill of the reservoir during the 2007 irrigation season and the control of the release from the Dam remained with the irrigation district until the irrigation season ended. The maximum release to the river occurred on July 10th, with an average for the day of 1,203 cfs. With most of the snowpack gone by the first of June, inflows for the remainder of the runoff season were well below average at 54 and 34 percent of



average for June and July, respectively. At the end of July the reservoir held 555,134 AF at 5381.83 feet.

Below average inflow continued during August, and September and the reservoir level fell through the end of the water year. On September 30, the reservoir held 417,846 AF of water at elevation 5362.74 feet. The end of September content was 96 percent of the 1993-2006 average for the enlarged reservoir. The total inflow to Buffalo Bill during the April through July runoff period was 426,546 AF, which was 67 percent of average. The total water year inflow of 577,228 AF was 70 percent of average.

Total energy generated at all powerplants that directly receive water out of Buffalo Bill Reservoir totaled 92,243,000 kWh in 2007. Of this total amount, Heart Mountain Powerplant generated 14,170,000 kWh, Buffalo Bill Powerplant generated 41,356,000 kWh, Shoshone Powerplant generated 20,317,000 kWh and Spirit Mountain Powerplant generated 16,400,000 kWh. The powerplants used 523,656 AF of water to generate this amount of energy, or 87 percent of the total water released from Buffalo Bill Reservoir during water year 2007. About 37 percent, or 221,472 AF of the total water released from Buffalo Bill Reservoir, was released to the Heart Mountain Canal for irrigation purposes.

### Important Events - 2007

October 13, 2006: Irrigation diversions to the Heart Mountain Canal were discontinued for the 2006 irrigation season.

October 16, 2006: Irrigation releases to the Shoshone River were discontinued for the 2006 irrigation season, control of releases was returned to the Bureau of Reclamation, and a river release of 200 cfs was established for the winter.

March 27, 2007: Buffalo Bill Reservoir Public Information meeting was held in Powell to discuss water year 2006 operation and expected 2007 operation.

April 30, 2007: Releases from Buffalo Bill Reservoir were increased to meet downstream irrigation demand.

May 1, 2007: Irrigation releases to the Heart Mountain Canal were initiated for the 2007 irrigation season.

June 26, 2007: Buffalo Bill Reservoir reached a maximum elevation for the water year of 5390.66 feet.

Additional hydrologic and statistical information pertaining to the operations of Buffalo Bill Reservoir during water year 2007 can be found in Table WYT8 and Figure WYG5.

# TABLE WYT8 HYDROLOGIC DATA FOR WATER YEAR 2007 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	5366.19	441,121	OCT 01, 2006
END OF YEAR	5362.74	417,846	SEP 30, 2007
ANNUAL LOW	5362.74	417,846	SEP 30, 2007
HISTORIC LOW*		19,080	JAN 31, 1941
ANNUAL HIGH	5390.66	623,630	JUN 26, 2007
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)	577,228	OCT 06-SEP 07	600,503	OCT 06-SEP 07
DAILY PEAK (cfs)	4,693	MAY 13, 2007	2,096	MAY 22, 2007
DAILY MINIMUM (cfs)	21	DEC 05, 2007	193	DEC 02, 2007
PEAK SPILLWAY FLOW (cfs)				
TOTAL SPILLWAY FLOW (AF)				

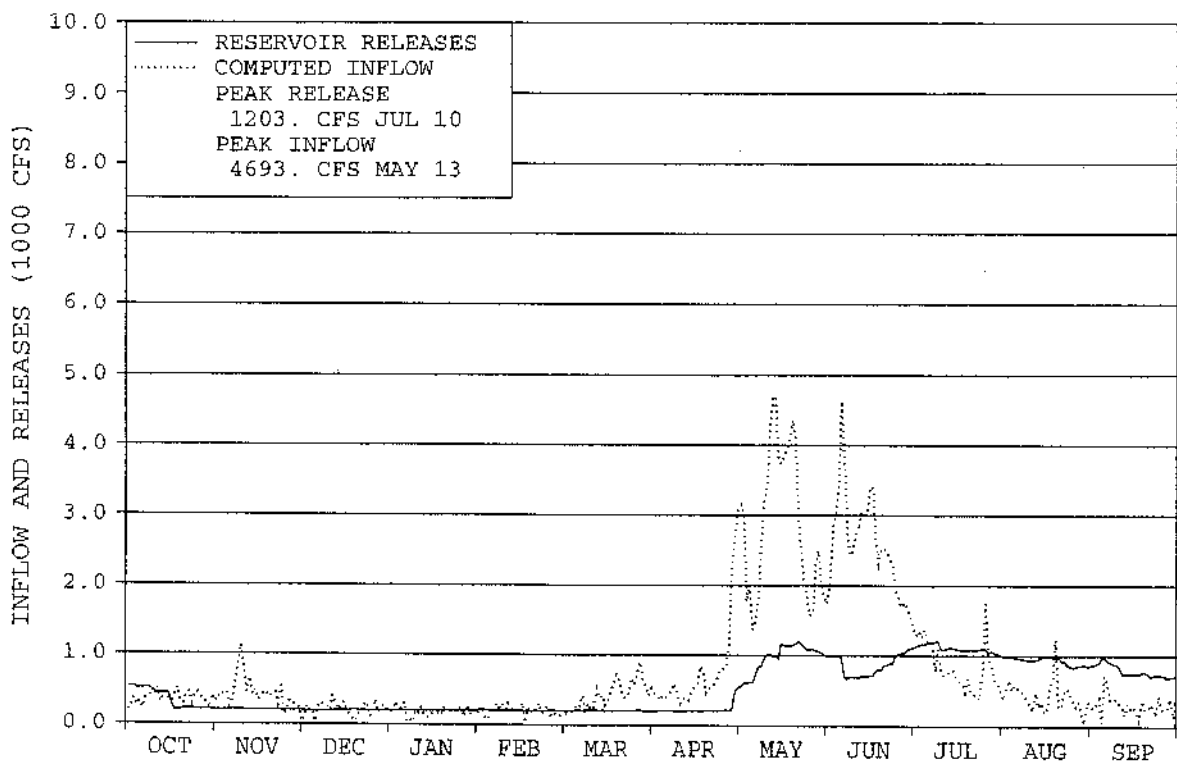
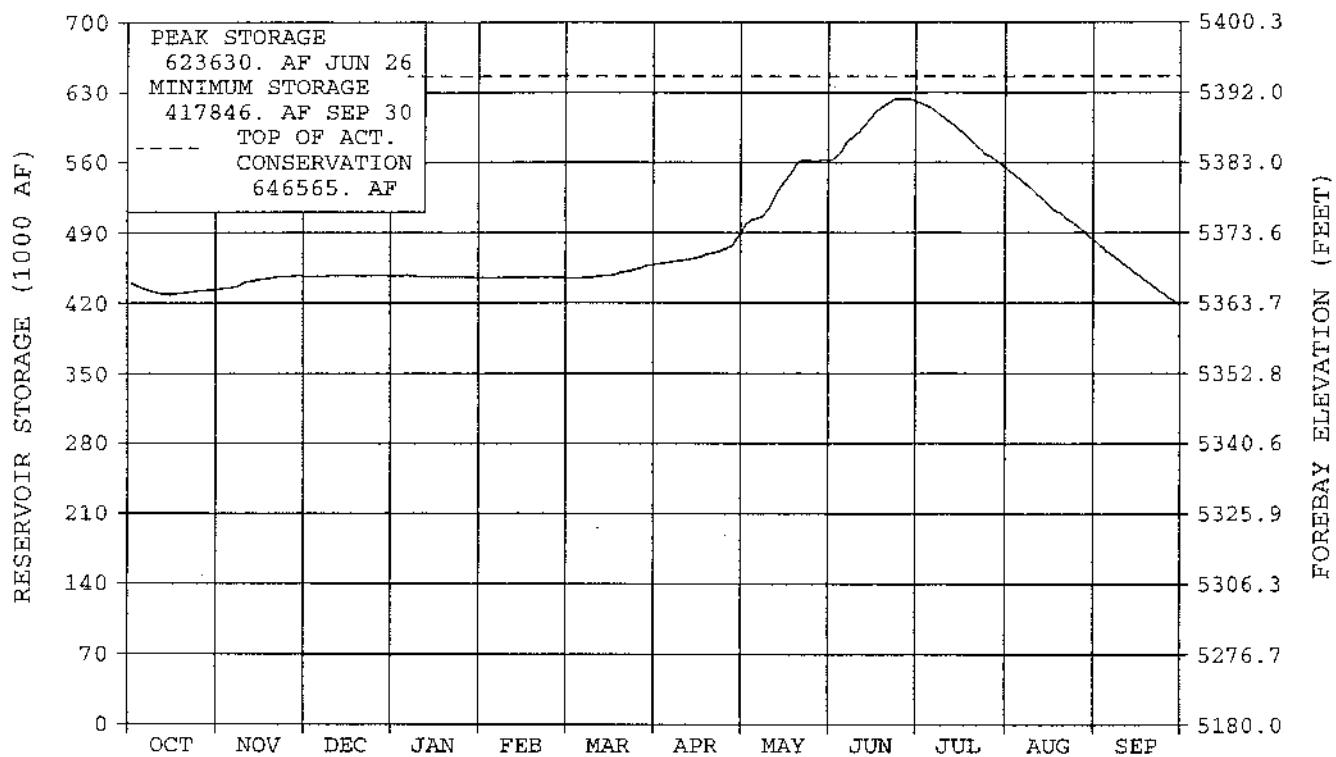
\*Daily peak and minimum are releases to the river

MONTH	INFLOW		OUTFLOW		CONTENT		
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*	
OCTOBER	21.6	89	29.2	82	433.5	105	
NOVEMBER	25.4	124	12.2	65	446.7	108	
DECEMBER	12.8	81	12.4	66	447.2	108	
JANUARY	10.7	72	12.5	70	445.3	108	
FEBRUARY	11.2	85	11.4	70	445.1	109	
MARCH	25.4	135	12.8	61	457.7	114	
APRIL	40.9	99	13.0	24	485.6	128	
MAY	177.1	115	100.2	94	562.5	132	
JUNE	154.9	54	95.3	57	622.1	111	
JULY	53.6	34	120.6	70	555.1	99	
AUGUST	25.8	57	98.4	90	482.5	97	
SEPTEMBER	17.8	68	82.5	106	417.8	96	
ANNUAL	577.2	70	600.5	74			
		APRIL - JULY INFLOW (AF)					
		ACTUAL	AVERAGE				
		426,546	640,100				

\* Average for inflow and outflow is the 1977-2006 period. Because of the enlargement of Buffalo Bill Reservoir in 1992, the period of record on which average content is based is 1993-2006.

FIGURE WYG5

BUFFALO BILL RESERVOIR



WATER YEAR 2007

**Table WYT9**

**WATER YEAR 2007 ACTUAL OUTAGES FOR WYOMING  
POWERPLANTS**

<u>Facilities</u>	<u>Description of Work</u>	<u>Outage Dates</u>
<b><u>BOYSEN</u></b>		
Unit 1	Wicket Gate Adjustment	11/06/06 - 11/09/06
Unit 1	Annual Maintenance	11/13/06 - 12/14/06
Unit 2	Annual Maintenance / Replace Air Coolers	01/11/07 - 05/02/07
<b><u>PILOT BUTTE</u></b>		
Unit 1	Annual Maintenance	12/11/06 - 01/04/07
Unit 1	K4 Switching	03/26/07 - 03/27/07
Unit 2	Annual Maintenance	12/11/06 - 01/04/07
Unit 2	Bad Stator Test	03/15/07 - 04/02/07
Unit 2	Governor Gear Chain	05/14/07 - 05/30/07
<b><u>BUFFALO BILL</u></b>		
Buffalo Bill Powerplant		
Unit 1	Annual Maintenance	11/13/06 - 12/18/06
Unit 1	BBP-118 Maintenance	01/16/07 - 01/31/07
Unit 1	Breaker Maintenance / Repair	02/12/07 - 06/05/07
Unit 2	No Unit Breaker / Annual Maintenance	12/13/06 - 01/18/07
Unit 3	Annual Maintenance / Breaker Maintenance	01/22/07 - 02/12/07
Shoshone Powerplant		
Unit 3	Annual Maintenance / Ball Stud Reinstall	02/12/07 - 02/23/07
Heart Mountain Powerplant		
Unit 1	KZ1A Maintenance	11/06/06 - 11/09/06
Unit 1	Tri-ennial Maintenance	03/05/07 - 03/29/07
Unit 1	Points Check	04/02/07 - 04/05/07

Unit 1	Turbine Bearing Oil Leak	06/09/07 - 06/12/07
Spirit Mountain Powerplant		
Unit 1	Annual Maintenance & Conduit Inspection	10/16/06 - 11/02/06

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

### **Bull Lake Reservoir**

During water year 2006, Midvale and Reclamation entered into an agreement whereby Reclamation could store Boysen water in Bull Lake under any combination of four conditions set forth in the agreement. The Boysen water stored in Bull Lake allows Bull Lake to be maintained at a higher content and also provides a flow of 20 to 25 cfs in Bull Lake Creek below the dam as the Boysen water is released from Bull Lake through the winter months. On October 2, 2006, when Midvale began transferring the Boysen water held in Bull Lake back to Boysen, Bull Lake Reservoir held 51,258 AF of water. Of the 51,258 AF held in Bull Lake, 20,000 AF was Boysen water in Bull Lake. Inflow to Bull Lake was slightly greater than the release and the reservoir slowly rose through the winter. Inflow began to increase in late March as snowmelt runoff began. During the April-July period the inflow was 74 percent of average and the reservoir reached a maximum elevation of 5785.77 feet on June 28th. As inflows receded and irrigation demands increased, the reservoir fell to a minimum elevation of 5764.31 feet on September 16, or a range of 21.46 feet of fluctuation from maximum to minimum elevation. At the end of water year 2007, the content of Bull Lake was 47,673 AF, with 19,811 AF of the total being Boysen storage water in Bull Lake. This water will be transferred back to Boysen during the winter months of water year 2008 to provide a winter flow in Bull Lake Creek.

### **Boysen Reservoir**

Boysen Reservoir storage at the beginning of water year 2007 was 80 percent of average and 60 percent of capacity. Following the 2006 irrigation season, the release from Boysen Dam was set at approximately 500 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. April inflow almost matched the outflow during the month and the reservoir level remained fairly stable, with the reservoir level on April 30 only 0.10 feet lower than it was on March 31. The reservoir level fell another 0.03 feet during the first days of May before it began to fill and ended the month 1.49 feet higher than at the end of April. The reservoir level was at 4709.44 feet going into the Memorial Day weekend, which was 4.24 feet lower than at the beginning of the holiday weekend in 2006.

### **Buffalo Bill Reservoir**

Following the 2006 irrigation season the release from Buffalo Bill Reservoir was set at approximately 200 cfs, based on winter release criteria contained in the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement. A winter release of 100 cfs, 150 cfs, 200 cfs, or 350 cfs will be provided below Buffalo Bill Powerplant based on the total inflow to Buffalo Bill Reservoir during the previous water year and the amount of storage in the reservoir and in the State account on September 30th. A release of 100 cfs will be maintained in the river below the dam at all times.

Reclamation continues to support the 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 periods from October 1, 2006, through April 18, 2007, and September 7, 2007, through September 30, 2007, 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 5393.61 feet occurred on June 7, 2007, and the minimum elevation of 5388.95 feet occurred on March 27, 2007. At the maximum elevation, the pool behind the South Fork Dike covered 207 surface acres. On September 30, 2007, when the water surface elevation of Buffalo Bill Reservoir was at its low for the year of 5362.74 feet, the water surface elevation of the pool behind the North Fork Dike was approximately the same as the main reservoir and the water surface elevation of the pool behind the South Fork Dike was 5392.48 feet. At the minimum reported elevation of Buffalo Bill Reservoir, 189 more acres of land would have been exposed without the ability to store water behind the South Fork Dike.

The number of stoplogs at the outlet control structure on the South Fork Dike has been set 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 2007, 10,595 AF of water was pumped from Diamond Creek Reservoir into Buffalo Bill Reservoir.

Reservoir levels during all of water year 2007 were adequate for recreational activities on Buffalo Bill Reservoir.

## WEATHER SUMMARY FOR NORTH AND SOUTH DAKOTA

October precipitation was above normal at Jamestown Reservoir, and was below to much below normal at the remaining reservoirs.

November precipitation was normal to much above normal at Belle Fourche, Keyhole, and Pactola reservoirs, and below to much below normal at the remaining reservoirs.

December precipitation was much above normal at Jamestown Reservoir and was below to much below normal at the remaining reservoirs.

January precipitation was slightly above normal at Keyhole and below to much below normal at the remaining reservoirs.

February precipitation was below normal to much below normal at Dickinson, Angostura and Deerfield reservoirs, normal at Jamestown Reservoir, and above to much above at the remaining reservoirs.

March precipitation was below normal at Deerfield, and above normal to much above normal at the remaining reservoirs.

April precipitation was near normal at Angostura Reservoir, much below normal at Dickinson Reservoir, and below normal at the remaining reservoirs.

May precipitation was below normal at Angostura and Deerfield reservoirs, near normal at Pactola reservoir, and above normal to much above normal at the remaining reservoirs.

June precipitation was above normal at Shadehill and Jamestown reservoirs, near normal at Belle Fourche and Heart Butte reservoirs, and much below normal to below normal at the remaining reservoirs.

July precipitation was much above normal at Dickinson Reservoir, much below normal at Heart Butte and Jamestown reservoirs, and below normal at all remaining reservoirs.

August precipitation was much below normal at Jamestown Reservoir, normal at Dickinson Reservoir, and above normal to much above normal at all remaining reservoirs.

September precipitation was slightly above normal at Angostura, Heart Butte, Jamestown reservoirs and below normal 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**  
**Total Annual Precipitation for Reclamation Reservoirs**  
**in North Dakota, South Dakota, and Northeastern Wyoming in Inches**

Reservoir	2007 Total	Average Total	Percent
Angostura 1/	46.59	64.49	72
Belle Fourche 2/	64.54	69.30	93
Deerfield	12.20	21.53	57
Keyhole 3/	31.37	32.16	98
Pactola	15.92	21.10	75
Shadehill 4/	32.68	32.61	100
Dickinson	17.22	16.35	105
Heart Butte	18.65	15.75	118
Jamestown	19.72	18.49	107

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 Dillinger, WY and Sundance, WY climate stations.

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, 2006, and September 30, 2007, at reservoirs in North and South 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, 2006	Storage September 30, 2007	Change in Storage
Angostura	43,815	48,933	5,118
Belle Fourche	29,002	61,406	32,404
Deerfield	12,028	12,483	455
Keyhole	54,170	58,803	4,633
Pactola	32,296	28,478	-3,818
Shadehill	81,099	69,637	-11,462
Dickinson	4,897	5,733	836
Heart Butte	49,032	52,910	3,878
Jamestown	28,133	29,217	1,084

FLOOD BENEFITS FOR RESERVOIRS IN NORTH AND  
SOUTH DAKOTA AND NORTHEASTERN WYOMING

Several Bureau of Reclamation reservoirs in northeastern Wyoming, South Dakota, and North Dakota provided flood relief during Water Year (WY) 2007. They are: Heart Butte on the Heart River near Glen Ullin, North Dakota; Shadehill on the Grand River near Shadehill, 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.

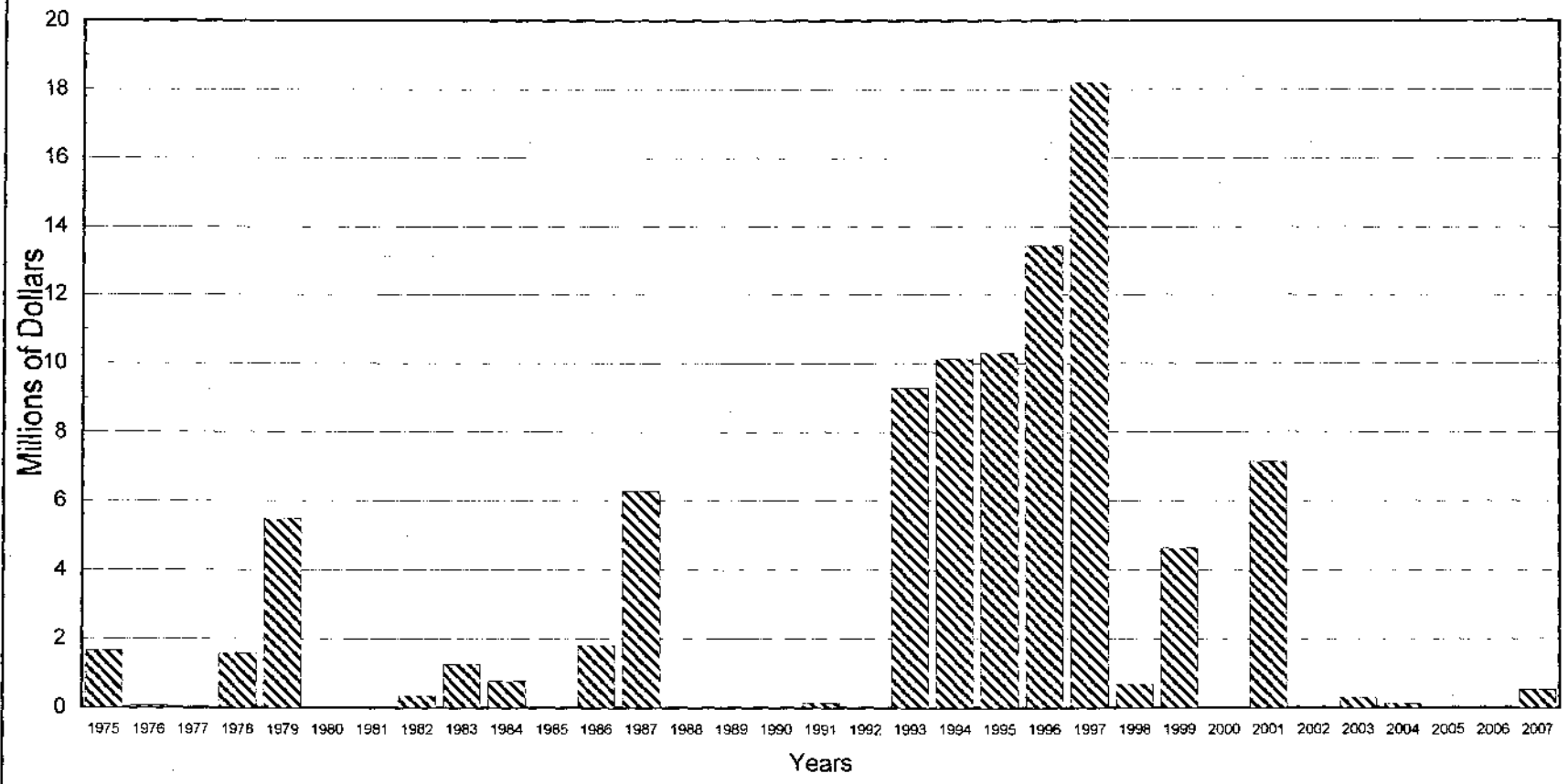
The information on the distribution of flood damages prevented is provided by the Corps of Engineers. The distributions of flood damages prevented for each reservoir are as follows:

FLOOD DAMAGE PREVENTED IN 2007  
ACCUMULATED TOTAL 1950-2007

	Local	Main-Stem	2007 Total	Previous Accumulations	1950-2007 Accum Totals
Heart Butte	<u>\$0</u>	\$144,700	\$144,700	\$13,305,600	\$13,450,300
Shadehill	\$0	\$145,600	\$145,600	\$9,032,600	\$9,178,200
Angostura	\$0	\$0	\$0	\$21,100	\$21,100
Pactola	<u>\$0</u>	\$71,100	\$71,100	\$3,116,500	\$3,187,600
Keyhole	<u>\$0</u>	\$166,900	\$166,900	\$3,762,700	\$3,929,600
Jamestown	\$0	<u>\$0</u>	<u>\$0</u>	\$86,807,300	\$86,807,300
Total	\$0	\$597,700	\$597,700	\$116,045,800	\$116,643,500

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

FIGURE DKG1  
**FLOOD DAMAGES PREVENTED**  
By Dakota Area Projects Between Garrison and Gavins Point Dams



# **UNIT OPERATIONAL SUMMERIES FOR WATER YEAR 2007**

## **DICKINSON RESERVOIR**

### **BACKGROUND**

Dickinson Dam and 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 2007 OPERATIONS SUMMARY**

Dickinson Reservoir started WY 2007 at elevation 2416.28 and storage of 4,897 acre-feet, which is 3.72 feet, and 3,715 acre-feet below the top of the conservation pool (elevation 2420.00 and storage 8,612 ac-ft). Dickinson Reservoir peaked at elevation 2418.98 on June 15th with 7,450 acre-feet of storage. Water was released through the river bypass valve to lower the reservoir elevation to facilitate coating of the Bascule gate. The reservoir elevation on September 30, 2007 was 2417.25 with storage of 5,733 acre-feet, which is 2.75 feet, and 2,879 acre-feet below the top of conservation pool.

The maximum discharge of 100 cfs occurred on August 16th for the Annual Dam Inspection; otherwise the 'maximum discharge was 30 cfs on July 10th and 11 th. Reservoir net inflows for water year 2007 totaled 1,326 acre-feet, 7 percent of average. Precipitation for the water year totaled 17.22 inches, which is 105 percent of average.

Irrigation releases began on July 10th and continued until August 16th•

An Emergency Management/Security orientation was conducted on September 6, 2007

The Annual Facility Review was done on August 16th by personnel from the Dakotas Area Office.

### **MONTHLY STATISTICS FOR WY 2007**

Record and near record monthly inflows in 56 years of record keeping were recorded in the following months: November has its 12th lowest inflow, December had its 9th lowest inflow, January had its 10th lowest inflow, and July had its 5th lowest inflow.

No record or near record monthly end of month content in 56 years of record keeping were recorded at Dickinson Reservoir

Additional statistical information on Dickinson Reservoir and its operations during 2007 can be found on Table DKT3 and Figure DKG2.

TABLE DKT3  
HYDROLOGIC DATA FOR 2007  
DICKINSON RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE	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			

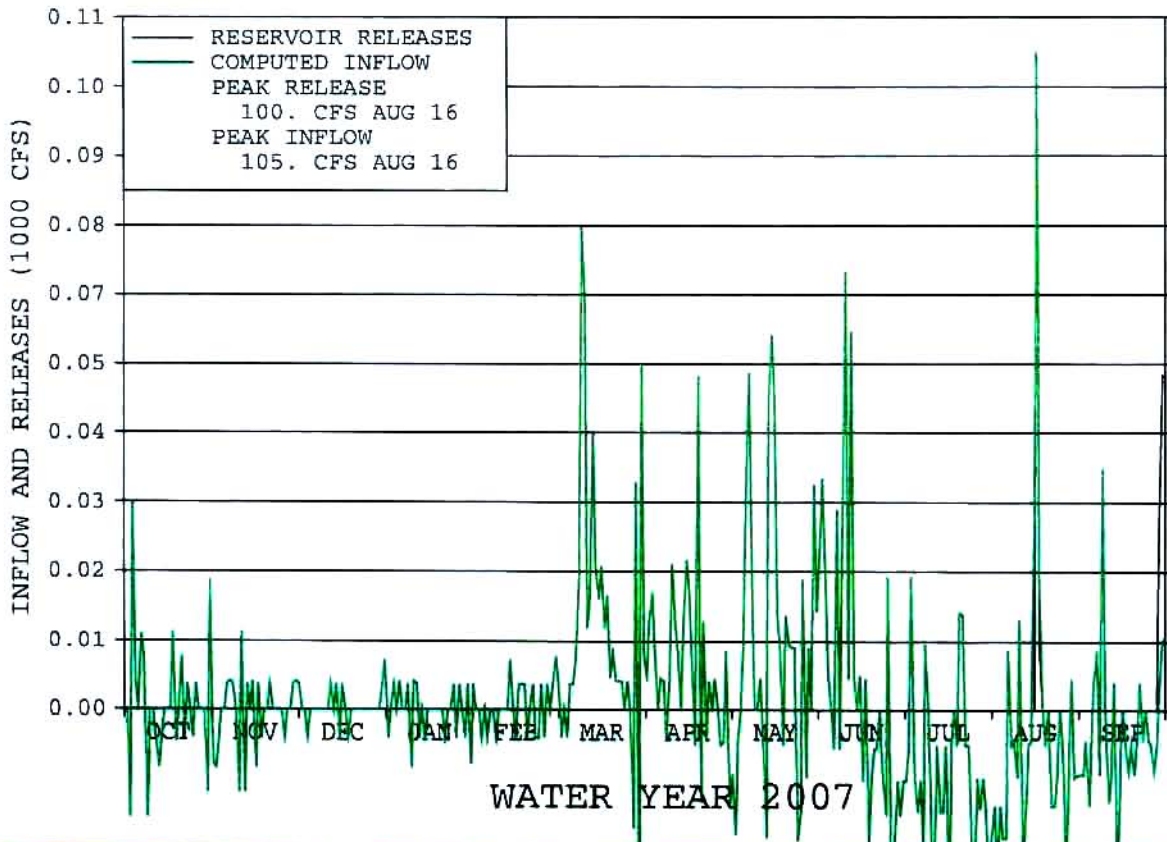
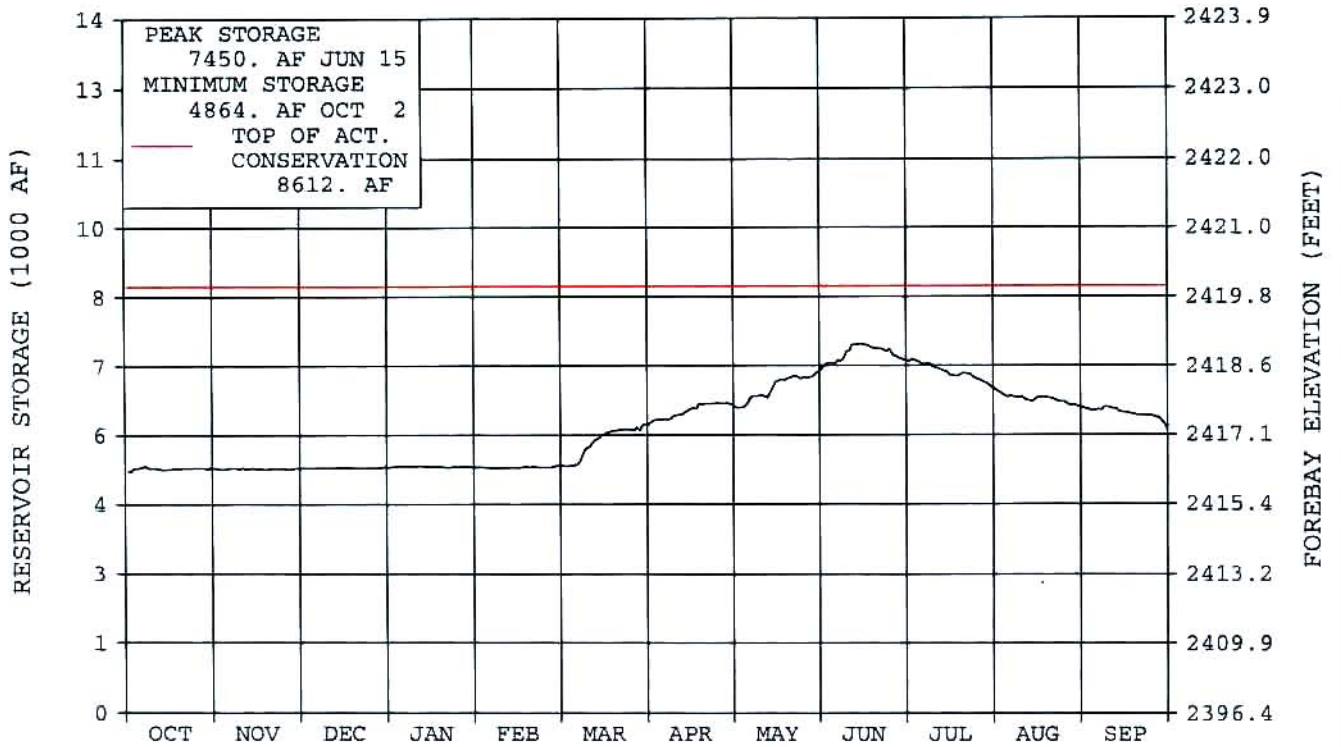
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,416.28	4,897	OCT 01, 2006
END OF YEAR	2,417.25	5,733	SEP 30, 2007
ANNUAL LOW	2,416.24	4,864	OCT 02, 2006
ANNUAL HIGH	2,419.88	7,450	JUNE 15, 2007
HISTORIC HIGH	2,422.19	**9,348	MAR 21, 1997

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	1,327	OCT 06-SEP 07	491	AUG07-SEP07
DAILY PEAK (CFS)	104	AUG 16, 2007	100	AUG 16, 2007
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	49	19	0	NA	4,946	89
NOVEMBER	0	0	0	NA	4,946	90
DECEMBER	16	13	0	NA	4,962	91
JANUARY	0	0	0	NA	4,962	90
FEBRUARY	25	2	0	NA	4,987	85
MARCH	837	12	0	NA	5,824	85
APRIL	403	10	0	NA	6,227	89
MAY	654	29	0	NA	6,881	99
JUNE	249	10	0	NA	7,130	102
JULY	-572	NA	0	NA	6,558	101
AUGUST	-179	NA	0	30	6,160	102
SEPTEMBER	-156	N	219	81	5,733	100
			271			
ANNUAL	1,327	7	491	3		
APRIL-JULY	734	7				

\* Frequently observed during fall and winter months.

FIGURE DKG2  
E. A. PATTERSON LAKE





# HEART BUTTE RESERVOIR

## 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. Heart Butte Reservoir 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 2007 OPERATIONS SUMMARY

Heart Butte Reservoir started WY 2007 at elevation 2058.56 and storage of 49,088 acre-feet, which is 5.94 feet, and 18,054 acre-feet below the top of conservation pool (elevation 2064.50 and storage 67,142 ac-ft). Heart Butte Reservoir peaked at elevation 2062.72 on June 17th with 61,407 acre-feet of storage. The reservoir elevation on September 30, 2007 was 2059.91 with storage of 52,910 acre-feet, which is 4.59 feet and 14,232 acre-feet below the top of conservation pool.

The maximum discharge of 70 cfs occurred from July 25th to August 7th. Reservoir net inflows for water year 2007 totaled 11,179 acre-feet, 13 percent of average. Precipitation for the water year totaled 18.65 inches, which is 118 percent of average.

## MONTHLY STATISTICS FOR WY 2007

Record and near record monthly inflows in 58 years of record keeping were recorded in the following months:

November had its 9th lowest inflow, April had its 6th lowest inflow, July had its 7th lowest inflow, July had its 2nd lowest inflow, and September has its 12th lowest inflow.

Record and near record monthly end of month content in 58 years of record keeping were recorded in the following months:

October had its 7th lowest EOM, November had its 8th lowest EOM, December had its 7th lowest EOM, January had its 8th lowest EOM, February had its 9th lowest EOM, March had its 10th lowest EOM, April had its 6th lowest EOM, May had its 9th lowest EOM, June had its 7th lowest EOM, July had its 8th lowest EOM, August had its 7th lowest EOM, and September had its 10th lowest EOM.

Additional statistical information on Heart Butte Reservoir and its operations during 2007 can be found on Table DKT4 and Figure DKG3.

TABLE DKT4  
HYDROLOGIC DATA FOR 2007  
HEART BUTTE RESERVOIR

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

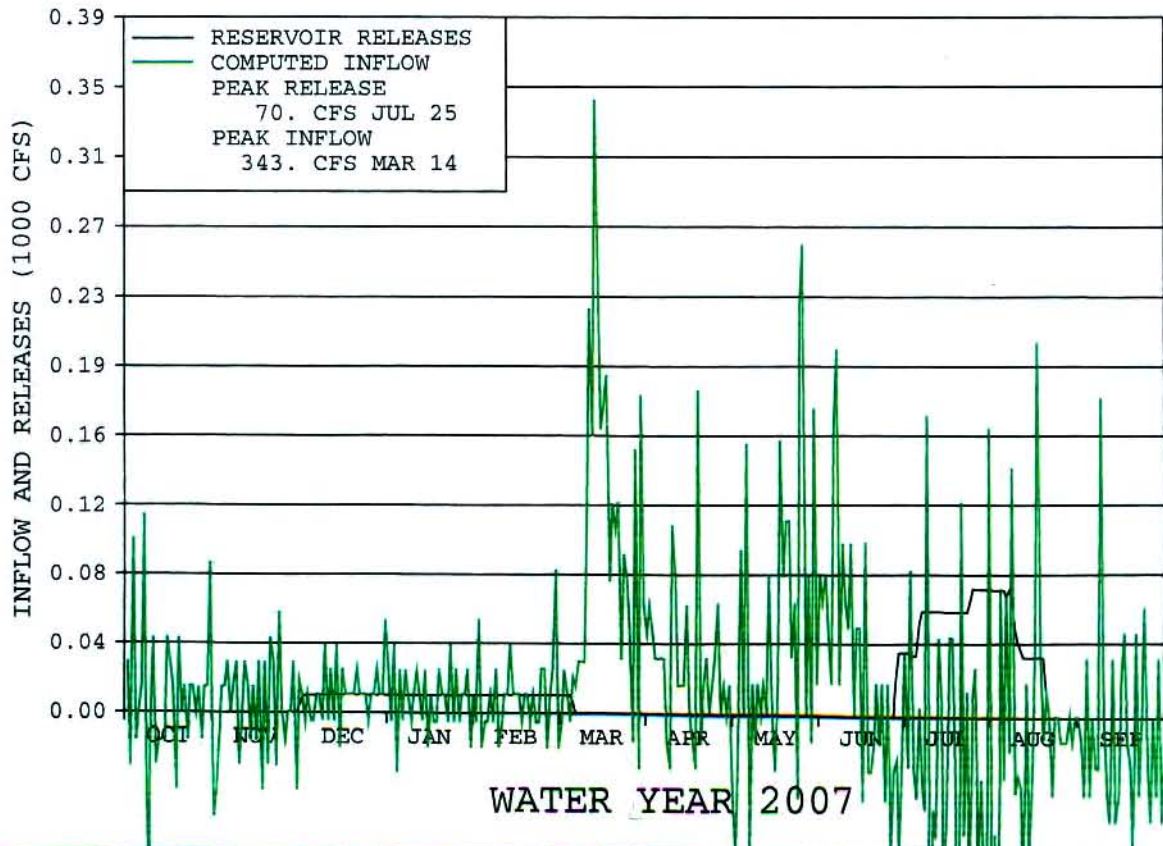
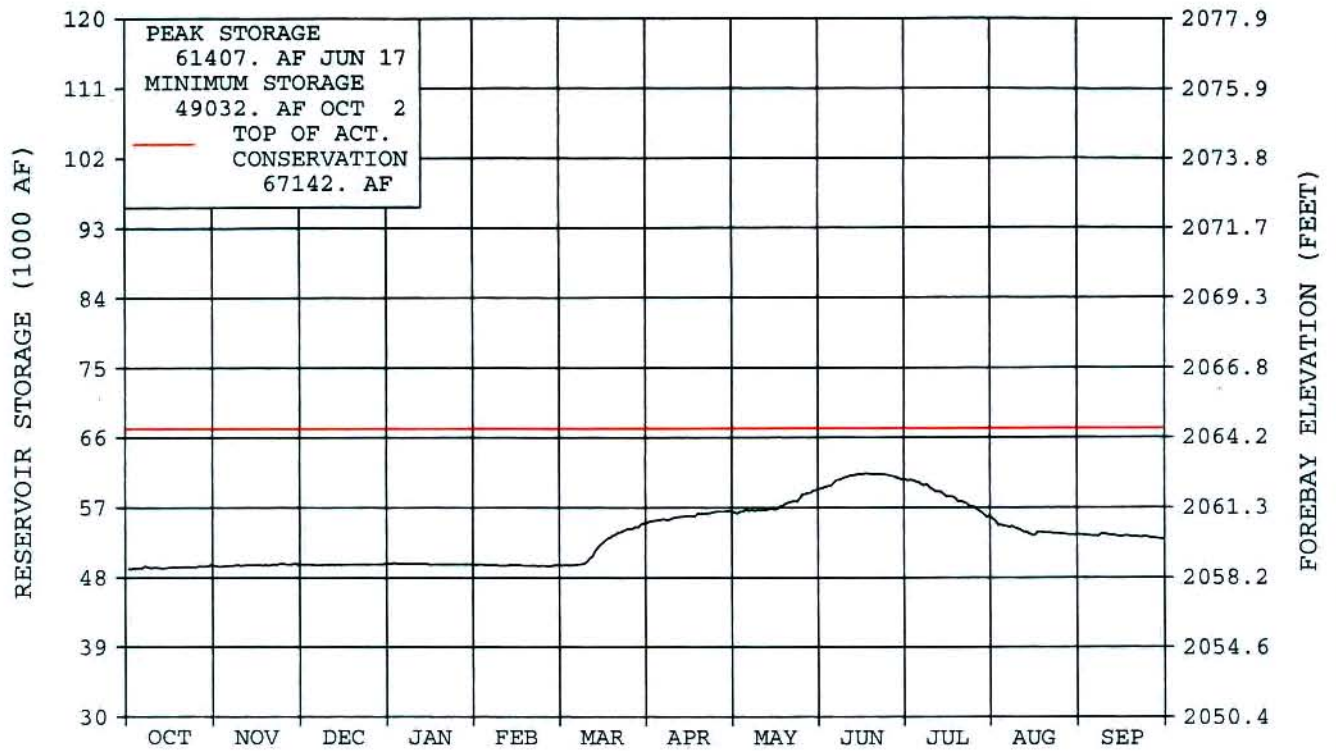
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,058.56	49,088	OCT 01, 2006
END OF YEAR	2,059.91	52,910	SEP 30, 2007
ANNUAL LOW	2,058.54	49,032	OCT 02, 2006
ANNUAL HIGH	2,062.72	61,407	JUNE 17, 2007
HISTORIC HIGH	2,086.23	173,203	APR 09, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	11,179	OCT 06-SEP 07	7,301	OCT 06-SEP 07
DAILY PEAK (CFS)	343	MAR 14, 2007	70	JUL 25, 2007
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	471	48	0	NA	49,503	84
NOVEMBER	230	19	7	0	49,726	85
DECEMBER	678	84	595	46	49,809	86
JANUARY	429	48	596	52	49,642	86
FEBRUARY	538	15	538	28	49,642	84
MARCH	5,399	19	107	1	54,934	78
APRIL	1,611	7	0	NA	56,545	80
MAY	2,682	28	0	NA	59,227	85
JUNE	1,545	15	180	2	60,592	86
JULY	-1,206	NA	3,441	42	55,945	84
AUGUST	-586	NA	1,837	35	53,522	85
SEPTEMBER	-612	NA	0	NA	52,920	88
ANNUAL	11,179	13	7,301	9		
APRIL-JULY	4,632	10	10			

\* Frequently observed during fall and winter months.

FIGURE DKG3  
LAKE TSCHIDA



# 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.

## WATER YEAR 2007 OPERATIONS SUMMARY

Jamestown Reservoir started WY 2007 at elevation 1429.41 and storage of 28,112 acre-feet, which is 1.41 feet, and 2,755 acre-feet above the top of the conservation pool (elevation 1428.00 and storage 25,357 ac-ft). Jamestown Reservoir peaked at elevation 1432.62 on June 22nd with 35,416 acre-feet of storage. The reservoir elevation on September 30, 2007 was 1429.95 with storage of 29,217 acre-feet, which is 1.95 feet, and 3,860 acre-feet above the top of active conservation pool.

The maximum discharge of 104 cfs occurred on June 20th• Reservoir net inflows for water year 2007 totaled 32,008 acre-feet, 75 percent of average. Precipitation for the water year totaled 19.72 inches at 107 percent of average.

All project irrigation demands were met from flood control releases. There were no storage releases for irrigation needed during water year 2007.

An Emergency Management/Security orientation was conducted on September 20, 2007.

The Annual Facility Review was done on August 7th by personnel from the Dakotas Area Office.

## MONTHLY STATISTICS FOR WY 2007

Record and near record monthly inflows in 54 years of record keeping were recorded in the following months:

March had its 11th highest inflow, June had its 5th highest inflow; August had its 11th highest inflow, and September had its 9th highest inflow.

Record and near record monthly end of month content in 54 years of record keeping were recorded in the following months:

March had its 10th highest end of month.

Additional statistical information on Jamestown Reservoir and its operations during 2007 can be found on Table DKT5 and Figure DKG4.

