

## DESCRIPTION OF THE COLORADO-BIG THOMPSON PROJECT

The Colorado-Big Thompson Project (C-BT) is one of the largest and most complex natural resource developments undertaken by the Bureau of Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided.

The C-BT spreads over approximately 250 miles in the state of Colorado. It stores, regulates, and diverts water from the Colorado River west of the Rocky Mountains, providing supplemental water for irrigation of 720,000 acres of land east of the Rocky Mountains. It also provides water for municipal use, industrial use, hydroelectric power, and water-oriented recreation.

Major features of the C-BT includes; dams, dikes, reservoirs, powerplants, pumping plants, pipelines, tunnels, transmission lines, substations, and other associated structures (Table 1, Exhibits 1 and 2).

Historically, the C-BT has diverted approximately 230,000 acre-feet of water annually (310,000 acre-feet maximum) from the Colorado River headwaters on the western slope to the South Platte River Basin on the eastern slope, for distribution to project lands and communities. The Northern Colorado Water Conservancy District (NCWCD) apportions the water used for irrigation to more than 120 ditches and 60 reservoirs. Twenty-nine communities receive municipal and industrial water from the C-BT. The Western Division of the Pick-Sloan Missouri Basin Program markets the electric power produced at the six powerplants.

The western slope collection system captures runoff from the high mountains and stores, regulates, and conveys the water to Adams Tunnel for diversion to the east slope under the Continental Divide.

To ensure irrigation and power generation under prior rights on the Colorado River, Green Mountain Reservoir was constructed on the Blue River. Spring runoff is stored in this reservoir and later released to meet the requirements of the senior water rights holders downstream along the Colorado River and to allow east slope diversion of water by the C-BT throughout the year.

Pursuant to authorities in Senate Document 80, (which authorized the C-BT), and the 1984 Green Mountain Operating Policy and the agreements in the September 1996 Stipulation and Agreement of the Orchard Mesa Check Case settlement (Case No. 91CW247, Colorado Water Div. 5), the content of the Historic Users Pool (HUP) in Green Mountain Reservoir is evaluated during the summer to determine the availability of water surplus to historic beneficiaries needs. If it is determined that surplus water is available, it may be delivered based upon need, first to the federal Grand Valley Powerplant and then to other uses based on a priority system or on specific agreements.

Irrigation systems on the Colorado River, above the Blue River confluence, were improved to enable continued use of existing rights. Releases are made from Lake Granby to maintain the Colorado River as a live fishing stream.

The C-BTs principal storage facilities on the west slope are Lake Granby, Grand Lake, and Shadow Mountain Reservoir located on the Colorado River near Granby, and Willow Creek Reservoirs located on Willow Creek, a tributary to the Colorado River below Lake Granby. Willow Creek Pumping Plant lifts the water 175 feet. It then flows by gravity via the Willow Creek Feeder Canal down to Lake Granby.

Granby Pumping Plant lifts the water 99 feet from Lake Granby to Granby Pump Canal. The canal conveys the water 1.8 miles to Shadow Mountain Lake, which also intercepts North Fork flows of the Colorado River. Shadow Mountain Lake connects with Grand Lake to make a single body of water from which diversions flow to Adams Tunnel to begin the journey to the eastern slope.

Emerging from Adams Tunnel into the East Portal Reservoir, the water flows across Aspen Creek Valley in a siphon and then under Rams Horn Mountain through a tunnel. At this point, it enters a steel penstock and falls 205 feet to Marys Lake Powerplant. This powerplant is located on the west shore of Marys Lake, which provides afterbay and forebay capacity for re-regulating the flow. The water is conveyed between Marys Lake and Estes Powerplant, on the shore of Lake Estes, through Prospect Mountain Conduit and Prospect Mountain Tunnel.

Lake Estes, which serves as an afterbay for the Estes Powerplant, is formed by Olympus Dam. The storage in Lake Estes and the forebay storage in Marys Lake enable the Estes Powerplant to meet daily variations in energy demand.

Water from Lake Estes and the Big Thompson River flows are conveyed by Olympus Siphon and Tunnel, and Pole Hill Tunnel and Canal, to a penstock through which the water drops 815 feet to Pole Hill Powerplant. The flow is then routed through Pole Hill Powerplant Afterbay, Rattlesnake Tunnel, Pinewood Lake, and Bald Mountain Pressure Tunnel, and eventually dropped 1,055 feet through two penstocks to Flatiron Powerplant. This powerplant discharges into Flatiron Reservoir, which regulates the water for release to the foothills storage and distribution system. The afterbay storage in Flatiron Reservoir and the forebay storage in Pinewood Lake enable Flatiron Powerplant to meet daily power loads.

Southward, the Flatiron reversible pump/turbine lifts water from Flatiron Reservoir, a maximum of 297 feet, and delivers it through Carter Lake Reservoir Pressure Conduit and Tunnel to Carter Lake Reservoir. When the flow is reversed, the unit acts as a turbine-generator and produces electrical energy.

The Saint Vrain Supply Canal delivers water from Carter Lake Reservoir to the Little Thompson River, St. Vrain Creek, and Boulder Creek Supply Canal. The latter delivers water to Boulder Creek and Boulder Reservoir. The South Platte Supply Canal, diverting from Boulder Creek, delivers water to the South Platte River.

Northward, the Charles Hansen Feeder Canal transports water from Flatiron Reservoir to the Big Thompson River and Horsetooth Reservoir. The canal crosses the Big Thompson River in a siphon above the river and highway.

Water from the Big Thompson River can be diverted into the canal by Dille Diversion Dam and utilized for power generation at Big Thompson Powerplant.

C-BT water deliveries and Big Thompson River water to be returned to the river are dropped through a chute from the feeder canal ahead of the siphon crossing, or are passed through the Big Thompson Powerplant to convert the available head to electrical energy.

Horsetooth Reservoir is located west of Fort Collins between two hogback ridges, where Horsetooth Dam closes the gap at one end. Soldier, Dixon, and Spring Canyon Dams and Satanka Dike close the remaining gaps. An outlet at Soldier Canyon Dam supplies water to the city of Fort Collins, three rural domestic water districts, Colorado State University, and the Dixon Feeder Canal for the irrigated area cut off from its original water supply by the reservoir. The principal outlet from Horsetooth Reservoir is through Horsetooth Dam into the Charles Hansen Supply Canal. This canal delivers water to a chute discharging into the Cache la Poudre River and to a siphon crossing the river to supply the Windsor Reservoir and Canal Company. A turnout from the Supply Canal supplies the city of Greeley municipal water works. Water is delivered to the river to replace, by exchange, water diverted upstream to the North Poudre Supply Canal, which conveys it to the North Poudre Irrigation Company System.

## SUMMARY OF OPERATIONS DURING WATER YEAR 2009

The winter season of WY 2009 was relatively wet in some parts of the Upper Colorado River Basin, especially over the Blue River and the Eagle River watersheds, despite a snowpack which was not as deep as during the previous year. Average snow accumulated over that section of the state between the months of November and April. In most places the snowpack reached slightly above-average levels in some instances. But in general it was an average snowpack year for the C-BT over the west slope.

By contrast, the east slope did not experience that kind of snowpack. The Big Thompson River Basin had a relatively dry winter season with below average snowpack.

Cool temperatures over the state kept the snowpack relatively intact until June. Peak runoffs for most of the river basins in Colorado developed after the middle of June. Runoff was slow coming, steady, and with very few high peak flows in WY 2009. The Colorado River Basin experienced significant runoff for the season but the peak flows were not very high. As temperatures began to warm up in June, snowfall turned to rain. The rain showers over the high country in late June caused the remaining snowpack to diminish rapidly. By late July the runoff season was over, the high temperatures of the summer arrived and the river basins began to dry off.

The snowpack over the Blue River Basin was slightly above average in 2009. The runoff produced by snowpack pushed Dillon Reservoir, located upstream of Green Mountain Reservoir, up to its maximum capacity. Dillon's spill in 2009 was significant in volume and length. Its releases kept Green Mountain Reservoir near its maximum storage capacity for most of July and into August.

Operations at Green Mountain Reservoir were relatively normal during most of the year. The spillway rehabilitation work was resumed in the spring and continued until June before it was suspended to allow spillway releases during runoff. The spillway work continues once the reservoir level was well below the top of the spillway gates.

Green Mountain Reservoir's fill operation began on April 20. As the reservoir level rose during April and May the decision was made to allow Green Mountain Reservoir to participate in the Coordinated Reservoir Operations (CROS) for 2009. With a promising runoff forecast and a nearly full Dillon Reservoir upstream, Green Mountain Reservoir was able to contribute to the 2009 CROS. Its contribution was as high as 875 ft<sup>3</sup>/sec on May 21, and its total contributed volume was 14,094 acre-feet. Despite the CROS contribution, the reservoir continued to rise at a steady pace. Depletions out of the Blue River were low earlier in the summer, which kept Green Mountain Reservoir's inflow high and water surface level rising. By late June, the reservoir level was reaching its maximum capacity. The two turbines also reached its maximum flow capacity in June. With the spill at Dillon Reservoir and the continuing local runoff Green Mountain Reservoir's inflow was approaching 3,000 ft<sup>3</sup>/sec by late June. Releases from Green Mountain Reservoir reached over 2,900 ft<sup>3</sup>/sec by June 26 and almost 3,000 ft<sup>3</sup>/sec by June 27. A significant portion of those releases was being made using the spillway gates. The high releases triggered an alert Level 1, but no incidents were reported. The alert Level 1 only lasted a couple of days. Green Mountain Reservoir stayed almost completely full from late June until the middle of August.

Granby Reservoir did not experience a runoff season comparable to the one at Green Mountain Reservoir. The Upper Colorado watershed above Lake Granby did not receive as much precipitation as the Blue River watershed.

As normal, Granby Reservoir began the water year with a water surface elevation on a downward trend. The trend continued from late fall until the spring. Transmountain diversions began in the middle of December and continued uninterrupted until the middle of May, bringing the reservoir level down to 8,238.09 feet on April 20. As soon as runoff began in May the diversions through Adams Tunnel were reduced significantly. At that point, Lake Granby began capturing and storing most of its inflow while rising fast. Pumping from Windy Gap and Willow Creek Reservoir also added to Granby's rapid rise. Granby's water surface level rose to its highest elevation since the year 2000, creating concerns about a possible spill. Granby's highest elevation for the year was 8276.23 feet recorded on July 16.

The abundance of water stored at most east slope reservoirs combined with the rainy weather this affected the region during May and June, which kept the demands for C-BT water low, therefore diversions through Adams Tunnel were also low during the spring and early summer. All those factors combined contributed to the high water surface level at Granby last summer. Once deliveries of C-BT water began by the middle of July diversions through Adams Tunnel resumed and Granby's level stabilized. By early August the high inflow to Granby was practically over. Pumping to Shadow Mountain Reservoir was suspended for two consecutive weeks as part of a water clarity study for Grand Lake. The reservoir maintained a steady level during the testing period. Once the test was concluded diversions through Adams Tunnel resumed, requiring pumping from the Farr Plant. Granby's reservoir level began dropping in late August and continued that trend until the end of the water year.

Granby Reservoir's total inflow in WY 2009 was 280,960 acre-feet. Its highest daily inflow for the year was 627 cfs on June 26. This inflow does not include water pumped from Willow Creek Reservoir or from the Windy Gap Project, or any inflow from Shadow Mountain Reservoir or Grand Lake.

Willow Creek Reservoir also had a good runoff year although not like the one during the 2008 season. The total inflow computed for Willow Creek Reservoir during WY 2009 was 71,770 acre-feet, from which 54,200 acre-feet was diverted to Granby Reservoir. Given the extremely high inflow during the peak of the runoff season combined with the limited storage capacity of the reservoir and the limited conveyance capacity of the Willow Creek Pumping Canal, the total volume of water released through the outlet works was higher than normal. A total of 13,050 acre-feet were released from the reservoir in WY 2009. From that total, 6,350 acre-feet was released as surcharge during the runoff season. The highest 24-hour average inflow for the year was 817 ft<sup>3</sup>/s on May 17. Meanwhile, Windy Gap pumped a total of 54,699 acre-feet back to Granby Reservoir during WY 2009 according to numbers provided by the NCWCD.

Most of the pumping from Farr Plant to Shadow Mountain Reservoir took place between December and May. With full reservoirs, low C-BT water demands and high runoff down the Big Thompson River, the Adams Tunnel was practically shutdown by the middle of May. The Farr Plant pumps were off-line between May until August.

With Adams Tunnel passing limited flows during the late spring and early summer months, at the peak of the runoff season, Shadow Mountain Reservoir bypassed most of the inflow sending it to Lake Granby. Between May and July of 2009 Shadow Mountain Reservoir bypassed to Lake Granby 176,000 acre-feet of water. During the same period the Farr Plant only pumped 8,000 acre-feet to Shadow Mountain Reservoir. The total volume pumped from Farr Plant to Shadow Mountain Reservoir in WY 2009 was 203,150 acre-feet, most of that between October 2008 and May 2009. During August 2008, at the request of Grand County and other local groups, Eastern Area Colorado Office (ECAO) in consultation with the NCWCD conducted a water clarity test for Grand Lake. The goal of the test was to determine if by reducing the flow from Shadow Mountain Reservoir into Grand Lake during the hot summer days the clarity of the water at Grand Lake could be improved. The two week test took place between August 13 and August 27. Transmountain diversions for the year totaled 242,600 acre-feet, 44,000 acre-feet lower than the previous year. This total includes Windy Gap Project water.

Over the east slope the runoff season came a little later in 2009 than during previous years. Colder temperatures during the spring months prevented any sudden inflow peaks to Lake Estes. The snowpack melted slowly with most of the runoff occurring between late May and June. The highest 24-hour average inflow computed for Lake Estes during WY 2009 was 764 ft<sup>3</sup>/s on June 27. The total inflow for the year at Lake Estes was 93,200 acre-feet, close to the 30-year average.

The unavailability of Flatiron Powerplant Units #1 was the limiting factor for the C-BT project in 2009. With only Unit #2 available, the system was limited to 460 cfs. That is 90 cfs short of the system's capacity. Despite the flow limitations the C-BT had a very productive skim operation in 2009, skimming most of the water available from the Big Thompson River. Most of the skim took place through the Olympus Tunnel, therefore maximizing power generation. Skimmed water through Olympus Tunnel total 39,734 acre-feet, while the Dille Tunnel (Tunnel #1) skimmed 13,665 acre-feet.

Horsetooth Reservoir reached its targeted elevation for the water season by the middle of May, as planned earlier in the year. However, the low demands for C-BT water combined with the need to keep water in the Charles Hansen Feeder Canal, plus the availability of priority water in June and July pushed the reservoir level to its highest in several years. On July 17, Horsetooth Reservoir reached an elevation of 5421.18, with a content of 139,313 acre-feet, its maximum for the year. The reservoir level remained high through July, but by August the reservoir content began to diminish rapidly. A combination of high demands for water and minimum diversion from the west pulled the Horsetooth Reservoir content down almost 32,000 acre-feet in 31 days. By the end of September 2009, the reservoir content had reached 85,319 acre-feet. Despite the rapid drop in reservoir level towards the end of the season all the boat ramps were kept functional until the fall.

Carter Lake also enjoyed a full recreational season during 2009, with reservoir levels that kept all the boat ramps in the water until the fall. The reservoir reached its maximum capacity by April 20. That maximum level was the highest in several years and almost reached the top of its operational pool. On April 20, the Carter Lake water surface reached an elevation of 5758.68 feet, with a total content of 111,863 acre-feet.

Similar to Horsetooth Reservoir, Carter did not drop very fast until August and September. Despite the rapid drop in water surface elevation in the summer months, recreational activities at Carter Lake were not affected. Pumping to Carter Lake took place mainly between December and April before resuming in September. A total of 95,178 acre-feet of water were pumped to Carter Lake during WY 2009.

Winter and early spring were relatively dry over Northern Colorado in 2009. However, many reservoirs on the east slope were left with near-capacity pools from the previous year. The rainy weather experienced during May and June kept demands for C-BT water low. Dry conditions returned to the region in July and demands for C-BT water began to increase. The initial quota set by the NCWCD for C-BT water in November was 60 percent or 186,000 acre-feet. However NCWCD increased their quota for the season in April to 80 percent. The C-BT ended the year delivering 224,181 acre-feet. That total volume included C-BT water and Windy Gap water. Potential carryover volume for this year is 60,035 acre-feet.

With the near-average runoff season for the Big Thompson River in 2009 the C-BT was able to capture 6,126 acre-feet of priority water this year. Most of the priority water was captured in June, with the remaining volume captured in July.

Total C-BT generation for the WY 2009 was above average with 655.1 giga-watt hours produced (GWh), which is 109 percent of the 30-year average. This total includes power generated at Green Mountain Reservoir, Marys Lake, Lake Estes, Pole Hill, Flatiron, and the Big Thompson powerplants.

## **WATER YEAR 2009 OPERATIONS**

### **Green Mountain Reservoir**

Green Mountain Reservoir and Powerplant, completed in 1943, are located south of the town of Kremmling, a few miles upstream of the confluence of the Blue River and the Colorado River in North Central Colorado. The reservoir, with a total capacity of 153,639 acre-feet, provides storage water releases for power production, replacement of out-of-priority depletions, and contract water deliveries. The powerplant has two units with a total installed capacity of 26 megawatts. The spillway, located on the left abutment, is controlled by three 25 x 22 foot radial gates and is capable of discharging 25,000 ft<sup>3</sup>/s.

Start of fill for 2009 was declared as April 20, with the reservoir holding 67,134 acre-feet in storage, slightly above its historic 65,000 acre-feet start of fill target. Pursuant to the State Engineers Office's interim policy, "Administration of Green Mountain Reservoir for 2009" of April 29, 2009, (Attachment B), Green Mountain Reservoir achieved a "paper fill" on May 24, 2009. On that date, Denver Water and Colorado Springs Utilities (Cities) owed Green Mountain Reservoir 35,554 acre-feet of water for their out-of-priority diversions. A provision of the interim policy allowed Green Mountain Reservoir to continue storing its inflow under a 1955 water right after "paper filling" to reduce the amount of water owed by the Cities. Under this provision, Green Mountain Reservoir was able to store sufficient water by June 7 to entirely eliminate the amount owed by the Cities.

By taking advantage of its junior and senior refill rights, Green Mountain Reservoir was able to continue storing some of its inflow after June 7, attaining a maximum physical content for the year of 152,814 acre-feet on June 26. With the reservoir achieving a "paper fill" this year, the 52,000 acre-feet Colorado-Big Thompson Project replacement pool, the 5,000 acre-feet Silt Project reservation, the 66,000 acre-feet HUP allocation, and the 20,000 acre-feet set aside for contracts were all fully available this year.

The maximum drawdown rate limitations initially put in place in 2003 due to landslide concerns were continued in 2009. These drawdown rate limitations were to be initiated when the reservoir's water surface elevation dropped below 7880.0 feet. With the reservoir achieving both a "paper fill" and a physical fill in 2009, the water surface elevation remained above 7900.0 feet during the irrigation season, and therefore, the drawdown rate limitations were never triggered.

While the interim policy requires that upstream depletions by Green Mountain beneficiaries junior to Green Mountain Reservoir be charged against the "paper fill" of Green Mountain Reservoir, those depletions were not charged against this year's HUP allocation. Therefore, the entire 66,000 acre-feet HUP allocation remained available when the reservoir achieved its fill. With the relatively wet spring and early summer, releases to augment the water rights of HUP beneficiaries downstream of Green Mountain Reservoir didn't commence until August 17, with a total of only 3,195 acre-feet being released for that purpose during the year.



HUP surplus releases began on August 19 at an initial rate of 50 cfs and were quickly ramped up to a rate of 405 cfs by August 27. The HUP surplus release remained at a constant rate of 405 cfs through October 27. The releases were then ramped down and terminated for the year on October 31. HUP surplus releases totaled 56,290 acre-feet in 2009, with 6,841 acre-feet being released under the agreement for the Grand Valley Powerplant and 49,449 acre-feet being attributable to the Municipal/Recreation Contract. Together, the release for HUP beneficiaries and the HUP surplus release totaled 59,485 acre-feet in 2009. This resulted in an HUP balance of 6,515 acre-feet on October 31.

Operations at Blue River, Dillon, and Green Mountain Reservoirs during WY 2009 are summarized in Table 2, Appendix B. Gross generation at the Green Mountain Powerplant totaled 71,500,000 kilowatt-hours during WY 2009. That total is 138 percent of the 30-year average.

### **Willow Creek Reservoir**

Completed in 1953, Willow Creek Reservoir has a total storage capacity of 10,600 acre-feet. The uncontrolled spillway, located at the left abutment, has a maximum flow capacity of 3,200 ft<sup>3</sup>/s. The Willow Creek Feeder Canal also begins at the left abutment and it has a capacity of 400 ft<sup>3</sup>/s. The canal is used to transfer water to Granby Reservoir. Excess inflow into the reservoir is moved by way of the Willow Creek Feeder Canal and pumped to Lake Granby for storage.

The Willow Creek watershed received average snow during the winter and spring months of WY 2009. By March 2009, the snow-water content over the watershed was 100 percent of average. The average snow-water content resulted in an April-July most-probable runoff forecast of 49,000 acre-feet, just above average. However, the inflow reported for Willow Creek Reservoir was 61,470 acre-feet for the same period. The sometimes high inflow in May and June forced releases through the outlet works in excess of the regular discharges. Between May 6 and July 8 of 2009, a total of 10,012 acre-feet were released through the outlet works above the normal 870 acre-feet. The releases combined with the water pumped to Lake Granby kept the reservoir elevation below spillway levels. Total pumpage for the water year totaled nearly 54,200 acre-feet. Total inflow for the water year was 71,770 acre-feet, 120 percent of average. The highest reservoir release recorded for the water year was a daily average flow of 347 ft<sup>3</sup>/s on May 10. The highest average daily inflow for the water year was 817 ft<sup>3</sup>/s on May 13.

### **Granby Reservoir**

Completed in 1950, Granby Reservoir on the upper Colorado River collects and stores most of the water supply for the C-BT. The reservoir stores the flow of the Colorado River as well as water pumped from Willow Creek Reservoir. The reservoir has a total storage capacity of 539,800 acre-feet. The spillway is located on the left abutment. Flows over the spillway are controlled by two radial gates, with a total release capacity of 11,500 ft<sup>3</sup>/s. The Granby Pumping Plant has three units with a combined installed capacity of 600 ft<sup>3</sup>/s.

Granby Reservoir's carryover content going into WY 2009 was 408,300 acre-feet, or 93 percent of the 30-year average for October 1. Its reservoir level continued to drop during the fall and winter months as diversions through the Adams Tunnel were kept at maximum system capacity.

Lake Granby's water year began with average precipitation during the winter months. By late winter and early spring that pattern changed thanks to a series of weather disturbances which impacted the west slope. By the end of March, the snow-pack reports were promising. Snowstorms continued to hit the region during the spring, although most of the precipitation was south and west of the Upper Colorado watershed. The April-July runoff forecast for Granby called for 201,000 acre-feet of water or 103 percent of average. Temperatures during the spring months of 2009 were cooler than normal over most of Colorado resulting in a relatively late runoff season. As warmer weather arrived to the region in May, runoff began to increase. A series of rain storms reached northern Colorado in June, augmenting the inflow to Lake Granby. By July, it was determined that final recorded volume was 238,200 acre-feet, much higher than previously expected.

Total precipitation for the water year in the Granby Reservoir watershed was 14.37 inches or 83 percent of average. The 30-year average precipitation for the watershed is 17.35 inches. Despite the low precipitation for the water year the total cumulative inflow for the entire water year was 280,960 acre-feet, much higher than the 30-year average of 252,930 acre-feet. The highest daily average natural inflow to Lake Granby was 2,713 ft<sup>3</sup>/s recorded on June 26.

The summer months were relatively dry and warm over Northern Colorado, which increased demands for C-BT water from allotments. Lake Granby reached its highest content of 512,719 acre-feet on July 16. The reservoir level remained relatively steady during July and August. High demands for C-BT water from the east slope began by the middle of July. However, even with the high demands for C-BT water, Lake Granby's elevation remained relatively stable during that period. One of the reasons for the stable water surface levels during the late summer was an alternative operational test which took place in August. This test was conducted to determine to which extent the project operations affect the water clarity at Grand Lake. The operation required zero pumping from the Farr Plant for over 2 weeks in August. Without any pumping from the Farr Plant the reservoir level remained fairly flat for a number of weeks.

Granby Reservoir never reached its maximum capacity during WY 2009, although by late June there were some concerns about a possible spill. The reservoir finished the water year with 474,776 acre-feet in storage, which represents 108 percent of the 30-year average. That volume was also 68,000 acre-feet higher than the volume recorded on September 30, 2008.

### **Grand Lake/Shadow Mountain Reservoir**

During August 2009, the regular operations of the C-BT were modified in order to verify the impact of regular project operations on water clarity at Grand Lake. The plan for this test was to suspend pumping from the Farr Plant to Shadow Mountain Reservoir for a period of 2 weeks while maintaining a positive flow from Grand Lake to Shadow Mountain Reservoir. This test took place between August 13 and August 26. Pumping at the Farr Plant resumed on August 27.

## **Adams Tunnel**

The total volume diverted through the Adams Tunnel was 242,600 acre-feet during WY 2009. That was 44,350 acre-feet lower than the previous year but 107 percent of the 30-year average. Water diversions began in October 2008, were interrupted to allow maintenance work to take place at multiple facilities in the system and then resume in early December. The tunnel was run uninterrupted until May. By the middle of May both Carter and Horsetooth Reservoirs had reached their respective desired levels. Flows through the tunnel were reduced significantly at that point to accommodate the skim operation over the east slope. Diversions from the west continued on a limited basis during late May, June, July, and part of August. After a 2 week interruption in August to accommodate the water clarity test for Grand Lake, full capacity flows resumed on August 27, 2009.

## **Lake Estes**

Completed in 1949, Lake Estes on the Big Thompson River provides regulating capacity for power generation purposes. The reservoir has a total capacity of 3,100 acre-feet. It captures the discharge of Estes Powerplant and inflows coming from the Big Thompson River, which regulates river flow below the dam, and releases of water to the Foothills Power System via Olympus Tunnel (550 ft<sup>3</sup>/s capacity). The Estes Powerplant has three hydroelectric units with a total installed capacity of 45 megawatts. The combined flow capacity for the three units is 1,300 ft<sup>3</sup>/s. The spillway, located on the right abutment, has five radial gates with a total discharge capacity of 21,200 ft<sup>3</sup>/s. The center gate has been automated, and is operated remotely from the Loveland Control Center (LCC). During the winter months, C-BT water is diverted through Adams and Olympus Tunnels and routed through the Foothills Power System on its journey to terminal storage at Carter and Horsetooth Reservoirs. This complete operation is controlled remotely from the LCC.

The winter season of WY 2009 was relatively dry over the Big Thompson River watershed. The April 1 snow-water content was 9.2 inches or 87 percent of average with an April-July runoff forecast of 63,000 acre-feet or 90 percent of average. The dry pattern continued for the Big Thompson River watershed. By June 1, the snow-water content was down to 63 percent of average. By the middle of May a rainy pattern moved into the area which lasted into late June. The rainy weather pushed the runoff higher than previously anticipated. The April-July total inflow to Lake Estes was 74, 670 acre-feet, almost 12,000 acre-feet higher than forecasted. Cool temperatures continued over the region until the middle of June, which kept demands for C-BT water relatively low. Runoff came late in early July as temperatures finally began to rise.

The C-BT was able to capture native water from the Big Thompson River during WY 2009. The demands for C-BT water did not begin until the middle of July. With many of the local storage reservoir near full capacity and the continuing wet conditions over the area demands for water were low. The C-BT entered priority status to capture Big Thompson River water on June 20. Adams Tunnel transmountain diversions were at a minimum in June therefore the Foothill's System had nearly full capacity to capture and store native runoff.

The skim operation was also very successful during 2009. Olympus Tunnel was able to skim a total of 39,734 acre-feet of water between May and August. The highest daily average inflow for Lake Estes this past water year was 764 ft<sup>3</sup>/sec, computed on June 27. The total cumulative inflow for the water year was 94,287 acre-feet, representing 100 percent of the 30-year average.

### **Foothill's System**

The C-BT system continued to run short of its full capacity in 2009 due to the limitations at the Flatiron Powerplant. The unavailability of Flatiron's Unit #1 and the operational limitations of Unit #2 prevented the system from functioning at full capacity. For that reason the system had to operate for longer periods of time which created some complications for outage schedules at some facilities and reduced system flexibility. Despite these limitations all the demands for C-BT water were met on time and the power generation operations were very successful. The skim operation had a good season in 2009 and the C-BT system was able to capture and store 6,126 acre-feet of Big Thompson River's native water.

The water year began with the seasonal fall demands for C-BT water in October 2008. Those demands kept the Adams Tunnel running at nearly full capacity for almost 3 weeks in October. Given the limitations of the Flatiron Powerplant some water was transported down the Big Thompson River and captured at the Dille Tunnel diversion structure, therefore bypassing power generation at Pole Hill and Flatiron Powerplants. Most of the C-BT water delivered in October came out of Horsetooth Reservoir, although a significant volume was supplied by Carter Lake. The rest was delivered via the Big Thompson Powerplant. Some pumping to Carter Lake took place in early October 2008, but most to the water diverted from Grand Lake was sent to Horsetooth Reservoir.

November is typically the time of the year for maintenance work at powerplants and other facilities in the system. It is also the time to inspect conveyance facilities and control point along the C-BT. In early November Pinewood Reservoir was drained in order to allow inspections of the Bald Mountain Tunnel and the headgate structure for Flatiron Powerplant. That operation lasted a few weeks. With Pinewood drained and given the need to meet all the C-BT commitments along the Charles Hansen Feeder Canal, the decision was made to keep moving some C-BT water down the Big Thompson River and capturing it at the Dille Tunnel diversion structure. A total of 2,327 acre-feet of water were captured at the Dille Tunnel diversion and sent north to Horsetooth Reservoir during the month of November. The Dille Tunnel diversion was winterized in early December.

By early December, the Adams Tunnel diversions were initiated. Pumping to Carter Lake began on December 9, 2008, and continued until March 17, 2009, with only one brief interruption in February. By the middle of March, the reservoir was only 10,000 acre-feet below its maximum capacity. At that point the decision was made to begin sending water to Horsetooth Reservoir. The Charles Hansen Feeder Canal 930 Section continued moving water to Horsetooth Reservoir for 2 weeks before the canal's annual maintenance began in April. The pump was put back on-line in April for 2 weeks while the canal's maintenance was taking place. Carter Lake reached its maximum level for the water year on April 20. Its storage content at that point was almost 112,000 acre-feet. By the time the canal maintenance work ended, pumping to Carter Lake concluded and the deliveries of C-BT water to Horsetooth Reservoir resumed.

Water continued to flow to Horsetooth Reservoir through late April and into May until the reservoir reached an elevation of 5416.82 feet on May 20. With low water demands due to the wet conditions over Colorado during the late spring the reservoir level continued to rise slowly, even as diversions through the Adams Tunnel had been reduced significantly. The Foothill's Conveyance System was carrying mainly skim water in late May and through June. C-BT water was being used mainly to augment the flow and keep some of the powerplants running at maximum capacity. The flow of C-BT fluctuated daily depending on the runoff and skim water available. Despite the low diversions through Adams Tunnel, by July 17 Horsetooth Reservoir had reached elevation 5421.18 feet, its highest level of the water year.