TABLE DKT5  
HYDROLOGIC DATA FOR 2007  
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

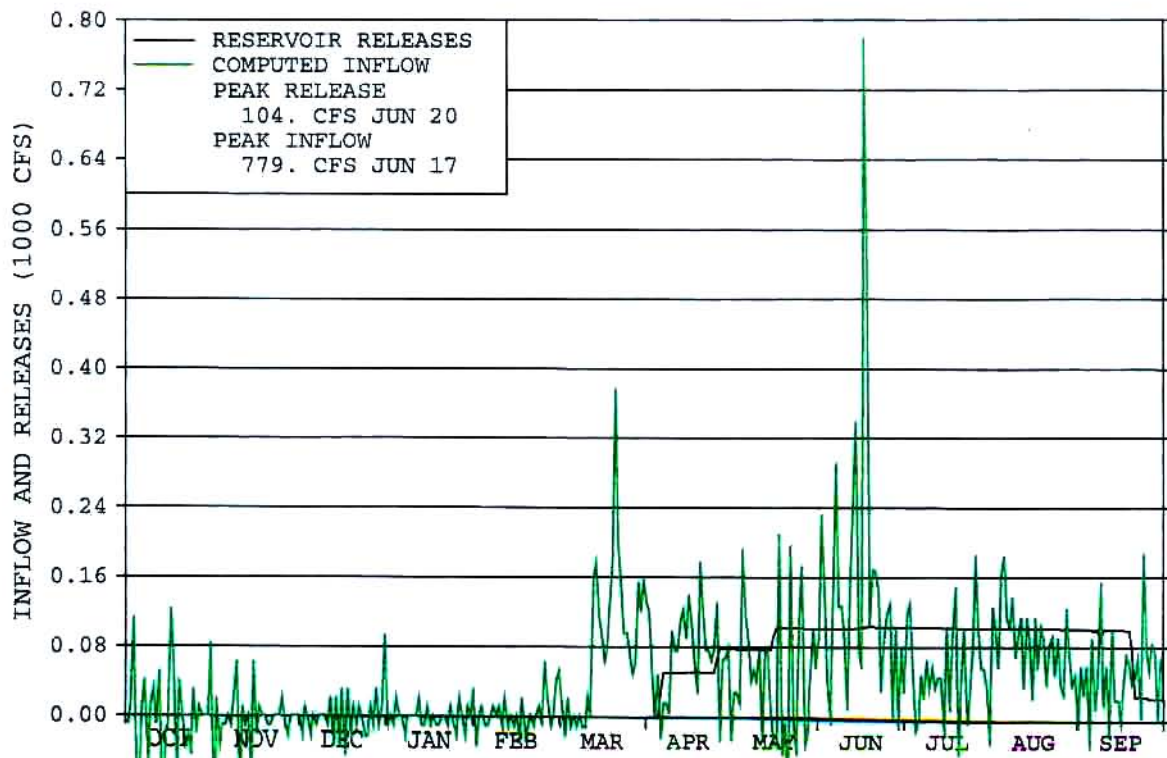
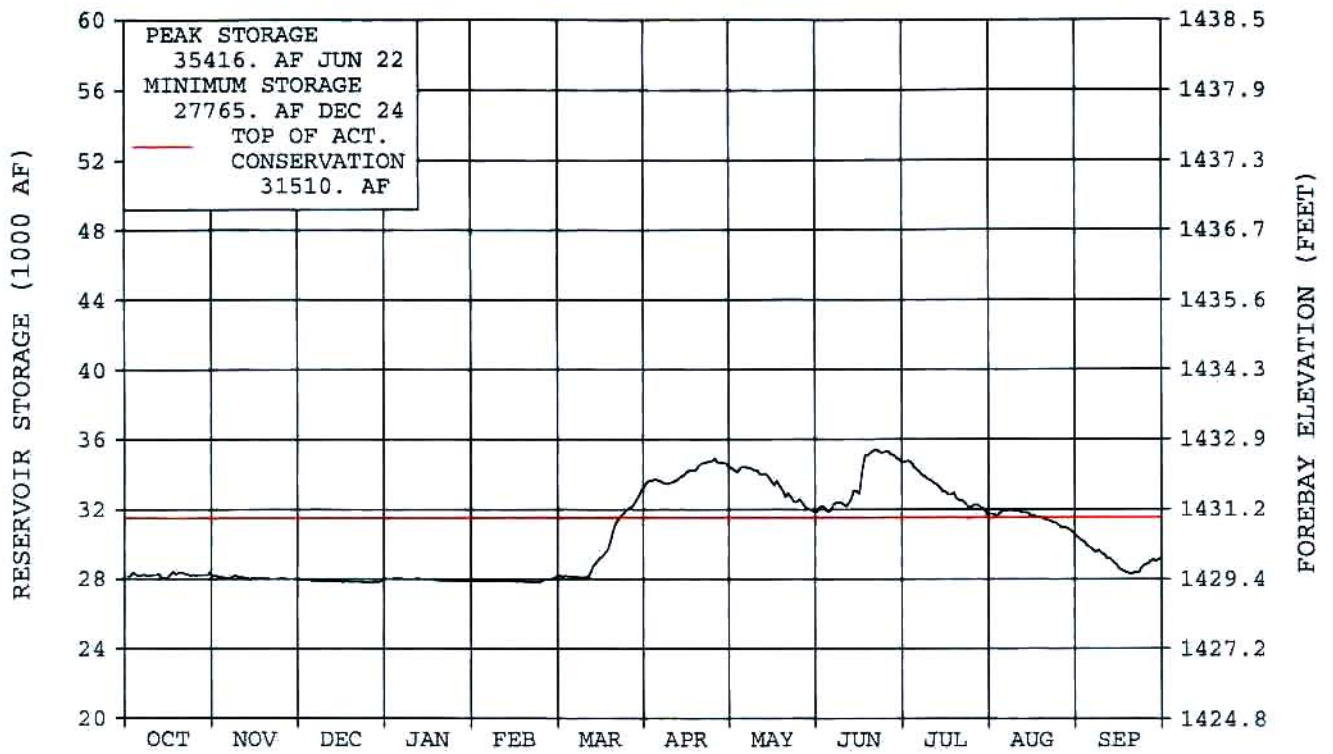
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	1,429.41	28,112	OCT 01, 2006
END OF YEAR	1,429.95	29,217	SEP 30, 2007
ANNUAL LOW	1,429.24	27,765	DEC 24, 2006
ANNUAL HIGH	1,432.62	35,416	JUNE 22, 2007
HISTORIC HIGH	1,445.91	126,067	MAY 05, 1997

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	32,009	OCT 06-SEP 07	30,924	OCT 06-SEP 07
DAILY PEAK (CFS)	779	JUN 17, 2007	104	JUN 20, 2007
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	0	0	0	NA	28,133	113
NOVEMBER	-164	NA	0	NA	27,969	114
DECEMBER	20	6	0	NA	27,989	114
JANUARY	-102	NA	0	NA	27,887	113
FEBRUARY	143	62	0	NA	28,030	113
MARCH	5,027	82	0	NA	33,057	109
APRIL	4,268	24	2,690	37	34,636	84
MAY	2,758	40	5,509	51	31,885	85
JUNE	9,037	320	6,085	86	34,837	105
JULY	3,108	104	6,271	125	31,674	101
AUGUST	4,974	190	6,212	139	30,436	103
SEPTEMBER	2,939	306	4,158	109	29,217	109
ANNUAL	32,009	75	30,924	72		
APRIL-JULY	19,171	62				

\* Frequently observed during fall and winter months.

FIGURE DKG4  
JAMESTOWN RESERVOIR



WATER YEAR 2007

## **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 1995-96 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 modified 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.

### **WY 2007 OPERATIONS SUMMARY**

Deerfield Reservoir started WY 2007 at elevation 5898.79 and storage of 12,028 acre feet, which is 9.21 feet and 3,627 acre-feet below the top of the conservation pool. Inflows for WY 2007 totaled 5,464 acre-feet (57% of the average). The peak reservoir elevation for WY 2007 was 5901.76 and storage of 13,142 acre-feet and occurred on June 22, 2007. The minimum elevation for WY 2007 was 5897.80 acre-feet and storage of 11,669 acre-feet and occurred on March 4th, 2007. WY 2007 ended at elevation 5900.02 and storage of 12,483 acre-feet, which is 7.98 feet and 3,172 acre-feet below the top of the conservation pool. Precipitation for the water year was 57% of average.

Rapid Valley Water Conservancy District ordered 3,491 acre feet of water from Deerfield for the 2007 irrigation season.

An Emergency Management Functional Exercise was conducted on June 2, 2007.



The Annual Facility Review was done on July 24, 2007 by personnel from the Rapid City Field Office.

Solicitation No. 0751603500 was issued May 1, 2007 to bid specification No. 60-00514, Coatings Repair of Deerfield Dam. The principal components of work to be performed included: 1) Coat the exterior and repair 150 square feet of damaged interior coating of the 39 inch steel discharge pipe. 2) Recoat the 4 inch and 6 inch steel by-pass pipes. The contract was awarded to Hartman-Walsh Painting Company of St.Louis, Missouri for the amount of \$215,522 with a completion date of June, 2008.

#### MONTHLY STATISTICS FOR WY 2007

October EOM elevation, at Deerfield Reservoir, was below average. October inflow was much below average. Release is 7 cfs. Deerfield finished the month 9.2 feet from full.

November EOM elevation, at Deerfield Reservoir, was below average. November inflow was much below average. Release is 7 cfs. Deerfield finished the month 9.6 feet from full.

December EOM elevation, at Deerfield Reservoir, was below average. December inflow was much below average. Release is 7 cfs. Deerfield finished the month 9.8 feet from full.

January EOM elevation, at Deerfield Reservoir, was below average. January inflow was much below average. Release is 7 cfs. Deerfield finished the month 10.0 feet from full.

February EOM elevation, at Deerfield Reservoir, was below average. February inflow was much below average. Release is 7 cfs. Deerfield finished the month 10.1 feet from full.

March EOM elevation, at Deerfield Reservoir, was below average. March inflow was above average. Release is 7 cfs. Deerfield finished the month 8.8 feet from full.

April EOM elevation, at Deerfield Reservoir, was below average. April inflow was 2nd lowest in 54 years of record. Release is 7 cfs. Deerfield finished the month 7.9 feet from full.

May EOM elevation, at Deerfield Reservoir, was below average. May inflow was much below average. Release is 6 cfs. Deerfield finished the month 6.8 feet from full.

June EOM elevation, at Deerfield Reservoir, was below average. June inflow was below average. Release is 8cfs. Deerfield finished the month 6.3 feet from full.

July EOM elevation, at Deerfield Reservoir, was below average. July inflow was 3rd lowest 54 years of record. Release is 8cfs. Deerfield finished the month 6.9 feet from full.

August EOM elevation, at Deerfield Reservoir, was slightly above average. August inflow was below average. Release is 8cfs. Deerfield finished the month 7.4 feet from full.

August EOM elevation, at Deerfield Reservoir, was slightly above average. August inflow was below average. Release is 8cfs. Deerfield finished the month 7.4 feet from full.

September EOM elevation, at Deerfield Reservoir, was above average. September inflow was much below average. Release is 8cfs. Deerfield finished the month 8.0 feet from full.

Additional statistical information on Deerfield Reservoir and its operations during 2007 can be found on Table DKT6 and Figure DKG5.

TABLE DKT6  
HYDROLOGIC DATA FOR 2007  
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	15,654	15,503
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

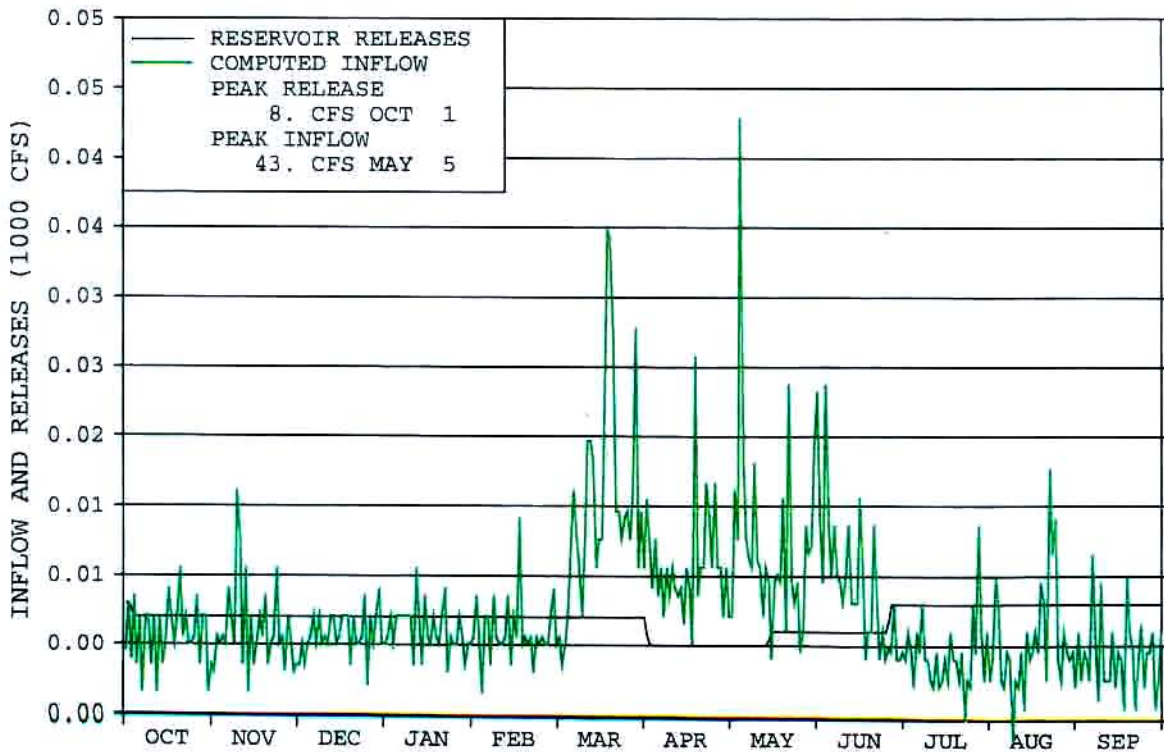
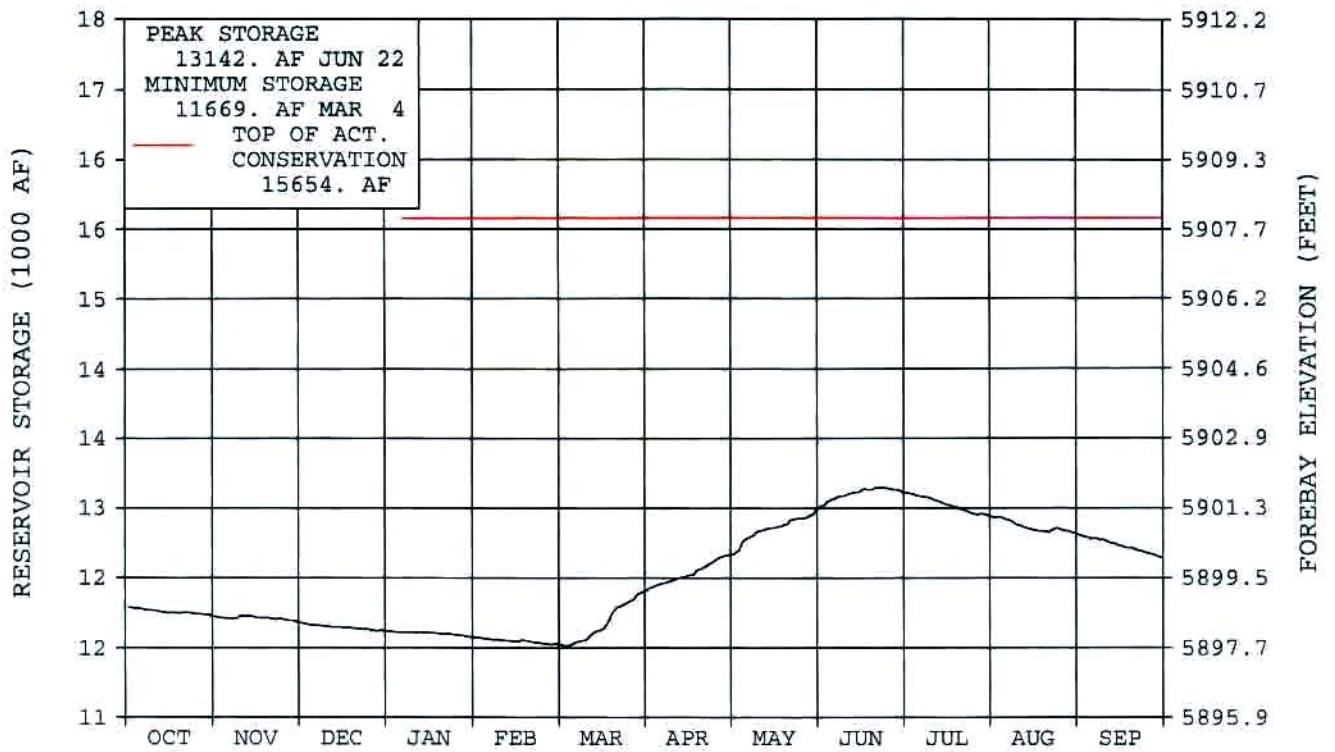
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5,898.79	12,028	OCT 01, 2006
END OF YEAR	5,900.02	12,483	SEP 30, 2007
ANNUAL LOW	5,897.80	11,669	MAR 04, 2007
ANNUAL HIGH	5,901.76	13,142	JUNE 22, 2007
HISTORIC HIGH	5,909.05	16,157	FEB 25, 1985

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	5,464	OCT 06-SEP 07	5,009	OCT 06-SEP 07
DAILY PEAK (CFS)	43	MAY 05, 2007	8	OCT 01, 2006
DAILY MINIMUM (CFS)	0	*	6	APR 03, 2007

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	348	53	435	58	11,941	97
NOVEMBER	362	62	417	123	11,866	95
DECEMBER	350	56	430	145	11,806	92
JANUARY	369	60	430	145	11,745	89
FEBRUARY	331	58	389	127	11,687	87
MARCH	911	105	430	74	12,168	88
APRIL	644	55	303	29	12,509	90
MAY	747	56	340	27	12,916	93
JUNE	566	48	375	31	13,107	94
JULY	263	32	492	44	12,878	95
AUGUST	318	48	492	40	12,704	98
SEPTEMBER	255	43	476	40	12,483	100
ANNUAL	5,464	57	5,009	52		
APRIL-JULY	2,220	49				

\* Frequently observed during fall and winter months.

FIGURE DKG5  
DEERFIELD RESERVOIR



WATER YEAR 2007

# **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.

## **WY 2007 OPERATIONS SUMMARY**

Pactola Reservoir started WY 2007 at elevation 4546.97 and storage of 32,296 acre-feet, which is 23,676 acre-feet and 33.23 feet below the top of the conservation pool. Inflows for WY 2007 totaled 16,798 acre-feet (49% of the average). The peak reservoir elevation for WY 2007 was 4553.84 and storage of 36,486 acre-feet and occurred on June 17, 2007. The minimum elevation for WY 2007 was 4540.22-feet and storage of 28,478 acre-feet and occurred on September 30, 2007. WY 2007 ended at elevation 4540.22 and storage of 28,478 acre-feet, which is 39.98 feet and 27,494 acre-feet below the top of the conservation pool. Precipitation for the water year was 75% of average.

The City of Rapid City ordered 3,268 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 2007.

The operation of Pactola Reservoir provided minimal local and mainstream flood relief during WY 2007. 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 at 100 cfs on July 7.

An Emergency Management Functional Exercise was conducted on June 2, 2007.

The Annual Facility Review was done on August 16th, 2007 by personnel from the Rapid City Field Office.

A new long term storage contract was signed on July 31, 2007 between Reclamation and the city of Rapid City. The contract provides storage space of 49,000 acre-feet for the city and 6,000 acre-feet was retained by Reclamation.

#### MONTHLY STATISTICS FOR WY 2007

October EOM elevation and October inflow, at Pactola Reservoir, were much below average. Winter release set at 16cfs. Pactola ended the month 33.2 feet from full.

November EOM elevation, at Pactola Reservoir, was much below average. November inflow was below average. Winter release set at 16cfs. Pactola ended the month 33.3 feet from full.

December EOM elevation, at Pactola Reservoir, was below average. December inflow was below average. Winter release set at 16cfs. Pactola ended the month 33.6 feet from full.

January EOM elevation, at Pactola Reservoir, was much below average. January inflow was below average. Winter release set at 16 cfs. Pactola ended the month 33.7 feet from full.

February EOM elevation, at Pactola Reservoir, was below average. February inflow was below - average. Winter release set at 16 cfs. Pactola ended the month 33.7 feet from full.

March EOM elevation, at Pactola Reservoir, was much below average. March inflow was slightly below average. Winter release set at 16 cfs. Pactola ended the month 31.5 feet from full.

April EOM elevation, at Pactola Reservoir, was much below average. April inflow was much below average. Winter release set at 16 cfs. Pactola ended the month 29.9 feet from full.

May EOM elevation and May inflow, at Pactola Reservoir, were much below average. Began City/Irrigation releases on May 10th. Release is 25 cfs. Pactola ended the month 28.5 feet from full.

June EOM elevation, at Pactola Reservoir, was much below average. June inflow was below average. Release is 78 cfs. Pactola ended the month 28.3 feet from full.

July EOM elevation, at Pactola Reservoir, was much below average. July inflow was 5th lowest in 55 years of record. Release is 65 cfs. Pactola ended the month 35.3 feet from full.

August EOM elevation and August inflow, at Pactola Reservoir, were much below average. Release is 31 cfs. Pactola ended the month 38.7 feet from full.

September EOM elevation, at Pactola Reservoir, was much below average. September inflow was 4th lowest in 52 years of record. Release is 25 cfs. Pactola ended the month 40.0 feet from full.

Additional statistical information on Pactola Reservoir and its operations during 2007 can be found on Table DKT7 and Figure DKG6.

TABLE DKT7  
HYDROLOGIC DATA FOR 2007  
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	4,546.97	32,296	OCT 01, 2006
END OF YEAR	4,540.22	28,478	SEP 30, 2007
ANNUAL LOW	4,540.22	28,478	SEP 30, 2007
ANNUAL HIGH	4,553.84	36,486	JUN 17, 2007
HISTORIC HIGH	4,585.87	61,105	MAY 19, 1965

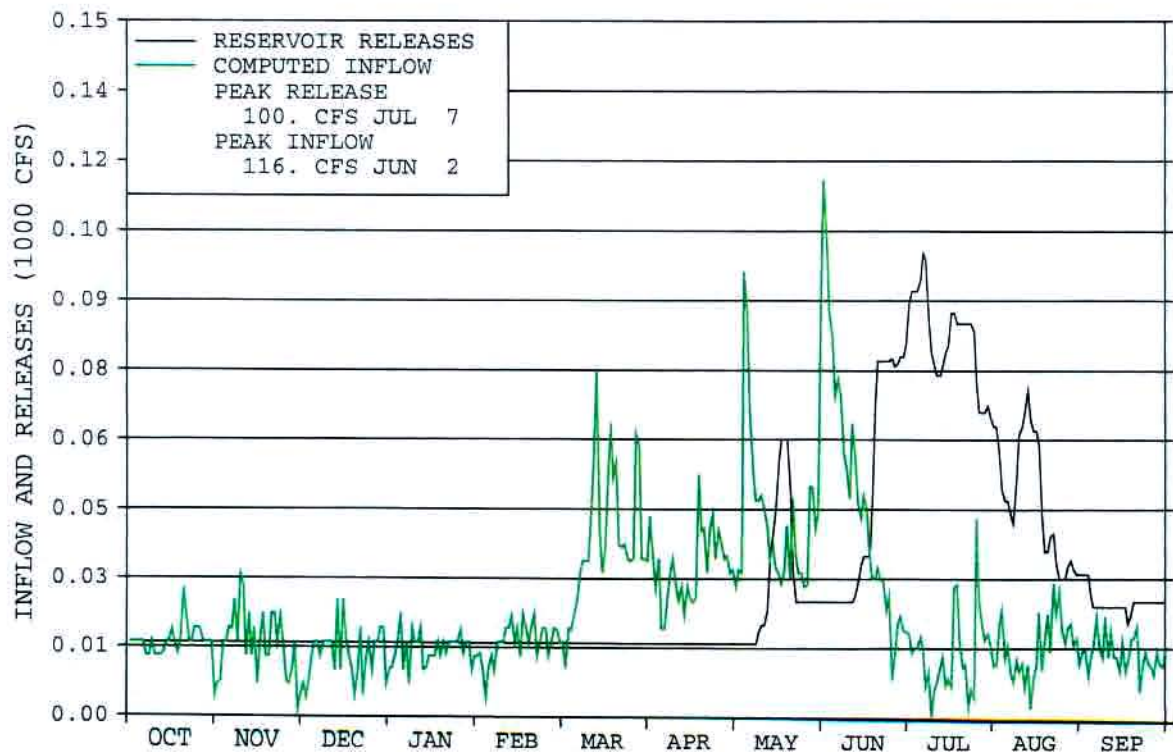
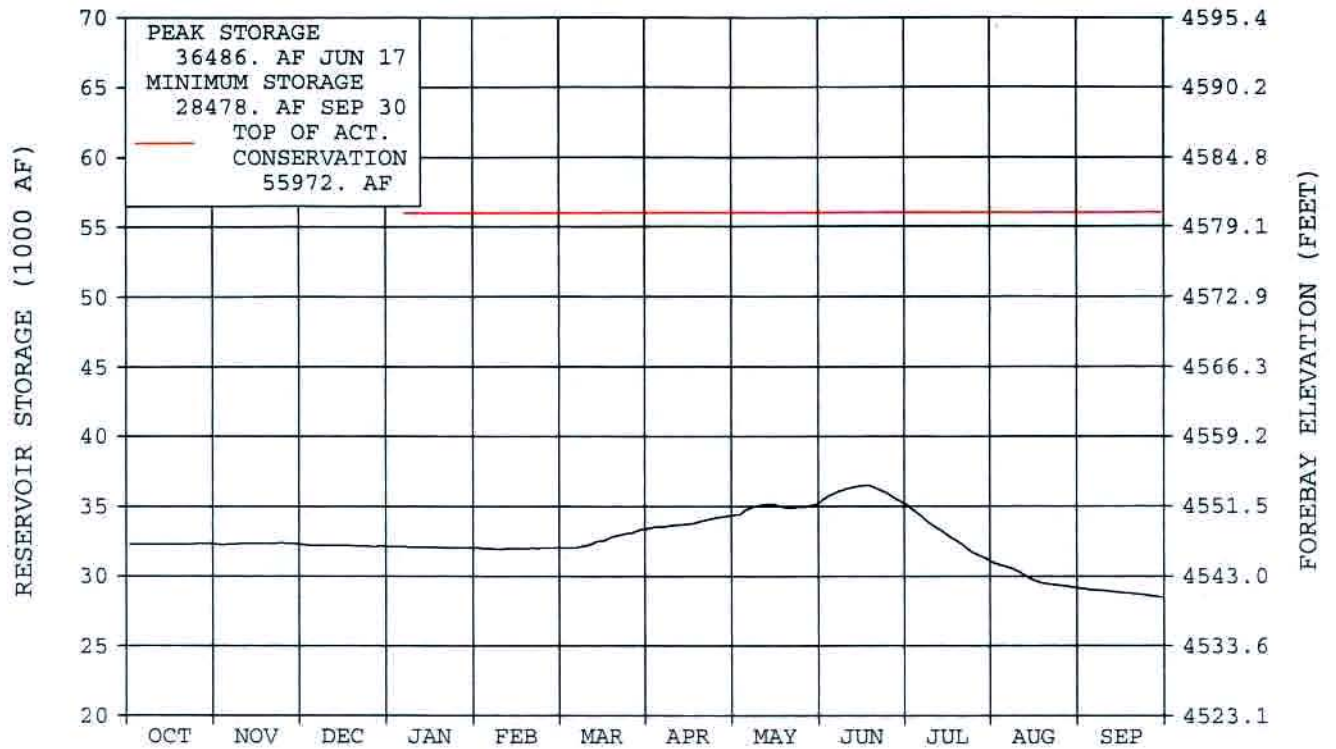
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	16,798	OCT 06-SEP 07	20,616	OCT 06-SEP 07
DAILY PEAK (CFS)	116	JUN 02, 2007	100	JUL 07, 2007
DAILY MINIMUM (CFS)	0	JULY 10, 2007	16	OCT 01, 2007

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	978	48	984	60	32,290	73
NOVEMBER	923	62	952	71	32,261	73
DECEMBER	819	65	984	72	32,096	72
JANUARY	885	68	984	75	31,997	72
FEBRUARY	889	67	889	75	31,997	72
MARCH	2,308	97	984	58	33,321	74
APRIL	1,922	46	952	34	34,291	74
MAY	2,586	41	1,757	33	35,120	74
JUNE	2,905	45	2,738	47	35,287	73
JULY	856	24	5,026	96	31,117	67
AUGUST	919	35	2,879	72	29,157	66
SEPTEMBER	809	37	1,488	57	28,478	65
ANNUAL	16,798	49	20,616	61		
APRIL-JULY	8,269	40				

\* Frequently observed during fall and winter months.



FIGURE DKG6  
PACTOLA RESERVOIR



WATER YEAR 2007

# 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 123,048 acre-feet with an additional surcharge capacity of 57,308 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 capacity 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.

## WY 2007 OPERATIONS SUMMARY

Angostura Reservoir started WY 2007 at elevation 3163.69 and storage of 43,815 acre-feet, which is 79,233 acre-feet and 23.51 feet below the top of the conservation pool. Inflows for WY 2007 totaled 14,156 acre-feet (18% of the average). Peak inflows occurred in May, totaling 3,197 acre-feet for the month. The peak reservoir elevation for WY 2007 was 3169.36 and storage of 58,286 acre-feet and occurred on May 20, 2007. The minimum elevation for WY 2007 was 3163.70-feet and storage of 43,839 acre-feet and occurred on October 1, 2006. WY 2007 ended at elevation 3165.80 and storage of 48,933 acre-feet, which is 21.40 feet and 74,115 acre-feet below the top of the conservation pool. Precipitation for the water year was 72% of average.

Water users were allocated 15% of their full allotments of project water. Releases for irrigation began May 21 and reached a peak of 158 cfs on June 1. The irrigation release was terminated on June 30, with 50,016 acre-feet in total storage and 7,811 acre-feet in active storage. Total irrigation releases were 8,863 acre-feet.

Reclamation's Sedimentation and River Hydraulics Group of the Technical Service Center in Denver conducted a sedimentation survey of Angostura Reservoir in 2004 and provided a survey report and new Area and Capacity Tables in August of 2005. The last survey was done in 1979. Angostura Reservoir accumulated 7,716 acre-feet of sediment since the last survey. Since construction in 1949,- Angostura has accumulated 36,867 acre-feet of sediment. **The** sedimentation rate from 1949 through 2004 has averaged 670 acre-feet per year. The new Area and Capacity Tables were used, beginning, in WY 2006 and all 2006 numbers reflect the change in capacity.

An Emergency Management Functional Exercise was conducted on September 25, 2007.

The Annual Facility Review was done on August 7, 2007 by personnel from the Rapid City Field Office.

#### MONTHLY STATISTICS FOR WATER YEAR 2007

October end-of-month (EOM) elevation, at Angostura Reservoir, was 3rd lowest in 55 years of record. October inflow was below average. Angostura ended the month 23.1 feet from full.

November end-of-month (EOM) elevation, at Angostura Reservoir, was 3rd lowest in 55 years of record. November inflow was below average. Angostura ended the month 22.6 feet from full.

December end-of-month (EOM) elevation, at Angostura Reservoir, was 3rd lowest in 55 years of record. December inflow was below average. Angostura ended the month 22.0 feet from full.

January end-of-month (EOM) elevation, at Angostura Reservoir, was 3rd lowest in 55 years of record. January inflow was below average. Angostura ended the month 21.3 feet from full.

February end-of-month (EOM) elevation, at Angostura Reservoir, was 2nd lowest in 55 years of record. February inflow was below average. Angostura ended the month 20.5 feet from full.

March end-of-month (EOM) elevation, at Angostura Reservoir, was 2nd lowest in 55 years of record. March inflow was 4th lowest in 55 years of record. Angostura ended the month 19.5 feet from full.

April end-of-month (EOM) elevation, at Angostura Reservoir, was 2nd lowest in 55 years of record. April inflow was much below average. Angostura ended the month 18.9 feet from full.

May end-of-month (EOM) elevation, at Angostura Reservoir, was 2nd lowest in 55 years of record. May inflow was below average. Began filling canal on May 21st. Angostura ended the month 18.7 feet from full.

June end-of-month (EOM) elevation, at Angostura Reservoir, was the lowest June EOM elevation in 55 years of record. Previous low was 3166.26 in 1961. June inflow was below average. Angostura ended the month 21.0 feet from full. Angostura ended their irrigation season on June 30th because of lack of water.

July end-of-month (EOM) elevation, at Angostura Reservoir, was 3rd lowest in 55 years of record. July inflow was much below average. Angostura ended the month 21.3 feet from full.

August end-of-month (EOM) elevation, at Angostura Reservoir, was 4th lowest in 55 years of record. August inflow was below average. Angostura ended the month 21.3 feet from full.

September end-of-month (EOM) elevation, at Angostura Reservoir, was 5th lowest in 55 years of record. September inflow was below average. Angostura ended the month 21.4 feet from full.

Additional statistical information on Angostura Reservoir and its operations during 2007 can be found on Table DKT8 and Figure DKG7.

TABLE DKT8  
HYDROLOGIC DATA FOR 2007  
ANGOSTURA RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3,613.00	42,205	42,205
TOP OF ACTIVE CONSERVATION	3,187.20	123,048	80,843
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

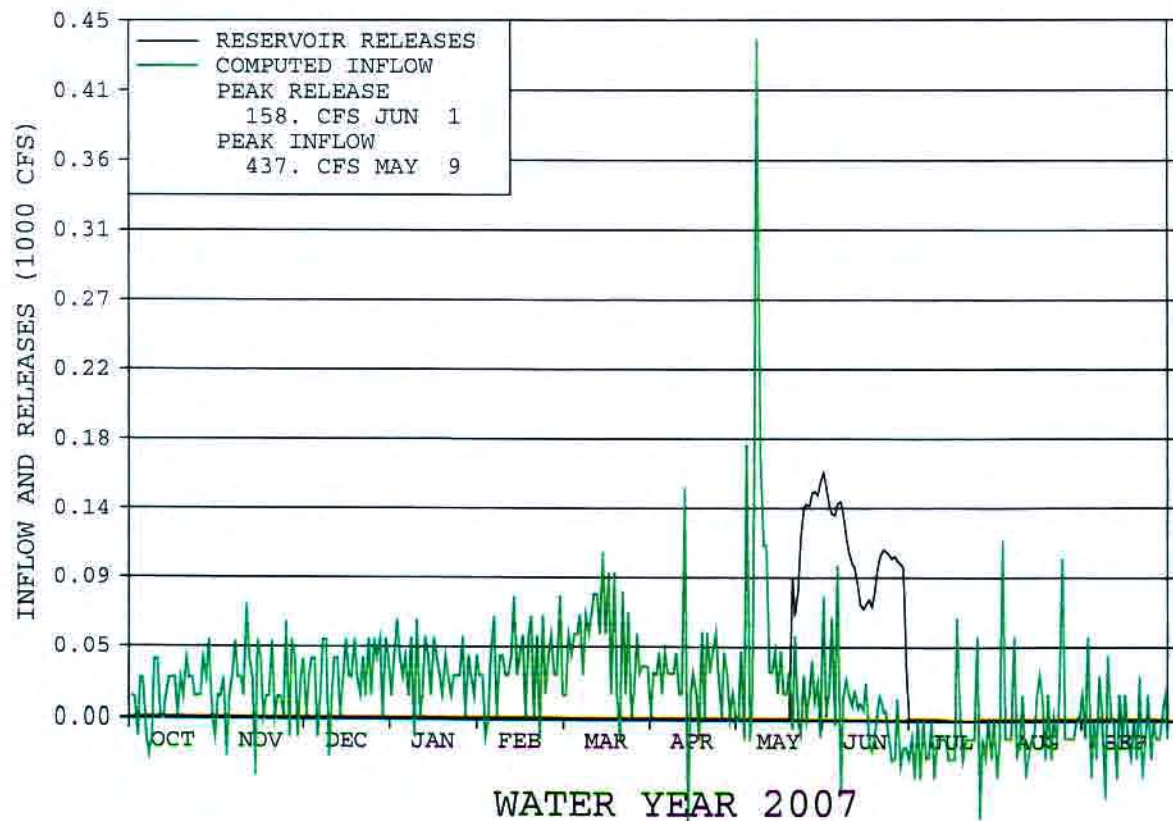
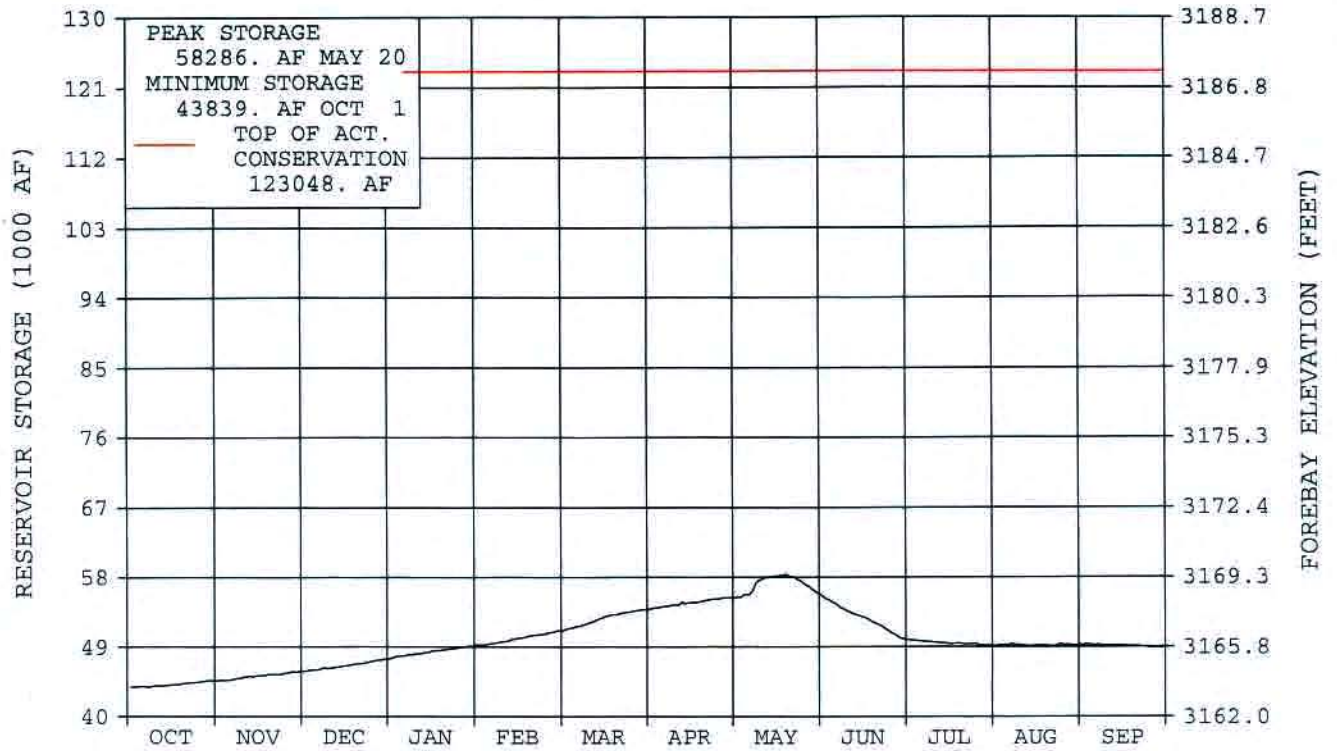
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3,163.69	43,815	OCT 01, 2006
END OF YEAR	3,165.80	48,933	SEP 30, 2007
ANNUAL LOW	3,163.70	43,839	OCT 01, 2007
ANNUAL HIGH	3,169.36	58,286	MAY 20, 2007
HISTORIC HIGH	3,189.37	**152,228	MAY 20, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	14,156	OCT 06-SEP 07	9,038	OCT 06-SEP 07
DAILY PEAK (CFS)	437	MAY 09, 2007	158	JUN 01, 2007
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	870	53	18	2	44,667	54
NOVEMBER	1,236	55	16	1	45,887	55
DECEMBER	1,623	91	16	3	47,494	56
JANUARY	1,781	86	16	3	49,259	57
FEBRUARY	1,841	42	14	1	51,086	57
MARCH	2,801	25	18	0	53,869	56
APRIL	1,506	20	18	0	55,357	56
MAY	3,197	19	2,687	21	55,867	54
JUNE	325	2	6,176	32	50,016	48
JULY	-817	NA	15	0	49,184	51
AUGUST	99	3	24	0	49,259	58
SEPTEMBER	-305	NA	21	0	48,933	61
ANNUAL	14,156	18	9,038	11		
APRIL-JULY	4,211	8				

\* Frequently observed during fall and winter months.

**FIGURE DKG7  
ANGOSTURA RESERVOIR**



WATER YEAR 2007

## **KEYHOLE RESERVOIR**

### **BACKGROUND**

Keyhole Reservoir (P-S MBP) located on the Belle Fourche River below Moorcroft, Wyoming, has a conservation capacity of 188,671 acre-feet (182,079 acre-feet active) and 140,463 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, 1985, 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.

### **WY 2007 OPERATIONS SUMMARY**

Keyhole Reservoir started WY 2007 at elevation 4076.99 and storage of 54,170 acre-feet, which is 22.31 feet and 134,501 acre-feet below the top of the conservation pool. Inflows for WY 2007 totaled 12,189 acre-feet (77% of the average). Peak inflows occurred in May, totaling 8,595 acre-feet for the month. The peak reservoir elevation for WY 2007 was 4081.59 and storage of 71,927 acre-feet and occurred on June 17, 2007. The minimum elevation for WY 2007 was 4076.87 feet and storage of 53,753 acre-feet and occurred on October 17, 2006. WY 2007 ended at elevation 4078.28 and storage of 58,803 acre-feet, which is 20.90 feet and 129,868 acre-feet below the top of the conservation pool. Precipitation for the water year was 98% of average.

Irrigation releases began in July and continued through August with Crook County Irrigation District taking 613 acre-feet and the Belle Fourche Irrigation District ordering 6,942 acre-feet.

Reclamation's Sedimentation and River Hydraulics Group of the Technical Service Center in Denver conducted a sedimentation survey of Keyhole Reservoir in 2003 and provided a survey report and new area and capacity tables in July of 2005. The last survey was done in 1978. Keyhole Reservoir accumulated 5,082 acre-feet of sediment since the last survey. Since construction in 1952, Keyhole has accumulated 12,495 acre-feet of sediment. The sedimentation rate from 1952 through 2003 has averaged 240 acre-feet per year. The new area and capacity tables were used, beginning, in WY 2006.

An Emergency Management/Security Orientation was held February 28, 2007.

A Periodic Facility Review (PFR) was conducted June 5, 2007 by personnel from the Great Plains Regional Office and the Rapid City Field Office.

#### MONTHLY STATISTICS FOR WATER YEAR 2007

October EOM elevation and October inflow, at Keyhole Reservoir, were below average. Keyhole finished the month 22.4 feet from full.

November EOM elevation, at Keyhole Reservoir, was below average. November inflow was much above average. Keyhole finished the month 22.3 feet from full.

December EOM elevation, at Keyhole Reservoir, was below average. December inflow was below average. Keyhole finished the month 22.4 feet from full.

January EOM elevation, at Keyhole Reservoir, was below average. January inflow was below average. Keyhole finished the month 22.4 feet from full.

February EOM elevation, at Keyhole Reservoir, was below average. February inflow was below average. Keyhole finished the month 22.1 feet from full.

March EOM elevation, at Keyhole Reservoir, was below average. March inflow was below average. Keyhole finished the month 21.3 feet from full.

April EOM elevation, at Keyhole Reservoir, was below average. April inflow was near average. Keyhole finished the month 20.7 feet from full.

May EOM elevation, at Keyhole Reservoir, was below average. May inflow was much above average. Keyhole finished the month 18.5 feet from full.

June EOM elevation, at Keyhole Reservoir, was below average. June inflow was below average. Keyhole finished the month 17.9 feet from full.

July EOM elevation, at Keyhole Reservoir, was below average. July inflow was below average. Began irrigation releases for Belle Fourche on July 5th and Crook County on July 16th. Release is 77 cfs. Keyhole finished the month 19.2 feet from full.

August EOM elevation, at Keyhole Reservoir, was below average. August inflow was below average. Ended irrigation releases to Crook County on August 15th and Belle Fourche on August 23rd. Keyhole finished the month 20.6 feet from full.

September EOM elevation, at Keyhole Reservoir, was below average. September inflow was slightly above average. Keyhole finished the month 21.0 feet from full.



Additional statistical information on Keyhole Reservoir and its operations during 2007 can be found on Table DKT9 and Figure DKG8.

TABLE DKT9  
HYDROLOGIC DATA FOR 2007  
KEYHOLE RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,051.00	6,592	6,592
TOP OF ACTIVE CONSERVATION	4,099.30	188,671	182,079
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	4,111.50	329,134	140,463

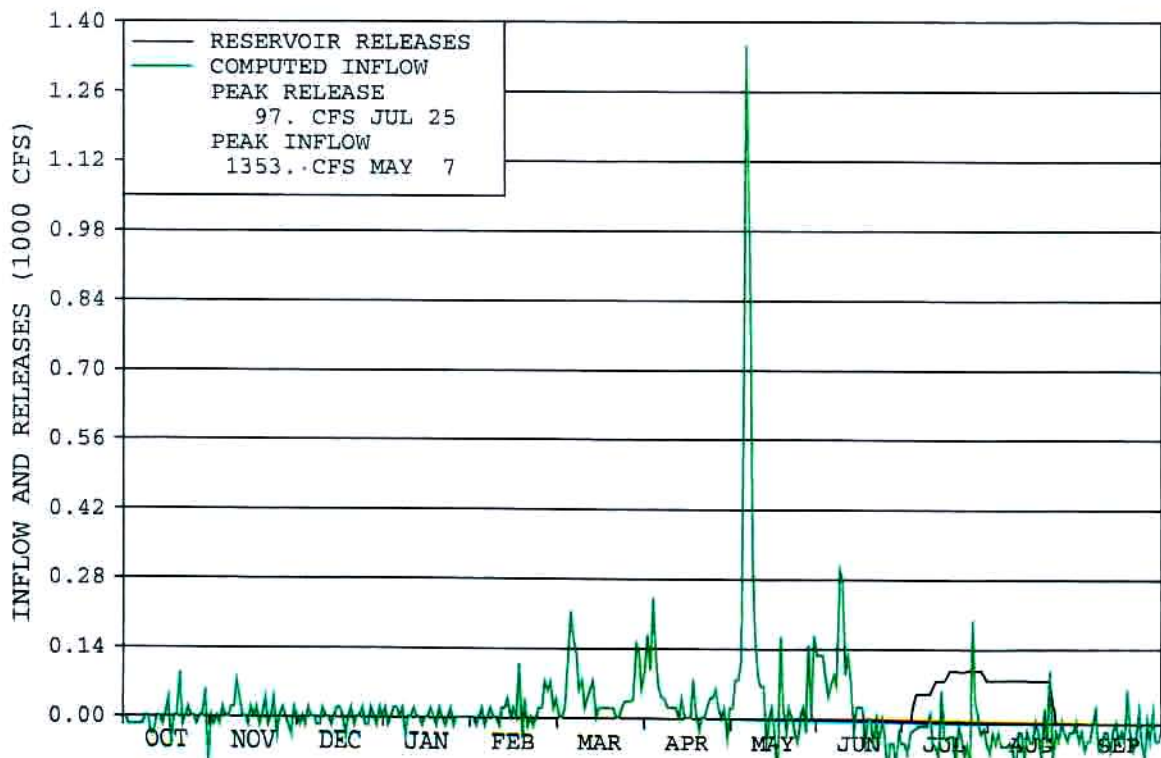
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,076.99	54,170	OCT 01, 2006
END OF YEAR	4,078.28	58,803	SEP 30, 2007
ANNUAL LOW	4,076.87	53,753	OCT 17, 2006
ANNUAL HIGH	4,081.59	71,927	JUN 17, 2007
HISTORIC HIGH	4,100.38	210,222	MAY 21, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	12,189	OCT 06-SEP 07	7,556	OCT 06-SEP 07
DAILY PEAK (CFS)	1,353	MAY 07, 2007	97	JUL 25, 2007
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-348	NA	0	NA	53,822	86
NOVEMBER	243	NA	0	NA	54,065	87
DECEMBER	-69	NA	0	NA	53,996	87
JANUARY	0	NA	0	NA	53,996	87
FEBRUARY	769	27	0	NA	54,765	84
MARCH	3,083	46	0	NA	57,848	81
APRIL	2,294	92	0	NA	60,142	86
MAY	8,595	189	0	NA	68,737	94
JUNE	2,297	65	0	NA	71,034	94
JULY	-1,262	NA	4,151	98	65,621	93
AUGUST	-1,924	NA	3,405	87	60,292	93
SEPTEMBER	-1,489	NA	0	NA	58,803	94
ANNUAL	12,189	77	7,556	51		
APRIL-JULY	11,924	8				

\* Frequently observed during fall and winter months.