By the middle of July 2009, a dry weather pattern had settled over the region and temperatures were reaching over 90°F. The runoff season was rapidly coming to an end. Water demands began to increase by the middle of the month particularly demands for C-BT water. Reservoir levels at Carter Lake and Horsetooth Reservoir began to drop rapidly. With water demands on the rise, skim water availability dropping fast and a system shutdown planned for August to support the water clarity study for Grand Lake, the decision was made to increase diversions through the Adams Tunnel.

Reservoir levels for Carter Lake and Horsetooth Reservoir continued to drop fast in August, in particular by the middle of the month when the C-BT system was shutdown in support of Grand Lake's water clarity study, limiting diversions through the Adams Tunnel for 2 weeks. Fortunately the plan of operations for Carter Lake and Horsetooth Reservoir had taken into consideration these possible scenarios. The reservoir contents at Carter Lake and Horsetooth Reservoir were sufficiently high in July to continue water deliveries without any major consequences during August and September. The impact on recreation was also minimal. Diversions through Adams Tunnel resumed immediately after the water clarity study was concluded in late August and continued through September and into October.

Most of the power generated by the C-BT during the WY 2009 was produced using C-BT diversions. However, a significant portion of the power generated in 2009 by the powerplants along the Foothill's Power System can be attributed to the skim operation during the runoff season. The six powerplants in the C-BT produced a total of 583.6 GWh of power during the WY 2009, which represents over 97 percent of the 30-year average. Flatiron, Pole Hill and the Big Thompson Powerplants produced a total of 394.3 GWh, 96 percent of the 30-year average.

### **Carter Lake Reservoir**

Completed in 1952 with three dams, Carter Lake Reservoir has a total storage capacity of 112,200 acre-feet. Inflow of C-BT water to Carter Lake Reservoir is from the Flatiron Pumping Plant with a capacity of up to 480 ft<sup>3</sup>/s.

Carter Lake Reservoir began the WY 2009 with a storage content of 53,434 acre-feet. Pumping from Flatiron Reservoir began on December 9, 2008, and continued through March 2009. By March 17, Carter's storage content was 103,211 acre-feet. During April, pumping resumed for an extra 21 days, pushing the content up to 111,863 acre-feet by April 20 in preparation for the C-BT shutdown in August in support of the water clarity study at Grand Lake.

During an outage such as the one at Carter Lake could be used as the source of C-BT water for deliveries to the Big Thompson River.

Demands for C-BT water from Carter Lake became significant by the middle of July. As expected the reservoir level dropped very rapidly during the middle of August. By the middle of September pumping had resumed once again and the reservoir level rose slightly. By the end of September Carter's Reservoir content was 65,293 acre-feet.

The pumping operation with Flatiron Unit #3 required a total of 30.5 giga-watt hours(Gwh) of energy, 114 percent of the 30-year average. Water deliveries via the Saint Vrain Supply Canal during WY 2009 totaled 82,128 acre-feet. The 30-year average total is 81,500 acre-feet for water delivery. The month of September had the highest volume of water deliveries out of Carter Lake with a total of 14,155 acre-feet. Carter Lake Reservoir ended the water year at elevation 5707.40 feet and with a storage content of 53,434 acre-feet. All the recreation and water delivery targets for Carter Lake Reservoir were met during WY 2009.

### **Horsetooth Reservoir**

Completed in 1949, with four dams, Horsetooth Reservoir has a total constructed capacity of 156,700 acre-feet. Inflow to Horsetooth Reservoir is comes mainly from C-BT water delivered via the Charles Hansen Feeder Canal.

Horsetooth Reservoir began the WY 2009 with 80,035 acre-feet of water in storage and a water surface elevation of 5385.73 feet. Horsetooth Reservoir began the year at elevation 5386.14 feet, with 80,626 acre-feet of water in storage. Pumping to Carter Lake began early in December 2008; therefore, Horsetooth Reservoir's elevation rose slowly during the winter months. By the middle of March pumping to Carter Lake was interrupted and the entire C-BT flow was diverted to Horsetooth Reservoir. The reservoir elevation continued to rise until the middle of May. As skim operations began a big part of the C-BT conveyance capacity was dedicated to it. At that point the flow to Horsetooth Reservoir was diminished considerably. However, the wet weather condition over the region kept demands for C-BT and Windy Gap water low until July. Horsetooth Reservoir's level continued to rise slowly until it reached elevation 5421.18 feet on July 17, its highest level of the water year.

Once the demands for C-BT water increased in July the reservoir level began to drop very quickly. The combination of high demands and the shutdown of the Farr Pumping Plant in August in support of the water clarity study for Grand Lake pushed the Horsetooth Reservoir level down significantly in August. In spite of those conditions, the reservoir storage content in July was sufficient to meet all the demands while keeping the boat ramps in the water until the end of the recreational season. A total of 99,164 acre-feet of water were delivered out of Horsetooth Reservoir during WY 2009.

## **FLOOD BENEFITS**

The weather in Colorado was considered average during WY 2009. Precipitation over the Colorado River Basin during the winter season was average. Occasional snowstorms hit the mountain areas producing significant accumulations, but the snowpack at lower elevation was not very deep.

When the spring months arrived, temperatures remained cooler than normal preventing the runoff from having an early start. By early May temperatures began to warm up slowly and runoff started at most locations. Contrary to the winter months, the late spring season brought widespread rain to the region, especially in late May and throughout June. The rainy weather melted most of the remaining snow over the higher elevations. Runoff came sooner than anticipated. Once the snow was gone by the middle of July, the runoff season was over. Streams and tributaries high flows diminished rapidly.

The April-through-July most-probable runoff forecast for Green Mountain Reservoir predicted a total of 337,000 acre-feet of inflow, or 129 percent of average. Willow Creek had a forecast of 49,000 acre-feet or 102 percent of average, while Granby had a forecast of 201,000 acre-feet of 103 percent of average. The wet weather experienced in May and June pushed those totals much higher than previously forecasted. The actual Green Mountain Reservoir undepleted inflow for the period was estimated at 360,550 acre-feet, 23,000 higher than forecasted. Willow Creek also experienced a higher-than-predicted inflow with 61,470 acre-feet. Meanwhile Granby Reservoir experienced an inflow of 238,200 acre-feet, 5,200 acre-feet higher than the reasonable-maximum inflow predicted in April. Lake Estes had a total inflow of 73,800 acre-feet for the period, 105 percent of average and 10,000 higher than the April forecast.

Based on the data collected from the Colorado River Basin, and according to figures provided by the U.S. Army Corps of Engineers, the only C-BT reservoir over the west slope that prevented flood damages during WY 2009 was Green Mountain Reservoir. According to the Corps of Engineers report, Green Mountain Reservoir prevented a total \$10,500 in possible flood damages during the year, while Willow Creek, Granby, and Shadow Mountain/Grand Lake Reservoirs did not prevent any damages.

Since construction, the C-BT has prevented flood damages totaling \$412,800.

## **C-BT PLANNING AND CONTROL**

The C-BT is operated to provide supplemental municipal and industrial water supply, as well as irrigation water supply and hydroelectric power production. Some of the benefits from the operation of the project are reduction of flood damages, recreation, and fish-and-wildlife preservation, among others. The C-BT is operated for the purposes for which it was authorized and constructed.

The integrated operation of the C-BT is planned and coordinated by the Bureau of Reclamation, Water Scheduling and Control Group, Eastern Colorado Area Office in Loveland, Colorado. Staff at this office collects and analyzes information daily and makes the decisions necessary for successful operation of the C-BT. This continuous water management function involves coordination between the Division of Water Resources of the state of Colorado, the NCWCD, Upper Colorado and Great Plains Regions of Reclamation, the Western Area Power Administration (from the Department of Energy), and many other local, state, and Federal agencies.

Experience has proven that proper utilization of the available water resource in a multi-purpose project such as the C-BT can be achieved only through careful budgeting and management of the anticipated water supply. One end product of this budgeting and management process is an Annual Operating Plan (AOP).

The C-BT is operated on a water year basis (October 1 through September 30). The AOP is prepared in January of each year, following the plan's review and necessary public meetings. AOPs are prepared for reasonable-maximum and reasonable-minimum conditions of water supply and requirements as well as for the most-probable runoff conditions. The C-BT is operated to optimize the most-probable water supply without jeopardizing operational position should either the reasonable-maximum or the reasonable-minimum water supply conditions occur. The plan is reviewed and revised as necessary during the year as new information or changing conditions occur. Flexibility is a keynote and a necessity of the plan. Computer programs and models are used by Reclamation to develop the AOP and water supply forecasts.



## **GREEN MOUNTAIN RESERVOIR OPERATIONS**

Paragraph 6 of the October 5, 1955, Stipulation, in the decree for the Consolidated Cases Nos. 2782, 5016, and 5017 in the United States District Court for the District of Colorado (Blue River Decree), calls for periodic plans for the operation of Green Mountain Reservoir to be developed. The plans addressing this requirement are included as a part of this report.

Provisions guiding the operations of Green Mountain Reservoir are contained in the following documents:

Manner of Operation of Project Facilities and Auxiliary Features, Senate Document No. 80, 75th Congress, 1st Session

Consolidated Cases Nos. 2782, 5016, and 5017  
October 12, 1955, Stipulation and Decree  
April 16, 1964, Stipulation and Decree

Operating Policy for Green Mountain Reservoir, Colorado-Big Thompson Project, published in the Federal Register, Vol. 48, No. 247, December 22, 1983,

September 4, 1996, Stipulation and Agreement in Colorado Water Div. 5, Case No. 91CW247 (Orchard Mesa Check Case), and attached HUP Operating Criteria.

Operations will be consistent with the applicable provisions in these documents.

### **The general operations guided by these provisions are given below:**

#### **1. Winter operation (November-March)**

- a. Bypass inflow to supply downstream vested senior rights.
- b. Make releases to replace water diverted or stored out of priority by the C-BT collection system, as required.
- c. Make releases for west slope irrigation and domestic uses per Green Mountain Operating Policy and the HUP Operating Criteria.
- d. Make releases for water service contracts pursuant to the Operating Policy.
- e. Maximize power generation, while maintaining:
  - (1) Adequate storage to meet the anticipated needs under the guiding documents.
  - (2) A minimum power head consistent with the integrated system power operations.

## 2. Operation during snowmelt period (April-July)

- a. Bypass inflow to supply downstream vested senior rights.
- b. Make releases to replace water diverted or stored out of priority by the C-BT collection system, as required.
- c. Make releases for west slope irrigation and domestic uses per Green Mountain Operating Policy and the HUP Operating Criteria.
- d. Make releases for water service contracts pursuant to the Operating Policy.
- e. Participate in the Coordinated Reservoir Operations effort to enhance peak flows for the Colorado River Endangered Fishes. Reduce releases from traditional levels before and after the peak flow period on the Colorado River in the Grand Junction area. During peak flow period, release the lesser of inflows or turbine capacity for approximately a 10-day period.
- f. Fill without spilling to maximize power generation by utilizing the storage and power rights concurrently.
- g. On or before June 30 each year, meet with Managing Entities established under the settlement of the Orchard Mesa Check Case to assess availability of surplus water in the Historic Users Pool (HUP).
  - Confer with Managing Entities on a regular basis through the irrigation season to assess availability of surplus water in the Historic Users Pool (HUP).
  - If a surplus condition is declared, make releases up to the amount of surplus, under agreements, to:
    - the Grand Valley Powerplant up to its need or capacity; then to
    - the Grand Valley under the Municipal Recreation contract in excess of that needed by the powerplant
- j. Maximize power operation consistent with 1.e.
- k. Make releases as outlined in the above referenced documents.<sup>1</sup>

## 3. Operation after snowmelt period (August-October)

- a. Bypass inflow to supply downstream vested senior rights.

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<sup>1</sup> By the use of these provisions for current operating purposes, the United States does not intend to imply any definition of rights and obligations. The order in which these criteria are listed does

- b. Make releases to replace water diverted or stored out of priority by the C-BT collection system, as required.
- c. Make releases for west slope irrigation and domestic uses per Green Mountain Operating Policy and the HUP Operating Criteria.
- d. Make releases for water service contracts pursuant to the Operating Policy.
- g. Confer with Managing Entities on a regular basis through the irrigation season to assess availability of surplus water in the Historic Users Pool (HUP).
  - If a surplus condition is declared, make releases up to the amount of surplus, under agreements, to:
    - the Grand Valley Powerplant up to its need or capacity; then to
    - the Grand Valley under the Municipal Recreation contract in excess of that needed by the powerplant
- j. Maximize power operation consistent with 1.e.
- k. Make releases as outlined in the above referenced documents.<sup>2</sup>

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<sup>1</sup> By the use of these criteria for current operating purposes, the United States does not intend to imply any definition of rights and obligations. The order in which these criteria are listed does not reflect any intended priority.

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<sup>2</sup> By the use of these provisions for current operating purposes, the United States does not intend to imply any definition of rights and obligations. The order in which these criteria are listed does not reflect any intended priority.

## **GREEN MOUNTAIN HISTORIC USERS POOL AND THE ORCHARD MESA CHECK CASE SETTLEMENT**

### **Background and Authority**

The Orchard Mesa Check (Check) is a structure below the common afterbay of the Orchard Mesa Irrigation District (OMID) Pumping Plant and the federal Grand Valley Powerplant in the Grand Valley of Colorado. The operation of the Check provides the ability to raise the water level in the common afterbay to a level, which causes water to flow through the bypass channel and return to the Colorado River upstream of the Grand Valley Irrigation Company (GVIC) diversion dam.

Operation of the Check was determined to constitute an 'exchange' of water whereby water destined for the senior GVIC irrigation water rights is borrowed for pumping and hydroelectric power generation purposes and returned to GVIC for irrigation use. Operation of the Check influences the supply of water available to Grand Valley irrigation systems; to the Grand Valley Powerplant for power production; Green Mountain Reservoir releases; and the flow in the 15-Mile Reach of the Colorado River. The 15-Mile Reach is that section of the Colorado River from the GVIC diversion dam to the confluence of the Gunnison River and has been designated critical habitat by the Upper Colorado River Endangered Fish Recovery Program.

The Check has been operated on an informal basis without a decreed right since approximately 1926 to manage flows in the Colorado River for the benefit of the United States, Grand Valley Water Users Association (GVWUA), and OMID (Co-applicants). In the late 1980's, a hydropower development was proposed in a reach of the Colorado River between the Grand Valley Diversion Dam, the point where the exchange water is diverted, and the GVIC diversion dam where the exchange water is returned. The Co-applicants were concerned that a water right awarded for this development would have the ability to interfere with the exchange of water. In response to this potential threat to the continued operation of the exchange, the co-applicants filed an application in State Water Court on December 30, 1991, for approval of an exchange of water. This case (Water Division 5, Case No. 91CW247) was informally known as the Orchard Mesa Check Case. Resolution of the case resulted in a negotiated Stipulation and Agreement entered into the District Court, Water Division No. 5, State of Colorado, on September 4, 1996.