FIGURE DKG8  
KEYHOLE RESERVOIR



WATER YEAR 2007

## **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 to 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.

## WY 2007 OPERATIONS SUMMARY

Shadehill Reservoir started WY 2007 at elevation 2263.16 and storage of 81,099 acre-feet, which is 8.84 feet and 39,073 acre-feet below the top of the conservation pool. Inflows for WY 2007 totaled 2,935 acre-feet (4.4% of the average). Peak inflows occurred in March, totaling 3,254 acre-feet for the month. The peak reservoir elevation for WY 2007 was 2263.15 and storage of 81,061 acre-feet and occurred on October 1, 2006. The minimum elevation for WY 2007 was 2259.92 feet and storage of 69,637 acre-feet and occurred on September 30, 2007. WY 2007 ended at elevation 2259.92 and storage of 69,637 acre-feet, which is 12.08 feet and 50,535 acre-feet below the top of the conservation pool. Precipitation for the water year was 100% of average.

All project irrigation demands were met from river maintenance releases. There were no storage releases for irrigation needed during water year 2007.

An Emergency Management/Security orientation was conducted on April 4, 2007.

A mechanical Comprehensive Facility Review (CFR) was conducted November 2, 2006 and a civil CFR on May 2, 2007 by personnel from the TSC, GPRO, DKAO, and the RCFO.

## MONTHLY STATISTICS FOR WATER YEAR 2007

October EOM elevation and October inflow, at Shadehill Reservoir, were much below average. Controlled release at 21 cfs. Shadehill finished the month 9.5 feet below top of conservation.

November EOM elevation, at Shadehill Reservoir, was much below average. November inflow was 4th lowest in 55 years of record. Controlled release at 20 cfs. Shadehill finished the month 9.9 feet below top of conservation. Mechanical CFR done on November 2nd.

December EOM elevation, at Shadehill Reservoir, was much below average. December inflow was 4th lowest in 55 years of record. Controlled release at 20 cfs. Shadehill finished the month 10.5 feet below top of conservation.

January EOM elevation, at Shadehill Reservoir, was much below average. January inflow was much below average. Controlled release at 20 cfs. Shadehill finished the month 10.8 feet below top of conservation.

February EOM elevation, at Shadehill Reservoir, was 4th lowest in 55 years of record. (The last time the reservoir was below this elevation was in November, 1981.) February inflow was 3rd lowest in 55 years of record. Controlled release at 19 cfs. Shadehill finished the month 11.4 feet below top of conservation.

March EOM elevation, at Shadehill Reservoir, was 5th lowest in 55 years of record. March inflow below average. Controlled release at 19 cfs. Shadehill finished the month 10.8 feet below top of conservation.

April EOM elevation, at Shadehill Reservoir, was 4th lowest in 55 years of record. April inflow was below average. Controlled release at 19 cfs. Shadehill finished the month 10.5 feet below top of conservation.

May EOM elevation, at Shadehill Reservoir, was 3rd lowest in 55 years of record. May inflow was below average. Controlled release is 19 cfs. Shadehill finished the month 10.4 feet below top of conservation.

June EOM elevation, at Shadehill Reservoir, was 2nd lowest in 55 years of record. June inflow was below average. Controlled release is 20 cfs. Shadehill finished the month 9.9 feet below top of conservation.

July EOM elevation, at Shadehill Reservoir, was 2nd lowest in 55 years of record. July inflow was much below average. Controlled release is 19 cfs. Shadehill finished the month 10.7 feet below top of conservation.

August EOM elevation, at Shadehill Reservoir, was 2nd lowest in 55 years of record. August inflow was below average. Controlled release is 19 cfs. Shadehill finished the month 11.2 feet below top of conservation.

September EOM elevation, at Shadehill Reservoir, was 2nd lowest in 55 years of record. September inflow was much below average. Controlled release is 19 cfs. Shadehill finished the month 12.1 feet below top of conservation.

Additional statistical information on Shadehill Reservoir and its operations during 2007 can be found on Table DKT10 and Figure DKG9.

TABLE DKT10  
HYDROLOGIC DATA FOR 2007  
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

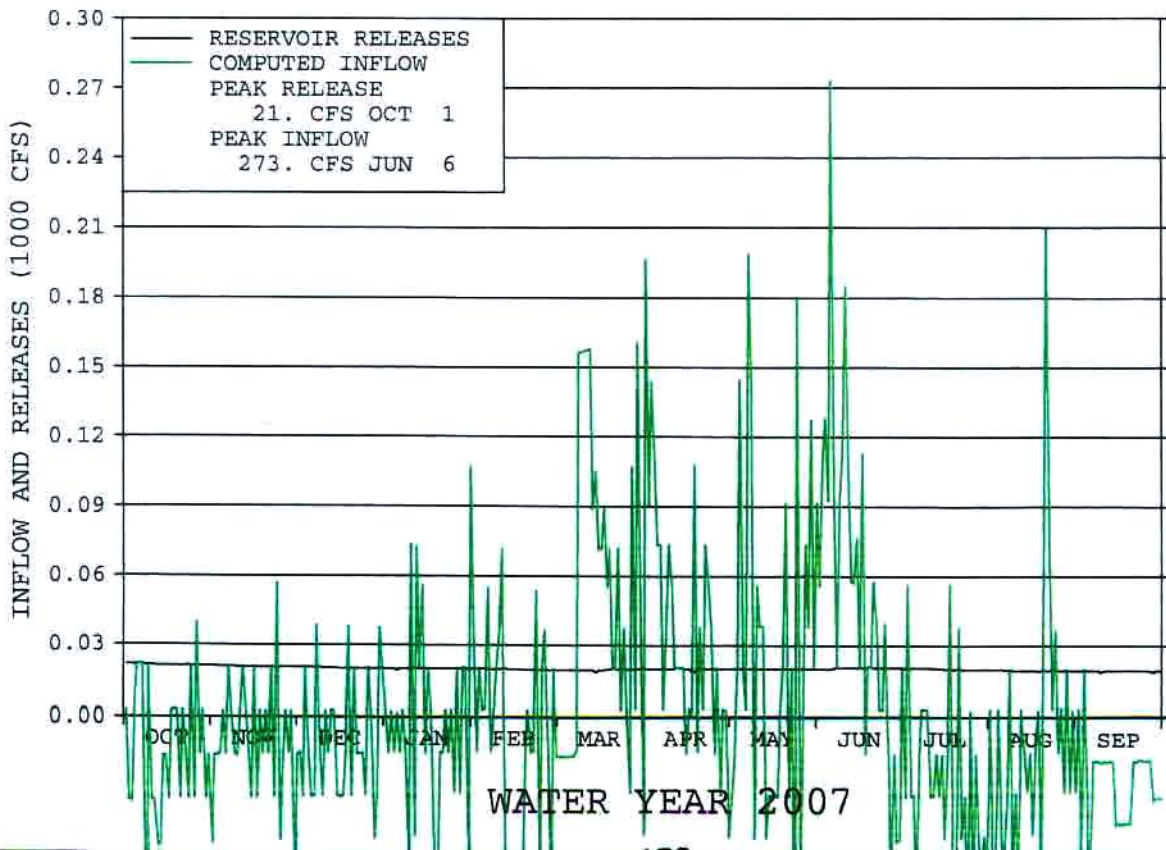
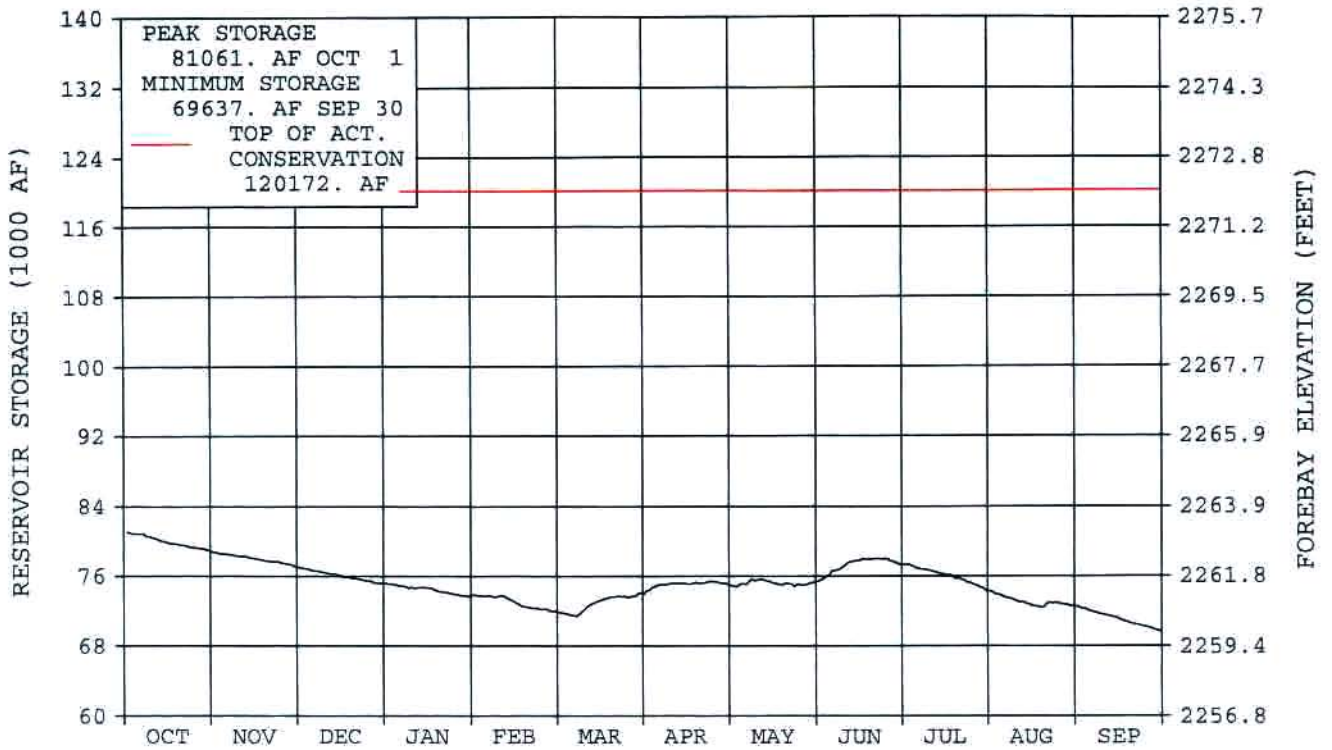
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,263.16	81,099	OCT 01, 2006
END OF YEAR	2,259.92	69,637	SEP 30, 2007
ANNUAL LOW	2,259.92	69,637	SEP 30, 2007
ANNUAL HIGH	2,263.15	81,061	OCT 01, 2006
HISTORIC HIGH	2,297.90	318,438	APRIL 10, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	2,935	OCT 06-SEP 07	14,397	OCT 06-SEP 07
DAILY PEAK (CFS)	273	JUN 06, 2007	21	OCT 01, 2006
DAILY MINIMUM (CFS)	0	*	18	MAR 15, 2007

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-1,024	NA	1,296	41	78,779	83
NOVEMBER	-537	NA	1,218	47	77,024	82
DECEMBER	-630	NA	1,230	50	75,164	82
JANUARY	-118	NA	1,216	52	73,830	82
FEBRUARY	-774	NA	1,081	52	71,975	79
MARCH	3,254	16	1,190	15	74,039	72
APRIL	2,264	12	1,175	8	75,128	70
MAY	1,362	13	1,220	13	75,270	70
JUNE	3,251	38	1,207	15	77,314	71
JULY	-1,762	NA	1,233	23	74,319	70
AUGUST	-643	NA	1,190	28	72,486	71
SEPTEMBER	-1,707	NA	1,142	32	69,637	71
ANNUAL	2,935	4	14,397	22		
APRIL-JULY	5,115	13				

\* Frequently observed during fall and winter months.

FIGURE DKG9  
SHADEHILL RESERVOIR





## **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 is satisfied by the reservoir filling, the South Dakota Department of Environment and Natural Resources provide guidelines for complying with water rights on the Belle Fourche River. The District is required 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 are greater than 45 cfs, the District is required to bypass up to 60 cfs for downstream irrigation rights. Any flows in excess of these amounts can be diverted into the reservoir and stored. If all of these rights are not needed, the District can divert flows into the reservoir.

### **WATER YEAR 2007 OPERATIONS SUMMARY**

Belle Fourche Reservoir started WY 2007 at elevation 2942.88 and storage of 29,002 acre-feet, which is 32.12 feet and 163,075 acre-feet below the top of the conservation pool. Inflows for WY 2007 totaled 123,888 acre-feet, which was 107 % of the average. Peak inflows occurred in June, totaling 26,653 acre-feet for the month, which was 229 % of average. The peak reservoir elevation for WY 2007 was 2969.97 and storage of 153,590 acre-feet and occurred on June 25, 2007. The minimum elevation for WY 2007 was 2943.06 feet and storage of 29,384 acre-feet and occurred on October 1, 2006. WY 2007 ended at elevation 2253.65 and storage of 61,406 acre-feet, which is 21.35 feet and 130,671 acre-feet below the top of the conservation pool. Precipitation for the water year was 93% of average.

Water users were allocated 14 inches of water for the 2007 irrigation season.

The Inlet Canal remained open all winter. The North Canal was turned on on June 21, 2007 and the South Canal on June 25. South Canal was shut off on September 10 and North Canal on September 24. Irrigation releases for the 2007 season were South Canal 37,560 acre-feet, North Canal 53,924 acre-feet, and Inlet Canal-Johnson Lateral 4,415 acre-feet for a total of 97,899 acre-feet.

An Emergency Management Functional Exercise was conducted on May 31, 2007.

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. Inclinerometers readings were taken quarterly as required by the periodic monitoring schedule.

A mechanical Comprehensive Facility Review (CFR) was conducted November 1, 2006 and a civil CFR on May 1, 2007 by personnel from the TSC, GPRO, DKAO, and the RCFO

Reclamation's Sedimentation and River Hydraulics Group (of the Technical Service Center in Denver) conducted a sedimentation survey of Belle Fourche Reservoir in 2006 and provided a survey report and new area and capacity tables in April, 2007. The last survey was done in 1949. Belle Fourche Reservoir accumulated 19,204 acre-feet since the 1949 survey and 36,364 acre-feet since the original survey in 1910. The sedimentation rate from 1910 through 2006 averages 375 acre-feet per year. The new area and capacity tables will be used beginning in WY 2008.

#### MONTHLY STATISTICS FOR WATER YEAR 2007

October EOM elevation, at Belle Fourche Reservoir, was below average. October inflow was above average. Belle Fourche ended the month 27.4 feet from full.

November EOM elevation, at Belle Fourche Reservoir, was below average. November inflow was slightly above average. Belle Fourche ended the month 24.3 feet from full. Mechanical CFR done on November 1st.

December EOM elevation, at Belle Fourche Reservoir, was below average. December inflow was above average. Belle Fourche ended the month 21.6 feet from full.

January EOM elevation, at Belle Fourche Reservoir, was below average. January inflow was below average. Belle Fourche ended the month 19.6 feet from full.

February EOM elevation, at Belle Fourche Reservoir, was below average. February inflow was below average. Belle Fourche ended the month 17.6 feet from full.

March EOM elevation, at Belle Fourche Reservoir, was below average. March inflow was above average. Belle Fourche ended the month 14.1 feet from full.

April EOM elevation, at Belle Fourche Reservoir, was below average. April inflow was near average. Belle Fourche ended the month 11.6 feet from full.

May EOM elevation, at Belle Fourche Reservoir, was below average. May inflow was above average. Belle Fourche ended the month 8.7 feet from full.

June EOM elevation, at Belle Fourche Reservoir, was above average. June inflow was much above average. District began irrigating from North Canal on June 21st and South Canal on June 25th. Belle Fourche ended the month 5.4 feet from full.

July EOM elevation, at Belle Fourche Reservoir, was above average. July inflow was 5th lowest in 55 years of record. Began irrigation releases from Keyhole on July 5th. Belle Fourche ended the month 12.1feet from full.

August EOM elevation, at Belle Fourche Reservoir, was above average. August inflow was above average. Inlet canal turned off on August 31st. Belle Fourche ended the month 18.1feet from full.

September EOM elevation, at Belle Fourche Reservoir, was above average. September inflow was 2nd lowest in 55 years of record, due to Inlet Canal being shut off for lining installation on

September 8th. South Canal turned off on September 10th and North Canal on September 24th. Belle Fourche ended the month 21.3 feet from full.

Additional statistical information on Belle Fourche Reservoir and its operations during 2007 can be found on Table DKT11 and Figure DKG10.

TABLE DKT11  
HYDROLOGIC DATA FOR 2007  
BELLE FOURCHE RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,927.00	6,800	6800
TOP OF ACTIVE CONSERVATION	2,975.00	192,077	185,277

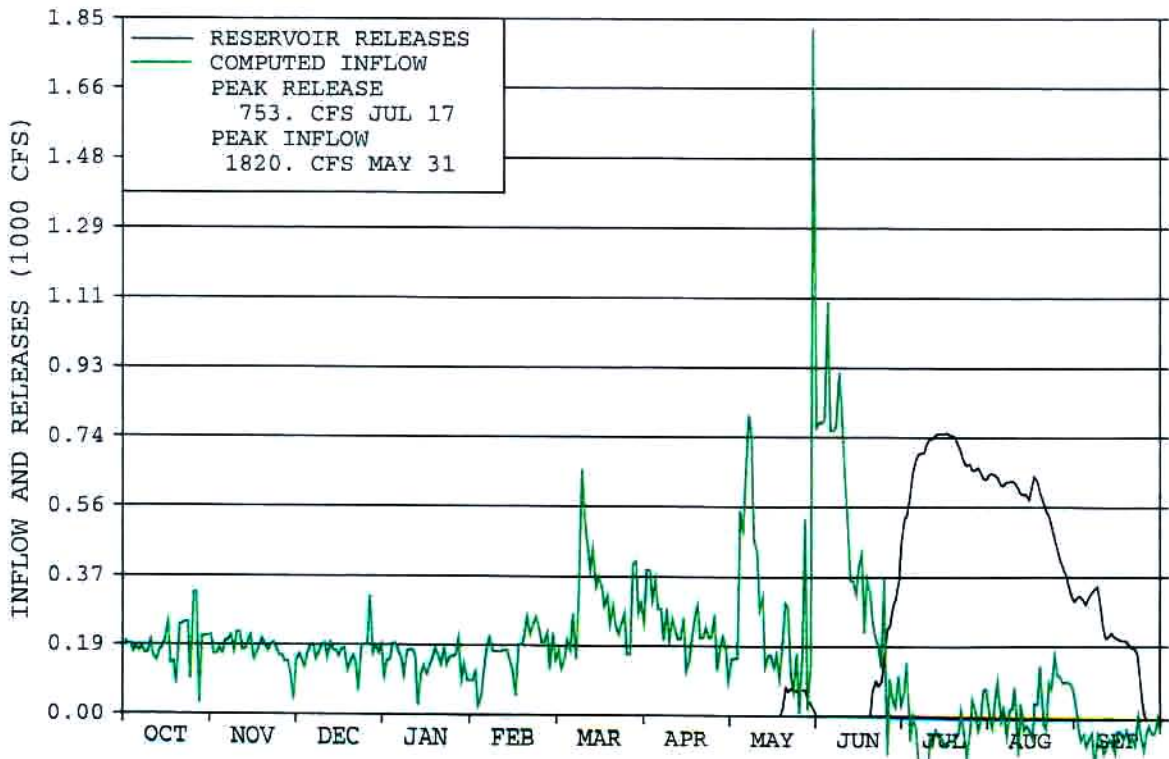
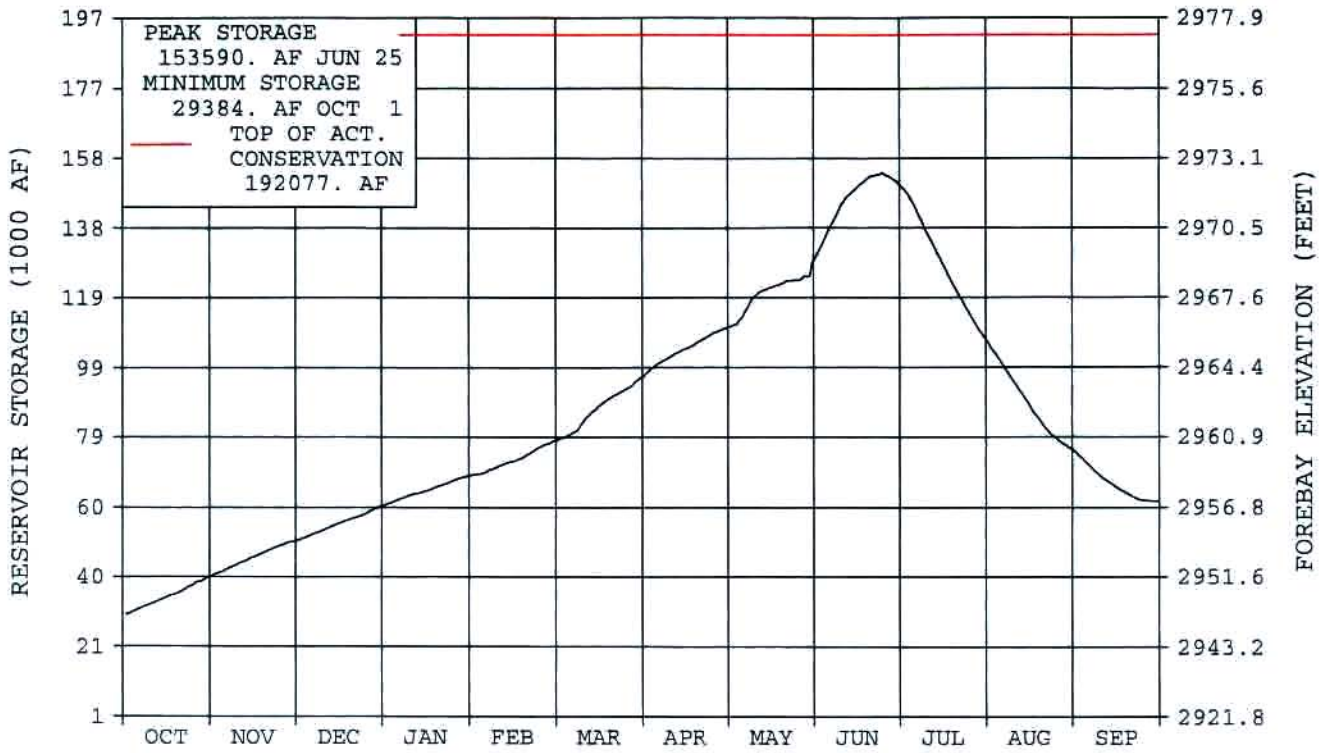
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,942.88	29,002	OCT 01, 2006
END OF YEAR	2,953.65	61,406	SEP 30, 2007
ANNUAL LOW	2,943.06	29,384	OCT 01, 2006
ANNUAL HIGH	2,975.80	153,590	JUN 25, 2007
HISTORIC HIGH		198,455	MAY 12, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	123,888	OCT 06-SEP 07	91,484	OCT 06-SEP 07
DAILY PEAK (CFS)	1,820	MAY 13, 2007	753	JUL 17, 2007
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	11,3699,	109	0	NA	40,371	59
NOVEMBER	964	101	0	NA	50,335	64
DECEMBER	9,975	106	0	NA	60,310	69
JANUARY	8,477	88	0	NA	68,786	71
FEBRUARY	9,321	91	0	NA	78,107	73
MARCH	17,894	109	0	NA	96,001	78
APRIL	14,056	100	1311	NA	110,057	80
MAY	19,463	138	3,795	18	128,209	89
JUNE	26,653	229	41,671	23	151,671	109
JULY	-2,155	NA	33,593	111	7,241	102
AUGUST	1,991	111	11,114	94	75,639	106
SEPTEMBER	-3,119	NA		66	61,406	104
ANNUAL	123,888	107	91,484	79		
APRIL-JULY	58,017	135				

\* Frequently observed during fall and winter months.

**FIGURE DKG10  
BELLE FOURCHE RESERVOIR**



WATER YEAR 2007

## **OPERATING PLANS FOR WATER YEAR 2008**

### **Clark Canyon Reservoir**

Three operating plans were prepared for 2008 to show the operations of Clark Canyon Reservoir which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Table MTT12A-C and Figure MTG13. These plans are presented only to show the probable limits of operations; therefore, unpredictable conditions may cause the actual operations to vary widely from the plans presented here. Flood control operations will be coordinated with the U. S. Army Corps of Engineers (Corps) as specified by the Flood Control Regulations. The Corps will issue instructions on release rates when storage rises into or above the joint-use space reserved for flood control.

The objectives of operations of Clark Canyon Reservoir are to meet all conservation commitments, to provide flood control in cooperation with the Corps, and meet fish, wildlife, and recreational needs. The reservoir is generally operated under the following criteria and limitations.

- (1) During the fall and winter, releases are adjusted to allow storage to reach no higher than 154,195 acre-feet at elevation 5542.10 by March 1.
- (2) From inflow forecasts prepared during January through the end of the spring runoff season, based on existing snow water content, releases are adjusted to allow storage to fill to 174,367 acre-feet at elevation 5546.10 during late May or early June.
- (3) During May-September, reservoir releases are adjusted to meet downstream irrigation demands or to control storage in the flood pool if storage increases above the top of the joint-use pool. If the Corps requests replacement storage, the reservoir is allowed to fill as high as 230,822 acre-feet at elevation 5556.50.
- (4) Whenever an adequate water supply is available, releases from Clark Canyon Dam will be maintained at rates to sustain flows in the Beaverhead River below Clark Canyon Dam between 100-200 cfs. During below normal runoff years, it may be necessary to reduce the releases to as low as 25-30 cfs in the Beaverhead River below Clark Canyon Dam, the absolute minimum flow required to protect the river fishery.
- (5) Whenever possible, stable flows are maintained during October through the spring to enhance the fish spawning conditions. Large fluctuations in the release changes will be avoided whenever possible.

The total annual inflow to Clark Canyon Reservoir during 2007 was 138,194 acre-feet, 52 percent of normal. Storage on September 30, 2007, was 62,052 acre-feet at elevation 5518.49, 50 percent of average for the end of September.

Storage in Lima Reservoir, a private facility located upstream of Clark Canyon Reservoir, ended water year 2007 with 39 percent of normal storage. Depending on snowpack and storage conditions Lima Reservoir may store much of the early season runoff during 2008 from the Red Rock River drainage will be stored in Lima Reservoir.

Clark Canyon Reservoir is not expected to fill during 2008 under the minimum and most probable runoff conditions, but would in the maximum probable runoff conditions. Water levels under the minimum and most probable runoff conditions are expected to peak in late April or early May at approximately 7 feet to 14 feet below the top of the joint-use pool. However, in the maximum probable runoff condition the water level in Clark Canyon is expected to peak in June at or near top of the joint-use pool. Under all three plans winter releases are expected to be reduced to approximately 30 cfs, upon close coordination with Montana Fish, Wildlife, and Parks. Irrigation shortages are expected to occur under the minimum probable plan.

The most probable October through January inflows were estimated to equal approximately the 15 percentile inflows or inflows that are historically exceeded 85 percent of the time. Inflows during February through April were estimated to equal 25 percentile inflows while May-September were estimated to equal 30 percentile inflows or inflows that are exceeded 70 percent of the time.

The minimum probable October through February inflows were estimated to equal the same inflows at water year 2004. The March-September inflows were estimated to equal 10 percentile inflows or inflows that are historically exceeded 90 percent of the time

The maximum probable October through February inflows were estimated to equal median values. The March-September inflows were estimated to equal 75 percentile inflows or inflow that are historically exceeded 25 percent of the time.

TABLE MTT12A

CLARK CANYON RESERVOIR OPERATING PLAN  
Based on October 1 2007 Inflow Estimates

2008 Minimum Probable Plan

Clark Canyon Reservoir	2007	Initial Cont			62.3 kaf			Maximum Cont			310.1 kaf			Minimum Cont			10.0 kaf	Total
		Oct	Nov	Dec	5518.58 ft	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	5489.22 ft	Sep			
Monthly Inflow	kaf	6.5	8.3	8.4	7.7	7.1	10.7	8.6	6.2	9.7	10.9	8.3	8.0	100.4				
Canyon Ditch Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	3.3	3.1	2.5	0.0	10.7				
Dillon Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.5	1.6	1.2	0.0	4.9				
West Side Canal Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	4.1	4.5	3.6	0.0	15.1				
COOP-Pt. Rocks Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.3	1.4	1.3	0.0	4.9				
Other Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	11.1	11.1	10.3	0.0	38.1				
CCWSCO Total Died	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	21.3	21.7	18.9	0.0	73.7				
Dmd, sat by rtn fl	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	6.2	6.1	5.7	0.0	21.7				
CCWSCO rel. req.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	15.1	15.6	13.2	0.0	52.0				
CCWSCO Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	15.1	15.6	13.2	0.0	52.0				
CCWSCO Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	5.0	5.2	4.5	0.0	17.4				
Senior Users Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.7	6.0	8.9	4.4	28.4				
Dmd. sat by rtn fl	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.9	1.7	2.7	1.6	8.6				
Senior rel. req.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	4.8	4.3	6.2	2.8	19.8				
Senior Users Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	4.8	4.3	6.2	2.8	19.8				
Senior Users Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7	-2.1	-1.8	-2.6	-1.2	-8.4				
E.B. Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	7.9	9.4	2.5	0.0	25.0				
E.B. Div @ Bar.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	14.4	17.1	4.5	0.0	45.5				
East Bench Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	7.8	9.4	2.5	0.0	24.9				
Gordon Spring Gain	cfs	15	15	15	15	15	15	15	15	15	15	15	15					
Min Release at Dam	cfs	28	28	28	28	28	28	28	28	28	28	28	28					
Total Irr Sto Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.3	34.3	37.0	23.9	2.8	117.3				
Total Dam Release	cfs	28	29	28	28	28	28	29	299	561	587	374	32					
Total Dam Release	kaf	1.7	1.7	1.7	1.7	1.6	1.7	1.7	18.4	33.4	36.1	23.0	1.9	124.6				
River flow bl dam	cfs	42	44	42	42	43	42	44	314	576	602	389	47					
Excess Release	cfs	0	0	0	0	0	0	0	0	0	0	0	0					
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
End-Month Content	kaf	67.1	73.7	80.4	86.4	91.9	100.9	107.8	95.6	71.9	46.7	32.0	38.1					
End-Month Elevation	ft	5520.23	5522.37	5524.42	5526.17	5527.71	5530.09	5531.83	5528.71	5521.80	5512.50	5505.46	5508.58					
Net Change Content	kaf	4.8	6.6	6.7	6.0	5.5	9.0	6.9	-12.2	-23.7	-25.2	-14.7	6.1	-24.2				



TABLE MTT12B

CLARK CANYON RESERVOIR OPERATING PLAN  
Based on October 1 2007 Inflow Estimates

2008 Most Probable Plan

Clark Canyon Reservoir	2007	Initial Cont Elev 5518.58 ft				62.3 kaf 5518.58 ft				Maximum Cont Elev 5569.57 ft				310.1 kaf 5569.57 ft				Minimum Cont Elev 5489.22 ft				Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep									
Monthly Inflow	kaf	11.7	12.8	11.9	11.0	11.4	13.8	13.0	13.8	21.0	17.8	13.3	13.5	165.0								
Canyon Ditch Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	4.4	4.0	3.1	0.3	14.2								
Dillon Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.9	2.0	1.6	0.1	6.4								
West Side Canal Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	5.4	5.8	4.6	0.4	20.0								
COOP-Pt. Rocks Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.7	1.8	1.7	0.1	6.5								
Other Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	14.2	14.7	13.2	1.0	50.7								
CCWSCO Total Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.8	27.6	28.3	24.2	1.9	97.8								
Dmd. sat by rtn fl	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	9.1	9.3	8.0	0.7	32.9								
CCWSCO rel. req.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	18.5	19.0	16.2	1.2	64.9								
CCWSCO Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	18.5	19.0	16.2	1.2	64.9								
CCWSCO Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2								
Senior Users Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.7	6.0	8.9	4.4	28.4								
Dmd. sat by rtn fl	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.2	2.0	2.9	1.6	9.6								
Senior rel. req.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	4.5	4.0	6.0	2.8	18.8								
Senior Users Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	4.5	4.0	6.0	2.8	18.8								
Senior Users Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-2.0	-1.7	-2.6	-1.2	-8.1								
E.B. Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	12.2	14.6	3.8	0.0	38.7								
E.B. Div @ Bar.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.7	22.2	26.5	6.9	0.0	70.3								
East Bench Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1								
Gordon Spring Gain	cfs	20	20	20	20	20	20	20	20	20	20	20	20									
Min Release at Dam	cfs	28	28	28	28	28	28	28	28	28	28	28	28									
Total Irr Sto Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	45.2	49.5	29.1	4.0	154.0								
Total Dam Release	cfs	28	29	28	28	28	28	29	407	739	786	454	47									
Total Dam Release	kaf	1.7	1.7	1.7	1.7	1.6	1.7	1.7	25.0	44.0	48.3	27.9	2.8	159.8								
River flow bl dam	cfs	47	49	47	47	49	47	49	426	760	805	473	67									
Excess Release	cfs	0	0	0	0	0	0	0	0	0	0	0	0									
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								
End-Month Content	kaf	72.3	83.4	93.6	102.9	112.7	124.8	136.1	124.9	101.9	71.4	56.8	67.5									
End-Month Elevation	ft	5521.93	5525.31	5528.17	5530.60	5533.02	5535.84	5538.34	5535.87	5530.35	5521.64	5516.57	5520.36									
Net Change Content	kaf	10.0	11.1	10.2	9.3	9.8	12.1	11.3	-11.2	-23.0	-30.5	-14.6	10.7	5.2								

TABLE MTT12C

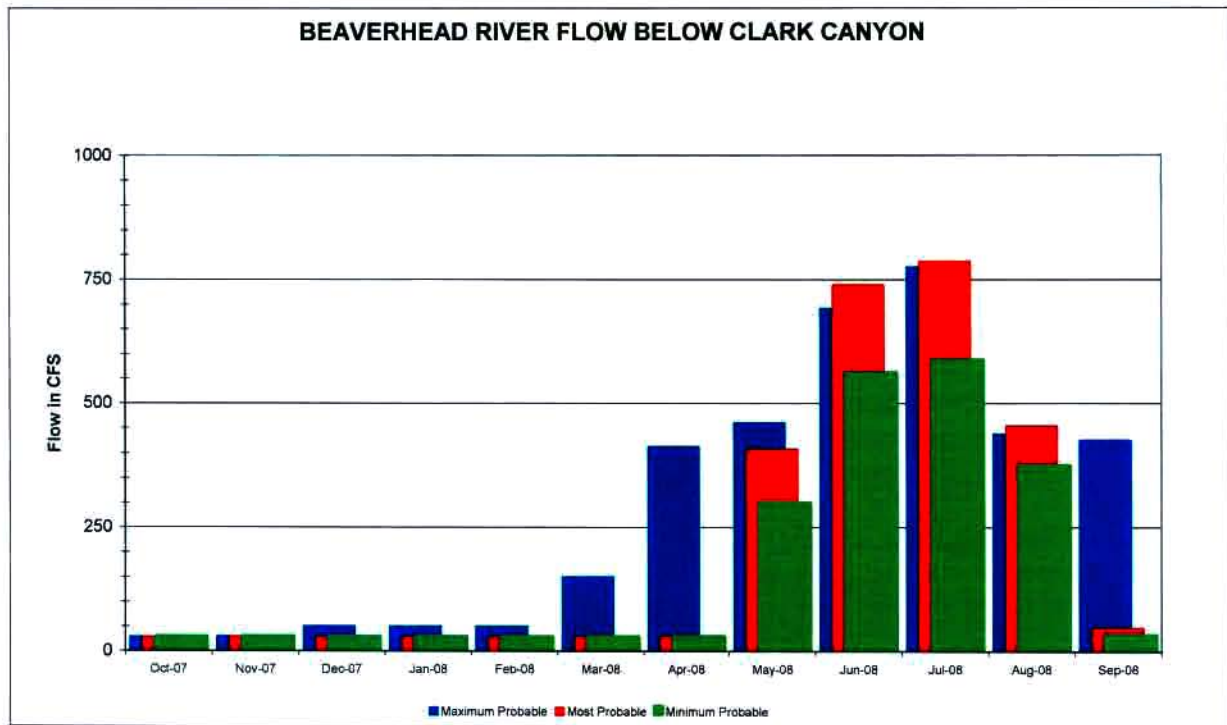
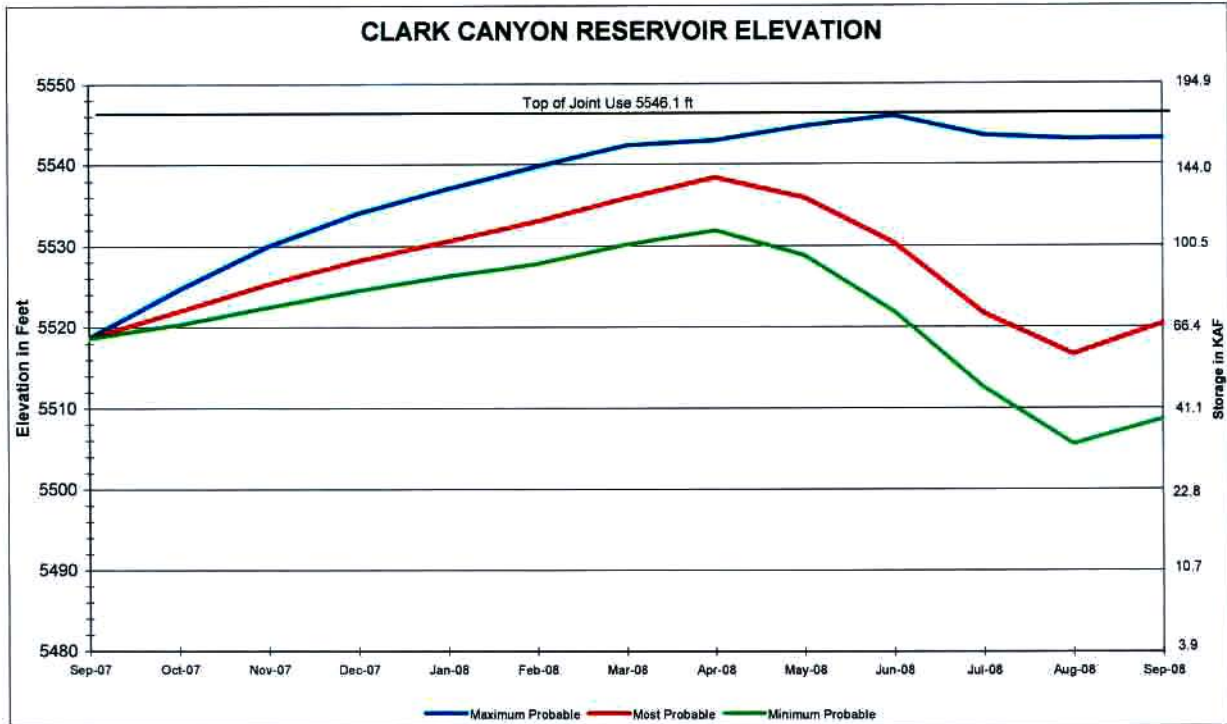
CLARK CANYON RESERVOIR OPERATING PLAN  
Based on October 1 2007 Inflow Estimates

2008 Maximum Probable Plan

Clark Canyon Reservoir	2007	Initial Cont			62.3 kaf			Maximum Cont			310.1 kaf			Minimum Cont			10.0 kaf	Total
		Oct	Nov	Dec	5518.58 ft	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Elev	5489.22 ft		
Monthly Inflow	kaf	20.2	21.2	19.6	16.4	15.3	21.8	27.4	37.3	47.6	35.2	24.4	25.6	312.0				
Canyon Ditch Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	4.1	4.1	3.3	0.3	14.2				
Dillon Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.8	2.1	1.7	0.1	6.5				
West Side Canal Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	5.0	6.0	4.8	0.4	20.0				
COOP-Pt. Rocks Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.6	1.9	1.7	0.1	6.5				
Other Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	13.7	14.7	13.7	1.0	50.7				
CCWSCO Total Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.8	26.2	28.8	25.2	1.9	97.9				
Dmd. sat by rtn fl	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	9.1	10.1	9.3	0.7	35.0				
CCWSCO rel. req.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	17.1	18.7	15.9	1.2	62.9				
CCWSCO Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	17.1	18.7	15.9	1.2	62.9				
CCWSCO Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Senior Users Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.7	6.0	8.9	4.4	28.4				
Dmd. sat by rtn fl	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.3	2.1	3.3	1.6	10.2				
Senior rel. req.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	4.4	3.9	5.6	2.8	18.2				
Senior Users Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	4.4	3.9	5.6	2.8	18.2				
Senior Users Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-1.9	-1.7	-2.4	-1.2	-7.8				
E.B. Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	11.6	14.6	3.8	0.6	38.7				
E.B. Div @ Bar.	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.7	21.1	26.5	6.9	1.1	70.3				
East Bench Short	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1				
Gordon Spring Gain	cfs	25	25	25	25	25	25	25	25	25	25	25	25					
Min Release at Dam	cfs	28	28	50	50	50	50	50	50	50	50	50	50					
Total Irr Sto Dmd	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	42.6	49.1	28.4	5.1	151.4				
Total Dam Release	cfs	28	29	50	50	50	150	412	460	691	774	437	425					
Total Dam Release	kaf	1.7	1.7	3.1	3.1	2.9	9.2	24.5	28.3	41.1	47.6	26.9	25.3	215.4				
River flow bl dam	cfs	52	54	75	75	75	174	437	485	716	799	462	450					
Excess Release	cfs	0	0	0	0	0	99	361	34	0	0	0	339					
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	6.1	21.5	2.1	0.0	0.0	0.0	20.2	49.9				
End-Month Content	kaf	80.8	100.3	116.8	130.1	142.5	155.1	158.0	167.0	173.5	161.1	158.6	158.9					
End-Month Elevation	ft	5524.54	5529.94	5534.00	5537.03	5539.69	5542.28	5542.87	5544.66	5545.93	5543.49	5542.99	5543.05					
Net Change Content	kaf	18.5	19.5	16.5	13.3	12.4	12.6	2.9	9.0	6.5	-12.4	-2.5	0.3	96.6				

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# FIGURE MTG13 CLARK CANYON RESERVOIR



WATER YEAR 2008

## Canyon Ferry Lake and Powerplant

Three operating plans were prepared for 2008 to show the operations of Canyon Ferry Lake which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Tables MTT13A-C and Figure MTG14. These plans are presented only to show the probable limits of operations; therefore, actual conditions and operations could vary widely from the plans in order to comply with the authorized project purposes and the current general operating criteria established for Canyon Ferry Dam and Lake.

Power operations will be closely coordinated with Pennsylvania Power & Light, MT (PPL-MT), formerly known as Montana Power Company (MPC), as specified in the formal Agreement to Coordinate Hydroelectric Power Operations dated March 1972. Flood control operations will be coordinated with the Corps of Engineers (Corps) as specified by the Flood Control Regulations Report dated March 1972. The Corps will issue instructions on release rates when storage rises into or above the joint-use space reserved for flood control. Both of these documents are on file and available for review at the Bureau of Reclamation's Montana Area Office.

The objectives of operations at Canyon Ferry are to meet all conservation commitments, to provide flood control in cooperation with the Corps, and to coordinate all operations with PPL-MT to achieve optimum benefits from the water resource. Except for special operations, the reservoir is generally operated under the following criteria and limitations:

- (1) The top 3 feet between elevations 3797 (1,891,888 acre-feet) and 3800 (1,992,977 acre-feet) are used exclusively for downstream flood control and when storage rises into this pool, operation of the reservoir is directed by the Corps. This storage is generally evacuated as fast as downstream conditions permit.
- (2) As soon as storage has peaked, usually in June or July, power releases are adjusted so that the pool will be drawn to near elevation 3775 (1,222,669 acre-feet) by the following April 1. Each month inflows are reevaluated and releases are adjusted accordingly. Releases to meet this schedule are limited to powerplant capacity. Water is generally not spilled to provide this drawdown.