### **Overview of the Stipulated Settlement**

The settlement contains two major components: the Stipulation and Agreement and the Green Mountain Reservoir Historic Users Pool Operating Criteria (Operating Criteria). The Operating Criteria further defines operation of the Green Mountain Reservoir Historic Users Pool (HUP) consistent with Senate Document 80 and the 1984 Operating Policy. The parts of the Stipulation and Agreement pertinent to the operation of the HUP are summarized below:

As part of the Stipulation and Agreement the Co-applicants and GVIC agree not to exercise their irrigation rights against any upstream HUP beneficiary provided that the Check is physically operable; there is at least 66,000 acre-feet of water in storage in the Green Mountain Reservoir HUP, or approved substitute storage reservoir, when Green Mountain Reservoir storage rights cease to be in priority; and the water rights for the Shoshone Powerplant continue to be exercised in a manner consistent with their historical operation. (Section 3.b. of the Stipulation and Agreement)

The Stipulation and Agreement also provides that Reclamation will declare surplus water which is in excess of the needs of HUP beneficiaries for a given water year. Water declared surplus might be delivered through agreements to beneficial uses in western Colorado. This is to be done in accordance with the provisions of the HUP Operating Criteria, which are summarized below:

### **Management of the HUP Under the Operating Criteria**

The management of the HUP is accomplished through the process defined in Sections 3.d. and 3.e. of the Operating Criteria. This process requires the development of this Annual HUP Operating Plan on or before June 30 of each year.

The Annual HUP Operating Plan is developed by the Bureau of Reclamation, in consultation with the Grand Valley Water Users Association, the Orchard Mesa Irrigation District, the Grand Valley Irrigation Company, the Division 5 Engineer, the Colorado Water Conservation Board and, Fish and Wildlife Service. These entities are collectively known as the 'Managing Entities'. The Managing Entities agree to make a good faith effort to develop an Annual HUP Operating Plan that is unanimously supported. However, the Bureau of Reclamation reserves the right to establish a release schedule, should unanimous consent be unattainable.

The Annual HUP Operating Plan is based upon actual HUP storage conditions; projected runoff forecasts; operational and climatological conditions; projected irrigation demands; and, 15-Mile Reach flow needs. It is expressly recognized, however, that in some years, release of the entire HUP by the end of the irrigation season will not be necessary or possible.

On or before June 30 of each year, the Bureau of Reclamation assembles initial information on storage in the HUP and comparative runoff years. Based upon the information assembled, a meeting is held with the other Managing Entities. During this meeting, a review of the forecasts is analyzed, and initial determinations of the level of "checking" required to preserve water in the HUP, as well as any determination of water surplus to HUP beneficiaries' needs are made.

The HUP operations are reviewed and modified by the Managing Entities as necessary to respond to changing conditions. Subsequent meetings or conference calls are held on an as needed basis to reexamine HUP storage conditions, runoff forecasts, climatological conditions, irrigation demands, 15-Mile Reach flow needs, and other operational conditions. Based upon this information, the Managing Entities adjust the checking. They also determine the water surplus for HUP beneficiary needs, as well as the release of such water.

During periods of below average river flows, review meetings or conference calls may be held as frequently as every week.

This mechanism provides a way to integrate management of releases from the HUP with operation of the Check to accomplish the purposes of the Operating Criteria. The mechanism is also used to integrate releases from the HUP with releases for the endangered fish from other reservoirs including Ruedi and Wolford Mountain.

## OPERATION SKIM

Big Thompson River water in excess of the minimum requirements, as recommended by the State of Colorado Division of Wildlife and the United States Fish and Wildlife Service, is diverted at Olympus Dam into the Foothills System to be used for power generation. This operation is known as operation "skim." The amount diverted depends on the flow at the Big Thompson River and the tributaries above Lake Estes, C-BT water imported through the Adams Tunnel, and the capacity of the Foothills System.

The water taken from the Big Thompson River can be used for power generation immediately. It can also be held in storage and replaced to the river with water from other sections of the system, depending on the power requirements. In general, water taken from the Big Thompson River at a variable rate, on a given date, is returned to the river at a flat rate, on the following day. This operation indirectly benefits the tourist and fishing industries along the Big Thompson Canyon by attenuating and diverting high flows, and by maintaining a steady stream during the runoff season.

Operation "skim" and storage of surplus water from the Big Thompson River in C-BT reservoirs are managed according to the AOP and as prescribed by the ECAO Water Scheduling staff.

The skim operation of WY 2009 was a very successful one. With Carter Lake and Horsetooth Reservoir contents at nearly full capacity by the middle of May diversions from the west were relatively low during the late spring and early summer. The Olympus Tunnel had the opportunity to skim almost all the available water from the Big Thompson River. The high flows through the Olympus Tunnel kept the rest of conveyance system also running full. But the capacity of the system at the moment was 460 cfs, limited by Flatiron's Powerplant.

It is expected that in WY 2010 will also have a very successful skim operation. The addition of Flatiron Powerplant's Unit #1 with a maximum capacity of 550 cfs will push the system back up to its operational limit, adding to the combined power generation of the system. The skim total could surpass last year's. As with WY 2009, during WY 2010 most of the skim water is expected to be captured at Olympus Dam and diverted via Olympus Tunnel. Dille Tunnel's contribution is anticipated to be below by comparison.

**Appendix A (Table 1 of 38)  
Green Mountain Reservoir, CO**

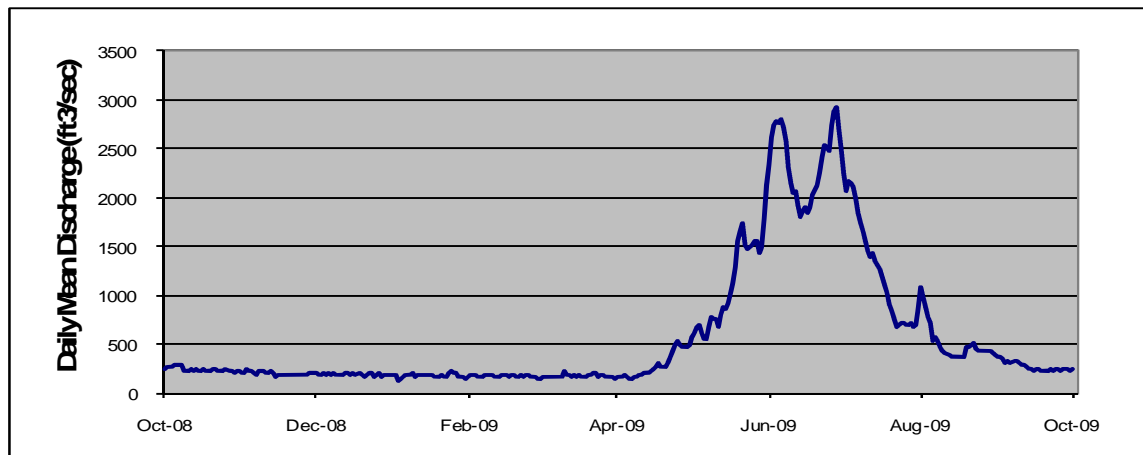
**Location.** --Lat 39°52'42", long 106°19'42", Summit County, Hydrologic Unit 14010002, on Green Mountain Dam, 13 miles southeast of Kremmling, Colorado, on the Blue River.

**Gage.** --Water level recorder with satellite telemetry. Elevation of gage is 7960 from topographic map.

**Remarks.**-- Inflow computed daily based on change in content from midnight to midnight, and on the 24-hour average releases from Green Mountain Reservoir. Recorders were operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Inflow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	243	206	199	189	183	149	158	618	2619	2061	986	371
2	260	213	189	189	181	159	160	675	2740	2166	871	349
3	262	241	190	127	185	164	185	691	2784	2149	777	305
4	257	220	214	152	173	171	172	620	2764	2103	726	328
5	285	220	178	157	169	162	150	558	2808	1982	525	309
6	277	202	198	190	172	157	146	555	2717	1847	572	331
7	278	188	194	179	182	168	165	667	2575	1732	531	328
8	284	216	204	186	183	160	172	768	2307	1665	474	314
9	227	223	194	196	179	157	192	749	2143	1558	434	286
10	226	219	190	172	170	219	185	751	2037	1454	411	285
11	226	209	188	190	162	186	202	680	2070	1393	383	257
12	245	206	192	187	166	176	207	794	1930	1432	365	236
13	231	215	205	179	180	170	208	871	1801	1356	363	251
14	236	202	207	183	184	175	217	849	1868	1301	360	230
15	225	174	174	187	176	172	240	914	1907	1259	373	247
16	224	194	195	181	165	181	275	1021	1848	1099	363	251
17	236	186	187	169	187	156	316	1120	1906	1032	363	224
18	233	179	205	167	181	159	269	1290	2032	898	475	218
19	231	188	188	161	170	161	257	1552	2123	841	465	219
20	234	182	172	180	154	189	275	1667	2259	748	495	227
21	239	192	187	162	180	183	310	1741	2424	684	507	243
22	243	189	203	171	165	199	364	1522	2534	703	444	232
23	230	183	204	206	175	203	437	1466	2522	725	438	240
24	233	177	171	219	179	173	498	1514	2487	713	438	239
25	220	182	194	208	164	175	530	1552	2752	703	433	234
26	245	182	208	196	161	186	487	1563	2889	701	438	253
27	234	194	171	165	154	156	465	1431	2928	715	428	237
28	217	210	184	167	144	159	469	1495	2694	683	430	238
29	207	196	184	167		163	494	1775	2477	686	403	231
30	219	203	191	139		158	564	2135	2247	868	390	237
31	218		183	157		152		2323		1076	366	
Min	207	174	171	127	144	149	146	555	1801	683	360	218
Max	285	241	214	219	187	219	564	2323	2928	2166	986	371
Mean	239	200	192	177	172	171	292	1159	2373	1237	485	265
ac-ft	14700	11862	11765	10846	9551	10493	17364	71141	140958	75897	29754	15736





**Appendix A (Table 2 of 38)**  
**Elliot Creek Canal near Green Mountain Reservoir, CO**

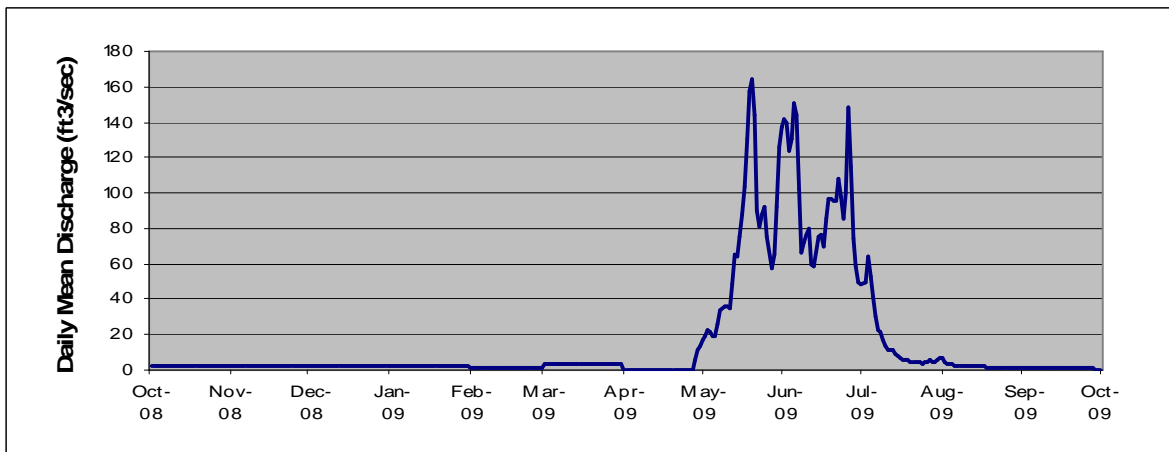
**Location.** --Lat 39°52'25", long 106°19'49", Summit County, Hydrologic Unit 14010002 , on left bank at concrete flume structure, and 1.1 mi west of Heeney.

**Gage.**--Water-stage recorder with satellite telemetry. Elevation of gage is 8050 ft from topographic map.

**Remarks.**—This is a diversion from Elliot Creek in the Blue River Basin to Green Mountain Reservoir. Recorder was operated 28-Apr-2009 through 30-Sep-2009. The date prior to 28-Apr-2009 is estimated. Records are incomplete and only reliable after 28-Apr-2009. This record contains operational data which could be subject to future revisions and changes. Official data is published by the United States Geological Survey.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	2	2	2	2	1	3	0	17	142	48	7	
2	2	2	2	2	1	3	0	19	139	49	4	
3	2	2	2	2	1	3	0	23	124	64	4	
4	2	2	2	2	1	3	0	22	131	53	3	
5	2	2	2	2	1	3	0	19	151	42	3	
6	2	2	2	2	1	3	0	19	144	30	3	
7	2	2	2	2	1	3	0	26	102	23	3	
8	2	2	2	2	1	3	0	34	66	21	2	
9	2	2	2	2	1	3	0	36	72	17	2	
10	2	2	2	2	1	3	0	36	76	13	2	
11	2	2	2	2	1	3	0	34	80	11	2	
12	2	2	2	2	1	3	0	49	60	11	2	
13	2	2	2	2	1	3	0	65	58	11	2	
14	2	2	2	2	1	3	0	64	75	9	2	
15	2	2	2	2	1	3	0	75	76	8	2	
16	2	2	2	2	1	3	0	88	70	7	2	
17	2	2	2	2	1	3	0	104	85	6	2	
18	2	2	2	2	1	3	0	130	97	5	2	
19	2	2	2	2	1	3	0	158	97	5	2	
20	2	2	2	2	1	3	0	164	96	5	1	
21	2	2	2	2	1	3	0	144	96	5	1	
22	2	2	2	2	1	3	0	90	108	5	1	
23	2	2	2	2	1	3	0	81	98	4	1	
24	2	2	2	2	1	3	0	88	85	4	1	
25	2	2	2	2	1	3	0	92	100	4	1	
26	2	2	2	2	1	3	0	75	148	5	1	
27	2	2	2	2	1	3	0	58	115	5	1	
28	2	2	2	2	1	3	6	65	74	5	1	
29	2	2	2	2		3	11	92	59	5	1	
30	2	2	2	2		3	14	126	49	6	1	
31	2		2	2		3		137		7	1	
Min	2	2	2	2	1	3	0	17	49	4	1	
Max	2	2	2	2	1	3	14	164	151	64	7	
Mean	2	2	2	2	1	3	1	72	96	16	2	
ac-ft	123	119	123	123	55	184	61	4415	5689	976	127	



**Appendix A (Table 3 of 38)  
Green Mountain Reservoir, CO**

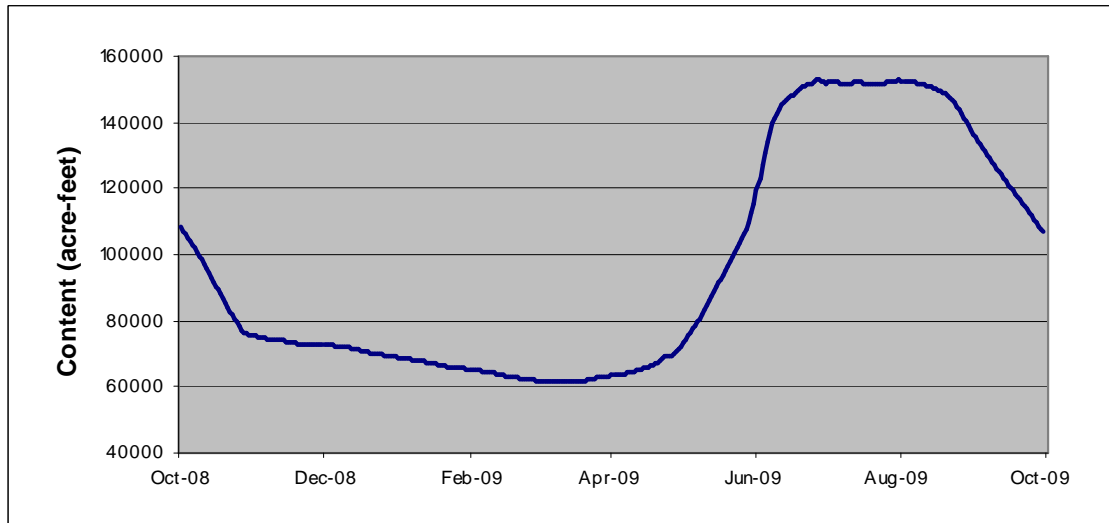
**Location.** --Lat 39°52'42", long 106°19'42", Summit County, Hydrologic Unit 14010002, on Green Mountain Dam, 13 miles southeast of Kremmling, Colorado, on the Blue River..

**Gage.** --Water level recorder with satellite telemetry. Elevation of gage is 7960 from topographic map.

**Remarks.**--Reservoir is formed by an earth-fill dam. Construction completed in 1943. Impoundment began on 16-Nov-1942. Green Mountain Reservoir provides storage used for replacement water of the Colorado-Big Thompson Project diversions. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Maximum capacity is 153,639 acre-feet at elevation 7950.00 ft, with 146,779 acre-feet of active capacity. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	108156	75445	72632	68923	65180	61878	63394	73280	119349	152603	152645	135306
2	107075	75253	72570	68816	65100	61790	63506	74388	123250	152497	152624	134332
3	106000	75113	72508	68744	65031	61713	63662	75534	127233	152243	152582	133282
4	104917	74934	72508	68588	64904	61658	63796	76551	130858	152159	152433	132241
5	103895	74756	72433	68421	64757	61592	63886	77446	134138	151989	152116	131183
6	102829	74539	72383	68314	64610	61516	63977	78334	137054	151926	152032	130151
7	101791	74362	72333	68184	64486	61461	64101	79456	139673	151905	151947	129122
8	100715	74299	72271	68066	64361	61396	64260	80776	141457	151926	151862	128100
9	99491	74249	72134	67972	64226	61331	64452	82057	142770	151736	151714	127083
10	98277	74186	71973	67830	64079	61386	64622	83339	143867	151609	151524	126108
11	97048	74111	71801	67724	63909	61364	64825	84496	145029	151714	151252	125120
12	95830	74022	71629	67606	63751	61342	65042	85846	145973	152010	150958	124099
13	94534	73947	71482	67476	63617	61342	65260	87337	146652	152180	150644	123103
14	93221	73846	71347	67358	63494	61342	65490	88718	147476	152201	150350	122128
15	91892	73695	71150	67251	63361	61342	65765	90028	148057	152137	150078	121198
16	90563	73582	70990	67123	63216	61407	66111	91321	148348	151841	149784	120305
17	89262	73468	70819	66948	63104	61461	66518	92495	148743	151461	149386	119349
18	87946	73343	70673	66774	62993	61516	66832	93651	149386	151482	149158	118393
19	86630	73217	70515	66588	62859	61603	67134	94999	150057	151714	148867	117448
20	85328	73080	70321	66436	62692	61768	67476	96377	150728	151736	148306	116521
21	84012	72993	70163	66250	62570	61922	67889	97878	151231	151651	147496	115603
22	82833	72918	70054	66088	62405	62108	68433	99086	151609	151630	146610	114653
23	81706	72831	69969	66018	62317	62295	69019	100447	151757	151736	145726	113658
24	80589	72732	69824	65995	62284	62427	69330	101903	151968	151841	144764	112669
25	79443	72669	69727	65972	62218	62570	69162	103441	152645	151926	143683	111668
26	78321	72632	69642	65915	62152	62725	69282	104950	152814	152032	142609	110693
27	77184	72620	69497	65800	62076	62837	69824	106229	152730	152116	141397	109688
28	76370	72644	69378	65685	61977	62948	70564	107640	152412	152159	140154	108695
29	76009	72632	69258	65570		63071	71347	109688	152264	152201	138856	107673
30	75828	72644	69150	65398		63182	72259	112617	151947	152476	137548	106643
31	75649		69031	65260		63283		115692		152793	136327	
Min	75649	72620	69031	65260	61977	61331	63394	73280	119349	151461	136327	106643
Max	108156	75445	72632	68923	65180	63283	72259	115692	152814	152793	152645	135306
EOM	75649	72644	69031	65260	61977	63283	72259	72259	151947	152793	136327	106643



**Appendix A (Table 4 of 38)**  
**Blue River below Green Mountain Reservoir, CO**

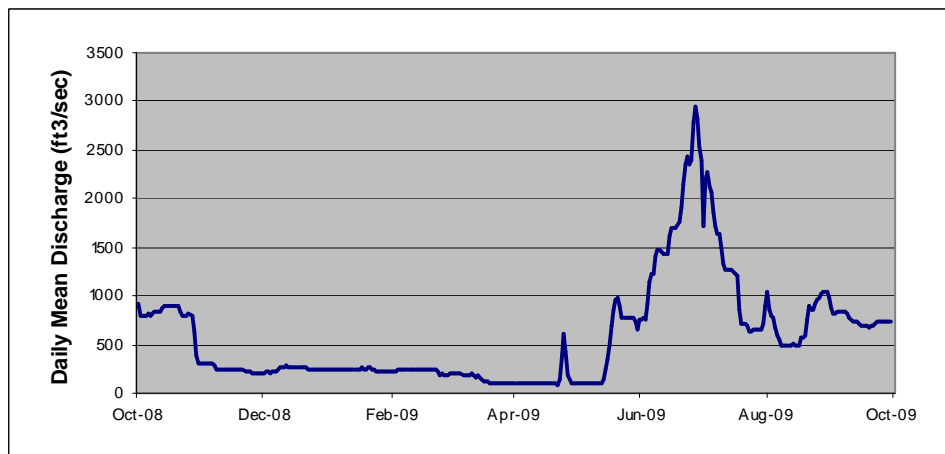
**Location.**--Lat 39°52'49", long 106°20'00", Summit County, Hydrologic Unit 14010002, on left bank 0.3 miles upstream from Elliot Creek, 0.3 miles downstream from Green Mountain Reservoir and 13 miles southeast of Kremmling.

**Gage.**-- Water-stage recorder with satellite telemetry. Datum of gage is 7682.66 feet (levels by U.S. Bureau of Reclamation).

**Remarks.**--Drainage area is 599 mi<sup>2</sup> including 15.3 mi<sup>2</sup> of Elliot Creek above the diversion for Elliot Creek feeder canal. Flow regulated by Green Mountain Reservoir since 1942. Diversions for irrigation of 5,000 acres upstream from station. Transmountain diversions upstream from station. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes. Official record is published by the United States Geological Survey.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	931	309	205	244	223	199	101	103	767	1709	1051	873
2	803	309	220	243	221	204	103	109	773	2191	867	826
3	802	309	221	243	220	203	102	108	766	2264	798	822
4	803	310	214	241	236	199	102	107	926	2138	785	839
5	800	309	216	241	244	195	104	107	1142	2063	673	835
6	814	311	223	243	246	196	101	107	1233	1865	597	841
7	802	277	219	244	245	194	102	102	1232	1721	559	836
8	827	248	236	245	246	193	92	103	1407	1630	496	814
9	845	248	260	243	246	190	95	103	1468	1630	489	786
10	838	249	271	244	244	192	99	96	1474	1499	491	764
11	845	247	275	243	245	197	99	97	1458	1321	501	742
12	846	249	278	244	246	187	97	95	1441	1273	495	743
13	884	253	275	244	248	170	98	102	1441	1271	504	742
14	898	253	275	243	240	175	101	145	1443	1272	495	717
15	895	250	273	240	238	172	101	242	1614	1269	496	697
16	894	251	275	246	238	148	100	355	1692	1229	496	695
17	892	243	274	257	241	129	101	519	1693	1203	564	696
18	897	243	275	255	237	132	105	695	1697	865	578	688
19	895	251	267	254	238	117	105	858	1762	709	598	686
20	891	251	268	256	238	106	102	963	1908	722	754	694
21	901	235	266	256	241	105	102	975	2156	720	894	692
22	838	227	253	253	248	105	90	905	2344	689	868	712
23	798	227	245	239	220	109	142	773	2432	642	868	734
24	796	227	244	221	194	107	341	775	2359	641	915	733
25	798	213	243	220	197	103	614	776	2395	646	968	733
26	811	200	245	223	194	100	426	779	2783	648	975	735
27	806	199	244	223	193	100	192	780	2956	651	1021	732
28	627	198	244	223	193	103	96	781	2834	650	1043	730
29	389	197	244	225	193	101	100	729	2534	647	1042	736
30	310	196	245	225	193	102	104	648	2390	711	1039	746
31	308		243	226	193	101		764		904	982	
Min	308	196	205	220	193	100	90	95	766	641	489	686
Max	931	311	278	257	248	204	614	975	2956	2264	1051	873
Mean	790	250	250	240	231	149	141	445	1751	1206	739	754
ac-ft	48477	14832	15317	14751	12790	9170	8357	27327	103987	74044	45348	44787



**Appendix A (Table 5 of 38)**  
**Willow Creek Reservoir, CO**

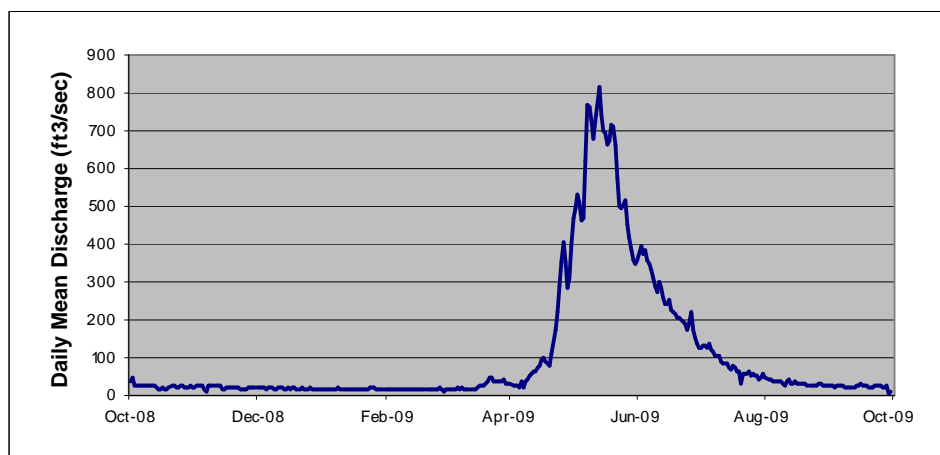
**Location.** -- Lat 40°08'52", long 105°56'28", Grand County, Hydrologic Unit 14010001, at Willow Creek Dam, 4 miles north of Granby, Colorado, on Willow Creek, a tributary of the Colorado River.

**Gage.**— Water level recorder with satellite telemetry. Elevation of gage is 8130 from topographic map.

**Remarks.**—Inflow computed daily using change in content from midnight to midnight, plus the 24-hour average releases through the Willow Creek Pump Canal and the reservoir outlet works. Recorders were operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Inflow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	36	22	20	18	15	16	30	466	359	128	47	26
2	46	25	20	17	16	18	25	495	396	131	43	24
3	25	27	20	18	15	18	29	531	375	132	41	22
4	25	26	19	16	16	17	26	510	382	125	39	24
5	28	24	14	15	16	13	22	466	359	137	37	25
6	26	18	20	17	15	16	35	470	346	123	38	24
7	24	12	21	16	15	23	22	619	333	113	35	25
8	26	25	20	16	15	17	36	770	312	108	35	23
9	24	27	18	19	17	20	40	762	291	108	33	23
10	26	27	16	17	16	17	55	726	273	103	29	23
11	24	25	19	18	16	14	59	677	301	89	35	21
12	27	24	21	17	15	18	64	726	283	85	41	20
13	25	26	20	17	15	18	65	817	258	82	33	26
14	19	18	17	17	17	17	76	740	244	75	32	24
15	18	14	16	16	16	17	79	699	242	69	36	32
16	17	23	20	16	14	22	95	697	251	78	34	28
17	20	22	18	16	15	24	98	665	228	76	32	24
18	18	22	20	15	15	26	90	672	221	61	31	24
19	18	21	19	15	17	28	84	713	217	63	30	22
20	20	21	17	15	14	32	79	710	207	33	30	22
21	25	19	17	16	15	37	111	665	207	59	28	21
22	25	18	19	13	14	45	172	576	196	57	28	25
23	22	16	18	18	16	46	223	500	189	58	26	24
24	21	15	18	19	15	39	289	493	172	62	27	26
25	26	15	18	19	17	37	355	507	189	50	29	24
26	25	16	19	19	19	35	405	517	220	56	31	23
27	21	20	16	16	17	37	355	454	174	55	32	21
28	22	22	18	16	12	36	284	414	152	54	26	24
29	23	22	17	16		41	312	383	137	44	26	8
30	25	20	17	17		32	397	358	127	47	24	11
31	20		17	16		30		348		56	25	
Min	17	12	14	13	12	13	22	348	127	33	24	8
Max	46	27	21	19	19	46	405	817	396	137	47	32
Mean	24	21	18	17	15	26	134	585	255	81	33	23
ac-ft	1472	1255	1128	1018	857	1595	7944	35931	15130	4989	2000	1364



**Appendix A (Table 6 of 38)  
Willow Creek Reservoir, CO**

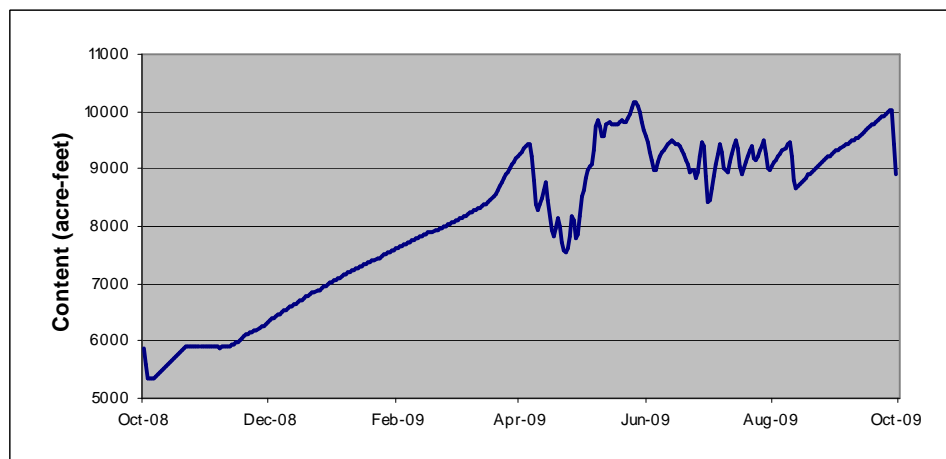
**Location.**—Lat 40° 08'52", long 105° 56'28", Grand County, Hydrologic Unit 14010001, at Willow Creek Dam, 4 miles north of Granby, Colorado, on Willow Creek, a tributary of the Colorado River.