(3) In accordance with operating procedures outlined in the license for the Madison-Missouri Hydro-electric Project, FERC Project No. 2188, most of the water stored in Hebgen Reservoir will be uniformly released from Hebgen during October through March. Releases during October and November may cause storage in Canyon Ferry Lake to rise slightly during these months. However, PPL-MT will try to limit the Hebgen drawdown during these months in an effort to maintain Canyon Ferry Lake below elevation 3794 (1,792,884 acre-feet) after December 1. Storage below elevation 3794 (1,792,884 acre-feet) prior to winter freeze-up is desired to reduce the potential for ice jam problems to occur at the head end of the lake.

(4) Beginning near the first of January and at least monthly thereafter through June, forecasts are made from snow cover and precipitation data, of the estimated spring inflow. When these forecasts become available, operational changes may be required. Releases are set based on the most probable spring inflow forecast to allow the reservoir to fill to the top of the joint-use pool at elevation 3797 (1,891,888 acre-feet) near the end of June. On occasions, high spring runoff may result in the reservoir filling above the top of the joint-use pool to the top of the exclusive flood at elevation 3800 (1,992,997 acre-feet).

(5) If spilling is required, it is made only to the extent current inflow and the reservoir content indicates additional spills are required. Attempts are made to limit river releases to 15,000 cfs or full downstream channel capacity as long as space is available.

(6) Depending on when the spring runoff starts, the release of water, based on inflow forecasts, may draw the pool as low as elevation 3770 (1,097,599 acre-feet). In a series of dry years, the pool may be drawn as low as elevation 3728 (396,031 acre-feet) to meet firm power generation requirements and satisfy PPL-MT's prior water rights. If storage is drawn below elevation 3728 (396,031 acre-feet), the powerplant efficiency is affected. If emergency maintenance is required on the dam or powerplant, the reservoir may be required to be drawn lower than elevation 3728 (396,031 acre-feet), however, the powerplant efficiency is affected.

(7) Whenever an adequate water supply is available, releases from Canyon Ferry Dam to the Missouri River will be maintained at rates required to sustain river flows equal to or greater than the minimum desired flow of 4,100 cfs below Holter Dam, to minimize impacts to downstream river fisheries and recreation activities. During below normal runoff years, it may be necessary to reduce the releases to lower rates that will provide an absolute minimum river flow of 3,000 cfs or less than 3,000 cfs to fulfill contractual obligations with PPL-MT.

The severe persistent drought across the western United States during water years 2001 through 2007 resulted in well below normal streamflows in the Missouri River Basin. Since April 2007 through September 2007, inflow to Canyon Ferry Lake was only 53 percent of average. This was the eleventh lowest April-September inflow of record and 621,225 acre-feet less than experienced in 2006. The July-September inflow totaled 283,423 acre-feet, making it the second lowest of record since construction of Canyon Ferry Dam. With releases from Canyon Ferry to

the Missouri River maintained at or above 3,500 cfs downstream of Holter Dam throughout the summer, storage in Canyon Ferry steadily declined from a peak storage of 1,885,225 acre-feet at elevation 3796.80 on June 21 to 1,500,636 acre-feet at elevation 3784.80 on September 30. This was 88 percent of normal for this time of year and 0.83 feet or 25,492 acre-feet lower than reported on September 30, 2006.

The most probable October-February natural inflows to Canyon Ferry Lake, without the effects of Clark Canyon and Hebgen Reservoirs, were estimated to vary from about 65 percent of normal during October to 80 percent of normal during February. The most probable March-September natural inflows were estimated to equal 35 percentile natural inflows or natural inflows that have historically been exceeded 65 percent of the time.

Under the minimum probable operating plan, the October-February natural inflows to Canyon Ferry Lake, without the effects of Clark Canyon and Hebgen Reservoirs, were estimated to be about 10 percent lower than the most probable natural inflows. The March-September natural inflows were estimated to equal lower decile natural inflows or natural inflows that have historically been exceeded 90 percent of the time.

Under the maximum probable operating plan, the October-February natural inflows to Canyon Ferry Lake, without the effects of Clark Canyon and Hebgen Reservoirs, were estimated to be about 20 percent higher than the most probable natural inflows. The maximum probable March-September natural inflows were estimated to equal 75 percentile natural inflows or natural inflows that have historically been exceeded 25 percent of the time.

Based on the storage level on October 1, 2008, Canyon Ferry Reservoir would be expected to fill to the top of the joint-use pool at elevation 3797 by the end of June only under the most probable and maximum probable runoff scenarios. However, under the minimum probable runoff condition, Canyon Ferry Reservoir would not be expected to fill and river releases would have to be maintained at 3,000 cfs all year to conserve storage in Canyon Ferry. Under the most probable runoff condition, releases to the Missouri River downstream of Holter Dam would be maintained at 3,300 cfs during the fall and winter to conserve storage. Beginning in April, it is anticipated the river releases could be increased to 3,500 cfs or higher and would allow the reservoir to fill to the top of the joint-use pool by the end of June. Under the maximum probable runoff condition, it is anticipated river releases to the Missouri River would be maintained at the desired minimum fishery flow of 4,100 cfs or higher downstream of Holter Dam beginning in November and continuing all year and would allow the reservoir to fill to the top of the conservation pool at elevation 3797 by the end of June.

The average power generation produced at Canyon Ferry Powerplant during 1967-2007 is 386.4 million kilowatt-hours. Under the minimum and most probable runoff conditions, power generation produced at Canyon Ferry Powerplant during 2008 would be about 154.5 and 68.5 million kilowatt-hours less than average, respectively. Under the maximum probable runoff condition, power generation would be about 14.9 million kilowatt-hours more than average. No spills are expected during the routine scheduled maintenance outages shown on Table MTT19.

TABLE MTT13A

**CANYON FERRY LAKE MONTHLY OPERATIONS**  
**Based on October 1 2007 Probable Inflow Estimates**

2008 Minimum Probable Plan

Canyon Ferry Reservoir		Initial Cont Elev 3784.80 ft			1500.6 kaf 3784.80 ft			Maximum Cont Elev 3800.00 ft			1993.0 kaf 3800.00 ft			Minimum Cont Elev 3732.31 ft			445.5 kaf	Total
2007		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep					
Reservoir Inflow	kaf	149.3	160.2	161.2	155.6	158.4	193.7	253.2	303.7	325.4	144.8	106.7	145.9	2258.1				
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
MV Canal Diversions	kaf	4.0	0.0	0.0	0.0	0.0	4.0	11.0	22.0	17.0	21.0	21.0	12.0	112.0				
HV Pump Turbines	kaf	5.1	0.0	0.0	0.0	0.0	5.4	14.4	27.0	19.3	23.3	24.3	14.5	133.3				
Turbine Release	kaf	183.1	172.4	176.8	179.9	164.3	168.6	155.2	155.9	149.5	154.6	156.2	159.8	1976.3				
Turbine Release	cfs	2978	2897	2875	2926	2856	2742	2608	2535	2512	2514	2540	2686					
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
River Release	kaf	188.2	172.4	176.8	179.9	164.3	174.0	169.6	182.9	168.8	177.9	180.5	174.3	2109.6				
River Release	cfs	3061	2897	2875	2926	2856	2830	2850	2975	2837	2893	2936	2929					
Min Release	cfs	3061	2897	2875	2926	2856	2830	2850	2975	2837	2893	2936	2929					
Total Dam Release	kaf	192.2	172.4	176.8	179.9	164.3	178.0	180.6	204.9	185.8	198.9	201.5	186.3	2221.6				
Total Dam Release	cfs	3126	2897	2875	2926	2856	2895	3035	3332	3122	3235	3277	3131					
End-Month Content	kaf	1457.7	1445.5	1429.9	1405.6	1399.7	1415.4	1488.0	1586.8	1726.4	1672.3	1577.5	1537.1					
End-Month Elevation	ft	3783.4	3783.0	3782.5	3781.6	3781.4	3782.0	3784.4	3787.6	3792.0	3790.3	3787.3	3786.0					
Net Change	kaf	-42.9	-12.2	-15.6	-24.3	-5.9	15.7	72.6	98.8	139.6	-54.1	-94.8	-40.4	36.5				
Canyon Ferry Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total				
Turbine Release	cfs	2978	2897	2875	2926	2856	2742	2608	2535	2512	2514	2540	2686					
Tailwater Elev	ft	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7	3650.7					
Average Head	ft	133.4	132.5	132.0	131.3	130.8	131.0	132.5	135.3	139.1	140.4	138.1	135.9					
Average Power	mw	29.4	28.3	27.9	28.4	27.5	26.1	24.7	24.3	24.5	24.7	24.7	26.2					
Average Kwh/Af		120	118	118	118	116	115	115	116	118	119	118	118	117				
Generation	gwh	21.903	20.362	20.780	21.152	19.133	19.441	17.813	18.049	17.640	18.377	18.384	18.886	231.920				
End-Month Power Cap	mw	60	60	60	60	60	60	60	60	60	60	60	60					
Hauser	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total				
Missouri Gain	kaf	4.0	4.8	7.1	4.5	7.2	8.6	7.8	0.4	1.9	1.9	0.9	1.8	50.9				
End-Month Content	kaf	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2					
Release	kaf	192.2	177.2	183.9	184.4	171.5	182.6	177.4	183.3	170.7	179.8	181.4	176.1	2160.5				
Release	cfs	3126	2978	2991	2999	2982	2970	2981	2981	2869	2924	2950	2959					
Turbine Release	cfs	3126	2978	2991	2999	2982	2970	2981	2981	2869	2924	2950	2959					
Turbine Bypass	cfs	0	0	0	0	0	0	0	0	0	0	0	0					
Generation	gwh	8.094	7.462	7.744	7.765	7.223	7.690	7.469	7.718	7.189	7.571	7.638	7.414	90.977				
Molter	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total				
Missouri Gain	kaf	1.5	1.3	0.6	0.1	1.1	1.9	1.1	1.2	7.8	4.7	3.1	2.4	26.8				
End-Month Content	kaf	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9					
Release	kaf	193.7	178.5	184.5	184.5	172.6	184.5	178.5	184.5	178.5	184.5	184.5	178.5	2187.3				
Release	cfs	3150	3000	3001	3001	3001	3001	3000	3001	3000	3001	3001	3000					
Min Release	cfs	3150	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000					
Turbine Release	cfs	3150	3000	3001	3001	3001	3001	3000	3001	3000	3001	3001	3000					
Turbine Bypass	cfs	0	0	0	0	0	0	0	0	0	0	0	0					
Generation	gwh	16.499	15.206	15.719	15.719	14.704	15.719	15.206	15.719	15.206	15.719	15.719	15.206	186.341				

TABLE MTT13B

**CANYON FERRY LAKE MONTHLY OPERATIONS**  
**Based on October 1 2007 Probable Inflow Estimates**

**2008 Most Probable Plan**

Canyon Ferry Reservoir		Initial Cont Elev 3784.80 ft				Maximum Cont Elev 3800.00 ft				Minimum Cont Elev 3732.31 ft				Total
		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Reservoir Inflow	kaf	152.1	167.3	163.3	154.2	162.8	228.1	324.3	515.9	628.7	263.5	123.6	166.6	3050.4
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NV Canal Diversions	kaf	0.0	0.0	0.0	0.0	0.0	4.0	11.0	22.0	17.0	21.0	21.0	12.0	108.0
NV Pump Turbines	kaf	0.0	0.0	0.0	0.0	0.0	5.6	14.4	26.1	18.0	20.9	21.5	12.8	119.3
Turbine Release	kaf	191.7	186.6	193.0	192.3	178.3	183.8	182.6	313.8	319.2	224.0	186.0	186.2	2537.5
Turbine Release	cfs	3118	3136	3139	3127	3100	2989	3069	5103	5365	3643	3025	3129	
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0	0.0	0.0	0.0	46.0
River Release	kaf	191.7	186.6	193.0	192.3	178.3	189.4	197.0	339.9	383.2	244.9	207.5	199.0	2702.8
River Release	cfs	3118	3136	3139	3127	3100	3080	3311	5528	6440	3983	3375	3344	
Min Release	cfs	3118	3136	3139	3127	3100	3080	3311	3358	3107	3381	3375	3344	
Total Dam Release	kaf	191.7	186.6	193.0	192.3	178.3	193.4	208.0	361.9	400.2	265.9	228.5	211.0	2810.8
Total Dam Release	cfs	3118	3136	3139	3127	3100	3145	3496	5886	6726	4324	3716	3546	
End-Month Content	kaf	1461.0	1441.7	1412.0	1373.9	1358.4	1393.1	1509.4	1663.4	1891.9	1889.5	1784.6	1740.2	
End-Month Elevation	ft	3783.5	3782.8	3781.8	3780.5	3780.0	3781.2	3785.1	3790.0	3797.0	3796.9	3793.8	3792.4	
Net Change	kaf	-39.6	-19.3	-29.7	-38.1	-15.5	34.7	116.3	154.0	228.5	-2.4	-104.9	-44.4	239.6
Canyon Ferry Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	cfs	3118	3136	3139	3127	3100	2989	3069	5103	5365	3643	3025	3129	
Tailwater Elev	ft	3650.8	3650.8	3650.8	3650.8	3650.7	3650.7	3650.8	3651.0	3651.1	3650.8	3650.8	3650.8	
Average Head	ft	133.3	132.4	131.5	130.4	129.6	129.9	132.4	136.6	142.4	146.2	144.5	142.3	
Average Power	mw	31.2	31.2	31.1	30.7	30.2	28.9	30.4	55.1	60.0	40.6	32.0	33.0	
Average Kwh/Af		121	120	120	119	118	117	120	131	135	135	128	127	125
Generation	gwh	23.190	22.471	23.124	22.841	21.026	21.531	21.874	41.002	43.200	30.169	23.786	23.731	317.945
End-Month Power Cap	mw	60	60	60	60	60	60	60	60	60	60	60	60	
Hauser	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	9.1	8.4	8.8	9.0	9.3	10.2	9.0	5.4	13.1	1.3	3.3	5.2	92.1
End-Month Content	kaf	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	
Release	kaf	200.8	195.0	201.8	201.3	187.6	199.6	206.0	345.3	396.3	246.2	210.8	204.2	2794.9
Release	cfs	3266	3277	3282	3274	3261	3246	3462	5616	6660	4004	3428	3432	
Turbine Release	cfs	3266	3277	3282	3274	3261	3246	3462	4740	4740	4004	3428	3432	
Turbine Bypass	cfs	0	0	0	0	0	0	0	876	1920	0	0	0	
Generation	gwh	8.456	8.211	8.497	8.477	7.898	8.404	8.674	12.272	11.877	10.367	8.876	8.599	110.608
Holter	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	2.1	1.4	1.1	1.6	2.2	3.3	2.3	3.3	10.3	6.0	4.4	4.1	42.1
End-Month Content	kaf	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	
Release	kaf	202.9	196.4	202.9	202.9	189.8	202.9	208.3	348.6	406.6	252.2	215.2	208.3	2837.0
Release	cfs	3300	3301	3300	3300	3300	3300	3501	5669	6833	4102	3500	3501	
Min Release	cfs	3300	3300	3300	3300	3300	3300	3500	3500	3500	3500	3500	3500	
Turbine Release	cfs	3300	3301	3300	3300	3300	3300	3501	5669	6833	4102	3500	3501	
Turbine Bypass	cfs	0	0	0	0	0	0	0	0	0	0	0	0	
Generation	gwh	17.285	16.732	17.285	17.285	16.169	17.285	17.746	29.693	34.635	21.485	18.332	17.746	241.678



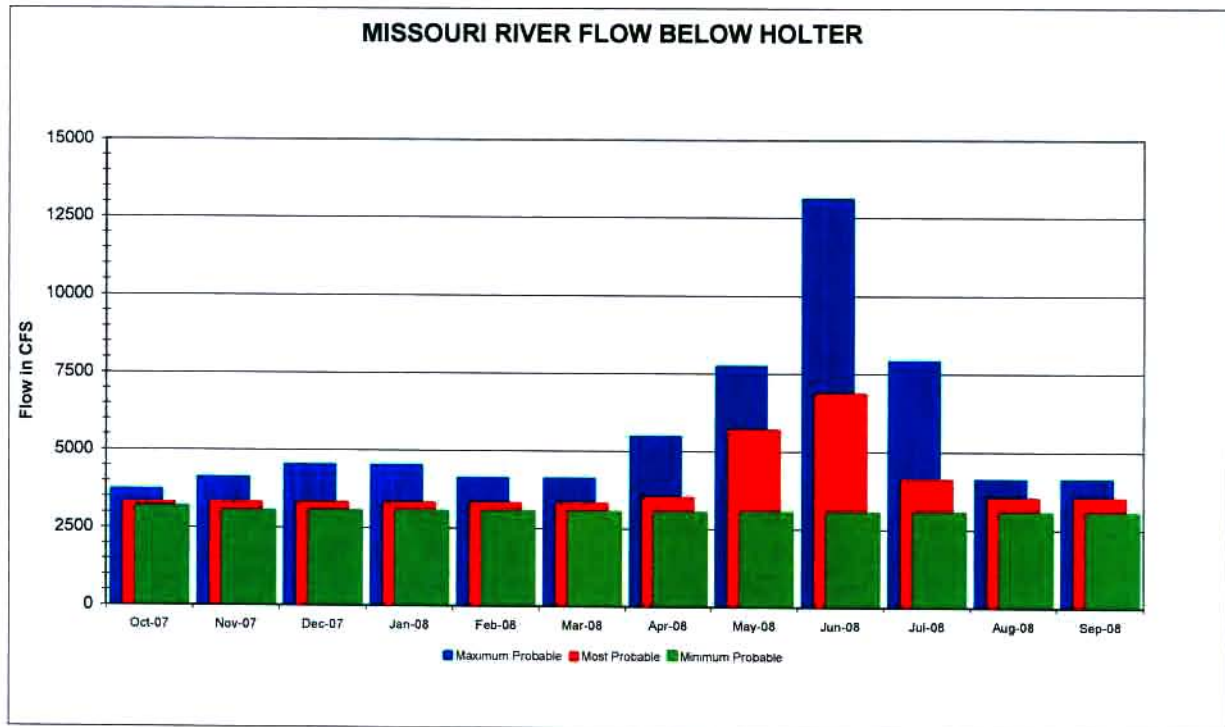
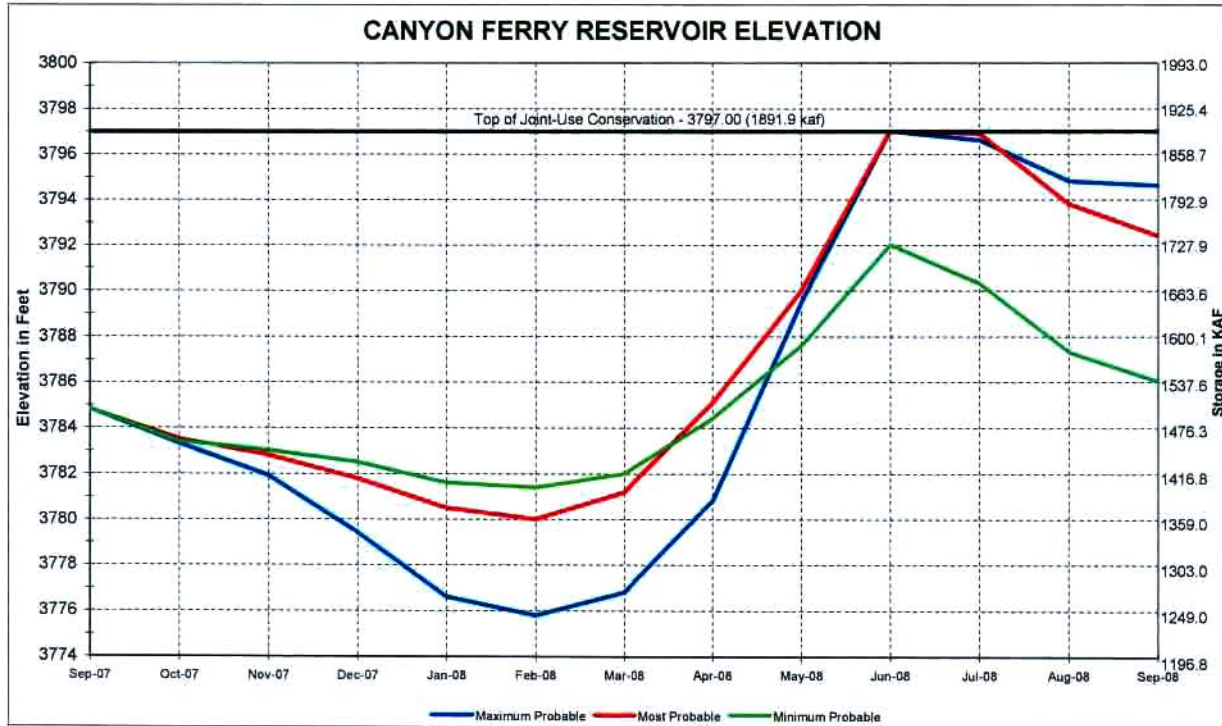
TABLE MTT13C

**CANYON FERRY LAKE MONTHLY OPERATIONS**  
**Based on October 1 2007 Probable Inflow Estimates**

2008 Maximum Probable Plan

Canyon Ferry Reservoir		Initial Cont Elev			1500.6 kaf 3784.80 ft		Maximum Cont Elev			1993.0 kaf 3800.00 ft		Minimum Cont Elev		445.5 kaf 3732.31 ft		Total
	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			
Reservoir Inflow	kaf	166.4	191.4	192.0	189.4	199.9	265.8	429.9	727.5	992.2	466.9	190.2	226.2	4237.8		
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
HV Canal Diversions	kaf	0.0	0.0	0.0	0.0	0.0	4.0	11.0	12.0	16.0	17.0	16.0	7.0	83.0		
NV Pump Turbines	kaf	0.0	0.0	0.0	0.0	0.0	6.2	16.0	15.0	17.0	17.0	16.3	7.3	94.8		
Turbine Release	kaf	210.8	232.7	265.3	265.3	221.0	229.0	292.9	357.2	322.5	322.6	217.8	221.1	3158.2		
Turbine Release	cfs	3428	3911	4315	4315	3842	3724	4922	5810	5419	5247	3542	3716			
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.9	391.4	122.2	0.0	0.0	591.5		
River Release	kaf	210.8	232.7	265.3	265.3	221.0	235.2	308.9	450.1	730.9	461.8	234.1	228.4	3844.5		
River Release	cfs	3428	3911	4315	4315	3842	3825	5191	7320	12283	7510	3807	3838			
Min Release	cfs	3428	3911	4315	4315	3842	3825	3850	3711	3284	3731	3807	3838			
Total Dam Release	kaf	210.8	232.7	265.3	265.3	221.0	239.2	319.9	462.1	746.9	478.8	250.1	235.4	3927.5		
Total Dam Release	cfs	3428	3911	4315	4315	3842	3890	5376	7515	12552	7787	4067	3956			
End-Month Content	kaf	1456.2	1414.9	1341.6	1265.7	1244.6	1271.2	1381.2	1646.6	1891.9	1880.0	1820.1	1810.9			
End-Month Elevation	ft	3783.3	3781.9	3779.4	3776.6	3775.8	3776.8	3780.8	3789.5	3797.0	3796.6	3794.8	3794.6			
Net Change	kaf	-44.4	-41.3	-73.3	-75.9	-21.1	26.6	110.0	265.4	245.3	-11.9	-59.9	-9.2	310.3		
Canyon Ferry Power	200	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total		
Turbine Release	cfs	3428	3911	4315	4315	3842	3724	4922	5810	5419	5247	3542	3716			
Tailwater Elev	ft	3650.8	3650.8	3650.9	3650.9	3650.8	3650.8	3651.0	3651.2	3652.1	3651.3	3650.8	3650.8			
Average Head	ft	133.3	131.8	129.8	127.1	125.4	125.5	127.8	134.0	141.2	145.5	144.9	143.9			
Average Power	mw	35.0	40.5	44.5	43.6	37.9	36.6	49.9	60.0	60.0	60.0	39.0	41.0			
Average Kwh/Af		124	125	125	122	119	119	123	125	134	138	133	134	127		
Generation	gwh	26.040	29.146	33.086	32.446	26.399	27.253	35.957	44.640	43.200	44.640	28.979	29.542	401.328		
End-Month Power Cap	mw	60	60	60	58	58	58	60	60	60	60	60	60			
Hauser	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total		
Missouri Gain	kaf	13.0	9.3	9.4	8.9	11.9	13.3	11.8	17.2	34.1	13.3	10.8	10.0	163.0		
End-Month Content	kaf	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2			
Release	kaf	223.8	242.0	274.7	274.2	232.9	248.5	320.7	467.3	765.0	475.1	244.9	238.4	4007.5		
Release	cfs	3640	4067	4468	4459	4049	4041	5390	7600	12856	7727	3983	4006			
Turbine Release	cfs	3640	4067	4468	4459	4049	4041	4740	4740	4740	4740	3983	4006			
Turbine Bypass	cfs	0	0	0	0	0	0	650	2860	8116	2987	0	0			
Generation	gwh	9.424	10.190	11.568	11.545	9.807	10.463	11.877	12.272	11.877	12.272	10.312	10.037	131.644		
Molter	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total		
Missouri Gain	kaf	3.7	2.0	2.0	2.5	2.9	3.6	3.1	6.7	14.5	9.4	7.2	5.6	63.2		
End-Month Content	kaf	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9			
Release	kaf	227.5	244.0	276.7	276.7	235.8	252.1	323.8	474.0	779.5	484.5	252.1	244.0	4070.7		
Release	cfs	3700	4101	4500	4500	4099	4100	5442	7709	13100	7880	4100	4101			
Min Release	cfs	3700	4100	4500	4500	4100	4100	4100	4100	4100	4100	4100	4100			
Turbine Release	cfs	3700	4101	4500	4500	4099	4100	5442	7100	7100	7100	4100	4101			
Turbine Bypass	cfs	0	0	0	0	0	0	0	609	6000	780	0	0			
Generation	gwh	19.380	20.787	23.570	23.570	20.084	21.475	27.584	37.188	35.988	37.188	21.475	20.787	309.076		

# FIGURE MTG14 CANYON FERRY RESERVOIR



WATER YEAR 2008

## Gibson Reservoir

Three operating plans were prepared for 2008 to show the operations of Gibson Reservoir which could occur under various conditions. These plans are shown in Table MTT14A-C and Figure MTG15. The plans are presented only to show the probable limits of operations; therefore, actual operations may vary widely from these plans.

The primary objective of operations at Gibson Reservoir is to provide irrigation water to the Sun River Project. Gibson Reservoir is operated under the following criteria and limitations:

- (1) Beginning near the first of January and at least monthly thereafter through June, forecasts are made of the estimated spring inflow from snow cover and precipitation data. When these forecasts become available, the Facility Operation and Maintenance Division provides assistance to Greenfields Irrigation District to provide incidental flood control and prevent storage content in Gibson Reservoir from exceeding elevation 4724.0 until the peak of the spring runoff has passed and has begun to recede.
- (2) The spillway crest elevation is 4712.0 feet (81,255 acre-feet). The spillway gates will remain open until after the peak inflow has occurred. The remaining 12 feet of storage shall be filled with recession inflows. This will normally occur during mid to late June or early July.
- (3) Once Gibson Reservoir has filled or reached its maximum level during spring runoff (normally late June or early July), releases are set to maintain the reservoir at or below elevation 4724.0.
- (4) After the spring runoff is over, releases during remainder of the irrigation season from July through mid-October are adjusted as necessary to meet the irrigation demands of the Sun River Project.
- (5) When irrigation demands of the Sun River Project places heavy demands on storage in Gibson Reservoir, the reservoir should not be drafted lower than elevation 4609.0 feet (5,000 acre-feet) to prevent sediment from being flushed through the reservoir in an effort to protect the water quality of the Sun River downstream of the dam.

(6) During the non-irrigation season, Gibson Reservoir should be maintained below elevation of 4712.0 feet (81,255 acre-feet) to provide incidental flood control. During most years, Gibson Reservoir is generally maintained below elevation 4702.5 (70,000 acre-feet). When normal or above normal inflow is forecast, the end-of-April target storage content is 55,000 acre-feet. When below normal inflow is forecast, the end-of-April target storage content can be increased but set no higher than 70,000 acre-feet.

(7) Whenever an adequate water supply is available, releases from Gibson Reservoir will be maintained at rates to sustain flows in the Sun River below Sun River Diversion Dam at 100 cfs or higher and in the river below the Fort Shaw Diversion Dam at 50 cfs or higher. This is normally required to achieve the desired end-of-April content and minimize impacts to downstream river fisheries and recreation activities. During below normal runoff years, it may be necessary to reduce the releases to as low as 50 cfs in the Sun River below the Sun River Diversion Dam, the absolute minimum flow required to protect the river fishery.

(8) Releases during July-September are made as necessary to meet irrigation requirements.

The persistent drought during water years 2001-2007 continued to have a major impact on the fall inflows to Gibson Reservoir leading into water year 2008. Inflows during August and September were 49 and 52 percent of average, respectively. Inflows during 2007 were less than the previous year principally due to the much below average snowpack conditions. The precipitation varied significantly during late spring and summer which also contributed to the overall drought conditions. The total inflow for Gibson Reservoir during 2007 was 417,094 acre-feet, 68 percent of average. By the end of water year 2007, storage in Gibson Reservoir was drafted to 6,233 acre-feet at elevation 4612.77. This was approximately 22 percent of average and 6 percent of full capacity. Storage at the end of water year 2007 was 4,316 acre-feet or 10.8 feet lower than at the end of water year 2006.

Under the most probable operating plan, the October inflows are estimated to equal the 2007 value. November through February inflows are estimated to equal 10 percentile inflows or inflows that are exceeded 90 percent of the time. The March and September inflows are estimated to equal 25 percentile inflows or inflows that are exceeded 75 percent of the time. The April-August inflows are estimated to equal 30 percentile flows or inflows that are exceeded 70 percent of the time.

Under the minimum probable operating plan, the October-February inflows are estimated to equal flows experienced during water year 1994. The March-September inflows are estimated to equal 10 percentile inflows or inflows that are exceeded 90 percent of the time.

Under the maximum probable operating plan, the October through February inflows are estimated to equal 50 percentile inflows or inflows that are exceeded 50 percent of the time. The March-July inflows are estimated to equal 75 percentile inflows or inflows that have historically

been exceeded 25 percent of the time. The August-September inflows are estimated at median values.

Under Maximum and Most Probable runoff scenarios, Gibson Reservoir is expected to fill to the top of the conservation pool at elevation 4724.0 (96,477 acre-feet); however the reservoir would not fill under the Minimum Probable runoff scenario. Based upon the storage content of Gibson Reservoir on September 30, 2007, a minimum winter release of approximately 60 ft<sup>3</sup>/s to the Sun River will be required in order to conserve storage for the 2008 irrigation season. These flow rates may vary as runoff and snowpack conditions change.





TABLE MTT14C

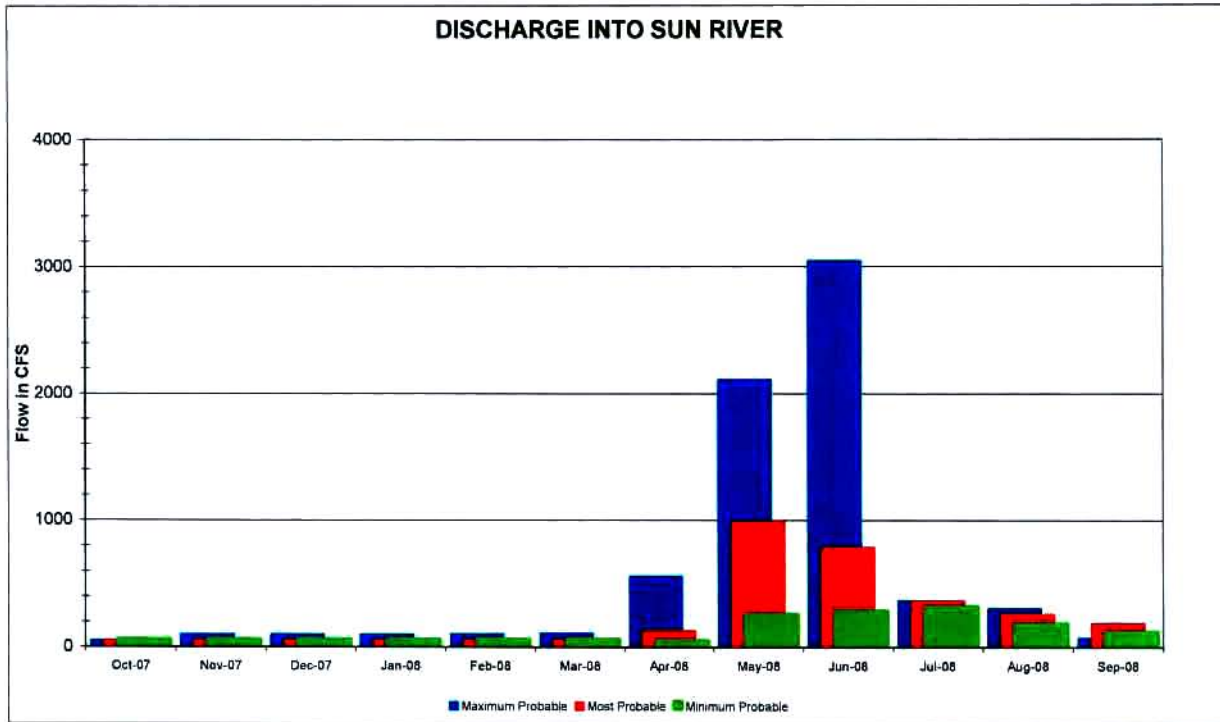
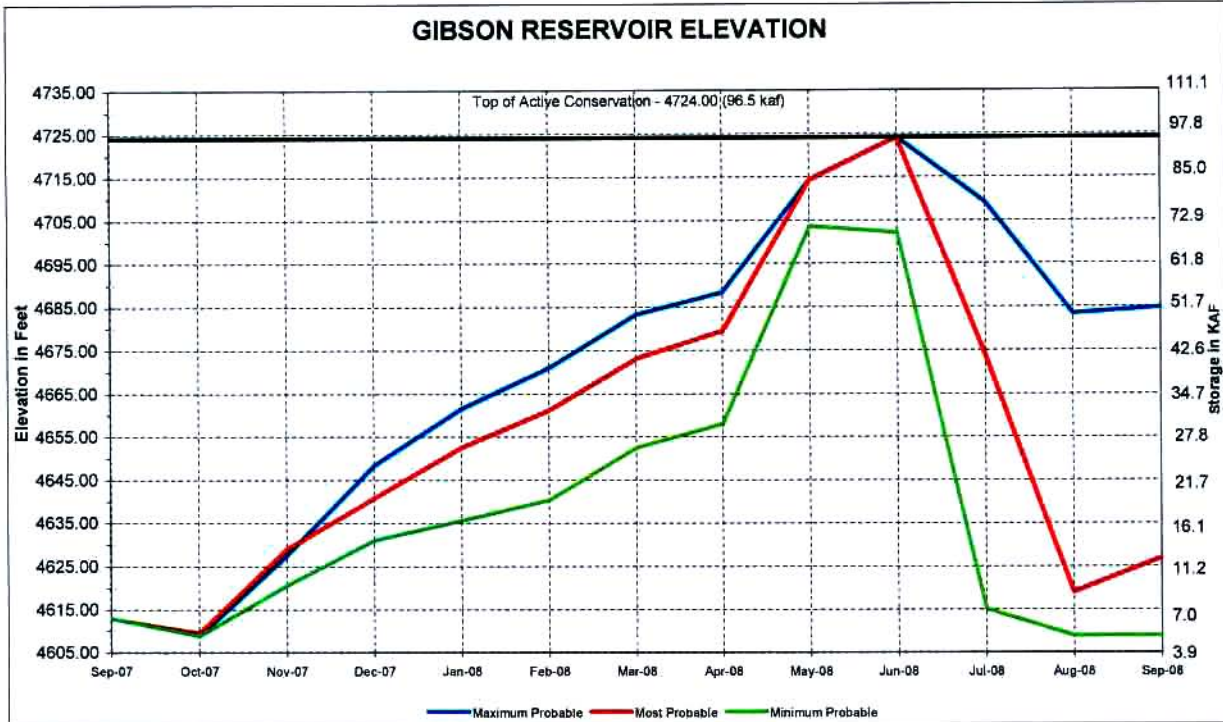
**GIBSON RESERVOIR MONTHLY OPERATIONS**  
Based on October 2007 Inflow Estimates

2008 Maximum Probable Runoff

Gibson Reservoir	Initial Cont		6.2 kaf		Maximum Cont		96.5 kaf		Minimum Cont		5.0 kaf		Total	
	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		Sep
Monthly Inflow	kaf	20.0	17.4	15.7	13.2	11.7	15.8	46.1	202.9	261.6	88.4	25.7	20.2	738.7
Spillway Rels	cfs	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Release	kaf	21.2	10.0	4.4	4.6	4.7	5.1	41.1	173.9	249.1	107.1	53.4	18.9	693.5
Total Release	cfs	345	168	72	75	82	83	691	2828	4186	1742	868	318	
End-Month Content	kaf	5.0	12.4	23.7	32.3	39.3	50.0	55.0	84.0	96.5	77.8	50.1	51.4	
End-Month Elevation	ft	4608.95	4627.59	4648.47	4661.66	4671.01	4683.20	4688.34	4714.21	4724.02	4709.17	4683.30	4684.66	
End-Month Area	acre	297.4	476.0	598.6	705.3	798.3	949.2	995.4	1249.1	1296.2	1207.9	950.3	964.2	
Net Change Content	kaf	-1.2	7.4	11.3	8.6	7.0	10.7	5.0	29.0	12.5	-18.7	-27.7	1.3	45.2
Sun River Div Dam	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Gain Below Gibson	cfs	34	32	28	24	23	24	62	280	370	125	46	50	
Rels to WFC	cfs	0	76	0	0	0	0	124	125	0	0	0	0	
Rels to PSC	cfs	329	24	0	0	0	0	71	870	1513	1503	612	296	
Total Diversion	kaf	20.2	5.9	0.0	0.0	0.0	0.0	11.6	61.2	90.0	92.4	37.6	17.6	336.5
Total Diversion	cfs	329	99	0	0	0	0	195	995	1513	1503	612	296	
Flow Over Div Dam	kaf	3.1	6.0	6.1	6.1	6.0	6.6	33.2	129.9	181.1	22.4	18.6	4.3	423.4
Flow Over Div Dam	cfs	50	101	99	99	104	107	558	2113	3043	364	303	72	
Min River Rels	kaf	3.1	6.0	6.1	6.1	5.8	6.1	11.9	12.3	11.9	6.1	6.1	3.0	84.5
Min River Rels	cfs	50	100	100	100	100	100	200	200	200	100	100	50	
Willow Crk Operations	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Native Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.0	0.0	1.1
Total Inflow	kaf	0.0	3.8	0.0	0.0	0.0	0.0	6.3	7.0	0.6	0.0	0.0	0.0	17.7
WCR Dam Rels	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	10.0	16.9
End-Month Content	kaf	14.2	18.0	18.0	18.0	18.0	18.0	24.3	31.3	31.9	31.9	25.0	15.0	
End-Month Elevation	ft	4127.95	4131.58	4131.58	4131.58	4131.58	4131.58	4136.61	4141.62	4142.04	4142.04	4137.13	4128.76	
Net Change Content	kaf	0.0	3.8	0.0	0.0	0.0	0.0	6.3	7.0	0.6	0.0	-6.9	-10.0	0.8
Pishkun Operations	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Rels to PSC	kaf	20.2	1.4	0.0	0.0	0.0	0.0	4.2	53.5	90.0	92.4	37.6	17.6	316.9
Total Inflow	kaf	17.2	1.2	0.0	0.0	0.0	0.0	3.6	42.8	73.8	78.5	32.0	15.0	264.1
PSH Dam Rels	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	74.0	85.0	40.0	15.0	249.0
End-Month Content	kaf	34.1	35.3	35.3	35.3	35.3	35.3	38.9	46.7	46.5	40.0	32.0	32.0	
End-Month Elevation	ft	4361.09	4362.01	4362.01	4362.01	4362.01	4362.01	4364.65	4370.00	4369.87	4365.44	4359.40	4359.40	
Net Change Content	kaf	17.2	1.2	0.0	0.0	0.0	0.0	3.6	7.8	-0.2	-6.5	-8.0	0.0	15.1
Greenfields Irrig	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
GID Demand	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	74.0	85.0	40.0	15.0	249.0
GID Delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	74.0	85.0	40.0	15.0	249.0
River Blw Div Dam	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow Over Div Dam	cfs	50	101	99	99	104	107	558	2113	3043	364	303	72	
PSC Return Flow	cfs	47	3	0	0	0	0	8	140	218	192	81	44	
WCR Dam Rels	cfs	0	0	0	0	0	0	0	0	0	0	112	168	
Sr Demand Above	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	12.9	13.3	13.3	2.0	50.2
Sr Demand Below	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	5.4	5.5	5.5	2.0	24.9
Flow 8 Ft.Shaw Div	cfs	89	124	120	122	127	150	689	2371	3292	278	213	242	
Ft Shaw Demand	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.7	10.0	10.0	14.0	10.0	6.0	50.7
Ft Shaw Tot Deliv	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.7	10.0	10.0	14.0	10.0	6.0	50.7
Flow blw Ft. Shaw	cfs	89	124	120	122	127	150	677	2209	3124	50	50	141	



# FIGURE MTG15 GIBSON RESERVOIR



WATER YEAR 2008

### Lake Elwell (Tiber Dam)

Three operating plans were prepared for 2008 to show the operations of Lake Elwell which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Table MTT15 and Figure MTG16. These plans are presented only to show the probable limits of operations; therefore, actual conditions and operations could vary widely from the plans.

In 2002, Reclamation surveyed Lake Elwell 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 October of 1957. The 2002 survey determined that Lake Elwell has a storage capacity of 925,649 acre-feet and a surface area of 18,275 acres at a reservoir elevation of 2993.00. Since closure in 1957, the reservoir has accumulated a sediment volume of 42,179 acre-feet below elevation 2993.00. This volume represents a 4.4 percent change in total capacity at this elevation. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

The objectives of operations at Lake Elwell are to provide flood control in cooperation with the Corps of Engineers, to provide fish and wildlife enhancement to the area, and supply water for irrigation and municipal uses. The reservoir is operated under the following criteria and limitations:

1. Whenever an adequate water supply is available, Tiber Dam and Reservoir is operated to maintain a minimum flow of 500 cfs or more in the Marias River immediately below Tiber Dam to provide a healthy river fishery. When an adequate water supply is not available to maintain a release of 500 cfs, releases will be reduced to 380 cfs during the irrigation season and to 320 cfs during the non-irrigation season. During periods of extreme extended drought it may be necessary to reduce releases to as low as 250 cfs during the non-irrigation season.
2. During unusually low runoff years, the reservoir may not fill in order to maintain the desired or minimum flow levels.
3. Based on monthly seasonal water supply forecasts prepared during January through June, releases are adjusted to allow storage to fill to elevation 2993 (925,649 acre-feet) (top of joint-use pool) by the end of June.
4. To minimize lowland flooding, maximum releases are currently maintained below 5,500 cfs. The maximum safe channel capacity of the Marias River is currently established as 10,000 cfs.

5. After storage has peaked, usually in June, releases are adjusted to evacuate storage to an elevation between 2976-2980 (667,213-719,885 acre-feet) by March 1. This elevation is dependent upon the monthly water supply forecasts in order to provide adequate space to control the next season's snowmelt runoff.
6. Maintain Tiber Reservoir at or above elevation 2982 (747,953 acre-feet) during Memorial Day Weekend in late May through Labor Day Weekend in early September, to protect flat water recreation interests.
7. During October to early November, set a release that can be reasonably maintained through the fall and winter. A stable flow or one that is gradually increased during the winter is needed to protect the spawning habitat for brown trout. This flow rate should be low enough to minimize the possibility that flows may need to be reduced as a result of below normal winter mountain snowpack and runoff projections.
8. If conditions allow, attempt to maintain stable releases to Marias River during April 1 through May 15 to protect goose nesting.
9. If conditions allow, avoid dropping the reservoir level during April and May, to protect fish spawning in the reservoir.
10. In close coordination with Montana Fish, Wildlife and Parks (MFWP), whenever an adequate water supply is available and conditions allow, releases will be scheduled to assimilate a natural spring runoff hydrograph which normally occurs in late May through early June.
11. All flood control operations are closely coordinated with the Corps of Engineers. If the Corps advises that replacement storage is desirable during the maximum probable runoff, releases during the spring runoff period from March through June will be maintained at about 500 cfs, allowing storage to exceed elevation 2993 feet (925,649 acre-feet), the top of the joint-use pool.
12. March-June releases are based on forecasted inflows with the objective of filling Lake Elwell to an elevation of 2993 feet (925,649 acre-feet) by the end of June. However, in some years, March-June releases may be based on filling the reservoir to as high as an elevation of 3008 feet (1,227,174 acre-feet) by the end of June, to provide replacement storage and assist the Corps with the operations of their main stem reservoir system.
13. Whenever possible, attempts are made to maintain water temperatures in the Marias River between 55°F and 60°F during June 1 through September 15.
14. To prevent ice jam flooding from occurring, the maximum desired winter release is maintained no higher than 700 cfs.
15. Under normal operations, river releases of up to about 700 cfs will generally be released through the 7.5 MW FERC powerplant. If releases greater than 700 cfs are required, flows in excess of the powerplant capacity will be released through

a combination of the river outlet works regulating gate and the powerplant or through the auxiliary outlet works or through the spillway gates.

At the beginning of water year 2008, the storage content in Lake Elwell was 691,869 acre-feet at elevation 2977.91 feet, approximately 88 percent of normal and 75 percent of full capacity. This was 77,332 acre-feet lower than at this same time a year ago.