**Gage.**— Water level recorder with satellite telemetry. Elevation of gage is 8130 from topographic map.

**Remarks.**—Reservoir is formed by an earth-fill dam. Construction completed in 1953. Impoundment began on April 2, 1953. Willow Creek Reservoir stores water from Willow Creek for diversion to Granby Reservoir via the Willow Creek Canal. Recorder was operated from 01-Oct 2008 to 30-Sep-2009. Record is complete and fair. Maximum capacity is 10,600 acre-feet at elevation 8,130.00 ft, with 9,100 acre-feet of active capacity between elevations 8077.00 and 8130.00 feet. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	5874	5900	6356	7048	7626	8093	9269	8527	9564	8417	9051
2	5600	5903	6382	7069	7644	8112	9305	8616	9454	8464	9112
3	5366	5911	6409	7092	7659	8133	9348	8838	9299	8667	9168
4	5361	5914	6433	7110	7677	8152	9385	8991	9152	8856	9221
5	5358	5916	6449	7126	7693	8164	9416	9051	8963	9070	9272
6	5358	5905	6475	7145	7709	8181	9421	9073	8981	9256	9323
7	5371	5887	6504	7164	7725	8209	9210	9313	9123	9419	9369
8	5409	5900	6530	7183	7741	8229	8795	9740	9226	9294	9413
9	5443	5911	6552	7207	7762	8254	8385	9854	9291	9025	9454
10	5478	5912	6569	7226	7778	8273	8292	9752	9334	8955	9229
11	5513	5911	6590	7245	7796	8287	8392	9561	9421	9107	8817
12	5554	5907	6616	7264	7812	8306	8504	9561	9479	9253	8649
13	5590	5932	6639	7284	7828	8328	8616	9780	9485	9394	8687
14	5622	5950	6657	7303	7849	8348	8751	9800	9460	9517	8728
15	5655	5961	6674	7320	7865	8368	8452	9775	9435	9367	8776
16	5688	5992	6700	7337	7879	8398	7933	9777	9432	9038	8817
17	5726	6022	6722	7354	7895	8429	7828	9763	9380	8924	8853
18	5759	6051	6747	7370	7911	8467	7981	9769	9318	9017	8890
19	5793	6078	6771	7385	7930	8509	8125	9814	9245	9117	8924
20	5822	6105	6791	7400	7942	8559	7991	9837	9154	9215	8955
21	5858	6127	6811	7415	7958	8619	7720	9803	9065	9310	8983
22	5893	6147	6835	7428	7972	8693	7581	9828	8950	9396	9012
23	5907	6166	6857	7450	7991	8771	7534	9882	8989	9194	9038
24	5903	6183	6879	7474	8007	8835	7621	9948	8968	9154	9070
25	5907	6199	6901	7499	8024	8895	7842	10049	8822	9229	9104
26	5911	6217	6925	7521	8047	8950	8161	10178	8939	9318	9144
27	5907	6244	6944	7538	8066	9007	8100	10178	9223	9405	9184
28	5905	6273	6966	7556	8076	9065	7801	10105	9462	9487	9210
29	5905	6303	6986	7574		9131	7856	9975	9388	9248	9237
30	5907	6329	7007	7594		9181	8176	9817	8866	9022	9264
31	5902		7027	7610		9226		9673		8983	9291
Min	5358	5887	6356	7048	7626	8093	7534	8527	8822	8417	8649
Max	5911	6329	7027	7610	8076	9226	9421	10178	9564	9517	9454
EOM	5902	6329	7027	7610	8076	9226	8176	8176	8866	8983	9291



**Appendix A (Table 7 of 38)**  
**Willow Creek below Willow Creek Reservoir, CO**

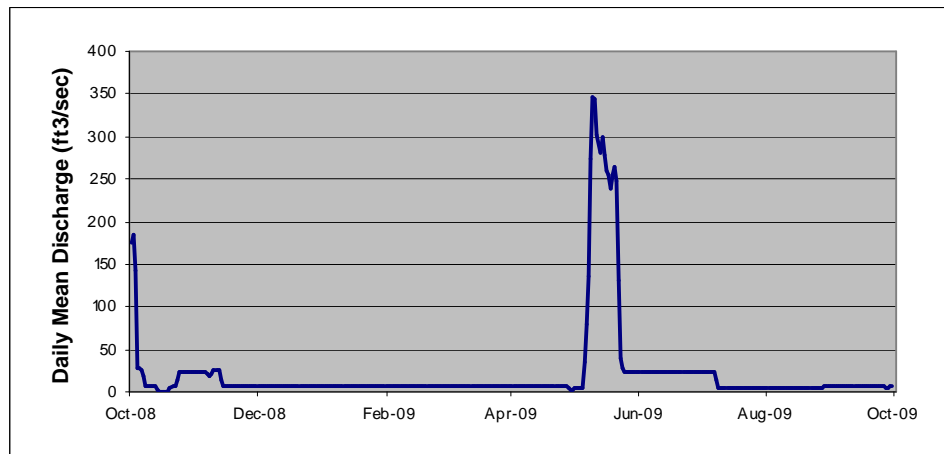
**Location.**--Lat 40°08'50", long 105°56'16", Grand County, Hydrologic Unit 14010001, at Willow Creek Dam, 4 miles north of Granby, Colorado, on Willow Creek, a tributary of the Colorado River.

**Gage.**--Water-stage recorder with satellite telemetry. Elevation of gage is 8040 feet from topographic map.

**Remarks.**-- Drainage area is 127 square miles. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	176	23	7	7	7	7	7	4	24	23	5	6
2	184	23	7	7	7	7	7	4	24	23	5	6
3	142	23	7	7	7	7	7	4	24	23	5	6
4	27	23	7	7	7	7	7	4	24	23	5	6
5	29	24	7	7	7	7	7	4	24	23	5	6
6	26	24	7	7	7	7	7	34	24	23	5	6
7	18	21	7	7	7	7	7	80	24	23	5	7
8	6	19	7	7	7	7	7	135	24	14	5	7
9	7	20	7	7	7	7	7	274	24	4	5	7
10	7	26	7	7	7	7	7	347	24	4	5	7
11	7	26	8	7	7	7	7	345	24	4	4	6
12	7	26	8	7	7	7	7	302	23	4	5	6
13	7	13	8	7	7	7	7	280	23	4	5	6
14	3	8	8	7	7	7	7	300	23	4	5	6
15	0	8	7	7	7	7	7	279	24	4	5	6
16	1	7	7	7	7	7	7	260	24	4	5	7
17	1	7	7	7	7	7	6	254	24	5	5	7
18	1	7	7	7	7	7	6	239	24	5	5	7
19	1	7	7	7	7	7	6	256	23	5	5	7
20	4	8	7	7	7	7	6	265	23	5	5	6
21	7	8	7	7	7	7	6	248	23	5	5	6
22	7	8	7	7	7	7	7	131	23	5	5	6
23	15	7	7	7	7	7	7	41	23	5	5	6
24	23	7	7	7	7	7	7	28	23	5	5	7
25	23	7	7	7	7	7	7	24	24	5	5	7
26	23	7	7	7	7	7	7	24	23	5	5	6
27	23	7	7	7	7	7	7	24	23	5	5	5
28	23	7	7	7	7	7	4	24	23	5	6	6
29	23	7	7	7		7	3	24	23	5	6	6
30	23	7	7	7		7	3	24	23	5	6	7
31	23		7	7		7		24		5	6	
Min	0	7	7	7	7	7	3	4	23	4	4	5
Max	184	26	8	7	7	7	7	347	24	23	6	7
Mean	28	14	7	7	7	7	7	138	24	9	5	6
ac-ft	1709	820	431	424	382	434	387	8488	1409	556	300	386



**Appendix A (Table 8 of 38)**  
**Willow Creek Pump Canal, CO**

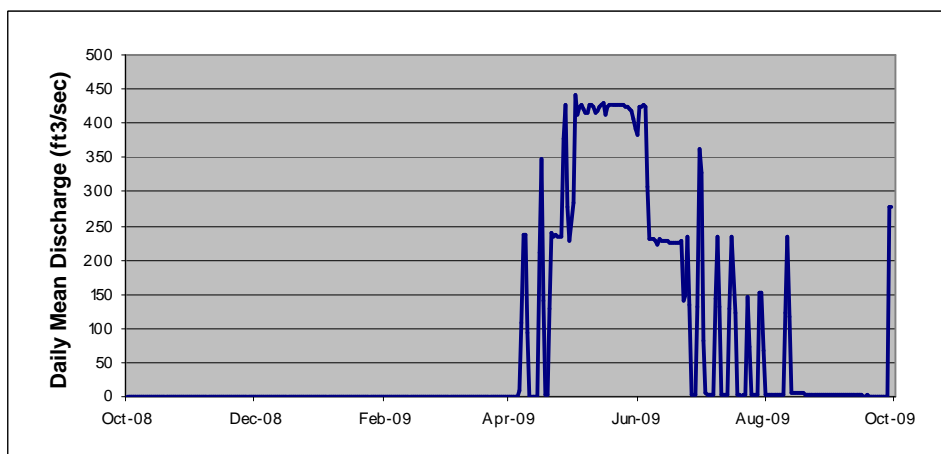
**Location.**—Lat 40°08'39", long 105°54'10", Grand County, Hydrologic Unit 14010001, at Willow Creek Pump Canal, 4 miles north of Granby, Colorado, on Willow Creek, a tributary of the Colorado River.

**Gage.**— Water-stage recorder with satellite telemetry at 15 foot Parshall Flume. Elevation of gage is 8300 feet from topographic map.

**Remarks.**—Canal is used to divert water from Willow Creek Reservoir to Granby Reservoir. Diversions are seasonal, mainly during late spring and early summer. Construction completed in 1953. Length of the canal is 3.4 miles. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	0	0	0	283	384	326	4	3
2	0	0	0	0	0	0	0	442	423	82	4	3
3	0	0	0	0	0	0	0	412	424	4	4	3
4	0	0	0	0	0	0	0	425	428	4	4	3
5	0	0	0	0	0	0	0	428	424	4	4	3
6	0	0	0	0	0	0	10	421	307	4	3	2
7	0	0	0	0	0	0	107	414	231	4	3	2
8	0	0	0	0	0	0	237	416	231	144	3	2
9	0	0	0	0	0	0	237	428	229	235	3	2
10	0	0	0	0	0	0	93	427	223	130	122	2
11	0	0	0	0	0	0	0	424	230	4	234	2
12	0	0	0	0	0	0	0	416	227	4	116	2
13	0	0	0	0	0	0	0	419	227	4	5	2
14	0	0	0	0	0	0	0	425	229	4	5	2
15	0	0	0	0	0	0	210	426	227	130	5	2
16	0	0	0	0	0	0	347	429	226	235	5	0
17	0	0	0	0	0	0	141	412	226	124	5	0
18	0	0	0	0	0	0	4	424	225	4	5	2
19	0	0	0	0	0	0	4	428	225	4	4	1
20	0	0	0	0	0	0	130	428	225	0	4	1
21	0	0	0	0	0	0	238	428	225	4	4	1
22	0	0	0	0	0	0	233	428	227	4	4	1
23	0	0	0	0	0	0	237	428	141	145	4	1
24	0	0	0	0	0	0	235	428	149	73	4	1
25	0	0	0	0	0	0	234	428	235	4	4	1
26	0	0	0	0	0	0	234	424	135	4	4	1
27	0	0	0	0	0	0	376	424	4	4	4	1
28	0	0	0	0	0	0	427	422	4	4	4	1
29	0	0	0	0	0	0	277	418	132	152	3	277
30	0	0	0	0	0	0	229	407	363	153	3	278
31	0		0	0		0		391		67	3	
Min	0	0	0	0	0	0	0	283	4	0	3	0
Max	0	0	0	0	0	0	427	442	428	326	234	278
Mean	0	0	0	0	0	0	141	418	240	67	19	20
ac-ft	0	0	0	0	0	1	8398	25647	14229	4087	1148	1190



**Appendix A (Table 9 of 38)  
Windy Gap Pumping Plant, CO**

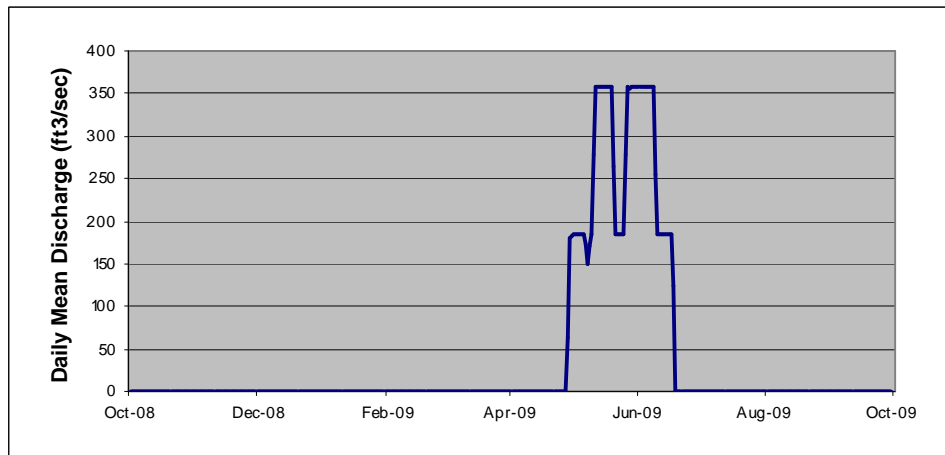
**Location.** --Lat 40°06'24", long 105°58'48", Grand County, Hydrologic Unit 14010001, 5.5 miles northeast of Granby, Colorado, on the Colorado River.

**Gage.**-- Reading taken directly from the pumps. Elevation of the pumping plant is 7823 from topographic map.

**Remarks.**— Water is pumped from Windy Gap Reservoir to Granby Reservoir. Water is stored at Granby Reservoir before delivery through Adams Tunnel. Data was provided by Farr Pumping Plant operators each morning. Data was collected from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Windy Gap Pump Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	0	0	0	283	384	326	4	3
2	0	0	0	0	0	0	0	442	423	82	4	3
3	0	0	0	0	0	0	0	412	424	4	4	3
4	0	0	0	0	0	0	0	425	428	4	4	3
5	0	0	0	0	0	0	0	428	424	4	4	3
6	0	0	0	0	0	0	10	421	307	4	3	2
7	0	0	0	0	0	0	107	414	231	4	3	2
8	0	0	0	0	0	0	237	416	231	144	3	2
9	0	0	0	0	0	0	237	428	229	235	3	2
10	0	0	0	0	0	0	93	427	223	130	122	2
11	0	0	0	0	0	0	0	424	230	4	234	2
12	0	0	0	0	0	0	0	416	227	4	116	2
13	0	0	0	0	0	0	0	419	227	4	5	2
14	0	0	0	0	0	0	0	425	229	4	5	2
15	0	0	0	0	0	0	210	426	227	130	5	2
16	0	0	0	0	0	0	347	429	226	235	5	0
17	0	0	0	0	0	0	141	412	226	124	5	0
18	0	0	0	0	0	0	4	424	225	4	5	2
19	0	0	0	0	0	0	4	428	225	4	4	1
20	0	0	0	0	0	0	130	428	225	0	4	1
21	0	0	0	0	0	0	238	428	225	4	4	1
22	0	0	0	0	0	0	233	428	227	4	4	1
23	0	0	0	0	0	0	237	428	141	145	4	1
24	0	0	0	0	0	0	235	428	149	73	4	1
25	0	0	0	0	0	0	234	428	235	4	4	1
26	0	0	0	0	0	0	234	424	135	4	4	1
27	0	0	0	0	0	0	376	424	4	4	4	1
28	0	0	0	0	0	0	427	422	4	4	4	1
29	0	0	0	0	0	0	277	418	132	152	3	277
30	0	0	0	0	0	0	229	407	363	153	3	278
31	0		0	0		0		391		67	3	
Min	0	0	0	0	0	0	0	283	4	0	3	0
Max	0	0	0	0	0	0	427	442	428	326	234	278
Mean	0	0	0	0	0	0	141	418	240	67	19	20
ac-ft	0	0	0	0	0	1	8398	25647	14229	4087	1148	1190





**Appendix A (Table 10 of 38)  
Granby Reservoir, CO**

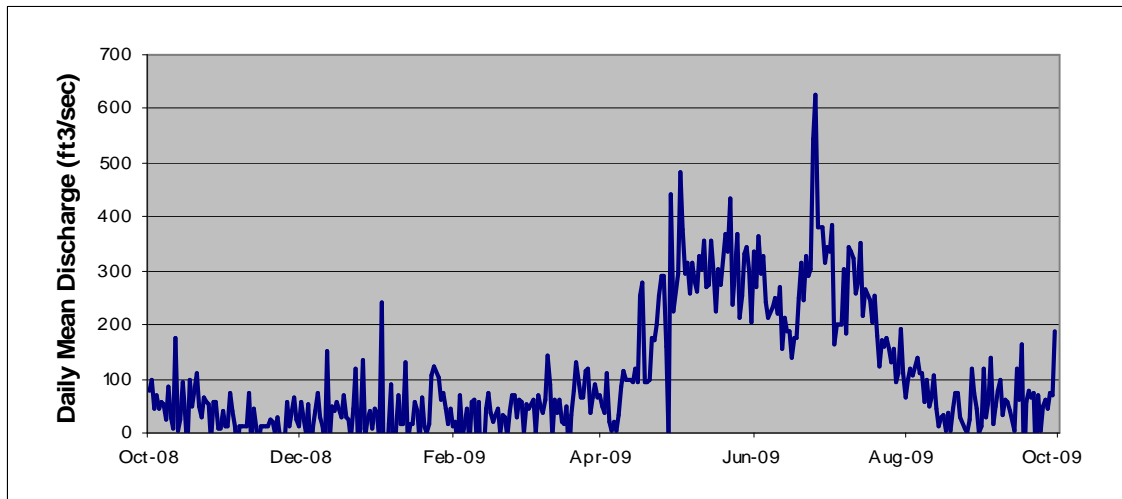
**Location.** --Lat 40°08'54", long 105°51'48", Grand County, Hydrologic Unit 14010001, on Granby Dam, 5.5 miles northeast of Granby, Colorado, on the Colorado River.

**Gage.**-- Water level recorder with satellite telemetry. Elevation of gage is 8300 from topographic map.

**Remarks.**-- Inflow computed daily based on change in content from midnight to midnight, and on the average daily releases through the reservoir outlet works. The computation does not include water pumped from Willow Creek Reservoir or the Windy Gap Project, or any inflow from Shadow Mountain Reservoir or Grand Lake. Recorders were operated from 01-Oct-2008 to 30-Sep-2009. Records are complete, but the data has not been revised or corrected. This record consists of operational data which could be subject to future revisions and changes.

**Inflow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	79	12	57	37	19	1	51	294	337	337	66	119
2	99	12	27	-17	-25	55	38	483	269	384	98	29
3	46	73	-2	241	70	43	112	377	364	165	119	62
4	69	42	52	-154	-8	62	19	296	293	202	105	141
5	45	12	-54	16	16	-2	3	317	327	200	140	16
6	57	-50	12	91	47	70	20	258	240	200	109	47
7	53	12	43	-76	-20	48	5	317	213	303	112	77
8	23	11	74	2	58	38	34	281	232	183	59	99
9	86	12	29	72	61	63	84	260	251	343	100	32
10	28	74	13	16	-10	142	113	329	221	335	48	61
11	7	-19	-32	15	57	91	97	304	269	325	67	56
12	177	43	150	129	-128	-6	97	356	157	258	107	43
13	4	12	-17	-15	46	63	94	269	212	278	44	5
14	25	-19	48	17	75	35	119	273	187	352	12	120
15	94	12	40	18	35	62	95	354	188	218	28	60
16	36	12	56	57	20	19	253	296	140	264	32	164
17	-32	12	30	40	31	17	277	227	175	246	2	-78
18	98	12	70	-16	44	50	93	303	174	206	36	58
19	49	25	27	67	1	-55	92	274	248	253	3	79
20	111	19	26	13	32	33	98	370	315	181	45	63
21	50	2	-12	1	30	76	175	334	245	122	72	72
22	27	29	45	15	-8	133	172	434	326	171	72	-56
23	67	-5	121	106	40	64	199	238	291	160	30	71
24	57	-111	-30	122	71	67	253	295	305	175	10	3
25	55	-19	6	101	71	115	291	369	545	156	1	50
26	-18	57	134	60	27	120	289	213	627	132	23	63
27	58	12	-10	72	62	37	160	253	382	154	117	46
28	56	65	23	45	58	64	-10	331	379	93	73	72
29	10	26	42	17		91	442	345	316	111	47	68
30	10	12	8	46		67	224	297	345	190	1	188
31	39		43	14		70		205		110	11	
Min	-32	-111	-54	-154	-128	-55	-10	205	140	93	1	-78
Max	177	74	150	241	75	142	442	483	627	384	140	188
Mean	50	13	33	37	28	56	133	308	286	220	58	61
ac-ft	3099	763	2015	2277	1528	3434	7904	18914	16975	13479	3537	3627



**Appendix A (Table 11 of 38)  
Granby Reservoir, CO**

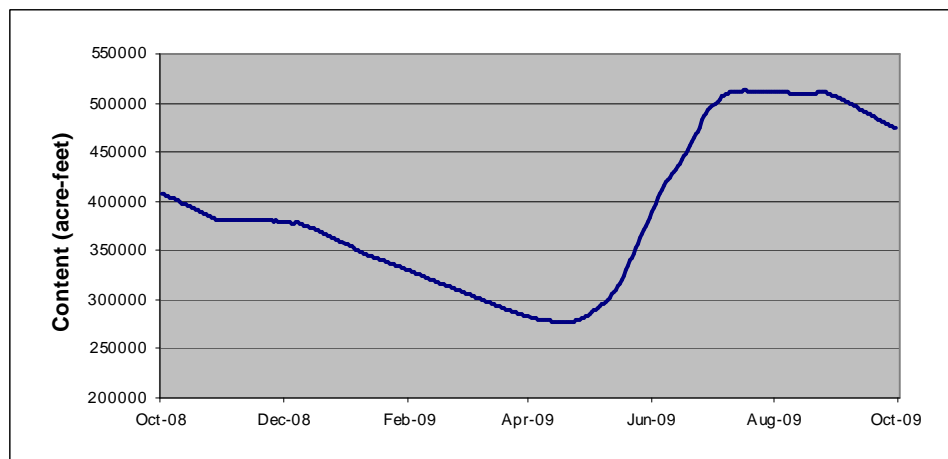
**Location.** --Lat 40°08'54", long 105°51'48", Grand County, Hydrologic Unit 14010001, on Granby Dam, 5.5 miles northeast of Granby, Colorado, on the Colorado River.

**Gage.**-- Water level recorder with satellite telemetry. Elevation of gage is 8300 from topographic map.

**Remarks.**--Reservoir is formed by an earth-fill dam and four earth-fill dikes. Construction completed in 1950. Impoundment began on 14-Sep-1949. Granby Reservoir provides west-slope storage for the Colorado-Big Thompson Project. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Maximum capacity is 539,800 acre-feet at elevation 8,280.00, with 463,300 acre-feet of active capacity between elevations 8186.90 and 8280.00 feet. Records are complete, but the data has not been revised. This record consists of operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	407558	380313	379945	355751	329449	306735	282502	285049	388921	497424	511295	505222
2	406864	380374	379822	354629	328479	305911	281764	287129	393575	498966	511365	504305
3	406045	380556	379576	354039	327679	305082	281184	288839	398124	501563	511154	503253
4	405348	380678	378846	352680	326824	304201	280603	290393	403020	503955	511012	502547
5	404464	380739	377931	351563	325969	303323	280022	291848	407558	506491	510942	501351
6	403585	380678	377992	350678	325176	302499	279496	293192	411871	507971	510731	500371
7	402577	380739	378115	349502	324265	301678	279129	294655	416077	509174	510590	499318
8	401509	380801	378299	348391	323468	300856	279076	296443	419275	509951	510307	498338
9	400568	380862	377503	347510	322679	300037	279024	298507	421586	510801	510094	497284
10	399502	381047	376650	346454	321883	299490	278972	300529	424230	511507	509951	496096
11	398376	381047	375921	345405	321036	298671	278498	302664	427206	511648	509809	495045
12	397749	381170	375315	344587	319909	297748	278024	304917	429930	511648	509597	493854
13	396565	381232	374522	343477	319118	296930	277711	307953	432409	511860	509738	492810
14	395504	381232	373855	343245	318444	296061	277447	310558	435418	512074	509880	491760
15	394568	381293	373006	342781	317655	295249	277553	313232	439029	512287	510094	490710
16	393575	381355	372160	342081	316816	294383	278076	316252	441998	512713	510165	489807
17	392518	381416	371070	341210	315861	293572	278339	319740	445441	512642	510165	488412
18	391522	381477	370162	340280	315637	292762	277868	323924	448833	512003	510236	487156
19	390471	381538	369079	339528	314963	291739	277394	329334	452038	511507	510236	485908
20	389603	381170	367994	338658	314072	290879	277183	334615	455994	510871	510236	484794
21	388549	380862	366850	337673	313232	290179	277341	339645	459902	510731	510307	483818
22	387566	380313	365890	336866	312338	289591	277605	343419	463833	510589	510378	482504
23	386453	380313	364990	336229	311617	288893	277972	347509	468051	510801	510449	481393
24	385465	380130	363851	335711	310837	288198	278550	352621	471608	510731	510519	480352
25	384423	380130	362833	335074	309949	287502	279286	357532	474626	510660	510590	479180
26	383377	380068	362058	334386	309281	286916	280181	362593	482018	510660	510660	478072
27	382515	380130	360862	333522	308509	286115	280865	366730	486878	510871	509951	476897
28	381721	380068	359850	332718	307677	285369	281343	371070	489876	510801	508892	475867
29	380985	379945	358838	331912		284678	282716	374826	492388	511083	508041	475247
30	380252	380007	357768	331112		283990	283830	379211	495324	511436	507338	475040
31	380252		356758	330251		283246		384052		511648	506279	
Min	380252	379945	356758	330251	307677	283246	277183	285049	388921	497424	506279	475040
Max	407558	381538	379945	355751	329449	306735	283830	384052	495324	512713	511365	505222
EOM	380252	380007	356758	330251	307677	283246	283830	283830	495324	511648	506279	475040



**Appendix A (Table 12 of 38)  
Granby Reservoir, CO**

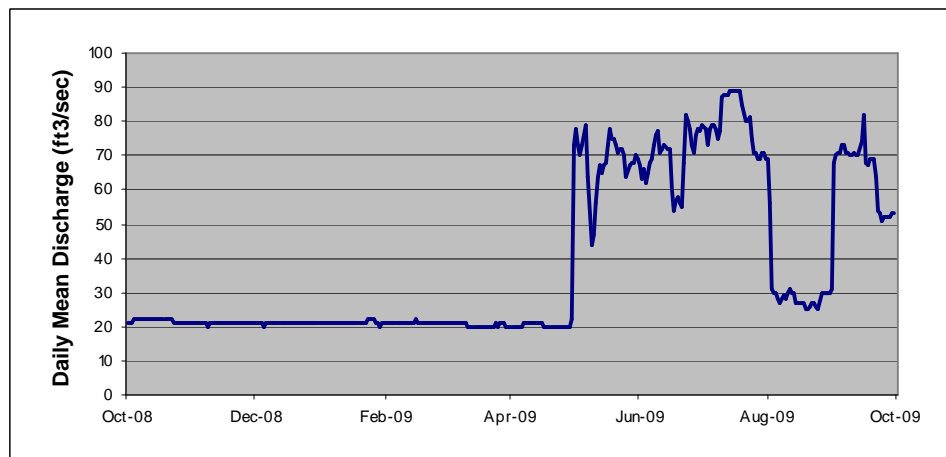
**Location.** --Lat 40°08'54", long 105°51'48", Grand County, Hydrologic Unit 14010001, on Granby Dam, 5.5 miles northeast of Granby, Colorado, on the Colorado River.

**Gage.**-- Water level recorder with satellite telemetry. Elevation of gage is 8300 from topographic map.

**Remarks.**--Reservoir is formed by an earth-fill dam and four earth-fill dikes. Construction completed in 1950. Impoundment began on 14-Sep-1949. Granby Reservoir provides west-slope storage for the Colorado-Big Thompson Project. Data was provided by personnel from the Northern Colorado Water Conservancy District. Releases were made through the outlet works valve. The stream gage directly below the dam is used to measure flows during winter. A USGS station further downstream is used to measure flows between spring and fall. Data was recorded from 01-Oct-2008 to 30-Sep-2009. Records are complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	21	21	21	21	21	21	20	73	67	79	69	68
2	21	21	21	21	21	21	20	78	63	78	56	70
3	21	21	21	21	21	21	20	73	66	73	31	71
4	22	21	21	21	21	21	20	70	62	78	30	71
5	22	21	20	21	21	21	20	73	65	79	30	73
6	22	21	21	21	21	21	20	76	68	79	28	73
7	22	21	21	21	21	21	21	79	69	78	27	71
8	22	20	21	21	21	21	21	64	73	75	29	71
9	22	21	21	21	21	21	21	44	76	77	28	70
10	22	21	21	21	21	21	21	47	77	87	30	70
11	22	21	21	21	21	21	21	56	71	88	31	71
12	22	21	21	21	21	20	21	64	72	88	30	70
13	22	21	21	21	21	20	21	67	73	88	30	70
14	22	21	21	21	21	20	21	65	72	89	27	74
15	22	21	21	21	22	20	21	67	72	89	27	82
16	22	21	21	21	21	20	21	68	60	89	27	68
17	22	21	21	21	21	20	20	73	54	89	27	67
18	22	21	21	21	21	20	20	78	57	89	27	69
19	22	21	21	21	21	20	20	75	58	89	25	69
20	22	21	21	21	21	20	20	75	56	85	25	69
21	22	21	21	21	21	20	20	73	55	80	26	64
22	22	21	21	21	21	20	20	71	68	80	27	54
23	21	21	21	22	21	20	20	72	82	81	27	53
24	21	21	21	22	21	20	20	72	80	75	26	51
25	21	21	21	22	21	21	20	70	78	71	25	52
26	21	21	21	22	21	20	20	64	73	71	30	52
27	21	21	21	21	21	21	20	67	71	69	30	52
28	21	21	21	21	21	21	20	68	76	69	30	52
29	21	21	21	20		21	20	68	78	71	30	53
30	21	21	21	21		20	22	70	77	71	30	53
31	21		21	21		20		69		69	31	
Min	21	20	20	20	21	20	20	44	54	69	25	51
Max	22	21	21	22	22	21	22	79	82	89	69	82
Mean	22	21	21	21	21	20	20	69	69	80	31	65
ac-ft	1327	1245	1287	1295	1166	1257	1212	4215	4097	4897	1873	3867



**Appendix A (Table 13 of 38)**  
**Farr Pumping Plant, Granby Reservoir, CO**

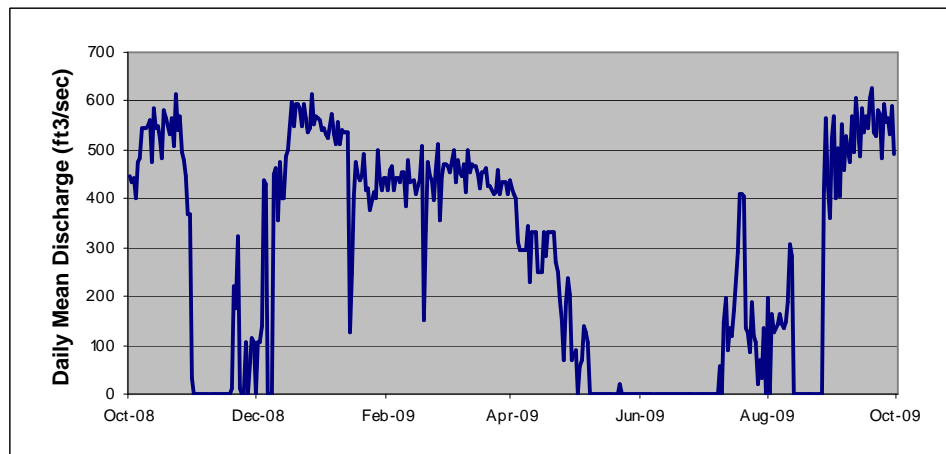
**Location.** --Lat 40°11'30", long 105°52'52", Grand County, Hydrologic Unit 14010001, at Farr Pumping Plant on the north end of Granby Reservoir, 8 miles northeast of Granby, Colorado, on the Colorado River.