The most probable October-February inflows to Lake Elwell were estimated to equal flows of a lower decile year or a year with a 90 percent chance of being exceeded. Most probable March-September inflows were estimated to equal flows of a lower quartile year or a year with a 75 percent chance of being exceeded based on historic records.

The minimum probable October-February inflows to Lake Elwell were estimated to equal 25 percent less than the most probable inflows. The minimum probable March-September inflows were estimated to equal flows of a lower decile year or a year with a 90 percent chance of being exceeded based on historic records.

The maximum probable October-February inflows to Lake Elwell were estimated to equal 25 percent more than the most probable inflows. The maximum probable March-September inflows were estimated to equal flows of a median year or a year with a 50 percent chance of being exceeded based on historic records.

Based on the end of September storage level, under normal runoff conditions, Lake Elwell would fill to elevation 2988.00 by the end of June and under low runoff conditions would fill to elevation 2983.66 by the end of June. Under maximum runoff conditions, Lake Elwell would fill to the top of the joint use pool at elevation 2993 feet (925,649 acre-feet) by the end of June. A minimum river release of 320 cfs would be maintained through the winter under the most and maximum probable runoff conditions. Under the minimum probable runoff conditions, releases would be maintained at 250 cfs through the winter.

TABLE MTT15

TIBER RESERVOIR OPERATING PLAN  
Based on October 1 2007 Inflow Estimates

**2008 MINIMUM Probable Inflow Forecast**

Tiber Reservoir	2007	Initial Cont Elev				Maximum Cont Elev				Minimum Cont Elev				Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
				691.9 kaf 2977.91 ft				1356.5 kaf 3013.69 ft					260.7 kaf 2932.27 ft	
Monthly Inflow	kaf	6.2	7.6	6.5	7.7	9.1	18.7	38.5	87.6	61.1	19.9	4.9	4.1	271.9
Evaporation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dam Release	kaf	19.7	14.9	15.4	15.4	14.4	15.4	19.3	24.6	23.8	24.6	24.6	23.8	235.9
Dam Release	cfs	320	250	250	250	250	250	324	400	400	400	400	400	
End-Month Content	kaf	678.4	671.1	662.2	654.5	649.2	652.5	671.7	734.7	772.0	767.3	747.6	727.9	
End-Month Elevation	ft	2976.87	2976.31	2975.60	2974.99	2974.57	2974.83	2976.35	2981.07	2983.66	2983.34	2981.98	2980.58	
Net Change Content	kaf	-13.5	-7.3	-8.9	-7.7	-5.3	3.3	19.2	63.0	37.3	-4.7	-19.7	-19.7	36.0

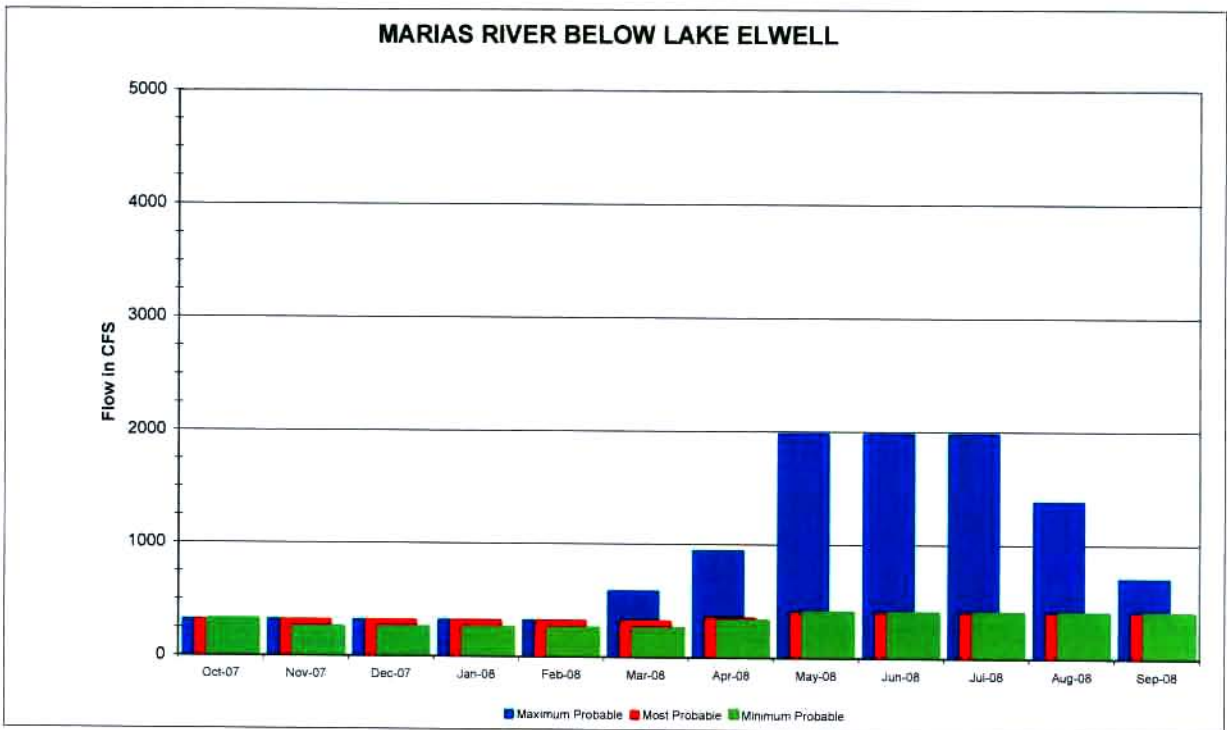
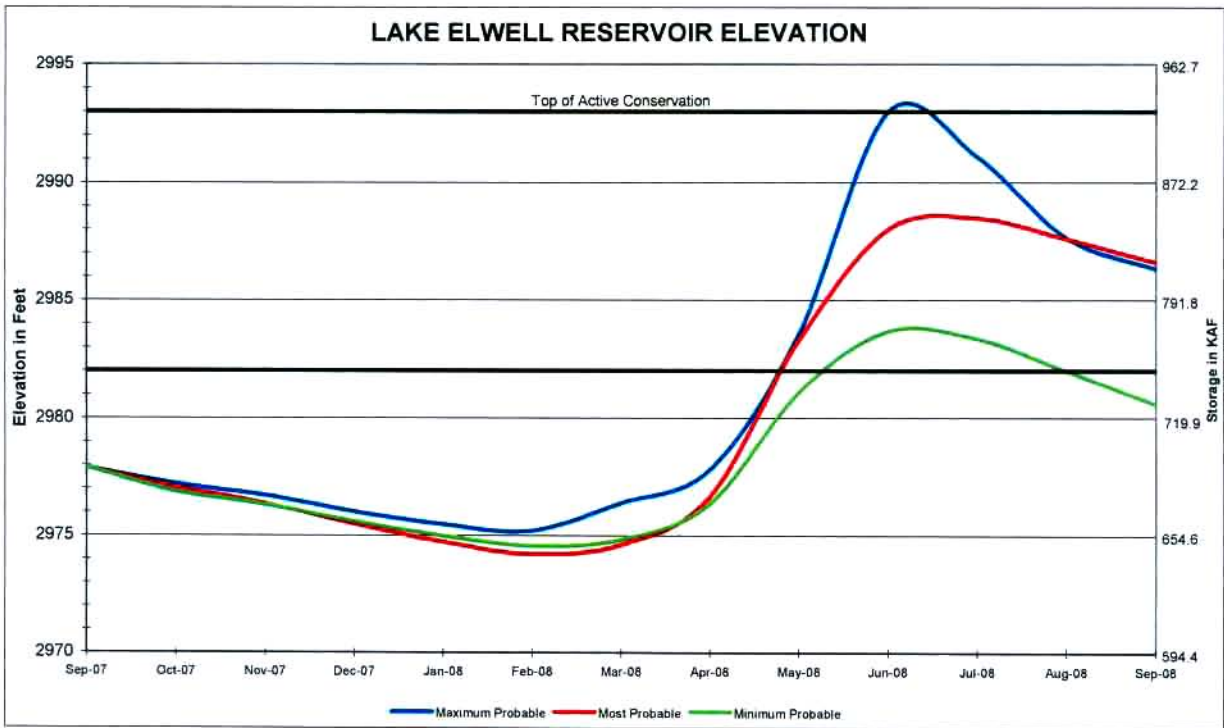
**2008 MOST Probable Inflow Forecast**

Tiber Reservoir	2007	Initial Cont Elev				Maximum Cont Elev				Minimum Cont Elev				Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
				691.9 kaf 2977.91 ft				1356.5 kaf 3013.69 ft					260.7 kaf 2932.27 ft	
Monthly Inflow	kaf	8.3	10.1	8.7	10.2	12.1	24.7	46.4	115.9	95.7	32.5	10.1	8.0	382.7
Evaporation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dam Release	kaf	19.7	19.0	19.7	19.7	18.4	19.7	20.8	24.6	23.8	24.6	24.6	23.8	258.4
Dam Release	cfs	320	319	320	320	320	320	350	400	400	400	400	400	
End-Month Content	kaf	680.5	671.6	660.6	651.1	644.8	649.8	675.4	766.7	838.6	846.5	832.0	816.2	
End-Month Elevation	ft	2977.04	2976.34	2975.48	2974.72	2974.21	2974.62	2976.64	2983.30	2988.00	2988.48	2987.59	2986.59	
Net Change Content	kaf	-11.4	-8.9	-11.0	-9.5	-6.3	5.0	25.6	91.3	71.9	7.9	-14.5	-15.8	124.3

**2008 MAXIMUM Probable Inflow Forecast**

Tiber Reservoir	2007	Initial Cont Elev				Maximum Cont Elev				Minimum Cont Elev				Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
				691.9 kaf 2977.91 ft				1356.5 kaf 3013.69 ft					260.7 kaf 2932.27 ft	
Monthly Inflow	kaf	10.4	12.6	10.9	12.8	15.1	50.8	74.2	201.5	273.2	87.3	26.5	20.7	796.0
Evaporation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dam Release	kaf	19.7	19.0	19.7	19.7	18.4	35.8	56.0	121.7	117.8	121.8	84.9	41.7	676.2
Dam Release	cfs	320	319	320	320	320	582	941	1979	1980	1981	1381	701	
End-Month Content	kaf	682.6	676.2	667.4	660.5	657.2	672.2	690.4	770.2	925.6	891.1	832.7	811.7	
End-Month Elevation	ft	2977.20	2976.70	2976.01	2975.47	2975.21	2976.39	2977.80	2983.54	2993.00	2991.08	2987.63	2986.31	
Net Change Content	kaf	-9.3	-6.4	-8.8	-6.9	-3.3	15.0	18.2	79.8	155.4	-34.5	-58.4	-21.0	119.8

# FIGURE MTG16 LAKE ELWELL



WATER YEAR 2008

## **Milk River Project**

The 120,000-acre Milk River Project is served by three reservoirs: Sherburne, Fresno, and Nelson. All are single-purpose irrigation structures except Fresno, which has some joint-use flood control space and furnishes a small amount of municipal water to Havre, Chinook, and Harlem, Montana, and to the Hill County Water District.

### **Lake Sherburne**

In 2002, Reclamation surveyed Lake Sherburne 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 1919. The 2002 survey determined that Lake Sherburne has a storage capacity of 66,147 acre-feet and a surface area of 1,719 acres at a reservoir elevation of 4788.00. Since Lake Sherburne closure in 1919, the measured total volume change at reservoir elevation 4788.00 was estimated to be 343 acre-feet between the 1948 and 2002 surveys and 1,707 acre-feet between the 1983 and 2002 surveys. Due to the upstream lakes, the loss due to sediment deposition in Lake Sherburne should be minimal so it is assumed the volume differences between the surveys are due to the different survey methods and the differences in the vertical datum.

Storage on September 30, 2007 was 7,025 acre-feet, 84 percent of normal at elevation 4737.97. The total inflow to Lake Sherburne during water year 2007 was 140,322 acre-feet, 98 percent of normal. The diversion of the waters of the St. Mary River, including Lake Sherburne inflow, is carried out in accordance with the Order of the International Joint Commission dated October 4, 1921. There are no agreements for reservoir releases specifically for fish, wildlife, or recreation purposes. There is no minimum release requirement. All stored water is required for irrigation use, and other uses are incidental. Lake Sherburne lands are administered for recreation and wildlife habitat by the National Park Service in accordance with the management plan for Glacier National Park. Lake Sherburne is operated under the following criteria:

1. Near the end of the spring runoff, the discharge should be regulated based on snow measurements and inflow forecasts to insure filling the reservoir to elevation 4788.00. The final reservoir filling up to elevation 4788.00 should be delayed until near the end of the spring runoff. During this final phase, care should be taken to avoid use of the outlet works overflow crest because of less desirable hydraulic flow conditions which develop in the conduit. When the water surface reaches elevation 4788.00, the outlet gates must be opened to the extent necessary to maintain this elevation. If reservoir inflows continue to increase, the outlet gates must be fully opened and maintained in the full open position until the water surface recedes to elevation 4788.00.
2. Every effort must be made to prevent the reservoir from spilling while assuring a full reservoir. During all stages, except the final stage of the spring runoff, the outlet gates should be adjusted to maintain the water surface no higher than elevation 4778.00. The outlet gates should be fully opened during the spring runoff when the water surface rises to or above elevation 4788.00 and fully open at any time the water surface is above elevation 4788.00.

Three operating plans were prepared for 2008 to show the operations which could occur under various runoff conditions. These plans were prepared to show the probable limits of operations, therefore, actual conditions and operations could vary widely from the plans.

The most probable plan estimates October and December inflows increasing from 10 percentile to 25 percentile values. The January-April inflows are estimated to increase from 25 percentile to 30 percentile values. The May-July inflows are estimated to equal median flows. August and September inflows are estimated to be equal to the 25 percentile values.

October flows for the St. Mary River near the International Boundary are estimated to equal approximately 20 percentile flows and November-April are estimated to equal 30 percentile flows. May and June flows are estimated at median values, while July through September flows are estimated at 30 percentile values.

The minimum probable October inflow is estimated to equal near record low. The November through September inflows to Lake Sherburne were estimated to equal 10 percentile inflows or inflows that are exceeded 90 percent of the time. October September flows in the St. Mary River near the International Boundary are also estimated to equal near record low, while November-September flow are estimated to equal 10 percentile flows.

The maximum probable October through May inflows to Lake Sherburne are estimated to equal 75 percentile flows or inflows that are exceeded 25 percent of the time. The June and July inflows were estimated to equal 90 percentile inflows or inflows that are exceeded 10 percent of the time, while the August through September inflows are estimated to decrease to median values. October through April flows in the St. Mary River near the International Boundary are estimated to equal median flows as well as flows in August-September. The May-July flows are estimated to equal 75 percentile flows.

### **Fresno Reservoir**

Storage in Fresno Reservoir was 40,352 acre-feet, 101 percent of normal at elevation 2559.61, by the end of water year 2007. The natural runoff of the Milk River at the Eastern Crossing, which is immediately upstream of Fresno Reservoir, is computed as part of the International Joint Commission accounting and published in associated report each subsequent water year. The initial estimate of natural flow at Eastern Crossing for water year 2007 is approximately 61,600 acre-feet.

The storage is primarily for irrigation and municipal water supply. However, the operation of the joint use storage space does provide both conservation use and limited flood control benefits. There is no exclusive flood control space, but some flood benefits are obtained by maintaining the water level below elevation 2567.0 by March 1, prior to spring runoff. Maintaining the water level below elevation 2567.0 provides 32,534 acre-feet of space for storage of spring runoff.

Winter releases will be the amount necessary to provide a minimum of 32,534 acre-feet of space before spring runoff begins, however no less than 25 cfs to the Milk River as measured at the highway bridge at Havre. An anticipated release of 35 to 45 cfs will be



made from Fresno Reservoir during October through February to meet contractual amounts required for the maintenance of suitable water quality for municipal use for the cities of Havre, Chinook, and Harlem, Montana. After spring runoff begins, releases will be made only to meet conservation requirements until it becomes obvious that the reservoir will fill and spill. At that time, releases will be gradually increased so that spill will be minimized when the pool rises above the spillway crest. The only required summer releases will be those for irrigation and municipal uses. Municipal requirements are established by contract and scheduled in advance by the municipal water contractors.

The most probable inflows during October through September are estimated to transition from 12.5 percentile to median flow conditions.

The minimum probable inflows during October through September to Fresno Reservoir are estimated to equal 10 percentile inflows or inflows that have historically been exceeded 90 percent of the time.

The maximum probable inflows during October through January to Fresno Reservoir are estimated to equal median flow conditions. The February-September inflows are estimated to equal 75 percentile inflows or inflows that have historically been exceeded 25 percent of the time.

### **Nelson Reservoir**

Storage in Nelson Reservoir on September 30, 2007 was 53,097 acre-feet, 94 percent of average at elevation 2214.95. Nelson Reservoir is filled in the spring, prior to the irrigation season, utilizing Dodson South Canal to convey water from the Milk River to the reservoir. Under most circumstances, water is transferred from storage in Fresno Reservoir in the early spring instead of in the fall to minimize seepage losses from Nelson Reservoir during the winter. However, if water is available in Fresno Reservoir after the irrigation season, it may be transferred to Nelson Reservoir to ensure a full supply for the following irrigation season. Nelson Reservoir is operated to satisfy irrigation demands and all other uses are incidental to irrigation. In conjunction with delivering water to Nelson Reservoir, water is conveyed through the Dodson South Canal to provide the Bowdoin Wildlife Refuge adequate water for migratory birds. Bowdoin usually receives a proportional share of their full contract allotment, 3,500 acre-feet, based on the irrigation supply. The operation of Nelson Reservoir and delivery to Bowdoin is integrated with the operation of Fresno Reservoir and Lake Sherburne to ensure maximum utilization of expected runoff. During August through September of the 2007 irrigation season, approximately 11,100 acre-feet of water was transferred to Nelson Reservoir from Fresno Reservoir. This allowed storage to increase during September, ending the water year at 94 percent of normal levels.

Irrigation shortages are not expected to occur under the maximum or most probable expected runoff, but would occur under the minimum probable expected runoff. Lake Sherburne is expected to fill under the maximum probable runoff, but not under the most or minimum probably. Fresno Reservoir is expected to fill under the maximum or most probable expected, but not under the minimum expected runoff. These operations for the three runoff conditions are shown in Table MTT16A-C and Figure MTG17-18. Water will need to be transferred to Nelson Reservoir during early spring of 2008 to provide water for those users dependent on a full and supplemental supply from Nelson

Reservoir. The projected transfer of water during March and April is anticipated to be approximately 12,000-43,000 acre-feet for all three operational plans depending on irrigation allotments and available natural runoff.

TABLE MTT16A  
MILK RIVER BASIN OPERATING PLAN  
Based on October 1 Inflow Estimates

2008 Minimum Probable Runoff

Sherburne Reservoir		Initial Cont			7.0 kaf				Maximum Cont		66.2 kaf			Minimum Cont		3.1 kaf		Total
		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
				Elev	4737.94 ft			Elev	4788.03 ft			Elev	4731.73 ft					
Monthly Inflow	kaf	2.5	3.9	3.3	2.5	1.5	2.4	8.4	24.8	27.6	14.4	6.4	4.1	101.8				
Release	kaf	0.0	0.0	0.0	0.0	0.0	2.0	22.3	22.2	18.9	25.6	7.1	0.0	98.1				
Release	cfs	0	0	0	0	0	33	375	361	318	416	115	0					
Net Change Content	kaf	2.5	3.9	3.3	2.5	1.5	0.4	-13.9	2.6	8.7	-11.2	-0.7	4.1	3.7				
End-Month Content	kaf	9.5	13.4	16.7	19.2	20.7	21.1	7.2	9.8	18.5	7.3	6.6	10.7					
End-Month Elevation	ft	4741.33	4746.13	4749.83	4752.48	4754.01	4754.41	4738.22	4741.72	4751.75	4738.36	4737.36	4742.87					
St. Mary River		Initial Cont			7.0 kaf				Maximum Cont		66.2 kaf			Minimum Cont		3.1 kaf		Total
		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
St. Mary Gain	kaf	7.8	4.8	4.8	3.7	4.5	4.6	7.5	68.5	81.1	42.1	21.7	14.3	265.4				
Nat. flow at bound.	kaf	10.3	8.7	8.1	6.2	6.0	7.0	15.9	93.3	108.7	56.5	28.1	18.4	367.2				
US share	kaf	2.6	4.4	4.1	3.1	3.0	3.5	4.0	36.4	44.4	18.0	7.0	4.6	135.1				
Can share	kaf	7.7	4.3	4.0	3.1	3.0	3.5	11.9	56.9	64.3	38.5	21.1	13.8	232.1				
Excess to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Max canal flow	cfs	0	0	0	0	0	400	650	650	630	650	650	0					
Desired canal div	cfs	0	0	0	0	0	50	300	550	600	475	125	0					
St. Mary Canal Div	cfs	0	0	0	0	0	50	301	550	600	475	125	0					
St. Mary Canal Div	kaf	0.0	0.0	0.0	0.0	0.0	3.1	17.9	33.8	35.7	29.2	7.7	0.0	127.4				
Fresno Reservoir		Initial Cont			40.4 kaf				Maximum Cont		92.9 kaf			Minimum Cont		0.5 kaf		Total
		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
				Elev	2559.63 ft			Elev	2575.00 ft			Elev	2530.27 ft					
Milk R. runoff	kaf	0.8	0.8	0.4	0.5	1.2	3.5	5.2	2.7	0.0	0.0	0.0	1.6	16.7				
From St. Mary Canal	kaf	0.0	0.0	0.0	0.0	0.0	2.8	16.1	30.4	32.1	26.3	6.9	0.0	114.6				
Total inflow	kaf	0.8	0.8	0.4	0.5	1.2	6.3	21.3	33.1	32.1	26.3	6.9	1.6	131.3				
Release	kaf	2.6	2.6	2.6	2.6	2.5	2.6	6.7	17.3	32.1	39.1	23.9	11.2	145.8				
Release	cfs	42	44	42	42	43	42	113	281	539	636	389	188					
Project irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	24.9	28.4	18.5	6.1	87.0				
Bowdoin MR req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	1.5				
Ft Belknap irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	1.0	2.0	7.0				
Nelson transfer	kaf	1.0	0.0	0.0	0.0	0.0	5.0	7.0	7.0	2.0	5.0	3.0	5.0	35.0				
Irrigation delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.5	9.1	26.9	30.4	19.5	8.1	95.5				
Fresno bypass	kaf	2.5	2.6	2.6	2.6	2.5	2.0	-0.1	0.0	0.0	-0.1	0.0	0.0	14.6				
Irrigation shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Net Change Content	kaf	-1.8	-1.8	-2.2	-2.1	-1.3	3.7	14.6	15.7	0.0	-12.8	-17.0	-9.6	-14.6				
End-Month Content	kaf	38.6	36.8	34.6	32.5	31.2	34.9	49.5	65.3	65.3	52.5	35.5	25.9					
End-Month Elevation	ft	2558.84	2558.04	2557.03	2556.03	2555.40	2557.17	2563.30	2568.45	2568.45	2564.38	2557.45	2552.66					
Nelson Reservoir		Initial Cont			53.1 kaf				Maximum Cont		79.0 kaf			Minimum Cont		18.0 kaf		Total
		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
				Elev	2214.95 ft			Elev	2221.61 ft			Elev	2199.91 ft					
Nelson delivery	kaf	1.0	0.0	0.0	0.0	0.0	5.0	6.8	6.9	2.0	5.0	2.9	4.7	34.3				
Nelson Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.1	10.4	7.8	2.2	32.5				
Malta irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.1	7.2	5.0	1.6	21.9				
Glasgow irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	3.2	2.8	0.6	10.6				
Net Change Content	kaf	-0.8	-1.8	-1.8	-1.8	-1.7	3.2	5.0	-0.9	-5.9	-7.2	-6.7	0.7	-19.7				
End-Month Content	kaf	52.3	50.5	48.7	46.9	45.2	48.4	53.4	52.5	46.6	39.4	32.7	33.4					
End-Month Elevation	ft	2214.72	2214.19	2213.64	2213.08	2212.53	2213.55	2215.04	2214.78	2212.99	2210.43	2207.61	2207.92					

TABLE MTT16B  
MILK RIVER BASIN OPERATING PLAN  
Based on October 1 Inflow Estimates

2008 Most Probable Runoff

		Initial Cont				Maximum Cont				Minimum Cont				Total	
		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		Sep
Sherburne Reservoir			7.0 kaf				66.2 kaf				3.1 kaf				
			Elev 4737.94 ft				Elev 4788.03 ft				Elev 4731.73 ft				
	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	
Monthly Inflow	kaf	5.0	4.0	3.5	2.6	2.0	2.8	9.0	34.1	40.2	19.1	7.4	5.2	134.9	
Release	kaf	1.0	0.0	0.0	0.0	0.0	0.0	26.0	20.2	1.5	29.1	37.6	17.4	132.8	
Release	cfs	16	0	0	0	0	0	437	329	25	473	612	292		
Net Change Content	kaf	4.0	4.0	3.5	2.6	2.0	2.8	-17.0	13.9	38.7	-10.0	-30.2	-12.2	2.1	
End-Month Content	kaf	11.0	15.0	18.5	21.1	23.1	25.9	8.9	22.8	61.5	51.5	21.3	9.1		
End-Month Elevation	ft	4743.24	4747.96	4751.75	4754.41	4756.37	4759.02	4740.54	4756.08	4785.26	4779.02	4754.61	4740.81		
St. Mary River		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
St. Mary Gain	kaf	11.0	8.9	6.7	5.4	5.0	6.2	12.2	94.3	134.1	58.8	26.4	17.7	386.7	
Nat. flow at bound.	kaf	16.0	12.9	10.2	8.0	7.0	9.0	21.2	128.4	174.3	77.9	33.8	22.9	521.6	
US share	kaf	4.0	6.5	5.1	4.0	3.5	4.5	5.3	53.9	77.2	28.7	8.5	5.7	206.9	
Can share	kaf	12.0	6.4	5.1	4.0	3.5	4.5	15.9	74.5	97.1	49.2	25.3	17.2	314.7	
Excess to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Max canal flow	cfs	0	0	0	0	0	400	650	650	640	630	630	600		
Desired canal div	cfs	0	0	0	0	0	25	375	650	640	630	630	300		
St. Mary Canal Div	cfs	0	0	0	0	0	28	375	651	640	629	629	301		
St. Mary Canal Div	kaf	0.0	0.0	0.0	0.0	0.0	1.7	22.3	40.0	38.1	38.7	38.7	17.9	197.4	
Fresno Reservoir		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
			40.4 kaf				92.9 kaf				0.5 kaf				
			Elev 2559.63 ft				Elev 2575.00 ft				Elev 2530.27 ft				
Milk R. runoff	kaf	1.9	1.0	0.5	0.6	2.7	10.4	23.2	12.0	6.5	2.4	0.0	4.4	65.6	
From St. Mary Canal	kaf	0.0	0.0	0.0	0.0	0.0	1.5	20.1	36.0	34.3	34.8	34.8	16.1	177.6	
Total inflow	kaf	1.9	1.0	0.5	0.6	2.7	11.9	43.3	48.0	40.8	37.2	34.8	20.5	243.2	
Release	kaf	2.6	2.6	2.6	2.6	2.5	5.6	5.6	33.3	54.8	64.7	51.9	14.6	243.4	
Release	cfs	42	44	42	42	43	91	94	542	921	1052	844	245		
Project irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	45.3	51.7	33.7	7.1	154.3	
Bowdoin MR req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.5	0.0	0.0	0.0	0.0	3.5	
Ft Belknap irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.0	6.0	13.0	
Nelson transfer	kaf	3.0	0.0	0.0	0.0	0.0	15.0	18.0	16.0	5.0	7.0	10.0	5.0	79.0	
Irrigation delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	2.0	18.0	45.3	52.7	39.7	13.1	170.8	
Fresno bypass	kaf	2.3	2.6	2.6	2.6	2.5	0.0	0.0	0.5	-0.1	0.0	0.0	0.0	13.0	
Irrigation shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Net Change Content	kaf	-0.7	-1.6	-2.1	-2.0	0.2	6.3	37.7	14.7	-14.0	-27.5	-17.1	5.9	-0.2	
End-Month Content	kaf	39.7	38.1	36.0	34.0	34.2	40.5	78.2	92.9	78.9	51.4	34.3	40.2		
End-Month Elevation	ft	2559.33	2558.62	2557.68	2556.75	2556.84	2559.69	2571.78	2575.00	2571.94	2564.00	2556.89	2559.56		
Nelson Reservoir		2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
			53.1 kaf				79.0 kaf				18.0 kaf				
			Elev 2214.95 ft				Elev 2221.61 ft				Elev 2199.91 ft				
Nelson delivery	kaf	3.0	0.0	0.0	0.0	0.0	14.0	16.6	16.0	5.0	6.8	9.7	4.5	75.6	
Nelson Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	11.1	19.5	14.8	2.5	58.7	
Malta irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	7.4	13.0	9.0	1.8	38.4	
Glasgow irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.7	6.5	5.8	0.7	20.3	
Net Change Content	kaf	1.2	-1.8	-1.8	-1.8	-1.7	12.2	14.8	3.4	-7.9	-14.5	-6.9	0.2	-4.6	
End-Month Content	kaf	54.3	52.5	50.7	48.9	47.2	59.4	74.2	77.6	69.7	55.2	48.3	48.5		
End-Month Elevation	ft	2215.30	2214.78	2214.25	2213.71	2213.18	2216.71	2220.48	2221.29	2219.38	2215.55	2213.52	2213.58		

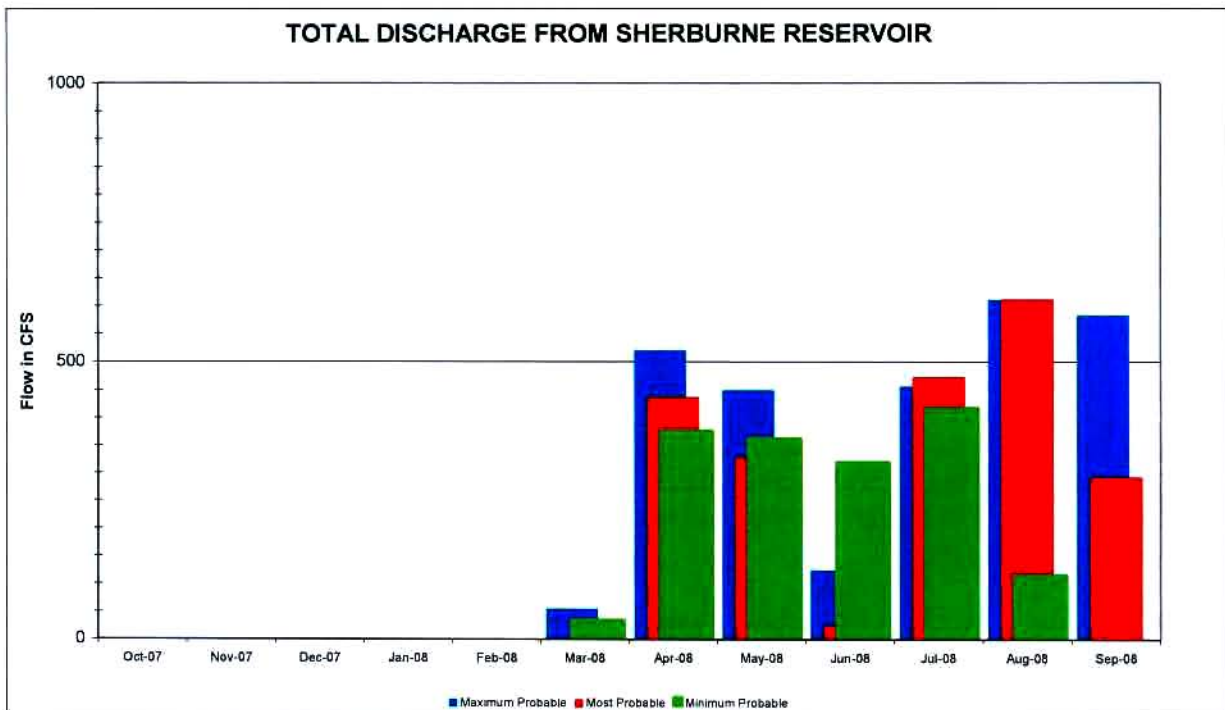
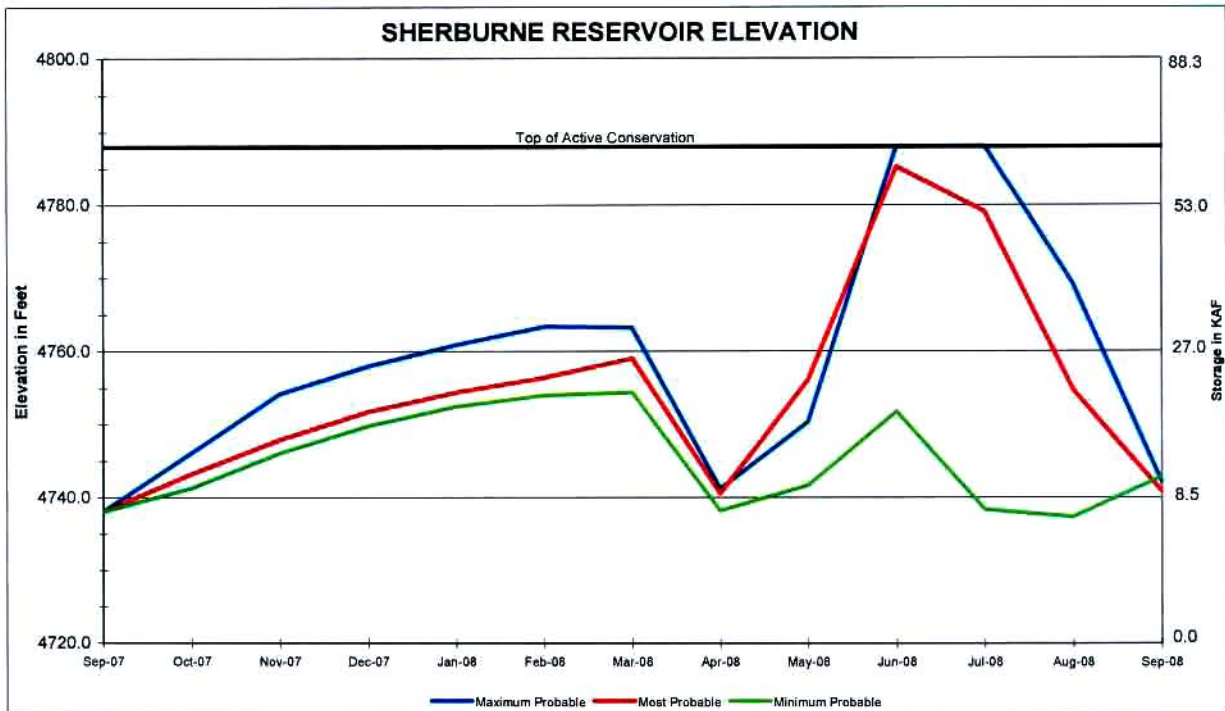
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TABLE MTT16C  
MILK RIVER BASIN OPERATING PLAN  
Based on October 1 Inflow Estimates

<u>2008 Maximum Probable Runoff</u>														
	2007	Initial Cont Elev 7.0 kaf 4737.94 ft				Maximum Cont Elev 66.2 kaf 4788.03 ft				Minimum Cont Kiev 3.1 kaf 4731.73 ft				Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Sherburne Reservoir														
Monthly Inflow	kaf	6.6	7.5	3.9	3.2	2.8	3.3	9.7	35.5	56.4	28.1	9.1	7.1	173.2
Release	kaf	0.2	0.0	0.0	0.0	0.0	3.4	31.0	27.7	7.4	28.1	37.6	34.7	170.1
Release	cfs	3	0	0	0	0	55	521	450	124	457	612	583	
Net Change Content	kaf	6.4	7.5	3.9	3.2	2.8	-0.1	-21.3	7.8	99.0	0.0	-28.5	-27.6	3.1
End-Month Content	kaf	13.4	20.9	24.8	28.0	30.8	30.7	9.4	17.2	66.2	66.2	37.7	10.1	
End-Month Elevation	ft	4746.13	4754.21	4757.99	4760.93	4763.41	4763.32	4741.20	4750.37	4788.03	4788.03	4769.17	4742.11	
St. Mary River	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
St. Mary Gain	kaf	18.9	10.7	8.6	6.9	6.1	8.6	24.3	125.4	164.1	100.0	31.8	19.1	524.5
Nat. flow at bound.	kaf	25.5	18.2	12.5	10.1	8.9	11.9	34.0	160.9	220.5	128.1	40.9	26.2	697.7
US share	kaf	6.4	9.1	6.3	5.1	4.5	6.0	8.5	70.2	100.3	53.8	10.2	6.6	287.0
Can share	kaf	19.1	9.1	6.2	5.0	4.4	5.9	25.5	90.7	120.2	74.3	30.7	19.6	410.7
Excess to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max canal flow	cfs	0	0	0	0	0	400	650	650	640	630	630	600	
Desired canal div	cfs	0	0	0	0	0	100	500	650	640	630	630	575	
St. Mary Canal Div	cfs	0	0	0	0	0	99	501	651	640	629	629	575	
St. Mary Canal Div	kaf	0.0	0.0	0.0	0.0	0.0	6.1	29.8	40.0	38.1	38.7	38.7	34.2	225.6
Fresno Reservoir	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Milk R. runoff	kaf	8.0	3.6	2.6	1.9	5.4	35.9	37.4	29.1	17.8	7.1	2.0	5.2	156.0
From St. Mary Canal	kaf	0.0	0.0	0.0	0.0	0.0	5.5	26.8	36.0	34.3	34.8	34.8	30.8	203.0
Total inflow	kaf	8.0	3.6	2.6	1.9	5.4	41.4	64.2	65.1	52.1	41.9	36.8	36.0	359.0
Release	kaf	2.6	2.6	2.6	2.6	2.5	17.4	52.2	57.2	58.6	62.8	53.6	19.2	333.9
Release	cfs	42	44	42	42	43	283	877	930	985	1021	872	323	
Project irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.7	48.7	55.5	36.2	6.3	164.4
Bowdoin MR req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.5	0.0	0.0	0.0	0.0	3.5
Ft Belknap irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.0	6.0	13.0
Nelson transfer	kaf	7.0	0.0	0.0	0.0	0.0	20.0	23.0	17.0	9.0	6.0	12.0	10.0	104.0
Irrigation delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	2.0	19.2	48.7	56.5	42.2	12.3	180.9
Fresno bypass	kaf	1.8	2.6	2.6	2.6	2.5	10.2	47.3	27.9	-0.1	0.0	0.0	-0.1	97.3
Irrigation shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change Content	kaf	5.4	1.0	0.0	-0.7	2.9	24.0	12.0	7.9	-6.5	-20.9	-16.8	16.7	25.0
End-Month Content	kaf	45.8	46.8	46.8	46.1	49.0	73.0	85.0	92.9	86.4	65.5	48.7	65.5	
End-Month Elevation	ft	2561.86	2562.26	2562.26	2561.98	2563.10	2570.50	2573.33	2575.00	2573.64	2568.52	2563.00	2568.51	
Nelson Reservoir	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Nelson delivery	kaf	7.0	0.0	0.0	0.0	0.0	20.0	11.4	13.5	8.6	5.4	11.4	9.5	86.8
Nelson Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	12.0	21.0	14.5	2.5	61.7
Malta irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	8.0	14.0	9.7	1.8	41.3
Glasgow irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	4.0	7.0	4.8	0.7	20.4
Net Change Content	kaf	5.2	-1.8	-1.8	-1.8	-1.7	18.2	9.6	0.0	-5.2	-17.4	-4.9	5.2	3.6
End-Month Content	kaf	58.3	56.5	54.7	52.9	51.2	69.4	79.0	79.0	73.8	56.4	51.5	56.7	
End-Month Elevation	ft	2216.41	2215.91	2215.41	2214.90	2214.40	2219.30	2221.61	2221.61	2220.38	2215.88	2214.49	2215.97	

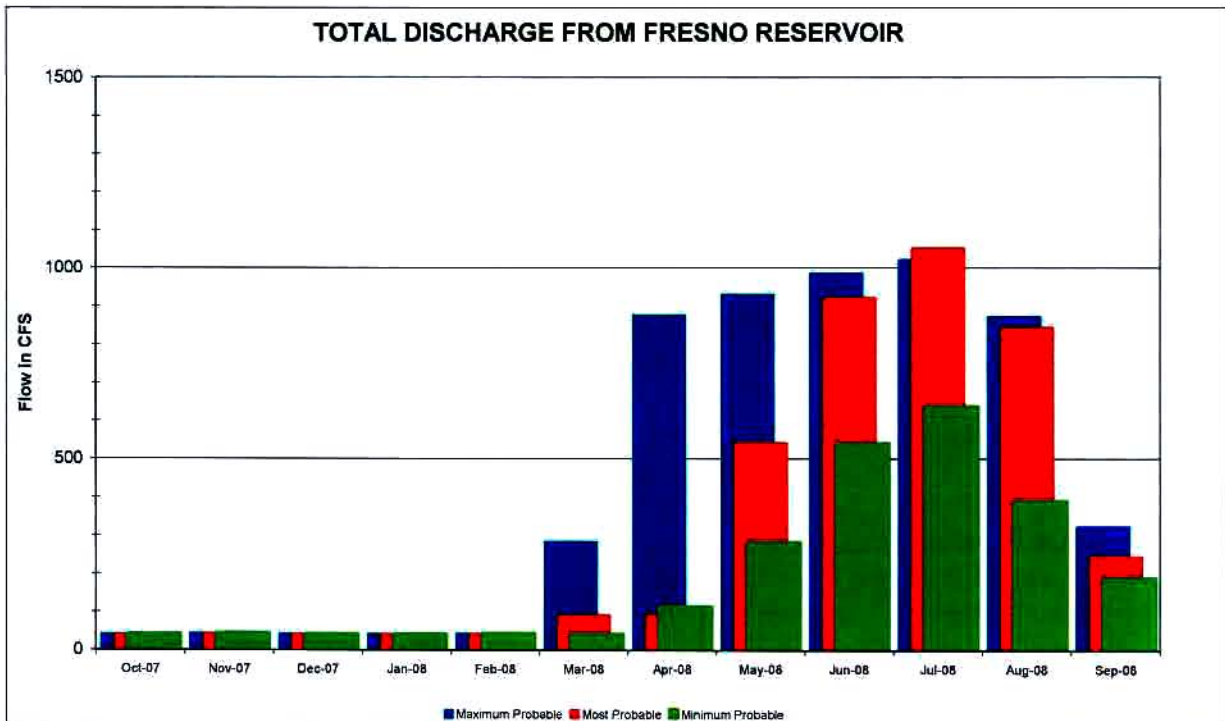
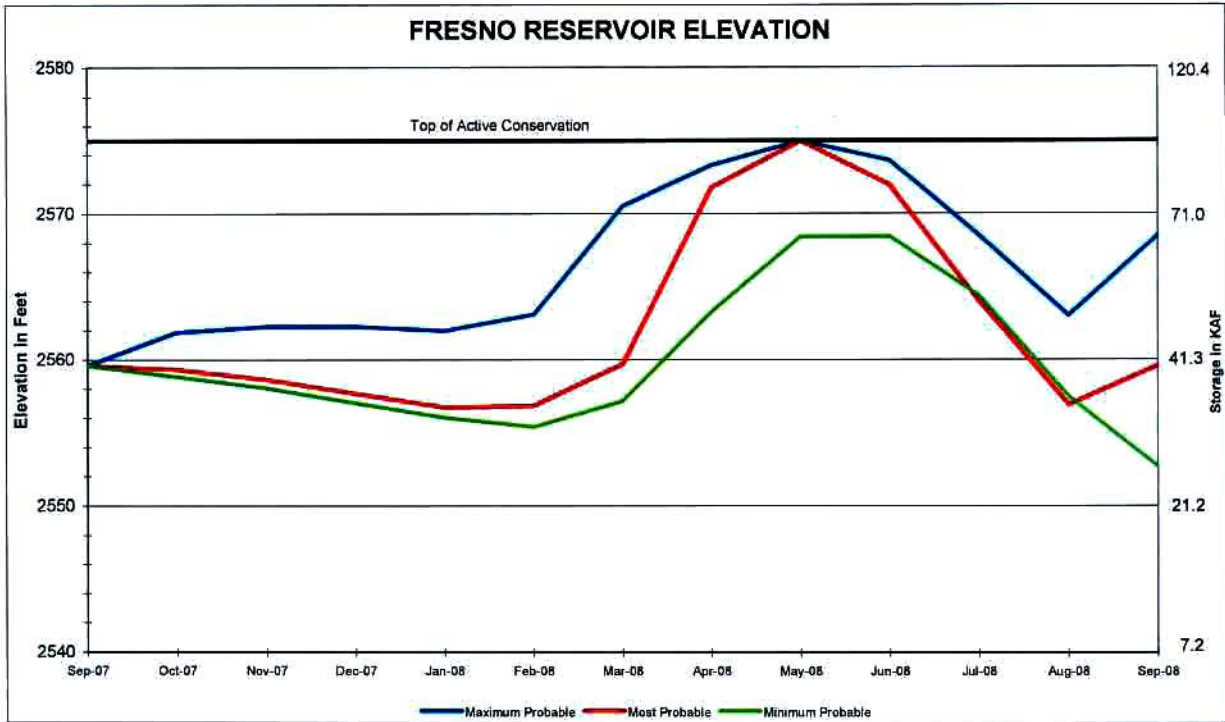
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# FIGURE MTG17 SHERBURNE RESERVOIR



WATER YEAR 2008

# FIGURE MTG18 FRESNO RESERVOIR



WATER YEAR 2008

## **Bighorn Lake and Yellowtail Powerplant**

Three operating plans were prepared for 2008 to show the operations of Bighorn Lake which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Tables MTT17A-C and Figure MTG19. These plans were prepared only to show the probable limits of operations and therefore, actual conditions and operations could vary widely from the plans in order to conform with the authorized project purposes and the current general operating criteria established for Yellowtail Dam and Bighorn Lake.

The objectives of operations at Yellowtail are to meet all contractual and agreement obligations, all conservation commitments, to optimize generation, provide flood control in cooperation with the Corps of Engineers, and meet fish and wildlife and recreational needs. The reservoir is operated under the following criteria and limitations:

- (1) Beginning near the first of January and at least monthly thereafter through June, forecasts are made of the estimated spring inflow from snow cover and precipitation data. When these forecasts become available, the Water and Facilities Management Group manages and regulates Yellowtail Dam and Bighorn Lake to allow storage to fill to the top of the joint-use pool at elevation 3640 (1,070,029 acre-feet) and prevent storage in Bighorn Lake from exceeding this level until the peak of the runoff has passed or has begun to recede. If releases in excess of full powerplant capacity are required, they are made only to the extent that current inflow and reservoir content indicate that spills are required. Depending on when the spring runoff starts, the release of water, based on inflow forecast, may draw the pool as low as elevation 3600.0 (744,582 acre-feet).
- (2) Once Bighorn Lake has filled or reached its maximum level during spring runoff (normally late June or early July), releases are adjusted to evacuate storage to no less than elevation 3635 (1,011,042 acre-feet) by mid-October. Maintaining Bighorn Lake above this elevation provides suitable waterfowl habitat and limits dust problems around the southern area of Bighorn Lake. Historically, it has also been observed that maintaining Bighorn Lake at or below elevation 3635 before winter freeze-up reduces the potential for ice jam problems to occur near the mouth of the Shoshone River where it enters Bighorn Lake.
- (3) In late fall, a uniform release from Bighorn Lake to the Bighorn River is scheduled during November through March with the objective of evacuating storage to an elevation between 3605-3614 (772,894-829,687 acre-feet) by the end of March, depending on the forecasted snowmelt runoff into Bighorn Lake. This attempts to provide the required storage space needed to safely store the spring runoff while protecting the desired reservoir levels for summer and fall lake recreation activities.
- (4) Releases during October and early November are generally maintained at the lowest forecasted minimum release rate to protect the brown trout spawn, if dry winter conditions require reducing releases later during the winter months.



(5) Whenever an adequate water supply is available, releases from Bighorn Lake will be maintained at rates to sustain flows in the Bighorn River at 2,500 cfs or higher. When there is not an adequate water supply available, it may be necessary to reduce releases to the Bighorn River to 2,000 cfs or the absolute minimum flow of 1,500 cfs required to protect a lower quality river fishery. These flow levels affect the river fishery as follows:

2,500 cfs - provides good spawning, rearing, and cover conditions in all major side channels.

2,000 cfs - provides adequate spawning and rearing conditions in most side channels but cover for adult fish is limited.

1,500 cfs - protects main channel habitat but not important side channels.

(6) During years of below normal runoff, storage in Bighorn Lake may not reach the top of the joint-use pool in efforts to protect the desired minimum river fishery flow levels. During some critical dry years, river flows may even have to be reduced to less than 1,500 cfs to ensure the operation of the Yellowtail powerplant and also provide desirable lake levels for the recreation season.

(7) All water released from Bighorn Lake is generally released through the Yellowtail Powerplant. Releasing any water in excess of the powerplant capacity (normally 7,500-8,200 cfs) is avoided, except during times of unusually heavy inflow or scheduled powerplant maintenance.

(8) For downstream flood control purposes, avoid making releases that would cause flows in the Bighorn River to exceed 20,000 cfs at St. Xavier and 25,000 cfs at Bighorn and 65,000 cfs in the Yellowstone River at Miles City.

(9) Attempts are made to prevent the reservoir level from dropping during April and May to protect walleye and sauger spawning activities in the Bighorn Lake.

(10) During April through October, water is diverted to the Bighorn Canal to meet downstream irrigation demands of the Crow Indian Irrigation Project. Maximum diversions to the Bighorn Canal are limited to a maximum of about 550 cfs.

(11) During low flow years when the Yellowstone River flow rate at Forsyth, Montana, drops below 6,000 cfs anytime between August 10 and September 15, river releases will be increased by 100 cfs to meet contractual commitments with Pennsylvania Power & Light, MT (PPL-MT) concerning their operations of Castle Rock Reservoir at Colstrip Powerplant. This release will continue for approximately 10-30 days.

(12) Every 3 years about mid-October after the irrigation season is over, all storage is evacuated from the Yellowtail Afterbay, except for approximately 200 acre-feet, to allow for the measurement of seepage downstream of Yellowtail Dam. During this time, releases to the Bighorn River are reduced to no lower than 400 cfs for approximately 6 hours. To minimize effects to downstream water users and landowners, changes in release rates from the Afterbay are done gradually.

(13) Release rates during the winter are generally not changed or fluctuated more than 100 cfs in 6 hours when the downstream river channel is ice covered.

(14) Because the inflow to Bighorn Lake is heavily dependent upon the releases from Boysen and Buffalo Bill Reservoirs, all reservoir and river operations are closely coordinated with the Wyoming Area Office (WYAO).

(15) In an Agreement with the Northern Cheyenne Indian Tribe and pursuant to the Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992, Reclamation recognizes 30,000 acre-feet of stored water in Bighorn Reservoir for use or disposition by the Tribe. The United States shall furnish a maximum of 30,000 acre-feet of water annually to the Tribe in accordance with the limitations set forth in the Compact and the Settlement Act.

The persistent drought that has continued to plague much of Montana and Wyoming for the past 8 years has continued into water year 2008. Inflows to Bighorn Lake during July and August were 35 percent of average, only to improve to 60 percent of average during September. Inflows during July through September were the sixth lowest of record since construction of Bighorn Lake. Annual inflows declined from 57 percent of average during WY-2006 to 54 percent of average during WY-2007. Near normal spring precipitation was experienced in the Bighorn Mountains south of Sheridan, Wyoming. Releases from Yellowtail Dam to the Bighorn River were increased from the minimum flow of 1,500 cfs in late June to 1,750 cfs. Inflows into Bighorn Lake were sufficient to allow storage in Bighorn Lake to reach a peak storage of 1,048,112 acre-feet at elevation 3638.22 on June 25. Throughout the remainder of the year releases to the Bighorn River were maintained at 1,750 cfs, causing storage to slowly decline to 956,743 acre-feet at elevation 3629.71 by the end of the year. This was approximately 94 percent of average and 89 percent of full capacity. This was also 10.29 feet or 113,286 acre-feet below the top of the joint-use pool and 26.64 feet or 194,956 acre-feet higher than at the beginning of water year 2007.

The forecasted inflows to Bighorn Lake are based upon the natural accretions between Boysen and Buffalo Bill Reservoirs to Yellowtail Dam plus the projected releases out of Boysen and Buffalo Bill Dams.

The most probable October-February accretions were estimated to equal 90 percent of the average October-February 2000-2007 accretions. The most probable March-September accretions were estimated to equal 25 percentile historic accretions or accretions that have historically been exceeded 75 percent of the time.

The minimum probable October-February accretions were estimated to equal 90 percent of the most probable October-February accretions. The minimum probable March-September accretions were estimated to equal 80 percent of the average March-September 2000-2006 accretions.

The maximum probable October-February accretions were estimated to equal 120 percent of the most probable October-February accretions. The maximum probable March-September accretions were estimated to equal 75 percentile historic accretions or accretions that have historically been exceeded 25 percent of the time.

Under the most probable and maximum probable runoff conditions, Bighorn Lake would be expected to fill to the top of the joint-use pool at elevation 3640 (1,070,029 acre-feet) by the end of July and essentially remain full through September. Under the minimum probable runoff scenario, Bighorn Lake would only fill to elevation 3624.06, about 15.94 feet below the top of the joint-use pool. Under the most probable runoff condition, the minimum release from Bighorn Lake to the Bighorn River will be maintained at 1,900 cfs during October 2007 through June 2008 to better assure the reservoir of filling to the top of the joint-use pool by late July. Under the minimum probable runoff condition, it is anticipated the minimum release from Bighorn Lake to the Bighorn River would be maintained at 1,750 cfs during October through mid-April and then reduced to 1,500 cfs to best assure the reservoir of filling to levels that would support lake recreation during water year 2008. Under the maximum probable runoff conditions, it is anticipated river releases would be maintained at 1,500 cfs during October and then increase to or above 2,250 cfs for the remainder of the year.

The average power generation produced annually at Yellowtail Powerplant during 1967-2007 is 866.5 million kilowatt-hours. Under the minimum and most probable runoff conditions, power generation produced at Yellowtail Powerplant during 2008 would be expected to be less than average. Under the minimum probable runoff plan, power generation would be about 387.7 million kilowatt-hours less than average and under the most probable runoff plan, power generation would be about 277.1 million kilowatt-hours less than average. Under the maximum probable runoff plan, power generation would be about 232.1 million kilowatt-hours more than average.

In all three plans, maintenance outages are scheduled as shown on Table MTT19. No spill in excess of full powerplant capacity is expected during these 2008 power outages.

TABLE MTT17A  
 BIGHORN LAKE OPERATING PLAN  
 Based on October 1 2007 Inflow Estimates

2008 MINIMUM Probable runoff

Bighorn Reservoir	2007	Initial Cont Elev 3629.70 ft				Maximum Cont Elev 3657.00 ft					Minimum Cont Elev 3547.00 ft				Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Boysen Release	kaf	24.6	23.8	24.6	24.6	23.0	24.6	32.7	65.8	66.0	71.3	62.7	46.4	490.1	
Boysen Release	cfs	400	400	400	400	400	400	550	1070	1109	1160	1020	780		
Buffalo Bill Riv Flo	kaf	24.7	8.9	9.2	9.2	8.6	9.2	24.4	64.9	62.7	70.4	63.0	50.0	405.2	
Buffalo Bill Riv Flo	cfs	402	150	150	150	150	150	410	1055	1054	1145	1025	840		
Station Gain	kaf	61.3	42.8	28.6	26.8	29.6	45.8	19.9	38.0	34.0	-38.2	-26.4	27.0	289.2	
Monthly Inflow	kaf	110.6	75.5	62.4	60.6	61.2	79.6	77.0	168.7	162.7	103.5	99.3	123.4	1184.5	
Monthly Inflow	cfs	1799	1269	1015	986	1064	1295	1294	2744	2734	1683	1615	2074		
Turbine Release	kaf	103.3	99.9	103.3	103.3	96.7	103.3	93.0	99.1	106.9	115.6	114.7	103.9	1243.0	
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Release	kaf	103.3	99.9	103.3	103.3	96.7	103.3	93.0	99.1	106.9	115.6	114.7	103.9	1243.0	
Total Release	cfs	1680	1679	1680	1680	1681	1680	1563	1612	1797	1880	1865	1746		
Spring Flow	kaf	4.3	4.2	4.3	4.3	4.0	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.9	
Irrigation Reqmnt	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.5	11.2	21.8	27.7	26.8	18.8	106.8	
Afterbay Rels	kaf	107.6	104.1	107.6	107.6	100.7	107.6	97.2	103.4	111.1	119.9	119.0	108.1	1293.9	
Afterbay Rels	cfs	1750	1749	1750	1750	1751	1750	1634	1682	1867	1950	1935	1817		
River Release	kaf	107.6	104.1	107.6	107.6	100.7	107.6	96.7	92.2	89.3	92.2	92.2	89.3	1187.1	
River Release	cfs	1750	1749	1750	1750	1751	1750	1625	1499	1501	1499	1499	1501		
Min Release	kaf	107.6	104.1	107.6	107.6	100.7	107.6	96.7	92.2	89.3	92.2	92.2	89.3	1187.1	
End-Month Targets	kaf										1070.0				
End-Month Content	kaf	964.0	939.6	898.7	856.0	820.5	796.8	780.8	850.4	906.2	894.1	878.7	898.2		
End-Month Elevation	ft	3630.46	3627.88	3623.15	3617.67	3612.65	3608.97	3606.34	3616.91	3624.06	3622.59	3620.66	3623.09		
Net Change Content	kaf	7.3	-24.4	-40.9	-42.7	-35.5	-23.7	-16.0	69.6	55.8	-12.1	-15.4	19.5	-58.5	
Yellowtail Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	
Turbine Release	kaf	103.3	99.9	103.3	103.3	96.7	103.3	93.0	99.1	106.9	115.6	114.7	103.9	1243.0	
Generation	gwh	40.948	39.490	40.390	39.807	36.736	38.805	34.665	37.327	41.208	44.905	44.342	40.196	478.819	
End-Month Power Cap	mw	278.1	275.6	271.2	266.1	261.4	258.1	255.7	265.4	272.0	270.6	268.8	271.1		
% Max Gen		19	19	19	19	18	18	17	17	20	21	21	19		
Ave kwh/af		396	395	391	385	380	376	373	377	385	388	387	387	385	
Upstream Generation	gwh	9.057	3.595	2.960	3.730	3.495	3.772	9.897	24.289	24.142	26.351	23.669	18.899	153.856	
Total Generation	gwh	50.005	43.085	43.350	43.537	40.231	42.577	44.562	61.616	65.350	71.256	68.011	59.095	632.675	

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TABLE MTT17B  
 BIGHORN LAKE OPERATING PLAN  
 Based on October 1 2007 Inflow Estimates

**2008 MOST Probable runoff**

Bighorn Reservoir		Initial Cont Elev 3629.70 ft			956.7 kaf		Maximum Cont Elev 3657.00 ft			1328.4 kaf		Minimum Cont Elev 3547.00 ft		493.6 kaf		Total
	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			
Boysen Release	kaf	24.6	23.8	24.6	24.6	23.0	24.6	50.6	67.6	69.9	118.9	97.3	68.4	617.9		
Boysen Release	cfs	400	400	400	400	400	400	850	1099	1175	1934	1582	1150			
Buffalo Bill Riv Flo	kaf	24.7	8.9	9.2	9.2	8.6	9.2	38.1	77.1	89.1	112.3	78.0	75.5	539.9		
Buffalo Bill Riv Flo	cfs	402	150	150	150	150	150	640	1254	1497	1826	1269	1269			
Station Gain	kaf	68.1	47.6	31.8	29.8	32.9	68.9	37.3	53.2	84.1	-20.0	-8.4	30.0	455.3		
Monthly Inflow	kaf	117.4	80.3	65.6	63.6	64.5	102.7	126.0	197.9	243.1	211.2	166.9	173.9	1613.1		
Monthly Inflow	cfs	1909	1349	1067	1034	1121	1670	2118	3219	4085	3435	2714	2922			
Turbine Release	kaf	107.4	108.9	112.5	112.5	105.3	112.5	109.5	123.6	118.9	147.9	166.9	173.9	1499.8		
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Release	kaf	107.4	108.9	112.5	112.5	105.3	112.5	109.5	123.6	118.9	147.9	166.9	173.9	1499.8		
Total Release	cfs	1747	1830	1830	1830	1831	1830	1840	2010	1998	2405	2714	2922			
Spring Flow	kaf	4.3	4.2	4.3	4.3	4.0	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.9		
Irrigation Reqmnt	kaf	4.1	0.0	0.0	0.0	0.0	0.0	0.6	11.1	10.0	27.7	26.8	18.8	99.1		
Afterbay Rels	kaf	111.7	113.1	116.8	116.8	109.3	116.8	113.7	127.9	123.1	152.2	171.2	178.1	1550.7		
Afterbay Rels	cfs	1817	1901	1900	1900	1900	1900	1911	2080	2069	2475	2784	2993			
River Release	kaf	107.6	113.1	116.8	116.8	109.3	116.8	113.1	116.8	113.1	124.5	144.4	159.3	1451.6		
River Release	cfs	1750	1901	1900	1900	1900	1900	1901	1900	1901	2025	2348	2677			
Min Release	kaf	107.6	113.1	116.8	116.8	109.3	116.8	113.1	116.8	113.1	116.8	116.8	113.1	1370.1		
End-Month Targets	kaf										1070.0					
End-Month Content	kaf	966.7	938.1	891.2	842.3	801.5	791.7	808.2	882.5	1006.7	1070.0	1070.0	1070.0			
End-Month Elevation	ft	3630.74	3627.71	3622.23	3615.79	3609.73	3608.15	3610.78	3621.14	3634.60	3640.00	3640.00	3640.00			
Net Change Content	kaf	10.0	-28.6	-46.9	-48.9	-40.8	-9.8	16.5	74.3	124.2	63.3	0.0	0.0	113.3		
Yellowtail Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total		
Turbine Release	kaf	107.4	108.9	112.5	112.5	105.3	112.5	109.5	123.6	118.9	147.9	166.9	173.9	1499.8		
Generation	gwh	42.592	43.056	43.920	43.188	39.758	42.063	40.995	47.079	46.889	60.076	68.434	71.304	589.354		
End-Month Power Cap	mw	278.3	275.4	270.3	264.3	258.8	257.3	259.7	269.3	282.1	287.5	287.5	287.5			
% Max Gen		20	21	20	20	20	20	20	22	23	28	32	34			
Ave kwh/af		397	395	390	384	378	374	374	381	394	406	410	410	393		
Upstream Generation	gwh	8.883	3.625	3.002	3.782	3.555	3.845	15.055	27.042	28.330	34.089	32.191	28.725	192.124		
Total Generation	gwh	51.475	46.681	46.922	46.970	43.313	45.908	56.050	74.121	75.219	94.165	100.625	100.029	781.478		

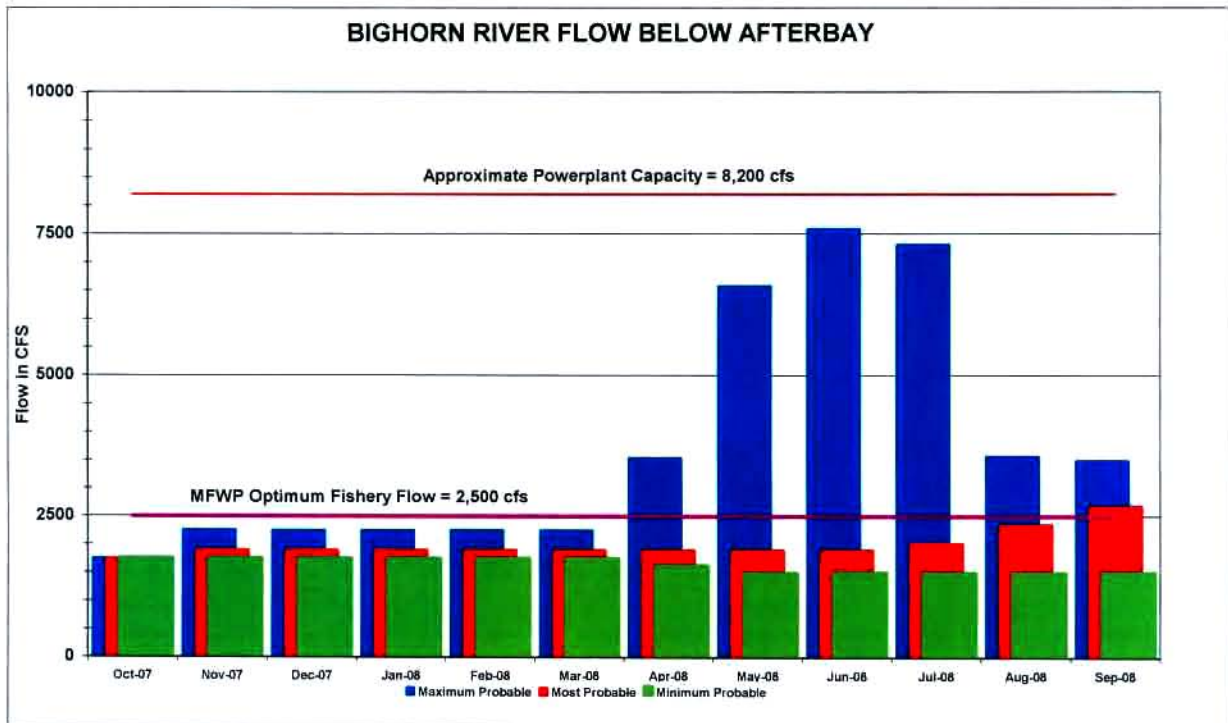
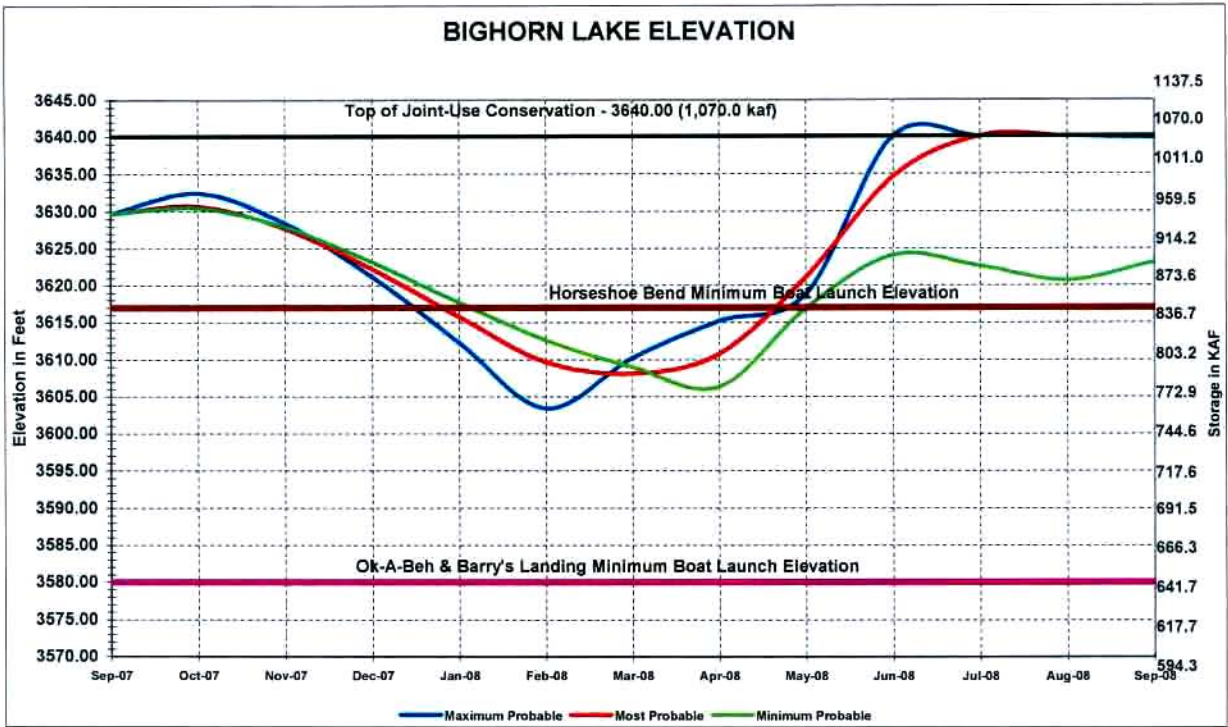
TABLE MTT17C  
 BIGHORN LAKE OPERATING PLAN  
 Based on October 1 2007 Inflow Estimates

2008 MAXIMUM Probable runoff

Bighorn Reservoir	Initial Cont 956.7 kaf				Maximum Cont 1328.4 kaf					Minimum Cont 493.6 kaf				Total
	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
				Elev 3629.70 ft				Elev 3657.00 ft				Elev 3547.00 ft		
Boysen Release	kaf	24.6	23.8	24.6	24.6	23.0	79.9	113.3	161.4	215.1	222.2	120.6	83.2	1116.3
Boysen Release	cfs	400	400	400	400	400	1299	1904	2625	3615	3614	1961	1398	
Buffalo Bill Riv Flo	kaf	24.7	8.9	9.2	9.2	8.6	9.2	67.7	156.3	218.7	204.9	104.9	77.8	900.1
Buffalo Bill Riv Flo	cfs	402	150	150	150	150	150	1138	2542	3675	3332	1706	1307	
Station Gain	kaf	81.7	57.1	38.2	35.8	39.5	85.7	59.7	120.2	240.6	45.4	16.7	59.6	880.2
Monthly Inflow	kaf	131.0	89.8	72.0	69.6	71.1	174.8	240.7	437.9	674.4	472.5	242.2	220.6	2896.6
Monthly Inflow	cfs	2131	1509	1171	1132	1236	2843	4045	7122	11334	7684	3939	3707	
Turbine Release	kaf	103.3	129.7	134.0	134.0	125.4	134.0	207.3	411.4	468.9	472.5	242.2	222.9	2785.6
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Release	kaf	103.3	129.7	134.0	134.0	125.4	134.0	207.3	411.4	468.9	472.5	242.2	222.9	2785.6
Total Release	cfs	1680	2180	2179	2179	2180	2179	3484	6691	7880	7684	3939	3746	
Spring Flow	kaf	4.3	4.2	4.3	4.3	4.0	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.9
Irrigation Reqmnt	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.5	11.2	21.8	27.7	26.8	18.8	106.8
Afterbay Rels	kaf	107.6	133.9	138.3	138.3	129.4	138.3	211.5	415.7	473.1	476.8	246.5	227.1	2836.5
Afterbay Rels	cfs	1750	2250	2249	2249	2250	2249	3554	6761	7951	7754	4009	3817	
River Release	kaf	107.6	133.9	138.3	138.3	129.4	138.3	211.0	404.5	451.3	449.1	219.7	208.3	2729.7
River Release	cfs	1750	2250	2249	2249	2250	2249	3546	6579	7584	7304	3573	3501	
Min Release	kaf	107.6	133.9	138.3	138.3	129.4	138.3	148.8	153.7	148.8	153.7	153.7	208.3	1752.8
End-Month Targets	kaf										1070.0			
End-Month Content	kaf	984.4	944.5	882.5	818.1	763.8	804.6	838.0	864.5	1070.0	1070.0	1070.0	1067.7	
End-Month Elevation	ft	3632.50	3628.41	3621.14	3612.29	3603.42	3610.22	3615.19	3618.81	3640.00	3640.00	3640.00	3639.81	
Net Change Content	kaf	27.7	-39.9	-62.0	-64.4	-54.3	40.8	33.4	26.5	205.5	0.0	0.0	-2.3	111.0
Yellowtail Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	103.3	129.7	134.0	134.0	125.4	134.0	207.3	411.4	468.9	472.5	242.2	222.9	2785.6
Generation	gwh	41.083	51.481	52.293	51.134	46.782	49.856	78.251	157.044	186.288	193.738	99.309	91.364	1098.623
End-Month Power Cap	mw	280.0	276.1	269.3	261.1	253.1	259.2	263.8	267.1	287.5	287.5	287.5	287.3	
% Max Gen		19	25	24	24	23	23	38	73	90	90	46	44	
Ave kwh/af		398	397	390	382	373	372	377	382	397	410	410	410	394
Upstream Generation	gwh	9.070	3.835	3.241	4.008	3.778	8.012	26.426	31.149	32.749	35.286	34.221	29.990	221.765
Total Generation	gwh	50.153	55.316	55.534	55.142	50.560	57.868	104.677	188.193	219.037	229.024	133.530	121.354	1320.3

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# FIGURE MTG19 BIGHORN LAKE



WATER YEAR 2008

## ENERGY GENERATION OPERATION PLANS

Energy generation at Canyon Ferry and Yellowtail powerplants for conditions of minimum probable, most probable, and maximum probable runoff is expected to vary between 711,000,000 and 1,500,000,000 kilowatt-hours as shown in Table MTT18.

**Table MTT18**

Estimated Energy Generation During Water Year 2008  
(Million Kilowatt-Hours)

Plant	Minimum Probable Runoff	Most Probable Runoff	Maximum Probable Runoff
Canyon Ferry	232	318	401
Yellowtail	479	589	1,099
Total	711	907	1,500

Operation of powerplants and transmission facilities in the Eastern and Western Divisions will be coordinated to bring about the most efficient utilization of power production to realize maximum project benefits. It is also anticipated that the marketing from all Federal power systems in the Missouri and Colorado River Basins will be closely coordinated to optimize the revenues to the Federal Government.

Powerplant maintenance is performed periodically throughout the year and the schedule for water year 2008 is shown on Table MTT19.



Table MTT19  
2008 SCHEDULED OUTAGES

YELLOWTAIL RESERVOIR

FACILITY	DESCRIPTION OF WORK	SCHEDULED DATE
Units #3	10-day outage for annual electrical and mechanical maintenance. RTU points check.	10/01-10/2007
Units #4	10-day outage for annual electrical and mechanical maintenance. RTU points check.	10/15-24/2007
Yellowtail Afterbay	2 day outage when maximum Afterbay elevation cannot exceed 3187.5 feet as the Fort Smith Government Camp sewage lagoon is drawn down in preparation for winter.	10/22-23/2007
Unit #1	10-day outage for annual electrical and mechanical maintenance. RTU points check.	02/04-13/2008
Unit #4	30-day outage for 4-year electrical and mechanical maintenance. RTU points check. Unbalanced headgate closure test.	02/25-03/25/2008
Yellowtail Afterbay	12-day outage for sluice gate maintenance. Maintain Afterbay elevation of 3183 to discharge all releases to the Bighorn River through the radial gates.	04/14-25/2008
Black Start Unit #2	Annual black start requirement from 0900-1200. Units #1 & #2 will be unavailable during this time.	04/22/2008
Yellowtail Afterbay	12-day outage for sluice gate maintenance. Maintain Afterbay elevation of 3183 to discharge all releases to the Bighorn River through the radial gates.	08/18-29/2008
Unit #2	10-day outage for annual electrical and mechanical maintenance. RTU points check.	10/06-16/2008
Units #1,2,3,&4	2-day outage for spring leakage test.	10/21-22/2008
Yellowtail Afterbay	2 day outage when maximum Afterbay elevation cannot exceed 3187.5 feet as the Fort Smith Government Camp sewage lagoon is drawn down in preparation for winter	10/28-29/2008

CANYON FERRY RESERVOIR

FACILITY	DESCRIPTION OF WORK	SCHEDULED DATE
Unit #3	6-month outage for penstock inspection.	02/12-08/8/2008
Unit #1	32-day outage for 3-year maintenance.	02/25-03/27/2008
Transformer KIA	4-day outage for 3-year maintenance.	03/03-06/2008
Unit #1 Protective Relays	1-day outage for relay functional test.	03/24/2008
Helena Valley	2-day outage to replace fixed wheel gate indicator chain.	03/31-04/01/2008
Unit #1	2-day outage to replace fixed wheel gate indicator chain.	04/02-03/2008
Crow Creek	4-day outage for annual maintenance on OCB 412 and transformer KY1A	04/07-10/2008
River Outlet Gates	4-day outage for annual inspection and maintenance.	04/14-17/2008
Radial Gates	4-day outage for CFR inspection.	04/21-24/2008
Unit #2	2-day outage to replace fixed wheel gate indicator.	04/21-22/2008
OCB 162	4-day outage for annual electrical and mechanical maintenance.	05/26-29/2008
OCB 266	4-day outage for annual electrical and mechanical maintenance.	06/02-05/2008
OCB 262	4-day outage for annual electrical and mechanical maintenance.	06/09-12/2008
OCB 366	4-day outage for annual electrical and mechanical maintenance.	06/16-19/2008
OCB 362	4-day outage for annual electrical and mechanical maintenance.	06/23-26/2008

## **Bull Lake**

Three operating plans were prepared for water year 2008 to show the operations which could occur under various runoff conditions. The operations for the three runoff conditions are shown in Table WYT10A, WYT10B, WYT10C and Figure WYG6. These plans were prepared only to show the probable limits of operations and therefore actual conditions and operations could vary widely from the most probable plan.

The primary objective of operations at Bull Lake is to provide irrigation water to the Midvale Irrigation District (Midvale). Under normal operation, the reservoir also provides small incidental flood control benefits and a water resource for fish, wildlife, and recreation. Bull Lake is operated under the following criteria and limitations:

- (1) Based on forecasted inflows, March-June releases are scheduled with the objective of filling the lake to a content of 152,459 acre-feet (AF) at elevation 5805.00 feet during July while eliminating or minimizing any spill.
- (2) During April-October, releases must be adequate to meet the irrigation needs of Midvale and downstream irrigators with senior water rights on Bull Lake Creek.
- (3) Based on the available water supply, non-irrigation season releases from Bull Lake to Bull Lake Creek are generally maintained between 20 and 45 cubic feet per second (cfs).
- (4) The reservoir water surface elevation will be kept below elevation 5794.00 feet during the winter to prevent ice damage to the spillway gates. The gates were not designed to withstand ice pressure. To prevent damage to the concrete in the spillway inlet from freezing and ice, the reservoir is operated to have a storage level of 100,000 AF or less by November 30. The objective at the onset of winter is to be as close as possible to the 100,000 AF level (5787.13 feet) to also provide winter fish habitat.

## **2008 Operating Plans**

In past years operating plans, median flows were used to estimate Bull Lake inflow and the flow of the Wind River above Bull Lake Creek for each month of the most probable inflow condition plan. Lower decile flows were used for each month of the reasonable minimum inflow condition plan and upper decile flows were used for each month of the reasonable maximum inflow condition plan. Due to the extended period of drought and conditions experienced in the Basin over the past eight years, the expected inflows used in the 2008 operating plans have been adjusted to reflect the trends of the last months of water year 2007.

A median flow is a flow which has historically been exceeded 50 percent of the time. A lower decile flow is a flow which has historically been exceeded 90 percent of the time. An upper decile flow is a flow which has historically been exceeded 10 percent of the time.

Under most probable inflow conditions, projected flows for October were estimated to be 70 percent of the median October flow. An incremental adjustment based on ramping from the projected October flow to achieving 100 percent of the median flow in April was determined for the months of November through March. The incremental increase of 5 percent was applied to each month from November through March. For example, the projected flow for November is 75 percent of the median November flow, the projected flow for December is 80 percent of the median December flow, and so on. Median flows are projected to occur from April through September.

Under reasonable minimum inflow conditions, projected flows for October were estimated to be 70 percent of the lower decile October flow. The same process used in the most probable plan was used to ramp the reasonable minimum inflows up based on achieving 100 percent of the lower decile flow in April. Lower decile flows are projected to occur from April through September.

Under reasonable maximum inflow conditions, projected flows for October were estimated to be 70 percent of the upper decile October flow. The same process used in the most probable plan was used to ramp the reasonable maximum inflows up based on achieving 100 percent of the upper decile flow in April. Upper decile flows are projected to occur from April through September.

Storage in Bull Lake at the end of water year 2007 was 47,673 AF at elevation 5765.42 feet, which is 31 percent of capacity and 62 percent of the end of September average. Under all three inflow scenarios, releases in October following the end of irrigation season and continuing through the fall and winter would be held at 25 cfs with the objective of maintaining the reservoir level through the winter period. The reservoir is expected to fill if most probable or greater inflows are realized. If reasonable minimum condition inflows occurred during each month of water year 2007, the reservoir would fall approximately 67,000 AF short of filling.

Water diverted into the Wyoming Canal can be delivered to Midvale lands directly or routed through Pilot Butte Reservoir and delivered to district lands via the Pilot Canal. A portion of the water which is diverted into Pilot Butte Reservoir is used to generate power at Pilot Butte Powerplant. Power unit maintenance outages for the Pilot Butte Powerplant are scheduled as shown in Table WYT13.

TABLE WYT10A

**RIVERTON PROJECT OPERATING PLAN**  
**Based on October 1 Inflow Estimates**  
**2008 Reasonable Minimum Inflow Estimates**

Bull Lake Reservoir Operations		Initial Content		47.7 Kaf			Operating Limits:		Max	151.9	Kaf, 5804.82 Ft.			Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Min	20.0	Jul	Aug	
Reservoir Inflow	kaf	3.3	1.6	1.4	1.3	1.1	1.4	2.7	24.9	39.8	25.9	14.5	7.3	125.2
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	27.2	1.5	40.5	43.6	20.4	143.8
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	443.	25.	659.	709.	342.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	49.5	49.6	49.4	49.2	48.9	48.7	49.9	47.6	85.9	71.3	42.2	29.1	
End-month Elevation	ft	5766.3	5766.3	5766.3	5766.1	5766.0	5765.9	5766.5	5765.4	5781.8	5775.9	5762.8	5756.0	
BLR Net Change	kaf	1.8	0.1	-0.1	-0.2	-0.3	-0.1	1.2	-2.3	38.3	-14.6	-29.1	-13.1	-18.6
Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	20.9	17.8	17.6	13.7	12.6	15.5	23.1	69.4	101.1	60.9	37.8	29.0	419.4
Crowheart Gage Flow	kaf	22.4	19.3	19.1	15.2	14.0	17.0	24.6	96.6	102.6	101.4	81.4	49.4	563.2
Flow Below Div Dam	kaf	10.5	19.3	19.1	15.2	14.0	17.0	4.7	23.7	29.0	30.3	24.8	18.3	226.0
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	1.2	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	31.3
LeClair/Riverton	kaf	5.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	114.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	70.0	324.1	311.2	247.8	244.1	277.1	70.0	100.0	100.0	70.0	70.0	70.0	
Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	11.9	0.0	0.0	0.0	0.0	0.0	19.9	72.9	73.6	71.2	56.6	31.1	337.2
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	13.5	42.0	33.4	38.7	24.2	15.0	166.8
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Butte Reservoir Operations		Initial Content		5.5 Kaf			Operating Limits:		Max	29.9	Kaf, 5459.98 Ft.			Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Min	10.0	Jul	Aug	
Reservoir Inflow	kaf	11.9	0.0	0.0	0.0	0.0	0.0	6.4	30.9	40.2	32.5	32.4	16.1	170.4
Power Generated	mwh	1.0	0.0	0.0	0.0	0.0	0.0	0.6	2.7	3.5	2.8	2.8	1.4	14.8
Pilot Canal Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	6.9	31.4	30.3	41.5	32.0	20.8	162.9
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	17.2	17.0	16.9	16.8	16.7	16.5	15.8	15.0	24.5	15.0	15.0	10.0	
PBR Net Change	kaf	11.7	-0.2	-0.1	-0.1	-0.1	-0.2	-0.7	-0.8	9.5	-9.5	0.0	-5.0	4.5
End-month Elevation	ft	5444.4	5444.1	5444.0	5443.9	5443.7	5443.4	5442.5	5441.3	5453.8	5441.3	5441.3	5433.5	

TABLE WYT10B

**RIVERTON PROJECT OPERATING PLAN**  
**Based on October 1 Inflow Estimates**  
**2008 Most Probable Inflow Estimates**

Bull Lake Reservoir Operations		Initial Content					Operating Limits:					Max		Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Min	Kaf, 5804.82 Ft.		
Reservoir Inflow	kaf	4.4	2.6	2.1	2.4	1.5	1.9	2.8	33.8	60.6	47.3	20.2	11.0	190.6
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	16.7	26.4	31.3	33.1	119.6
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	25.	281.	429.	509.	556.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.2	24.8	0.0	0.0	40.1
End-month Content	kaf	50.6	51.7	52.2	53.1	53.2	53.5	54.8	87.1	131.0	151.9	140.8	118.7	
End-month Elevation	ft	5766.8	5767.3	5767.6	5768.0	5768.0	5768.2	5768.8	5782.3	5798.0	5804.8	5801.3	5793.8	
BLR Net Change	kaf	2.9	1.1	0.6	0.9	0.1	0.4	1.3	32.3	43.9	20.9	-11.1	-22.1	71.0
Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	26.7	20.4	16.5	15.0	14.6	17.4	28.8	111.2	181.2	118.6	54.3	36.3	641.0
Crowheart Gage Flow	kaf	28.2	21.9	18.0	16.5	16.0	18.9	30.3	112.7	197.9	145.0	85.6	69.4	760.6
Flow Below Div Dam	kaf	10.5	21.9	18.0	16.5	16.0	18.9	9.7	64.2	114.6	48.4	24.8	18.3	382.0
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	1.2	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	31.3
LeClair/Riverton	kaf	5.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	114.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	70.0	367.8	293.3	269.0	278.8	308.0	154.0	759.0	1539.6	364.4	70.0	70.0	
Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	17.7	0.0	0.0	0.0	0.0	0.0	20.6	48.5	83.3	96.6	60.8	51.1	378.6
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	8.2	25.4	42.1	45.6	35.6	25.5	182.4
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Butte Reservoir Operations		Initial Content					Operating Limits:					Max		Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Min	Kaf, 5459.98 Ft.		
Reservoir Inflow	kaf	17.7	0.0	0.0	0.0	0.0	0.0	12.4	23.1	41.2	51.0	25.2	25.6	196.2
Power Generated	mwh	1.5	0.0	0.0	0.0	0.0	0.0	1.1	2.0	3.6	4.4	2.2	2.2	17.1
Pilot Canal Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.6	22.8	40.8	50.5	36.7	28.3	183.7
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	23.0	22.8	22.7	22.6	22.5	22.3	29.9	29.9	29.9	29.9	18.0	15.0	
PBR Net Change	kaf	17.5	-0.2	-0.1	-0.1	-0.1	-0.2	7.6	0.0	0.0	0.0	-11.9	-3.0	9.5
End-month Elevation	ft	5451.9	5451.7	5451.6	5451.4	5451.3	5451.1	5460.0	5460.0	5460.0	5460.0	5445.5	5441.3	

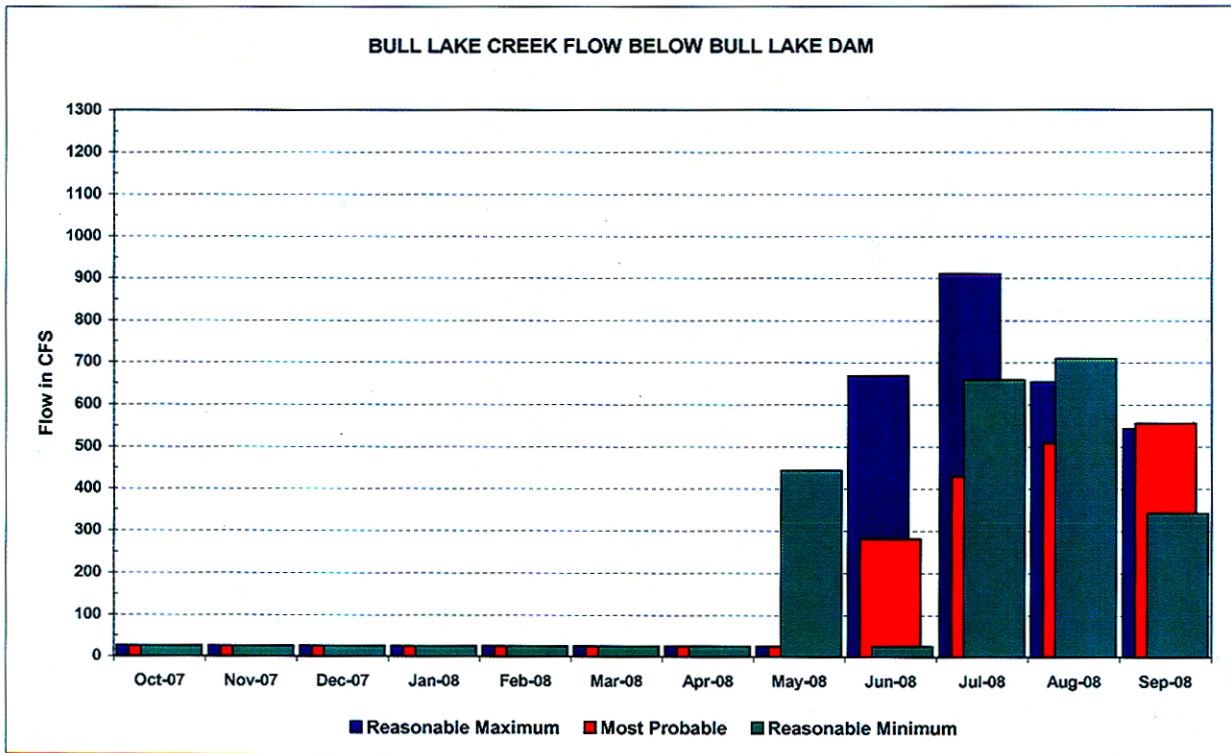
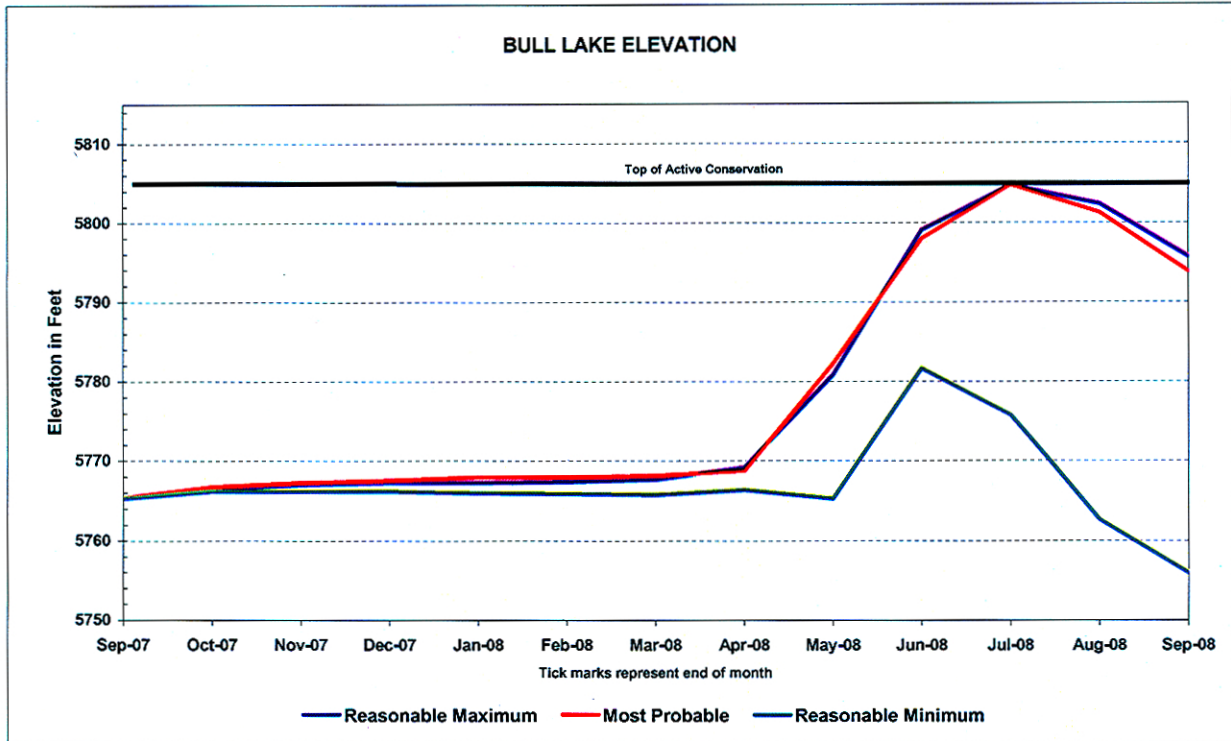
TABLE WYT10C

**RIVERTON PROJECT OPERATING PLAN**  
**Based on October 1 Inflow Estimates**  
**2008 Reasonable Maximum Inflow Estimates**

Bull Lake Reservoir Operations		Initial Content			47.7 Kaf			Operating Limits:			Max	151.9	Kaf,	5804.82	Ft.	Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Min	20.0	Kaf,	5750.93	Ft.	
Reservoir Inflow	kaf	4.1	2.4	2.2	2.1	1.7	2.1	4.8	29.4	90.5		73.3	33.0	12.1	257.7	
Total Dam Release	kaf	1.5	1.5	1.5	2.1	1.4	1.5	1.5	1.5	39.8		56.0	40.2	32.3	180.9	
Total Dam Release	cfs	25.	25.	25.	34.	25.	25.	25.	25.	668.		910.	654.	543.		
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.3		54.4	38.7	21.0	152.4	
End-month Content	kaf	50.3	51.2	51.8	51.8	52.1	52.7	56.0	83.8	134.6		151.9	144.7	124.5		
End-month Elevation	ft	5766.6	5767.1	5767.4	5767.4	5767.5	5767.8	5769.3	5781.0	5799.2		5804.8	5802.5	5795.8		
SLR Net Change	kaf	2.6	0.9	0.7	0.0	0.3	0.6	3.3	27.9	50.7		17.3	-7.2	-20.2	76.8	
Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		Jul	Aug	Sep	Total	
Flow abv BL Creek	kaf	26.1	19.8	17.0	7.7	14.8	18.9	25.2	113.9	312.8		185.4	80.7	45.8	868.1	
Crowheart Gage Flow	kaf	27.6	21.3	18.5	9.8	16.2	20.4	26.7	115.4	352.6		241.4	120.9	78.1	1049.0	
Flow Below Div Dam	kaf	10.5	21.3	18.5	9.8	16.2	20.4	11.9	71.1	274.6		153.5	66.3	32.8	707.0	
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1		7.4	6.1	5.4	38.2	
Indian Irrigation	kaf	1.2	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0		6.1	5.5	4.5	31.3	
LeClair/Riverton	kaf	5.0	0.0	0.0	0.0	0.0	0.0	3.2	16.9	21.8		24.5	19.0	13.5	103.9	
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Riverton Gage Flow	cfs	70.0	357.7	301.5	159.4	282.3	332.4	197.0	901.2	4268.0		2117.5	779.4	339.1		
Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		Jul	Aug	Sep	Total	
Total Diversion	kaf	17.1	0.0	0.0	0.0	0.0	0.0	14.7	44.4	78.0		87.9	54.6	45.3	342.0	
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	7.3	22.5	37.4		40.5	31.6	22.7	162.0	
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Pilot Butte Reservoir Operations		Initial Content			5.5 Kaf			Operating Limits:			Max	29.9	Kaf,	5459.98	Ft.	Total
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Min	10.0	Kaf,	5433.49	Ft.	
Reservoir Inflow	kaf	17.1	0.0	0.0	0.0	0.0	0.0	7.4	21.9	40.6		47.4	23.0	22.6	180.0	
Power Generated	mwh	1.5	0.0	0.0	0.0	0.0	0.0	0.6	1.9	3.5		4.1	2.0	2.0	15.7	
Pilot Canal Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.5	17.1	40.2		46.9	34.5	25.3	167.5	
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
End-month Content	kaf	22.4	22.2	22.1	22.0	21.9	21.7	25.4	29.9	29.9		29.9	18.0	15.0		
PBR Net Change	kaf	16.9	-0.2	-0.1	-0.1	-0.1	-0.2	3.7	4.5	0.0		0.0	-11.9	-3.0	9.5	
End-month Elevation	ft	5451.2	5450.9	5450.8	5450.7	5450.6	5450.3	5454.9	5460.0	5460.0		5460.0	5445.5	5441.3		

FIGURE WYG6

# BULL LAKE RESERVOIR





## Buffalo Bill Reservoir and Powerplants

Three operating plans were prepared for water year 2008 to show the operations of Buffalo Bill Reservoir which could occur under various runoff conditions. The operations for the three runoff conditions are shown in Table WYT12A, WYT12B, WYT12C, and Figure WYG8. These plans were prepared only to show the probable limits of operations, therefore, actual conditions and operations could vary widely from the most probable plan.

### Normal Operating Procedures

At the end of the irrigation season, releases will be adjusted with the objective of filling the reservoir to elevation 5393.50 feet (646,565 AF) while meeting the release criteria of the **Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement**. Under the Agreement, Buffalo Bill Reservoir will be operated to insure that a minimum flow of 100 cfs is provided in the river below the dam at all times. Additional winter releases beyond the 100 cfs minimum release up to a combined total of 350 cfs in the river below Buffalo Bill Powerplant will be provided based on the criteria set forth in the Agreement.

Reservoir releases to meet downstream irrigation requirements will, to the extent possible, be made through the most efficient power turbines available, after meeting winter flow requirements. A release of at least 100 cfs will be made through the Shoshone Powerplant, whenever the powerplant is available, to provide the required river flow directly below the dam. If the Shoshone Powerplant is not available, the release will be made through the jetflow valve at the Dam.

During irrigation season, releases are determined by the requirements for irrigation, and municipal and industrial demand. If snow conditions, inflow, and reservoir content indicate an assured fill of the reservoir, additional releases may be required after the start of the spring runoff to provide flood control and make optimum use of the water for power generation. Every attempt is made to maintain a non-damaging release of 7,000 cfs or less during the runoff season and also assure that outflow is less than inflow at all times of flood rate inflow.

### 2008 Operating Plans

In past years operating plans, median flows were used to estimate Buffalo Bill Reservoir inflow for each month of the most probable inflow condition plan. Lower decile flows were used for each month of the reasonable minimum inflow condition plan and upper decile flows were used for each month of the reasonable maximum inflow condition plan. Due to the extended period of drought and conditions experienced in the Basin over the past eight years, the expected inflows used in the 2008 operating plans have been adjusted to reflect the trends of the last months of water year 2007.

A median flow is a flow which has historically been exceeded 50 percent of the time. A lower decile flow is a flow which has historically been exceeded 90 percent of the time. An upper decile flow is a flow which has historically been exceeded 10 percent of the time.

Under most probable inflow conditions, projected flows for October were estimated to be 70 percent of the median October flow. An incremental adjustment based on ramping from the projected October flow to achieving 100 percent of the median flow in April was determined for the months of November through March. The incremental increase of 5.0 percent was

applied to each month from November through March. For example, the projected flow for November is 75 percent of the median November flow, the projected flow for December is 80 percent of the median December flow, and so on. Median flows are projected to occur from April through September.

Under reasonable minimum inflow conditions, projected flows for October were estimated to be 70 percent of the lower decile October flow. The same process used in the most probable plan was used to ramp the reasonable minimum inflows up based on achieving 100 percent of the lower decile flow in April. Lower decile flows are projected to occur from April through September.

Under reasonable maximum inflow conditions, projected flows for October were estimated to be 70 percent of the upper decile October flow. The same process used in the most probable plan was used to ramp the reasonable maximum inflows up based on achieving 100 percent of the upper decile flow in April. Upper decile flows are projected to occur from April through September.

At the beginning of water year 2008, storage in Buffalo Bill Reservoir was 417,846 AF at elevation 5362.74 feet. This was about 23,275 AF less water than the reservoir held at the beginning of water year 2007. Winter releases under minimum and maximum inflow scenarios are the same as under most probable conditions. Based on the criteria set forth in the *Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement*, the release from Buffalo Bill Dam through the winter will be 150 cfs. Ice in the Shoshone River can limit Reclamation's ability to change releases during the winter because of possible flooding due to ice jams, particularly near Lovell, Wyoming.

The Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants will all be available for power generation in water year 2008. Releases from Buffalo Bill Reservoir will be dependent upon the most efficient operation of all the powerplants while providing the required flow in the Shoshone River.

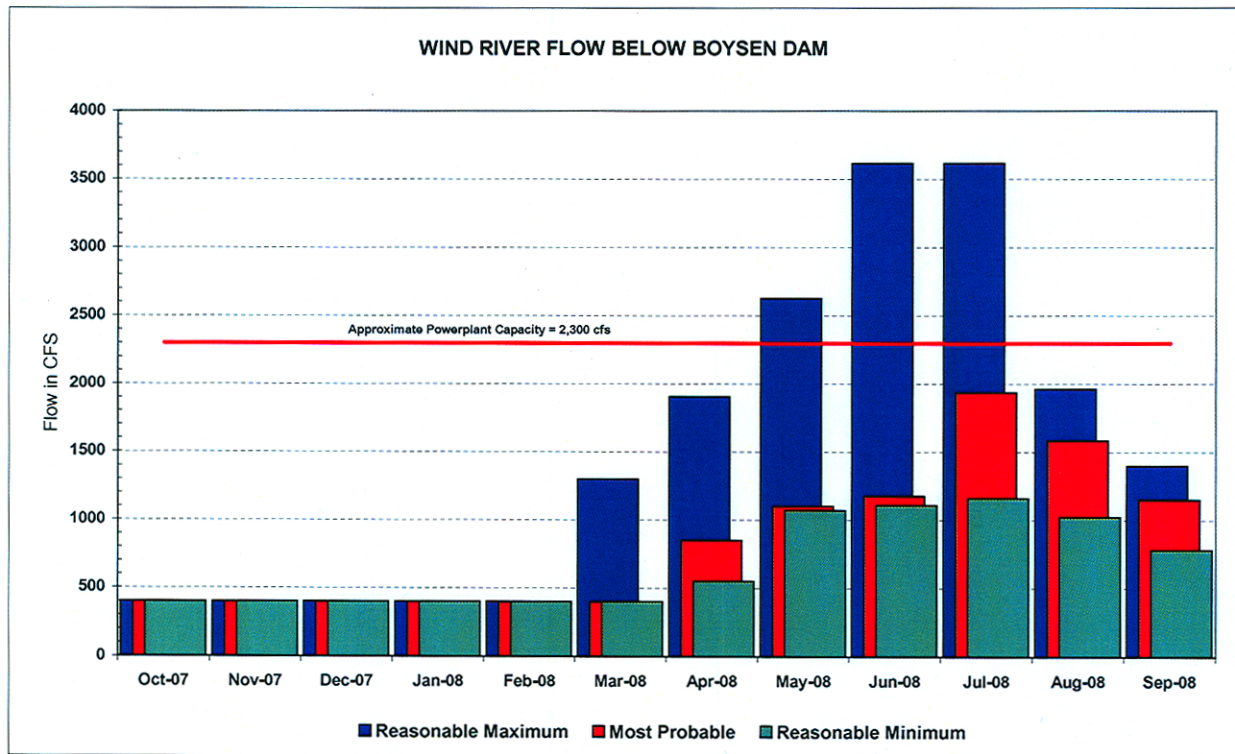
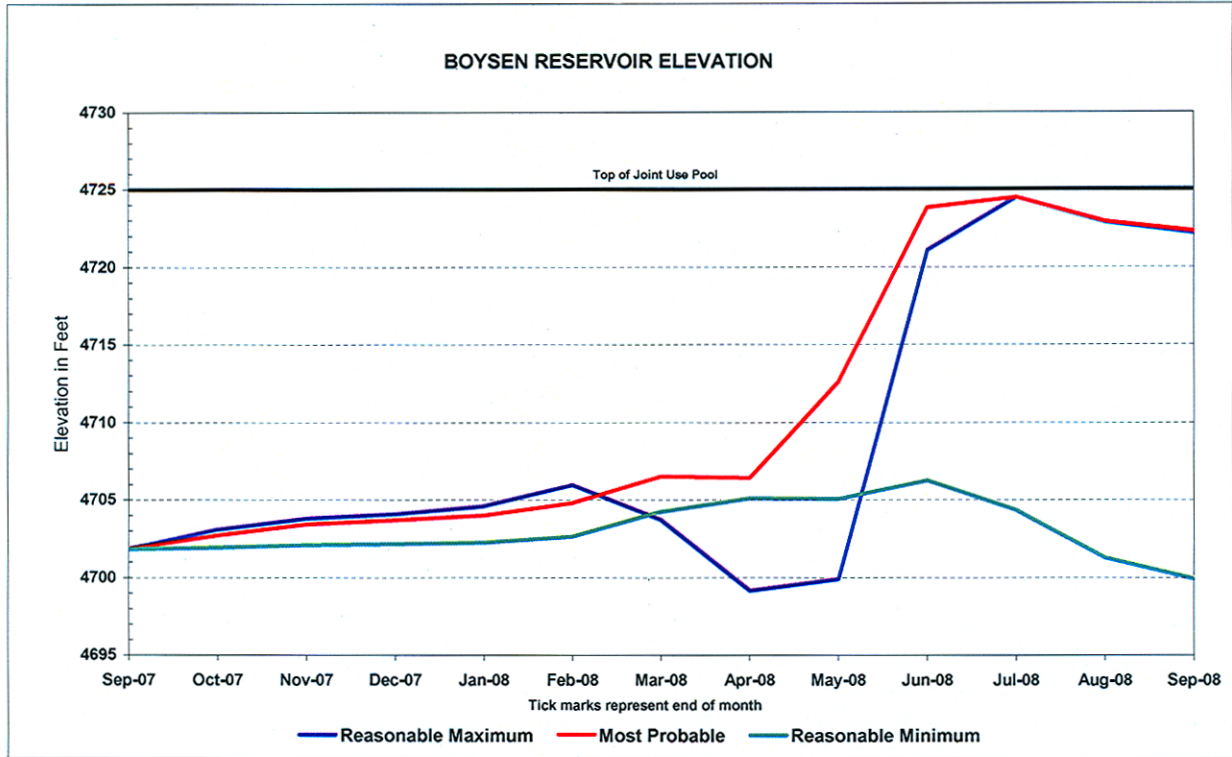
Under the most probable runoff plan, total generation from all the plants is expected to be 138,600,000 kilowatt hours (kWh). Total generation with reasonable minimum inflows is expected to be 114,800,000 kWh while generation is expected to total 149,400,000 kWh under the plan with reasonable maximum inflows.

Power unit maintenance outages for the Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants are scheduled as shown in Table WYT13.



FIGURE WYG7

# BOYSEN RESERVOIR



## Buffalo Bill Reservoir and Powerplants

Three operating plans were prepared for water year 2008 to show the operations of Buffalo Bill Reservoir which could occur under various runoff conditions. The operations for the three runoff conditions are shown in Table WYT12A, WYT12B, WYT12C, and Figure WYG8. These plans were prepared only to show the probable limits of operations, therefore, actual conditions and operations could vary widely from the most probable plan.

### Normal Operating Procedures

At the end of the irrigation season, releases will be adjusted with the objective of filling the reservoir to elevation 5393.50 feet (646,565 AF) while meeting the release criteria of the **Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement**. Under the Agreement, Buffalo Bill Reservoir will be operated to insure that a minimum flow of 100 cfs is provided in the river below the dam at all times. Additional winter releases beyond the 100 cfs minimum release up to a combined total of 350 cfs in the river below Buffalo Bill Powerplant will be provided based on the criteria set forth in the Agreement.

Reservoir releases to meet downstream irrigation requirements will, to the extent possible, be made through the most efficient power turbines available, after meeting winter flow requirements. A release of at least 100 cfs will be made through the Shoshone Powerplant, whenever the powerplant is available, to provide the required river flow directly below the dam. If the Shoshone Powerplant is not available, the release will be made through the jetflow valve at the Dam.

During irrigation season, releases are determined by the requirements for irrigation, and municipal and industrial demand. If snow conditions, inflow, and reservoir content indicate an assured fill of the reservoir, additional releases may be required after the start of the spring runoff to provide flood control and make optimum use of the water for power generation. Every attempt is made to maintain a non-damaging release of 7,000 cfs or less during the runoff season and also assure that outflow is less than inflow at all times of flood rate inflow.

### 2008 Operating Plans

In past years operating plans, median flows were used to estimate Buffalo Bill Reservoir inflow for each month of the most probable inflow condition plan. Lower decile flows were used for each month of the reasonable minimum inflow condition plan and upper decile flows were used for each month of the reasonable maximum inflow condition plan. Due to the extended period of drought and conditions experienced in the Basin over the past eight years, the expected inflows used in the 2008 operating plans have been adjusted to reflect the trends of the last months of water year 2007.

A median flow is a flow which has historically been exceeded 50 percent of the time. A lower decile flow is a flow which has historically been exceeded 90 percent of the time. An upper decile flow is a flow which has historically been exceeded 10 percent of the time.

Under most probable inflow conditions, projected flows for October were estimated to be 70 percent of the median October flow. An incremental adjustment based on ramping from the projected October flow to achieving 100 percent of the median flow in April was determined for the months of November through March. The incremental increase of 5.0 percent was

applied to each month from November through March. For example, the projected flow for November is 75 percent of the median November flow, the projected flow for December is 80 percent of the median December flow, and so on. Median flows are projected to occur from April through September.

Under reasonable minimum inflow conditions, projected flows for October were estimated to be 70 percent of the lower decile October flow. The same process used in the most probable plan was used to ramp the reasonable minimum inflows up based on achieving 100 percent of the lower decile flow in April. Lower decile flows are projected to occur from April through September.

Under reasonable maximum inflow conditions, projected flows for October were estimated to be 70 percent of the upper decile October flow. The same process used in the most probable plan was used to ramp the reasonable maximum inflows up based on achieving 100 percent of the upper decile flow in April. Upper decile flows are projected to occur from April through September.

At the beginning of water year 2008, storage in Buffalo Bill Reservoir was 417,846 AF at elevation 5362.74 feet. This was about 23,275 AF less water than the reservoir held at the beginning of water year 2007. Winter releases under minimum and maximum inflow scenarios are the same as under most probable conditions. Based on the criteria set forth in the *Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement*, the release from Buffalo Bill Dam through the winter will be 150 cfs. Ice in the Shoshone River can limit Reclamation's ability to change releases during the winter because of possible flooding due to ice jams, particularly near Lovell, Wyoming.

The Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants will all be available for power generation in water year 2008. Releases from Buffalo Bill Reservoir will be dependent upon the most efficient operation of all the powerplants while providing the required flow in the Shoshone River.

Under the most probable runoff plan, total generation from all the plants is expected to be 138,600,000 kilowatt hours (kWh). Total generation with reasonable minimum inflows is expected to be 114,800,000 kWh while generation is expected to total 149,400,000 kWh under the plan with reasonable maximum inflows.

Power unit maintenance outages for the Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants are scheduled as shown in Table WYT13

TABLE WYT12A

**BUFFALO BILL RESERVOIR OPERATING PLAN**  
**Based on October 1 Inflow Estimates**  
**2008 Reasonable Minimum Inflow Estimates**

Buffalo Bill Reservoir	Initial Cont		414.4 kaf		Maximum Cont		643.1 kaf		Minimum Cont		41.8 kaf		Total	
	2007	Oct	Nov	5362.83 ft	Jan	Feb	Mar	5393.50 ft	Apr	May	Jun	Flew		5259.64 ft
Monthly Inflow	kaf	17.7	16.4	11.6	11.0	10.6	14.7	39.0	142.0	201.7	72.6	25.7	21.2	584.2
Shoshone Release	kaf	6.1	8.9	5.9	9.2	8.6	9.2	8.9	9.2	6.0	6.2	6.2	6.0	90.4
Non-Power Release	kaf	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3
Total Flow Below Dam	kaf	6.1	8.9	9.2	9.2	8.6	9.2	8.9	9.2	6.0	6.2	6.2	6.0	93.7
Buffalo Bill Release	kaf	13.4	0.0	0.0	0.0	0.0	0.0	6.5	53.2	50.2	51.7	52.7	38.7	266.4
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	5.2	0.0	0.0	0.0	0.0	0.0	9.0	2.5	6.5	12.5	4.1	5.3	45.1
Heart Mtn Delivery	kaf	12.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	28.0	214.0
Total Outflow	kaf	37.0	9.2	9.5	9.5	8.9	9.5	31.7	101.2	105.0	118.7	104.3	78.3	622.8
Bypass/Spill	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-Month Targets	kaf										643.1			
End-Month Content	kaf	395.1	402.3	404.4	405.9	407.6	412.8	420.1	460.9	557.6	511.5	432.9	375.8	
Est Total Storage	kaf	398.5	405.7	407.8	409.3	411.0	416.2	423.5	464.3	561.0	514.9	436.3	379.2	
End-Month Elevation	ft	5359.87	5360.98	5361.30	5361.53	5361.79	5362.58	5363.69	5369.58	5382.69	5376.55	5365.59	5356.87	
Net Change Content	kaf	-19.3	7.2	2.1	1.5	1.7	5.2	7.3	40.8	96.7	-46.1	-78.6	-57.1	-38.6
Flow Below BE Pwr	kaf	19.5	8.9	9.2	9.2	8.6	9.2	15.4	62.4	56.2	57.9	58.9	44.7	360.1
Flow Below BB Pwr	cfs	317	150	150	150	150	150	259	1015	944	942	958	751	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.5	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.8
Passing Cody Gage	kaf	28.4	12.5	12.9	12.9	12.1	12.9	28.0	68.6	66.3	74.1	66.7	53.6	449.0
Passing Cody Gage	cfs	462	210	210	210	210	210	471	1116	1114	1205	1085	901	
Shoshone Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.1	8.9	5.9	9.2	8.6	9.2	8.9	9.2	6.0	6.2	6.2	6.0	90.4
Generation	gwh	1.228	1.782	1.185	1.850	1.731	1.856	1.803	1.892	1.286	1.347	1.101	1.208	18.469
Max Generation	gwh	2.232	2.160	1.194	2.232	2.088	2.232	2.160	2.232	2.160	2.232	2.232	2.160	25.314
% Max Generation		55	83	99	83	83	83	83	85	60	60	58	56	
Ave kwh/af		201	200	201	201	201	202	203	206	214	217	210	201	204
End-Month Power Cap	mw	3	3	2	3	3	3	3	3	3	3	3	3	
Buffalo Bill Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	13.4	0.0	0.0	0.0	0.0	0.0	6.5	53.2	50.2	51.7	52.7	38.7	266.4
Generation	gwh	3.555	0.000	0.000	0.000	0.000	0.000	1.742	13.349	12.814	13.113	13.307	9.811	67.691
Max Generation	gwh	13.392	12.960	13.392	13.392	12.528	13.392	12.960	13.392	12.960	13.392	13.392	12.960	158.112
% Max Generation		27	0	0	0	0	0	13	100	99	98	99	76	
Ave kwh/af		265						268	251	255	254	253	254	254
End-Month Power Cap	mw	18	18	18	18	18	18	18	18	18	18	18	18	
Spirit Mtn Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	17.2	0.0	0.0	0.0	0.0	0.0	16.0	34.4	33.3	34.4	34.4	33.3	203.0
Generation	gwh	1.651	0.000	0.000	0.000	0.000	0.000	1.576	2.898	2.951	2.989	2.951	2.853	17.869
Max Generation	gwh	1.674	0.000	0.000	0.000	0.000	0.000	1.620	3.348	3.240	3.348	3.348	3.240	19.818
% Max Generation		99	0	0	0	0	0	97	87	91	89	88	88	
Ave kwh/af		96						99	84	89	87	86	86	88
End-Month Power Cap	mw	2	0	0	0	0	0	2	4	4	4	4	4	
Heart Mtn Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	5.2	0.0	0.0	0.0	0.0	0.0	9.0	2.5	6.5	12.5	4.1	5.3	45.1
Generation	gwh	1.245	0.000	0.000	0.000	0.000	0.000	2.154	0.598	1.556	2.992	0.981	1.269	10.795
Max Generation	gwh	2.232	0.000	0.000	0.000	0.000	0.000	2.160	4.464	4.320	4.464	4.464	4.320	26.424
% Max Generation		56	0	0	0	0	0	100	13	36	67	22	29	
Ave kwh/af		239						239	239	239	239	239	239	239
End-Month Power Cap	mw	3	0	0	0	0	0	3	6	6	6	6	6	
Total Generation	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	7.679	1.782	1.185	1.850	1.731	1.856	7.275	18.737	18.607	20.441	18.540	15.141	114.824
End-month Power Cap	mw	26	21	20	21	21	21	26	31	31	31	31	31	





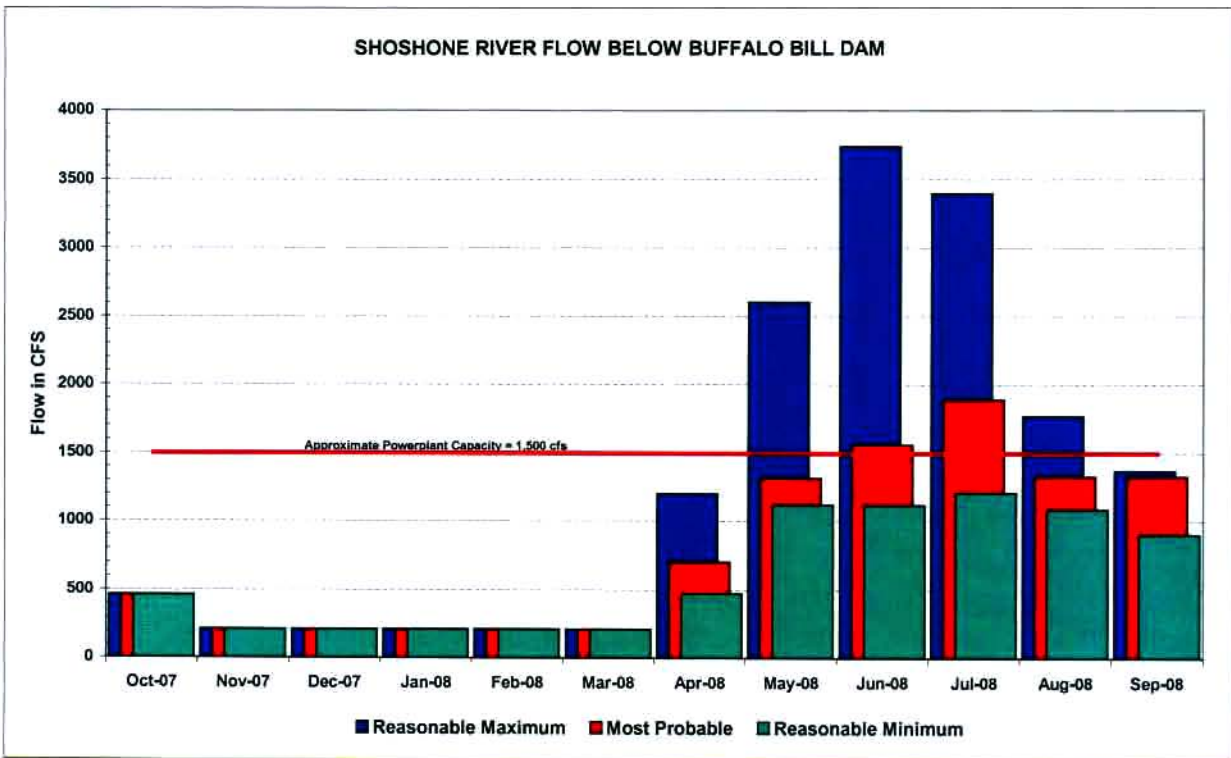
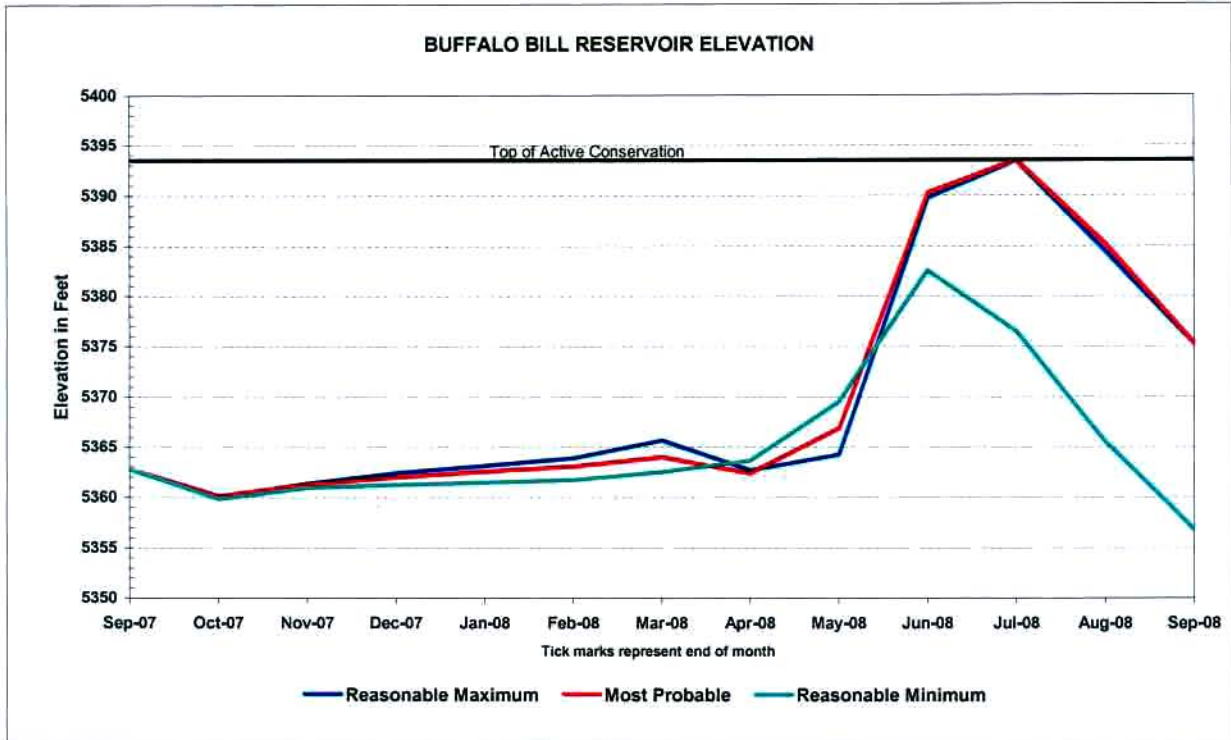
Table WYT12C

**BUFFALO BILL RESERVOIR OPERATING PLAN**  
**Based on October 1 Inflow Estimates**  
**2008 Reasonable Maximum Inflow Estimates**

Buffalo Bill Reservoir		Initial Cont Elev 414.4 kaf 5362.83 ft			Maximum Cont Elev 643.1 kaf 5393.50 ft					Minimum Cont Elev 41.8 kaf 5259.64 ft			Total	
2007		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Monthly Inflow	kaf	18.6	18.3	16.3	14.5	13.8	21.6	55.0	202.8	449.8	283.4	75.0	36.2	1205.3
Shoshone Release	kaf	6.2	6.0	2.9	6.2	5.8	6.2	8.2	11.1	10.2	9.9	10.0	9.9	92.6
Non-Power Release	kaf	0.0	0.0	3.3	0.0	0.0	0.0	0.0	70.5	138.2	124.9	25.3	0.0	362.2
Total Flow Below Dam	kaf	6.2	6.0	6.2	6.2	5.8	6.2	8.2	81.6	148.4	134.8	35.3	9.9	454.8
Buffalo Bill Release	kaf	13.3	2.9	3.0	3.0	2.8	3.0	50.5	56.1	52.3	51.5	51.0	49.9	339.3
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	5.2	0.0	0.0	0.0	0.0	0.0	9.0	18.6	18.0	18.6	18.6	18.0	106.0
Heart Mtn Delivery	kaf	12.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	28.0	214.0
Total Outflow	kaf	37.0	9.2	9.5	9.5	8.9	9.5	75.0	192.6	261.0	253.2	146.2	106.1	1117.7
Bypass/Spill	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.5	138.2	124.9	25.3	0.0	358.9
End-Month Targets	kaf										643.1		502.0	
End-Month Content	kaf	396.0	405.1	411.9	416.9	421.8	433.9	413.9	424.1	612.9	643.1	571.9	502.0	
Est Total Storage	kaf	399.4	408.5	415.3	420.3	425.2	437.3	417.3	427.5	616.3	646.5	575.3	505.4	
End-Month Elevation	ft	5360.01	5361.41	5362.45	5363.20	5363.94	5365.73	5362.75	5364.29	5389.83	5393.50	5384.56	5375.26	
Net Change Content	kaf	-18.4	9.1	6.8	5.0	4.9	12.1	-20.0	10.2	188.8	30.2	-71.2	-69.9	87.6
Flow Below BB Pwr	kaf	19.5	8.9	9.2	9.2	8.6	9.2	58.7	137.7	200.7	186.3	86.3	59.8	794.1
Flow Below BB Pwr	cfs	317	150	150	150	150	150	986	2239	3373	3030	1404	1005	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.5	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.8
Passing Cody Gage	kaf	28.4	12.5	12.9	12.9	12.1	12.9	71.3	160.0	222.3	208.6	108.6	81.4	943.9
Passing Cody Gage	cfs	462	210	210	210	210	210	1198	2602	3736	3393	1766	1368	
Shoshone Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.2	6.0	2.9	6.2	5.8	6.2	8.2	11.1	10.2	9.9	10.0	9.9	92.6
Generation	gwh	1.248	1.204	0.585	1.256	1.179	1.267	1.670	2.230	2.164	2.226	2.241	2.150	19.420
Max Generation	gwh	2.232	2.160	0.580	2.232	2.088	2.232	2.160	2.232	2.160	2.232	2.232	2.160	24.700
% Max Generation		56	56	101	56	56	57	77	100	100	100	100	100	
Ave kwh/af		201	201	202	203	203	204	204	201	212	225	224	217	210
End-Month Power Cap	mw	3	3	1	3	3	3	3	3	3	3	3	3	
Buffalo Bill Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	13.3	2.9	3.0	3.0	2.8	3.0	50.5	56.1	52.3	51.5	51.0	49.9	339.3
Generation	gwh	3.529	0.776	0.805	0.808	0.756	0.813	12.965	13.394	12.968	13.381	13.380	12.961	86.536
Max Generation	gwh	13.392	12.960	13.392	13.392	12.528	13.392	12.960	13.392	12.960	13.392	13.392	12.960	158.112
% Max Generation		26	6	6	6	6	6	100	100	100	100	100	100	
Ave kwh/af		265	268	268	269	270	271	257	239	248	260	262	260	255
End-Month Power Cap	mw	18	18	18	18	18	18	18	18	18	18	18	18	
Spirit Mtn Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	17.2	0.0	0.0	0.0	0.0	0.0	16.0	34.4	33.3	34.4	34.4	33.3	203.0
Generation	gwh	1.652	0.000	0.000	0.000	0.000	0.000	1.443	2.503	2.762	3.268	3.317	3.108	18.053
Max Generation	gwh	1.674	0.000	0.000	0.000	0.000	0.000	1.620	3.348	3.240	3.348	3.348	3.240	19.818
% Max Generation		99	0	0	0	0	0	89	75	85	98	99	96	
Ave kwh/af		96						90	73	83	95	96	93	89
End-Month Power Cap	mw	2	0	0	0	0	0	2	4	5	5	5	4	
Heart Mtn Power	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	5.2	0.0	0.0	0.0	0.0	0.0	9.0	18.6	18.0	18.6	18.6	18.0	106.0
Generation	gwh	1.245	0.000	0.000	0.000	0.000	0.000	2.154	4.453	4.309	4.453	4.453	4.309	25.376
Max Generation	gwh	2.232	0.000	0.000	0.000	0.000	0.000	2.160	4.464	4.320	4.464	4.464	4.320	26.424
% Max Generation		56	0	0	0	0	0	100	100	100	100	100	100	
Ave kwh/af		239						239	239	239	239	239	239	239
End-Month Power Cap	mw	3	0	0	0	0	0	3	6	6	6	6	6	
Total Generation	2007	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	7.674	1.980	1.390	2.064	1.935	2.080	18.232	22.580	22.203	23.328	23.391	22.528	149.385
End-month Power Cap	mw	26	21	19	21	21	21	26	31	32	32	32	31	

FIGURE WYG8

# BUFFALO BILL RESERVOIR



**Table WYT13**

**WATER YEAR 2008 SCHEDULED OUTAGES FOR WYOMING  
POWERPLANTS**

<u>Facilities</u>	<u>Description of Work</u>	<u>Scheduled Dates</u>
<b><u>BOYSEN</u></b>		
Unit 1	Annual Maintenance	11/06/06 - 11/23/06
Unit 1	Creep Detector	11/27/06 - 11/30/06
Unit 1	Transformer B-Kl A Maintenance	03/12/07 - 03/15/07
Unit 2	Annual Maintenance	12/04/06 - 01/04/07
Unit 2	Governor Alignment & Creep Detector	01/08/07 - 01/11/07
Unit 2	Air Cooler Overhaul	01/16/07 - 03/15/07
Unit 2	Transformer B-Kl A Maintenance	03/12/07 - 03/15/07
<b><u>PILOT BUTTE</u></b>		
Unit 1	Annual Maintenance	01/29/07 - 02/08/07
Unit 2	Annual Maintenance	01/29/07 - 02/08/07
<b><u>BUFFALO BILL</u></b>		
Buffalo Bill Powerplant		
Unit 1	Annual Maintenance	11/13/06 - 12/14/06
Unit 2	Annual Maintenance	12/26/06 - 01/11/07
Unit 3	Annual Maintenance	01/22/06 - 02/01/07
Unit 3	Replace Grounding Studs at Shoshone	02/13/07 - 02/15/07
Shoshone Powerplant		
Unit 3	Annual Maintenance	02/12/07 - 02/22/07
Heart Mountain Powerplant		
Unit 1	HM-KZ1A Maintenance	10/30/06 - 11/03/06
Unit 1	Annual Maintenance	03/05/07 - 03/29/07
Spirit Mountain Powerplant		
Unit 1	Annual Maintenance	10/17/05 - 10/28/05

## **OPERATING PLANS FOR WATER YEAR 2008**

### **DICKINSON RESERVOIR**

At the beginning of WY 2008, Dickinson Dam and E. A. Patterson Lake (Dickinson Reservoir) had storage of 5,733 acre-feet at elevation 2417.25, which is 2,879 acre-feet and 2.75 feet below the top of the active conservation pool (Elevation 2420.00 @ 8,612 ac-ft). The reservoir is normally operated as full as possible at all times. Excess water will be released by spilling over the Bascule gate after the reservoir has filled, and by gated releases through the 24 inch river outlet valve. No releases are planned until irrigation water is required or if the spring runoff deems it necessary for flood protection.

### **HEART BUTTE RESERVOIR**

At the beginning of WY 2008, Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) had storage of 52,910 acre-feet at elevation 2059.91, which is 14,232 acre-feet and 4.59 feet below the top of the active conservation pool (Elevation 2064.50 @ 67,142 ac-ft). Since there are no accurate inflow forecasts available, plans are to operate the reservoir as close to the top of the conservation pool as possible while regulating releases required, maintaining downstream conservation commitments, and preserving flood control space. During winter months, and when the reservoir level is below the spillway crest at elevation 2064.50, the river releases will be maintained at about 10 cfs to ensure a live stream flows below Heart Butte Dam. This will continue through the winter until the spring runoff requires higher releases some time in late March or early April. Excess water is released only when the reservoir is full or ensured of filling.

### **JAMESTOWN RESERVOIR**

At the beginning of WY 2008, Jamestown Reservoir had storage of 29,217 acre-feet at elevation 1429.95, which is 3,860 acre-feet and 1.95 feet above the top of the active conservation pool (Elevation 1428.00 @ 25,357 ac-ft). Water releases were cut to zero cfs in November and will be continued throughout the fall and winter until spring runoff requires releases to be made for flood protection. The reservoir is normally operated under the following criteria and limitations set forth in the Field Working Agreement between the Corps and Reclamation that reads:

#### Flood Control Regulation of Joint-Use Pool - Jamestown Reservoir

The joint space between elevations 1428 and 1431 will be used for seasonal multipurpose regulation. For purposes of flood control storage, the reservoir water elevation will be no higher than 1429.8 at the beginning of spring runoff period. That portion of the joint-use pool between elevations 1429.8 and 1431.0 will be used for storage and regulation of the spring runoff and summer rainstorms. In addition, water stored in this zone may be used during the summer months for conservation purposes. Storage remaining in the joint-use pool above elevation 1429.8 ft, msl after September 1st will be evacuated as directed by the Corps of Engineers.

The Bureau has the option of lowering the reservoir below elevation 1429.8 ft, msl should it be desirable based on water supply needs. There are no requirements for maintaining a specified minimum reservoir release.

SEASON: BEGINNING OF SPRING RUNOFF TO SEPTEMBER 1

El. 1429.80 (Base of flood control zone) to El. 1431.00 (Top of Joint Use Pool)

Release greater of:

- a. Conservation releases
- b. Based on inflows occurring at the time and the existing potential for further inflows, releases will be maintained as necessary to result in a pool elevation of 1431 at the time inflows cease.

SEASON: SEPTEMBER 1 TO NOVEMBER 1

Make releases necessary to evacuate reservoir to elevation 1429.80 prior to November 1.

SEASON: NOVEMBER 1 TO BEGINNING OF SPRING RUNOFF

Make releases necessary to maintain elevation 1429.80.

## **DEERFIELD RESERVOIR**

At the beginning of WY 2008, Deerfield Reservoir had storage of 12,483 acre-feet (12,332 acre-feet active storage) at elevation 5900.02 ft, which is 3,172 acre-feet and 7.98 feet below the top of conservation. Because of the dry water year and the continuing drought for the last 7 years, the reservoir winter drawdown will be around 12,000 acre-feet instead of the normal target of 15,000 acre-feet by December 1. A target of 15,000 acre-feet of storage by March 1 will usually dictate the winter release, which is set near December 1. The winter release for WY 2008 is set based on water usage from Deerfield by the Rapid Valley Water Conservancy District (District). Irrigation water used by the District during the 2007 irrigation season will be replaced to Pactola.

A release of 8 cfs will be maintained until the spring runoff requires higher releases in late March or early April. Excess water is normally released only when the reservoir is full or assured of filling. Since no inflow forecasts are available, the reservoir is normally operated as full as possible. Two Snowtel sites (North Rapid Creek and Blind Park) are operated in the Pactola and Deerfield drainage basin. Deerfield storage may be required to meet District irrigation needs in water year 2008.

The jet flow gates will be used for winter releases and provide minimum stream flows of 6 cfs or more which will enhance winter fishery conditions in Castle Creek and improve fishery production conditions in the stream.

Storage at the end of the water year will depend on the amount of inflow to the Pactola-Deerfield system and the need for project water deliveries from Deerfield Reservoir. During average and above average inflow years, summer releases will be made to bring the reservoir storage to about 14,900 acre-feet by September 30. This is to accommodate minimum releases of 6 cfs into Castle Creek during the winter. The actual release will depend on runoff conditions and will take into account downstream ice conditions in Castle Creek.

## PACTOLA RESERVOIR

At the beginning of WY 2008, Pactola Reservoir had storage of 28,478 acre-feet (27,461 acre-feet active storage) at elevation 4540.22 ft, which is 27,494 acre-feet and 39.98 feet below the top of conservation. Operating criteria established for the reservoir in the Definite Plan Report called for minimum winter conservation releases to be 7 cfs from October 1 to April 15 and 20 cfs from April 15 to April 30 when the reservoir content is below 29,000 acre-feet. Releases of 15 cfs from October 1 through March 1 and 20 cfs from March 1 through April 30 are established for reservoir content above 29,000 acre-feet. Minimum summer conservation releases are 20 cfs at all reservoir contents.

Pactola reservoir is operated as close to the top of the conservation pool as possible, while regulating releases required to maintain a downstream fishery and to preserve flood control space. The new long term storage contract, for Pactola, between Reclamation and the city of Rapid City was signed on July 31, 2007. New operating criteria for releases to Rapid Creek were established in the Standard Operating Plans. The following minimum releases will be made as long as water is available in the Fisheries, Wildlife, and Recreation Pool.

1. Reservoir content greater than 29,000 acre-feet  
Year round 20 cfs
2. Reservoir content less than 29,000 acre-feet  
October 1 to April 15 15 cfs  
April 15 to October 1 20 cfs

The winter release for WY 2008 is approximately 15 cfs and has been coordinated with the City of Rapid City, South Dakota Department of Game, Fish, and Parks, local water users, Forest Service, and Corps of Engineers. With a reservoir content of 29,000 acre-feet and above, a release of 20 cfs has been specified in the Finding of No Significant Impact for the Environmental Assessment for the Pactola Reservoir Water Service Contract Renewal (FONSI No. DK600-00-03). Pactola ended WY 2007 below 29,000 acre-feet, so a release of 15 cfs was set for WY 2008 to conserve water due to the ongoing drought of the last 7 years. Winter releases can be increased by 2 or 3 cfs during extremely cold weather to replace water that is lost in the formation of ice in the creek channel. Once the channel is covered with ice and snow, which provides insulation for the stream, the releases can be reduced if below average snow pack and inflow conditions indicate a need to conserve storage. During the flood control season, total releases will be controlled between 20 cfs and 1000 cfs. Releases in excess of 200 cfs when storage is below the top of the conservation pool at elevation 4580.20 will be cleared with the Corps of Engineers. The Corps will issue release orders on a current basis when storage is in the exclusive flood control pool. Contract negotiations with water users at Pactola Reservoir will provide the basis for future reservoir operations.

During the irrigation season of May 1 through October 30 sufficient natural flows to meet prior rights of the irrigators will be bypassed through the reservoir. Orders by water users will be released under the provisions of contracts with the water users. Drought conditions that have existed in past years have resulted in conservation measures being initiated by water users. Continuation of water conservation measures will assist in conserving reservoir storage and refilling of the reservoir.

## **ANGOSTURA RESERVOIR**

At the beginning of WY 2008, Angostura Reservoir had storage of 48,933 acre-feet (6,728 acre-feet active storage) at elevation 3165.80 ft, which is 74,115 acre-feet and 21.40 feet below the top of conservation. Since Angostura Reservoir is the principle source of water for the Angostura Irrigation District and no accurate inflow forecasts are available for this reservoir, it is operated as full as possible at all times. Excess water is released through the spillway when the reservoir is full or assured of filling.

## **KEYHOLE RESERVOIR**

At the beginning of WY 2008, Keyhole Reservoir had storage of 58,803 acre-feet (52,211 acre-feet active storage) at elevation 4078.28 ft, which is 129,868 acre-feet and 21.02 below the top of conservation. At the beginning of WY 2008, South Dakota storage for the Belle Fourche Irrigation District is 13,773 acre-feet and Wyoming storage for the Crook County Irrigation District is 7,655 acre-feet. Releases from Keyhole Reservoir are made for either irrigation requirements or flood control. Releases are not anticipated from the reservoir from October through May. Flood control releases are not expected unless extreme precipitation events occur to fill the reservoir. Discharges from toe drains of the dam and downstream inflows normally satisfy downstream requirements for stock water and other minor uses during this period. Releases from storage accounts will be made during the summer of 2008 in response to irrigation demand from the Belle Fourche Irrigation District in South Dakota and the Crook County Irrigation District in Wyoming. Each organization maintains a storage account in Keyhole Reservoir and the contract with the Belle Fourche Irrigation District also includes provisions for the annual purchase of additional unsold South Dakota storage. Peak irrigation demand is normally between 125 and 175 cfs.

The Belle Fourche Irrigation District has lands along the inlet canal that depend entirely on Keyhole Reservoir for storage. These lands will be served with flows from the Belle Fourche River and storage from Keyhole. Additional water from Keyhole Reservoir to supplement storage in Belle Fourche Reservoir may be necessary because Belle Fourche Reservoir ended the water year below average storage, and may not fill if runoff is near average. Crook County Irrigation District also depends entirely on Keyhole Reservoir for storage and has adequate supplies of water in its account for use this year.

## **SHADEHILL RESERVOIR**

At the beginning of WY 2008, Shadehill Reservoir had storage of 69,637 acre-feet (25,768 acre-feet active storage) at elevation 2259.92 ft, which is 50,535 acre-feet and 12.08 feet below the top of conservation. The winter release will be maintained at around 18 cfs to conserve storage and still maintain stream flow. This release rate will be maintained constant or reduced from the time the stream ices over until ice comes out of the channel in the spring to prevent ice jams at crossings. The release rate will be adjusted as necessary in the spring to control reservoir inflows and fill the reservoir. Excess water is released only when the reservoir is full or assured of filling. Releases for irrigation demands will be made based on water user requests.

## **BELLE FOURCHE RESERVOIR**

At the beginning of WY 2008, Belle Fourche Reservoir had storage of 61,406 acre-feet (54,606 acre-feet active storage) at elevation 2953.65 ft, which is 130,671 acre-feet and 21.35 feet below the top of the conservation pool.

A bypass of 5 cfs will be made at the Belle Fourche Diversion Dam to provide flows for domestic use between the diversion dam and the Belle Fourche River confluence with Owl Creek. No releases from the reservoir are planned until irrigation begins in the spring of 2008.

When the volume of water supply available from the reservoir can be estimated in May or June, the Belle Fourche Irrigation District will establish allotments of water to each irrigator and the storage will be used accordingly. The Standing Operating Procedures for Belle Fourche Dam limit the maximum drawdown of the reservoir to 0.3 feet per day as established in the 1984 Safety Evaluation of Existing Dams report. Higher rates of drawdown are acceptable if the total drawdown is limited to 20 feet. This restriction will affect delivery rates to water users in the late summer if the reservoir does not fill. At low reservoir levels, the draw down rate becomes the governing factor for releases.



## 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' 2007 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)

<u>Dam</u>	<u>Permanent</u>	Carryover <u>Multiple Use</u>	Annual Flood Control and <u>Multiple Use</u>	Exclusive Flood <u>Control</u>	<u>Total Storage</u>
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	1,621	0	117	60	1,798
Fort Randall	1,517	1,607	1,309	985	5,418
Gavins Point	<u>321</u>	<u>0</u>	<u>90</u>	<u>59</u>	470
Totals	18,023	38,983	11,656	4,670	73,332

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

<u>Powerplant</u>	<u>Units</u>	<u>Capacity (Kilowatts)</u>
Fort Peck	5	185,250
Garrison	5	583,300
Oahe	7	786,030
Big Bend	8	494,320
Fort Randall	8	320,000
Gavins Point	3	132,300
Totals	36	2,501,200

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 57.0 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 2006-2007, 2005-2006, 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*	Apr. - Dec.4	0.36 million tons (2007)	0.20 million tons (2006)	1.97 million tons <sup>1</sup>
Flood Damages Prevented	Oct. — Sept.	366 million (2007)	\$0.45 million (2006)	\$18.3 billion <sup>2</sup>
Energy	Aug. - Jul.	5.5 billion KWH (Aug. 06-July 07)	6.0 billion KWH (Aug. 05-July 06)	9.9 billion KWH <sup>3</sup>

\* Excludes sand, gravel, and waterway material (2007 estimated and 2006 preliminary)  
 2007 — 8.0 million tons sand, gravel, and waterway material  
 Total Tonnage including sand, gravel, and waterway material  
 8.41 million tons (2007)  
 8.30 million tons (2006)  
 7.14 million tons (41-year long-term average through 2007)

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

<sup>1</sup>Average for 41 years 1967-2007 with the peak shipments in 1977 (3.35 million tons)

<sup>2</sup>Total damages prevented (1937-2007)

<sup>3</sup>Average Annual 1968-2007

<sup>4</sup>End of navigation season shortened 48 days in 2006 and 44 days in 2007

A detailed description of the main stem system operations during 2007 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 2,501,200 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 2007 was 5855.348 million kilowatt hours, 1433.219 million kilowatt hours less than in WY 2006. 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 Kilo Watt Hours			
Year	USBR	COE	TOTAL
2007	794.348	5061.000	5855.348
2006	1088.603	6199.964	7288.567
2005	953.992	5553.800	6507.792
2004	688.367	7046.084	7734.451
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

A comparison of 2006 and 2007 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 2007 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 2007**

BUREAU PLANTS	INSTALLED CAPACITY (KW)	MILLION KILOWATT-HOURS GENERATED		WATER USED FOR GENERATION IN 2007			RIVER RELEASE 1,000 AF	TOTAL RELEASE 1,000 AF
		2006	2007	1,000 AF	PERCENT OF TOTAL RELEASE	KW-HOURS PER AF		
Canyon Ferry	50,000	346.280	294.510	2,402.257	92.30	122.60	2,505.424	2,602.642
Pilot Butte <sup>1</sup>	1,600	4.636	3.204	34.862	20.73	91.91	168.150	168.150
Boysen	15,000	57.556	38.982	522.230	99.20	74.65	526.466	526.466
<b>Buffalo Bill Reservoir Units</b>								
Shoshone	3,000	18.923	20.317	116.037	19.32	175.09	See below for	total.
Buffalo Bill	18,000	54.451	41.356	183.581	30.57	225.27	See below for	total.
Heart Mountain	6,000	15.824	14.170	69.048	11.50	205.22	See below for	total.
Spirit Mountain <sup>2</sup>	4,500	15.837	16.400	154.990	25.81	105.81	See below for	total.
Total for Buffalo Bill Reservoir <sup>3</sup>	31,500	105.035	92.243	523.656	87.20	176.15	375.795	600.503
Yellowtail	250,000	575.096	365.409	1,169.240	100.00	312.52	1,139.824	1,169.240
<b>Subtotal</b>	<b>348,100</b>	<b>1,088.603</b>	<b>794.348</b>	<b>4,652.245</b>	<b>91.81</b>	<b>170.75</b>	<b>4,715.659</b>	<b>5,067.001</b>

<b>CORPS PLANTS</b>								
Fort Peck	185,250	662.834	691.977	5,132.00	99.86	134.84	5,139.000	5,139.000
Garrison	517,750	1,558.061	1,335.338	10,468.00	100.00	127.56	10,468.000	10,468.000
Oahe	786,030	1,494.945	1,117.028	8,887.00	100.00	125.69	8,887.000	8,887.000
Big Bend	494,320	665.342	488.559	8,094.00	100.00	60.36	8,094.000	8,094.000
Fort Randall	320,000	1,226.790	933.804	9,110.00	100.00	102.50	9,110.000	9,110.000
Gavins Point	132,300	591.992	494.294	10,738.00	100.00	46.03	10,738.000	10,738.000
<b>Subtotal</b>	<b>2,435,650</b>	<b>6,199.964</b>	<b>5,061.000</b>	<b>52,429.00</b>	<b>99.99</b>	<b>96.53</b>	<b>52,436.000</b>	<b>52,436.000</b>

<b>TOTAL MISSOURI BASIN</b>	<b>2,783,750</b>	<b>7,288.567</b>	<b>5,855.348</b>	<b>57,081.25</b>	<b>99.27</b>	<b>102.58</b>	<b>57,151.659</b>	<b>57,503.001</b>
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<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> This represents the total for the four separate powerplants at Buffalo Bill Dam.

**TABLE CET3**  
**MONTHLY ENERGY GENERATION (MILLION KILOWATT-HOURS)**  
**WATER YEAR 2007**

MONTH	BUREAU OF RECLAMATION PLANTS								TOTAL
	CANYON FERRY	PILOT BUTTE	BOYSEN	BUFFALO BILL PLANTS				YELLOWTAIL	
				HEART MOUNTAIN	SPIRIT MOUNTAIN	BUFFALO BILL	SHOSHONE		
October	25.645	0.000	2.086	0.941	1.093	0.761	1.855	23.332	55.713
November	24.930	0.000	2.110	0.000	0.000	0.000	1.759	23.008	51.807
December	25.606	0.000	2.288	0.000	0.000	0.869	1.383	28.523	58.669
January	27.092	0.000	2.380	0.000	0.000	0.978	1.492	31.167	63.109
February	23.076	0.000	2.074	0.000	0.000	0.704	0.648	24.730	51.232
March	24.786	0.000	2.165	0.000	0.000	0.764	1.339	27.927	56.981
April	24.456	0.000	2.278	0.000	0.000	1.162	1.393	25.513	54.802
May	25.384	0.155	4.989	2.538	2.747	7.754	2.160	27.497	73.224
June	27.228	0.912	5.221	2.974	3.208	5.890	2.136	30.786	78.355
July	24.503	1.101	5.570	2.927	3.149	9.852	2.108	43.771	92.981
August	21.706	1.036	4.582	2.401	3.243	8.010	2.115	44.948	88.041
September	20.098	0.000	3.239	2.389	2.960	4.612	1.929	34.207	69.434
<b>TOTAL</b>	<b>294.510</b>	<b>3.204</b>	<b>38.982</b>	<b>14.170</b>	<b>16.400</b>	<b>41.356</b>	<b>20.317</b>	<b>365.409</b>	<b>794.348</b>

MONTH	CORPS OF ENGINEERS PLANTS						TOTAL	MISSOURI BASIN TOTAL
	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT		
October	47.438	94.534	55.474	24.373	70.900	41.037	333.756	389.469
November	59.397	99.072	75.921	37.024	54.769	31.889	358.072	409.879
December	76.849	117.784	116.922	53.453	61.237	36.436	462.681	521.350
January	79.610	121.942	112.842	55.737	76.670	39.359	486.160	549.269
February	75.721	108.113	123.854	57.318	54.929	34.428	454.363	505.595
March	50.397	112.359	60.699	27.485	27.918	29.236	308.094	365.075
April	32.180	100.052	64.573	26.213	45.803	29.247	298.068	352.870
May	57.888	104.596	29.053	11.502	51.197	31.227	285.463	358.687
June	52.367	125.814	95.187	40.397	96.901	48.728	459.394	537.749
July	58.796	130.747	154.842	63.904	138.360	58.137	604.786	697.767
August	60.076	129.425	166.318	68.057	134.712	58.631	617.219	705.260
September	41.258	90.900	61.343	23.096	120.408	55.939	392.944	462.378
<b>TOTAL</b>	<b>691.977</b>	<b>1,335.338</b>	<b>1,117.028</b>	<b>488.559</b>	<b>933.804</b>	<b>494.294</b>	<b>5,061.000</b>	<b>5,855.348</b>

### TABLE CET4

WATER USED FOR POWER GENERATION (1,000 ACRE-FEET)  
WATER YEAR 2007

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.							
October	212.352	30.821	0.000	11.580	5.186	4.536	10.868	87.862	351.000	743.000	450.000	379.000	764.000	895.000
November	205.082	29.898	0.000	11.952	0.000	0.000	0.000	85.180	427.000	782.000	619.000	582.000	588.000	680.000
December	211.628	29.167	0.000	8.668	3.546	0.000	0.000	88.452	584.000	943.000	947.000	849.000	651.000	777.000
January	226.959	30.345	0.000	9.364	2.962	0.000	0.000	88.179	621.000	980.000	919.000	891.000	778.000	855.000
February	192.425	28.039	0.000	3.900	3.739	0.000	0.000	78.924	592.000	877.000	1,021.000	935.000	536.000	735.000
March	204.647	30.792	0.000	7.101	5.446	0.000	0.000	87.306	386.000	910.000	492.000	467.000	253.000	623.000
April	200.083	32.714	0.000	7.389	5.379	0.000	0.000	84.948	248.000	802.000	510.000	462.000	408.000	605.000
May	201.902	64.260	1.832	11.458	27.233	13.405	27.069	92.602	417.000	820.000	229.000	208.000	471.000	651.000
June	210.852	65.951	9.903	11.449	28.453	13.858	30.086	101.258	362.000	955.000	729.000	690.000	922.000	1,053.000
July	191.675	71.260	11.903	11.366	42.588	13.691	28.341	130.205	414.000	980.000	1,194.000	1,083.000	1,298.000	1,299.000
August	174.668	62.634	11.224	11.409	33.888	12.135	29.324	129.201	429.000	984.000	1,298.000	1,169.000	1,254.000	1,322.000
September	169.984	46.349	0.000	10.401	25.161	11.423	29.302	115.123	301.000	692.000	479.000	379.000	1,187.000	1,243.000
<b>TOTAL</b>	<b>2,402.257</b>	<b>522.230</b>	<b>34.862</b>	<b>116.037</b>	<b>183.581</b>	<b>69.048</b>	<b>154.990</b>	<b>1,169.240</b>	<b>5,132.000</b>	<b>10,468.000</b>	<b>8,887.000</b>	<b>8,094.000</b>	<b>9,110.000</b>	<b>10,738.000</b>

<sup>1</sup> 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 2007

MONTH	CANYON FERRY	BOYSEN	PILOT BUTTE	BUFFALO BILL	BULL LAKE	ANCHOR	YELLOWTAIL	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT
October	212.352	30.821	0.000	29.248	2.010	0.010	87.862	351.000	743.000	450.000	379.000	764.000	895.000
November	205.082	29.898	0.000	12.164	1.756	0.030	85.180	427.000	782.000	619.000	582.000	588.000	680.000
December	211.628	30.755	0.000	12.355	1.823	0.092	88.452	584.000	943.000	947.000	849.000	651.000	777.000
January	226.959	31.072	0.000	12.539	1.826	0.065	88.179	621.000	980.000	919.000	891.000	778.000	855.000
February	192.425	28.039	0.000	11.360	1.649	0.004	78.924	592.000	877.000	1,021.000	935.000	536.000	735.000
March	207.476	31.042	0.000	12.783	1.823	0.282	87.306	386.000	910.000	492.000	467.000	253.000	623.000
April	214.530	32.740	6.897	13.035	8.132	0.446	84.948	255.000	802.000	510.000	462.000	408.000	605.000
May	240.108	65.905	31.423	100.236	10.965	3.134	92.602	417.000	820.000	229.000	208.000	471.000	651.000
June	244.010	65.951	30.289	95.261	20.080	2.677	101.258	362.000	955.000	729.000	690.000	922.000	1,053.000
July	236.688	71.260	41.510	120.605	50.769	0.725	130.205	414.000	980.000	1,194.000	1,083.000	1,298.000	1,299.000
August	217.742	62.634	31.982	98.448	25.510	0.725	129.201	429.000	984.000	1,298.000	1,169.000	1,254.000	1,322.000
September	193.642	46.349	20.833	82.469	20.640	0.398	115.123	301.000	692.000	479.000	379.000	1,187.000	1,243.000
<b>TOTAL</b>	<b>2,602.642</b>	<b>526.466</b>	<b>162.934</b>	<b>600.503</b>	<b>146.983</b>	<b>8.588</b>	<b>1,169.240</b>	<b>5,139.000</b>	<b>10,468.000</b>	<b>8,887.000</b>	<b>8,094.000</b>	<b>9,110.000</b>	<b>10,738.000</b>

**TABLE CET6**  
**TOTAL RESERVOIR STORAGE CONTENTS (1,000 ACRE-FEET)**  
**WATER YEARS 2006 AND 2007**

BUREAU RESERVOIRS	TOP OF CONSERVATION CAPACITY <sup>3</sup>	DEAD AND INACTIVE CAPACITY	TOTAL STORAGE SEPTEMBER 30		END OF SEPTEMBER PERCENT OF AVERAGE	
			2006	2007	2006	2007
Clark Canyon	174.4	1.1	64.4	62.1	52	63
Canyon Ferry	1,891.9	396.0	1,526.1	1,500.6	89	92
Helena Valley	10.5	4.6	10.2	7.5	138	106
Gibson	96.5	0.0	10.5	6.2	38	25
Willow Creek	31.8	0.0	22.0	14.2	126	71
Pishkun	46.7	16.0	16.0	16.0	49	49
Lake Elwell	925.6	554.3	769.2	691.9	98	90
Sherburne	66.1	1.9	7.7	7.0	91	46
Fresno	92.9	0.4	42.1	40.4	106	88
Nelson	79.0	18.1	48.8	53.1	86	104
Bull Lake	152.5	0.7	51.3	47.7	66	62
Pilot Butte	33.7	3.8	4.2	9.3	26	50
Boysen	741.6	219.2	447.8	389.7	80	64
Anchor <sup>1</sup>	17.2	0.1	0.2	0.3	70	78
Buffalo Bill <sup>2</sup>	646.6	41.7	441.1	417.8	101	96
Bighorn Lake	1,070.0	493.6	761.8	956.7	75	100
E. A. Patterson	8.6	0.5	4.9	5.7	77	90
Lake Tschida	67.1	5.2	49.0	52.9	83	90
Jamestown Reservoir	31.5	0.8	28.1	29.2	98	101
Shadehill Reservoir	120.2	43.9	81.1	69.6	73	64
Angostura Reservoir	123.0	42.2	43.8	48.9	48	55
Deerfield Reservoir	15.7	0.2	12.0	12.5	89	93
Pactola Reservoir	56.0	1.0	32.3	28.5	68	61
Keyhole Reservoir	188.7	6.6	54.2	58.8	56	62
Belle Fourche Reservoir	192.1	6.8	29.0	61.4	44	92
<b>Subtotal</b>	<b>6,076.9</b>	<b>1,751.6</b>	<b>4,223.4</b>	<b>4,220.4</b>		
<b>CORPS RESERVOIRS</b>						
Fort Peck	17,713.0	4,211.0	9,383.0	9,040.0		
Garrison	22,332.0	4,980.0	10,838.0	11,766.0		
Oahe	22,035.0	5,373.0	9,998.0	11,927.0		
Big Bend	1,799.0	1,682.0	1,648.0	1,669.0		
Fort Randall	4,433.0	1,517.0	2,732.0	2,662.0		
Gavins Point	411.0	321.0	399.0	389.0		
<b>Subtotal</b>	<b>68,723.0</b>	<b>18,084.0</b>	<b>34,998.0</b>	<b>37,453.0</b>		
<b>TOTAL UPPER MISSOURI BASIN</b>	<b>74,799.9</b>	<b>19,835.6</b>	<b>39,221.4</b>	<b>41,673.4</b>		

<sup>1</sup> Percent of average content of Anchor Reservoir is based on an 16-year average, 1991-2006.

<sup>2</sup> Percent of average content of Buffalo Bill Reservoir is based on an 14-year average, 1993-2006; 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.

<sup>3</sup> Includes joint-use space.





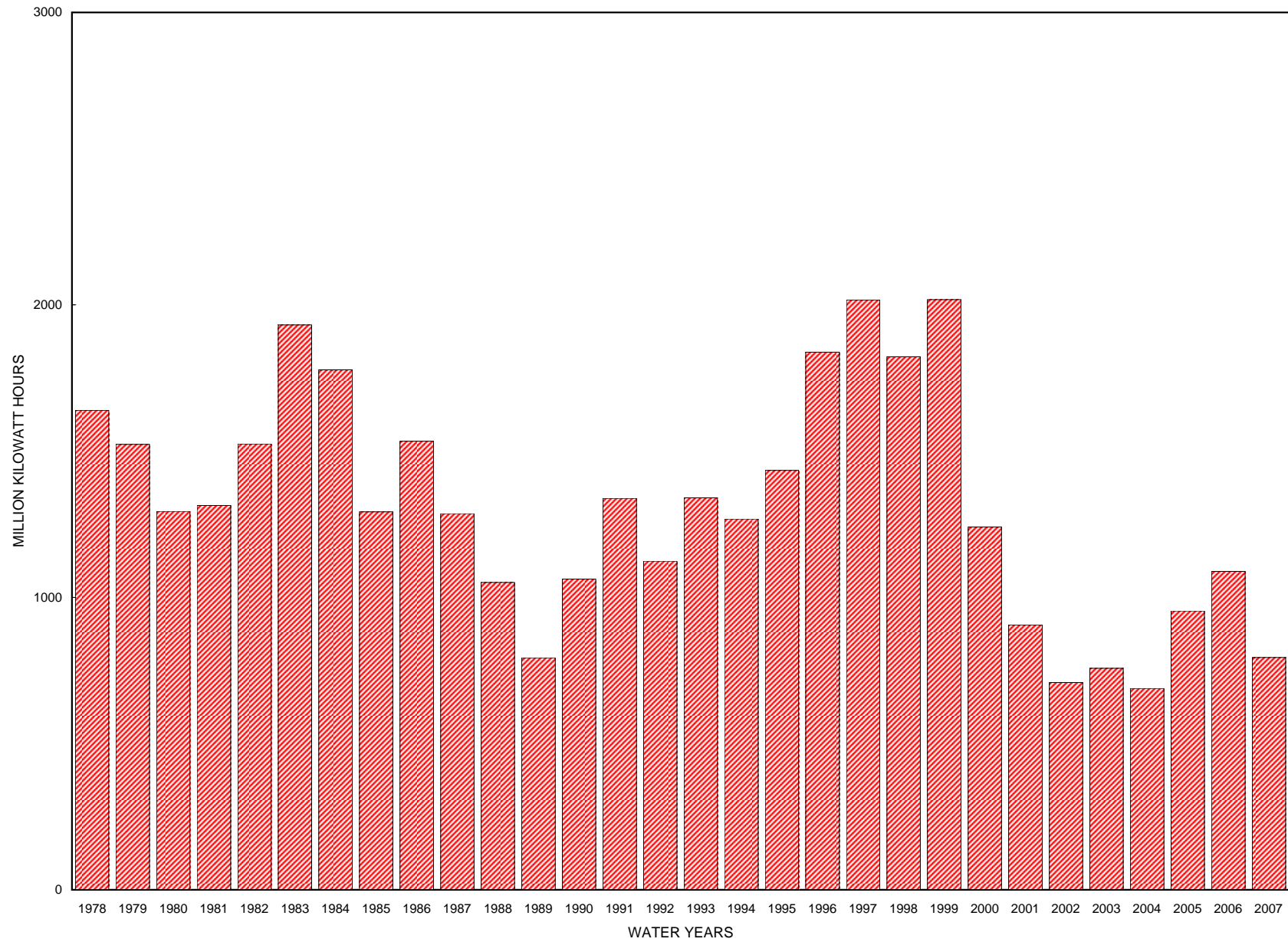
**TABLE CET8  
WATER YEAR 2007  
Monthly Inflow Amounts  
(1,000 Acre-Feet)**

<b>RECLAMATION RESERVOIR</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Total</b>
CLARK CANYON RESERVOIR	15.5	15.1	12.9	10.3	9.6	13.3	6.8	7.4	11.2	14.8	10.8	10.5	138.2
% of Average	67	68	68	64	66	71	31	27	31	54	56	52	52
CANYON FERRY RESERVOIR	219.8	221.8	205.7	177.0	200.7	278.4	246.9	409.2	334.7	100.3	81.7	101.4	2,577.2
% of Average	77	75	85	80	91	103	71	71	43	30	48	47	65
HELENA VALLEY RESERVOIR	0.5	0.4	0.3	0.4	0.3	0.8	5.8	22.4	2.8	15.8	14.9	8.4	72.9
% of Average	N/A	N/A	N/A	N/A	N/A	N/A	107	198	20	104	93	106	106
GIBSON RESERVOIR	9.7	26.8	13.4	10.2	8.5	28.5	43.7	138.7	86.4	28.0	12.9	10.0	417.1
% of Average	52	156	86	74	70	197	109	81	44	41	49	52	68
WILLOW CREEK	3.3	3.3	0.3	0.0	0.0	0.1	0.7	1.8	-0.4	-0.6	0.0	1.2	9.6
% of Average	406	457	83	N/A	N/A	6	35	44	N/A	N/A	N/A	256	66
PISHKUN RESERVOIR	0.0	0.0	0.0	0.0	0.0	13.6	15.2	45.9	72.1	80.8	7.1	0.0	234.8
% of Average	N/A	N/A	N/A	N/A	N/A	2883	220	127	124	116	17	N/A	103
LAKE ELWELL (TIBER DAM)	9.3	36.0	20.1	12.8	17.4	51.4	46.0	86.2	51.9	3.9	-2.9	2.5	334.8
% of Average	42	163	108	79	80	103	73	51	27	6	N/A	16	50
SHERBURNE LAKE	2.6	25.6	3.5	2.1	1.5	15.3	12.1	29.5	26.0	13.0	6.5	2.7	140.3
% of Average	43	456	92	73	63	510	135	91	62	62	69	42	98
FRESNO RESERVOIR	4.1	2.5	0.9	0.9	2.8	43.2	43.6	34.5	27.4	22.2	27.9	8.6	218.7
% of Average	54	121	94	183	82	142	110	79	60	63	85	33	81
NELSON RESERVOIR	1.0	-2.0	-1.6	-1.0	-1.1	8.5	22.1	13.9	6.8	-4.0	4.4	6.7	53.8
% of Average	24	N/A	N/A	N/A	N/A	588	299	205	89	N/A	63	113	134
BULL LAKE	7.6	3.1	2.1	2.1	1.4	1.8	2.8	36.1	37.8	25.3	16.3	7.1	143.4
% of Average	145	109	87	98	86	99	80	130	62	55	76	75	77
PILOT BUTTE RESERVOIR <sup>1</sup>	-0.2	-0.1	4.3	7.4	6.3	6.8	5.8	25.2	28.3	42.2	30.0	12.2	168.2
% of Average	N/A	N/A	N/A	N/A	N/A	344	72	111	74	101	93	52	94
BOYSEN RESERVOIR	52.1	41.0	25.1	19.6	24.4	35.9	31.4	85.9	61.3	32.4	30.7	28.5	468.4
% of Average	86	84	65	53	64	68	64	69	25	24	51	53	50
ANCHOR RESERVOIR	0.0	0.1	0.1	0.1	0.1	0.4	0.9	2.6	2.6	0.9	0.6	0.4	8.6
% of Average <sup>2</sup>	5	18	40	65	47	137	130	60	39	41	279	67	53
BUFFALO BILL RESERVOIR	21.6	25.4	12.8	10.7	11.2	25.4	40.9	177.1	154.9	53.6	25.8	17.8	577.2
% of Average	89	124	81	72	85	135	99	115	54	34	57	68	70
BIGHORN LAKE	125.6	98.7	82.5	67.4	77.8	100.2	100.6	206.7	219.2	87.5	91.3	106.7	1,364.2
% of Average	66	61	56	48	54	56	58	80	49	28	54	60	54
E. A. PATTERSON LAKE	0.0	0.0	0.0	0.0	0.0	0.8	0.4	0.7	0.2	-0.6	-0.2	-0.2	1.3
% of Average	10	0	9	0	1	11	11	50	12	-61	-45	-79	7
LAKE TSCHIDA	0.5	0.2	0.7	0.4	0.5	5.4	1.6	2.7	1.5	-1.2	-0.6	-0.6	11.2
% of Average	26	15	67	49	11	17	10	46	17	N/A	N/A	N/A	14
JAMESTOWN RESERVOIR	0.0	-0.2	0.0	-0.1	0.1	5.0	4.3	2.8	9.0	3.1	5.0	2.9	32.0
% of Average	N/A	N/A	4	N/A	37	58	17	30	247	62	106	182	52
SHADEHILL RESERVOIR	-1.0	-0.5	-0.6	-0.1	-0.8	3.3	2.3	1.4	3.3	-1.8	-0.6	-1.7	2.9
% of Average	N/A	N/A	N/A	N/A	N/A	14	15	11	58	N/A	N/A	N/A	4
ANGOSTURA RESERVOIR	0.9	1.2	1.6	1.8	1.8	2.8	1.5	3.2	0.3	-0.8	0.1	-0.3	14.2
% of Average	36	39	82	78	35	21	18	20	2	N/A	3	N/A	19
DEERFIELD RESERVOIR	0.3	0.4	0.4	0.4	0.3	0.9	0.6	0.7	0.6	0.3	0.3	0.3	5.5
% of Average	44	52	48	52	51	92	49	49	41	27	39	36	49
PACTOLA RESERVOIR	1.0	0.9	0.8	0.9	0.9	2.3	1.9	2.6	2.9	0.9	0.9	0.8	16.8
% of Average	44	51	55	57	57	83	42	38	47	24	32	37	45
KEYHOLE RESERVOIR	-0.3	0.2	-0.1	0.0	0.8	3.1	2.3	8.6	2.3	-1.3	-1.9	-1.5	12.2
% of Average	N/A	N/A	N/A	N/A	30	41	110	176	192	N/A	N/A	N/A	64
BELLE FOURCHE RESERVOIR	11.4	10.0	10.0	8.5	9.3	17.9	14.1	19.5	26.7	-2.2	2.0	-3.1	123.9
% of Average	93	99	106	88	100	110	107	132	296	N/A	105	N/A	107

<sup>1</sup> Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.

<sup>2</sup> Percent of average inflow for Anchor Reservoir is based on a 16-year average, 1991-2006, 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**

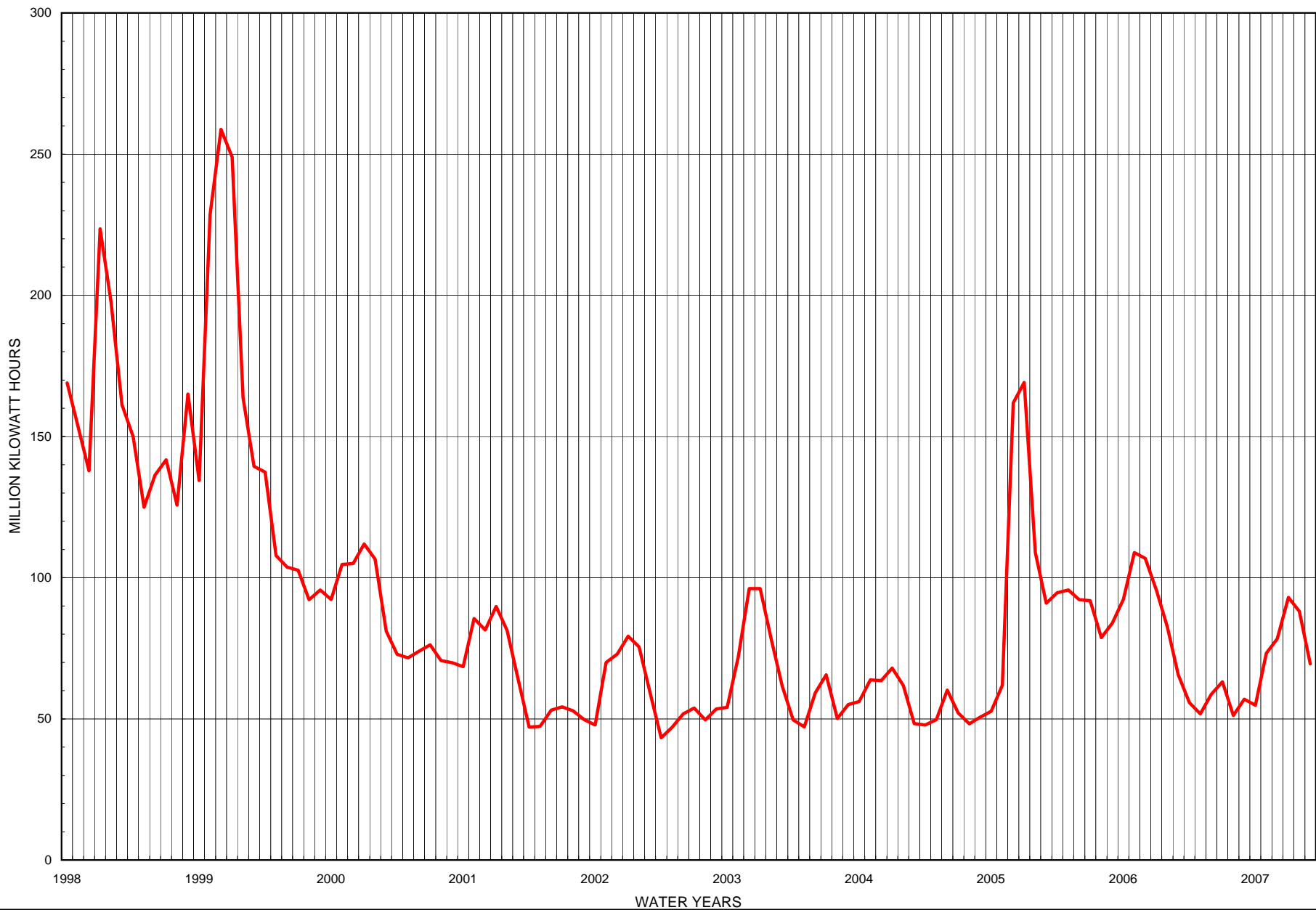
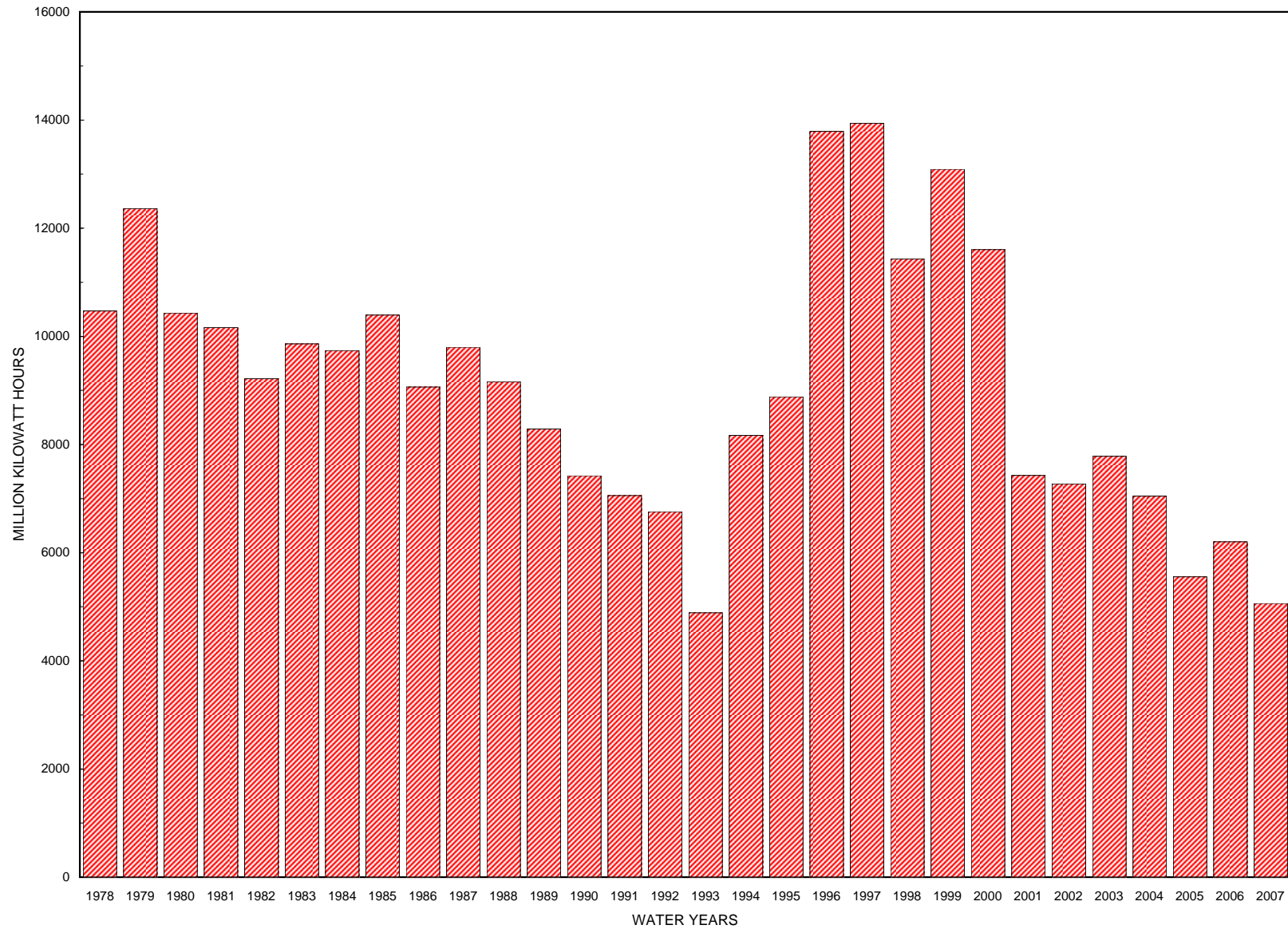
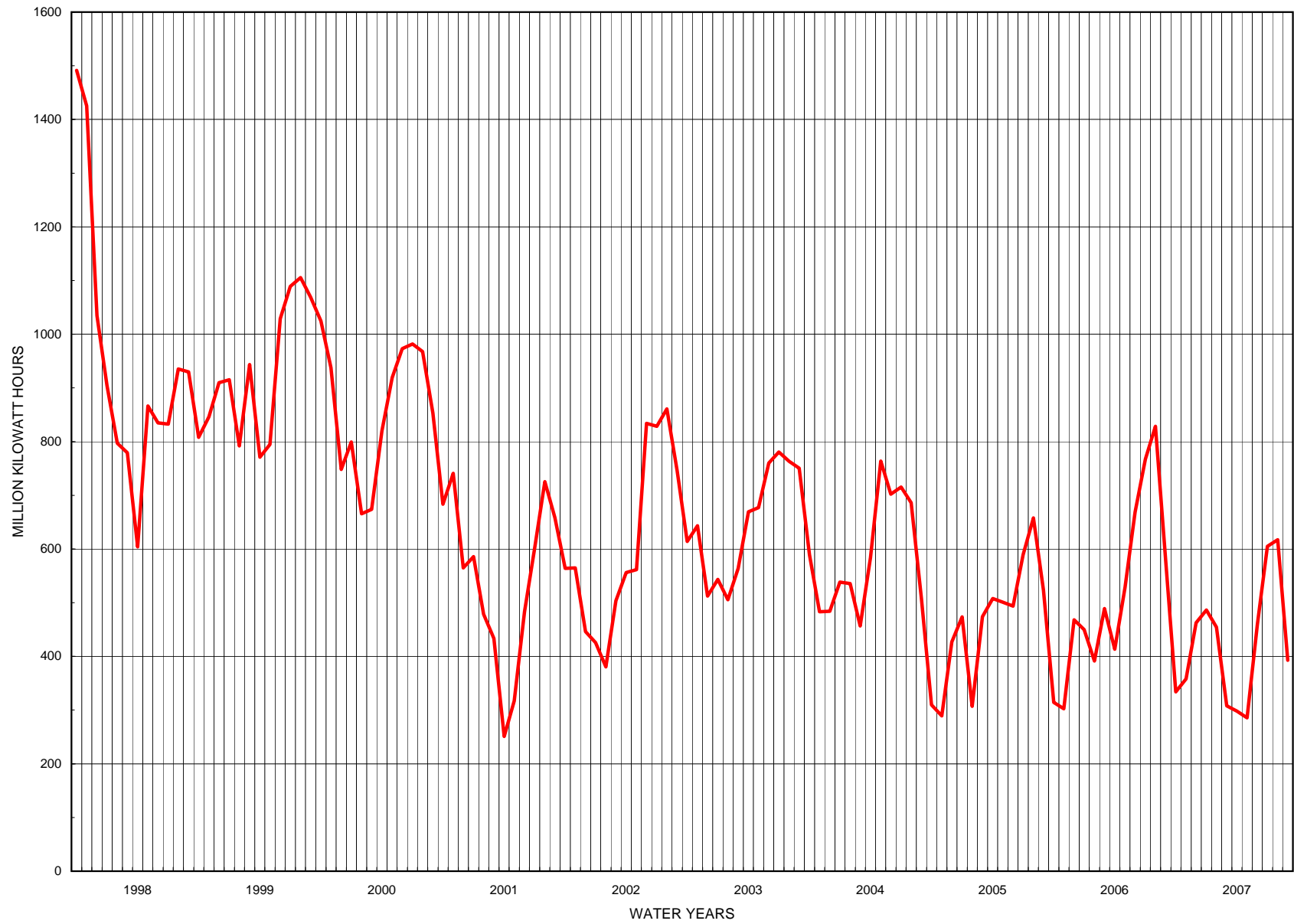


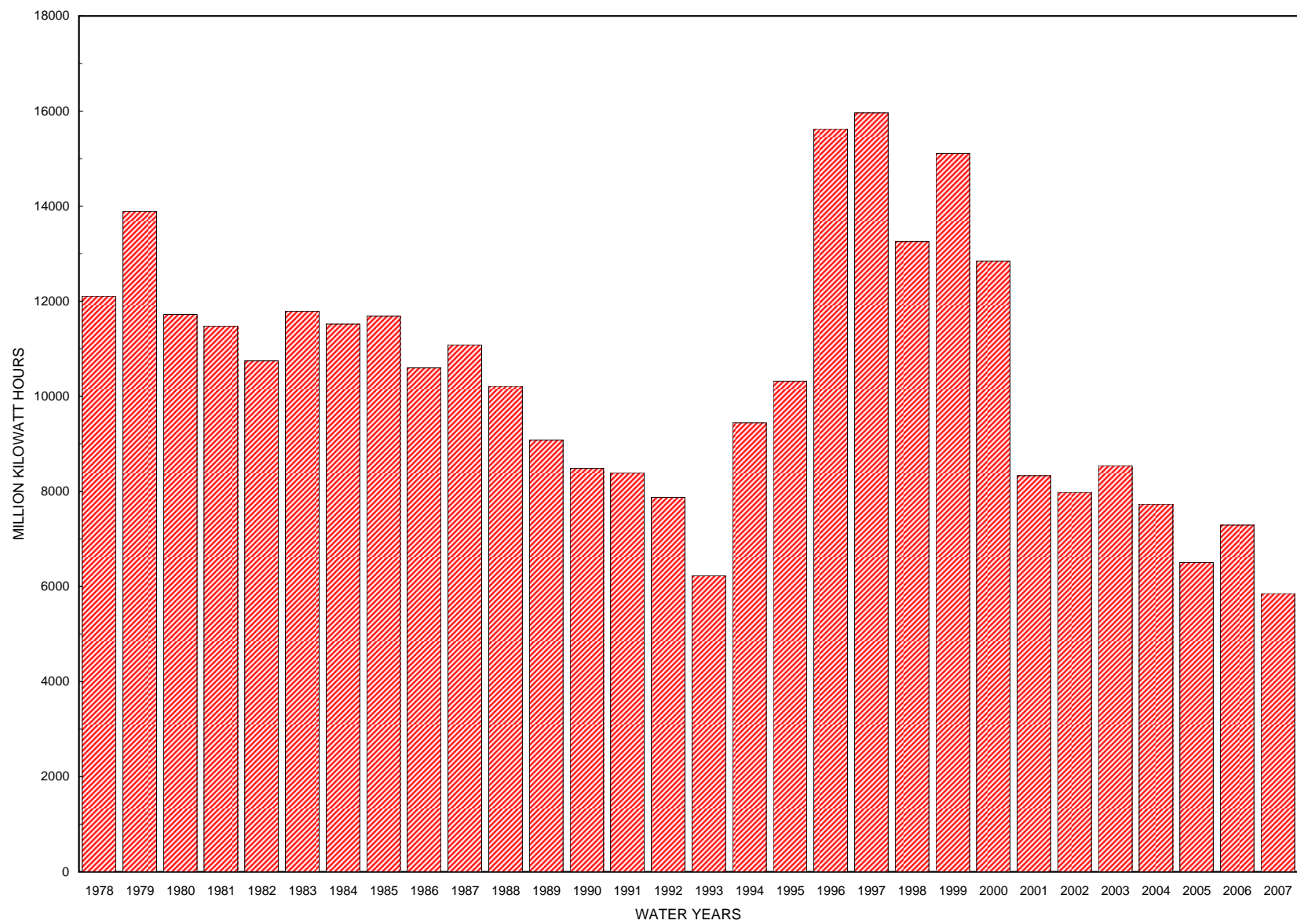
FIGURE CEG3  
ANNUAL GENERATION AT COE PLANTS



**FIGURE CEG4**  
**MONTHLY GENERATION AT COE PLANTS**



**FIGURE CEG5**  
**ANNUAL GENERATION - USBR & COE PLANTS**



**FIGURE CEG6**  
**MONTHLY GENERATION - USBR & COE PLANTS**