**Gage.**-- Reading taken directly from the pumps, based on conduit pressure and Granby Reservoir's elevation. Elevation of the pumping plant is 8320 from topographic map.

**Remarks.**-- Water is pumped from Granby to the Granby Pump Canal which discharges into Shadow Mountain Reservoir. The operation keeps Shadow Mountain Reservoir/Grand Lake at a steady water surface level when transmountain diversions via Adams Tunnel are taking place. Data was provided by Farr Pumping Plant operators each morning. Data was collected from 01-Oct-2008 to 30-Sep-2009. Daily data provided by the Northern Colorado Water Conservancy District. Records are complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	447	0	107	539	417	470	421	91	0	0	195	570
2	434	0	108	543	458	465	408	0	0	0	0	401
3	444	0	141	532	468	455	403	56	0	0	165	505
4	403	0	439	525	417	500	310	70	0	0	125	405
5	473	0	428	573	441	435	294	140	0	0	142	551
6	485	0	0	531	441	479	294	127	0	0	162	458
7	544	0	0	511	433	456	294	106	0	0	142	527
8	546	0	0	556	454	446	294	0	0	0	134	498
9	544	0	449	510	453	470	345	0	0	59	147	474
10	549	0	462	542	385	412	229	0	0	0	187	571
11	560	0	355	538	478	498	333	0	0	147	306	495
12	476	0	475	536	434	454	333	0	0	196	281	606
13	587	0	402	538	439	470	249	0	0	92	0	489
14	543	0	403	128	408	468	249	0	0	136	0	584
15	549	0	487	246	426	467	249	0	0	119	0	535
16	522	0	501	404	437	451	333	0	0	170	0	571
17	484	0	598	473	507	421	284	0	0	289	0	546
18	583	0	547	447	151	454	333	0	0	408	0	607
19	564	13	592	440	335	456	333	0	0	408	0	626
20	532	223	592	446	475	462	333	0	0	407	0	537
21	564	176	584	492	447	424	332	0	0	135	0	527
22	509	325	548	416	437	424	270	21	0	126	0	580
23	614	14	593	420	398	411	249	0	0	84	0	574
24	541	0	563	376	458	412	194	0	0	188	0	485
25	569	0	538	415	513	460	152	0	0	120	0	595
26	496	107	544	400	357	410	70	0	0	105	0	558
27	478	0	612	501	445	435	189	0	0	22	417	566
28	445	115	553	444	472	434	237	0	0	71	564	533
29	368	107	571	418		434	204	0	0	33	434	588
30	367	0	566	443		409	70	0	0	134	360	491
31	31		559	442		440		0	0	0	526	
Min	31	0	0	128	151	409	70	0	0	0	0	401
Max	614	325	612	573	513	500	421	140	0	408	564	626
Mean	492	36	430	462	428	448	276	20	0	111	138	535
ac-ft	30197	2138	26368	28364	23728	27486	16410	1210	0	6829	8488	31785



**Appendix A (Table 14 of 38)**  
**Shadow Mountain/Grand Lake, CO**

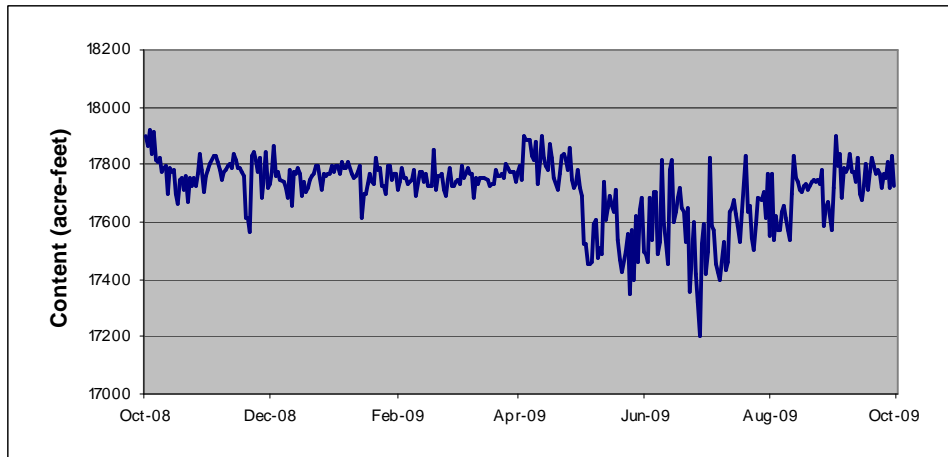
**Location.** --Lat 40°12'26", long 105°50'28", Grand County, Hydrologic Unit 14010001, on the Colorado River at the Shadow Mountain outlet works structure, 10 miles northeast of Granby, Colorado.

**Gage.**--Water-stage recorder with satellite telemetry. Elevation of gage is 8375 feet from topographic map.

**Remarks.**--Constructed between 1944 and 1946. Impoundment began in 1946. Active capacity between elevations 8,366 and 8,367 is 1,800 acre-feet. Grand Lake is used as forebay storage for Adams Tunnel. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Recorder was down between September 3 and September 24. During down time data was provided by Farr Pumping Plant operators. Records are complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	17900	17781	17734	17775	17709	17741	17796	17687	17485	17493	17768	17903
2	17863	17800	17771	17794	17741	17749	17746	17522	17458	17820	17534	17798
3	17924	17832	17866	17794	17788	17736	17898	17522	17686	17587	17624	17840
4	17840	17832	17757	17770	17751	17799	17885	17453	17539	17575	17574	17682
5	17915	17810	17776	17807	17754	17754	17885	17453	17704	17454	17574	17788
6	17816	17781	17745	17789	17732	17765	17885	17464	17704	17424	17634	17774
7	17811	17745	17739	17789	17741	17785	17830	17596	17488	17400	17653	17788
8	17821	17771	17721	17807	17746	17767	17819	17604	17529	17464	17616	17837
9	17772	17785	17684	17770	17783	17767	17879	17477	17819	17529	17569	17778
10	17785	17795	17779	17754	17691	17685	17734	17509	17594	17432	17537	17772
11	17799	17800	17654	17762	17772	17754	17806	17490	17539	17459	17698	17741
12	17699	17786	17774	17775	17772	17736	17898	17739	17456	17638	17832	17825
13	17791	17837	17769	17799	17741	17754	17825	17606	17784	17648	17755	17696
14	17772	17813	17788	17614	17764	17754	17793	17648	17817	17679	17737	17674
15	17780	17790	17767	17699	17722	17754	17779	17687	17599	17629	17713	17724
16	17699	17790	17689	17696	17722	17744	17874	17656	17636	17587	17708	17801
17	17662	17776	17738	17736	17727	17725	17821	17632	17686	17532	17726	17714
18	17746	17758	17702	17764	17853	17736	17751	17712	17717	17632	17732	17778
19	17754	17611	17720	17741	17712	17736	17714	17537	17646	17729	17713	17825
20	17712	17614	17744	17733	17759	17783	17769	17470	17633	17830	17726	17796
21	17762	17567	17762	17822	17759	17759	17832	17426	17529	17632	17739	17764
22	17667	17830	17767	17780	17764	17759	17838	17498	17648	17653	17745	17783
23	17754	17845	17794	17788	17714	17769	17816	17559	17357	17542	17739	17769
24	17725	17813	17794	17727	17691	17751	17783	17345	17603	17504	17745	17717
25	17754	17771	17752	17727	17744	17801	17856	17573	17416	17592	17732	17767
26	17725	17826	17715	17701	17788	17788	17746	17396	17324	17685	17781	17754
27	17766	17685	17770	17799	17727	17778	17719	17623	17200	17679	17586	17809
28	17840	17753	17762	17799	17722	17772	17732	17458	17520	17708	17649	17717
29	17779	17845	17770	17746		17772	17783	17641	17592	17614	17669	17832
30	17706	17716	17770	17767		17741	17719	17682	17416	17765	17572	17725
31	17763		17794	17767		17774		17495		17552	17719	
Min	17662	17567	17654	17614	17691	17685	17714	17345	17200	17400	17534	17674
Max	17924	17845	17866	17822	17853	17801	17898	17739	17819	17830	17832	17903
EOM	17763	17716	17794	17767	17722	17774	17719	17719	17416	17552	17719	17725



**Appendix A (Table 15 of 38)**  
**Alva B. Adams Tunnel at East Portal, near Estes Park, CO**

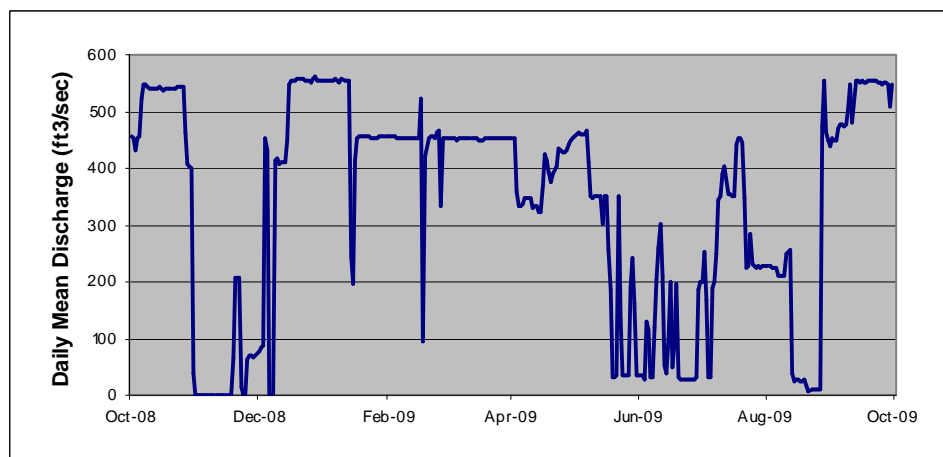
**Location.** --Lat 40°19'40", long 105°34'39", Larimer County, Hydrologic Unit 10190006, 4.5 miles southwest of Estes Park, Colorado.

**Gage.**-- Water-stage recorder with satellite telemetry at 15 foot Parshall flume. Elevation of gage is 8250 from topographic map.

**Remarks.**-- Constructed between 1940 and 1947. Tunnel is 13.1 miles long, and extends between Grand Lake and Estes Park. Its maximum capacity is 550 cubic feet per second. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	457	0	75	556	455	453	452	456	34	201	227	454
2	453	0	84	555	455	452	452	460	34	251	226	448
3	433	0	86	553	455	452	356	463	29	167	226	449
4	452	0	452	553	454	452	334	461	129	33	226	469
5	455	0	433	556	454	452	334	459	117	33	225	478
6	524	0	1	556	453	451	337	459	33	190	210	476
7	546	0	1	557	453	452	349	465	33	200	210	474
8	546	0	1	555	453	452	348	410	118	248	210	478
9	543	0	414	552	454	451	348	350	205	342	212	506
10	541	0	416	557	452	452	349	349	259	352	249	549
11	540	0	407	555	452	451	332	350	301	388	253	482
12	540	0	409	554	452	451	333	349	211	403	255	554
13	541	0	410	556	453	451	333	350	52	353	39	553
14	542	0	409	246	452	452	323	302	38	353	24	552
15	544	0	449	198	453	452	322	349	106	352	27	553
16	542	0	546	414	453	451	369	352	201	350	26	552
17	538	0	556	454	524	450	425	257	50	443	26	552
18	539	0	555	457	94	451	414	186	90	454	26	553
19	541	66	554	456	421	451	394	32	198	453	26	555
20	540	207	558	455	454	452	377	32	30	446	18	554
21	542	207	558	456	455	452	391	36	29	348	9	553
22	540	207	558	455	455	452	403	350	29	224	9	553
23	543	13	553	455	454	453	435	133	29	227	9	552
24	543	1	556	453	462	452	431	34	29	283	9	550
25	544	1	556	453	468	452	429	34	29	230	9	549
26	543	63	553	452	333	452	429	35	30	227	9	550
27	463	71	558	453	453	453	430	35	30	226	472	550
28	406	71	560	455	453	453	440	191	30	227	553	547
29	402	67	556	456		452	450	242	186	226	465	508
30	400	69	554	455		452	451	160	199	227	449	546
31	40		555	456		452		34		226	440	
Min	40	0	1	198	94	450	322	32	29	33	9	448
Max	546	207	560	557	524	453	452	465	301	454	553	555
Mean	494	35	417	480	439	452	386	264	96	280	173	523
ac-ft	30340	2067	25603	29491	24312	27732	22906	16185	5717	17196	10639	31085



**Appendix A (Table 16 of 38)**  
**Marys Lake, CO**

**Location.** --Lat 40°22'40", long 105°31'50", Larimer County, Hydrologic Unit 10190006, 2 miles southwest of Estes Park, Colorado.

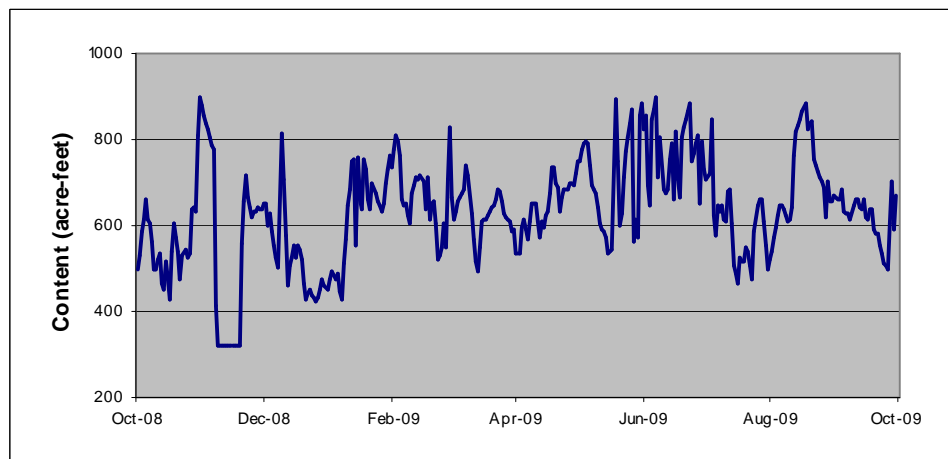
**Gage.**-- Water-level recorder with satellite telemetry. Elevation of gage is 8060 feet from topographic map.

**Remarks.**-- Constructed between 1947 and 1949. Impoundment began in August 1950. Active capacity between elevations 8,025 and 8,040 is 500 acre-feet. Used as a forebay storage for Estes Powerplant. The only measurable inflow into the reservoir comes from Adams Tunnel.

Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Record is not complete. The gage does not record water surface levels below elevation 8,022.62 feet, content of 321 acre-feet. The reservoir water surface level dropped below that elevation on November 9 and remained below it until November 19. Record is reliable except for those days. These are operational data which could be subject to further revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	498	877	653	474	778	664	534	750	824	705	542	666
2	529	856	649	494	811	615	533	778	854	721	572	660
3	586	839	598	484	794	634	597	793	691	848	597	661
4	613	822	628	476	762	657	612	794	646	622	624	682
5	659	804	584	489	660	664	591	791	848	575	648	633
6	613	786	554	446	648	672	566	741	871	645	647	629
7	604	778	528	428	650	682	609	695	895	631	639	626
8	565	412	501	511	624	738	650	682	713	645	624	614
9	500	321	812	569	604	717	650	676	805	614	610	645
10	496	321	706	649	672	630	651	643	683	609	613	661
11	519	321	578	683	693	566	610	603	676	681	642	661
12	536	321	460	749	711	515	573	591	682	682	764	643
13	463	321	507	752	709	494	608	588	755	603	819	639
14	452	321	526	552	718	551	594	573	790	508	831	661
15	516	321	555	760	701	609	624	536	660	487	848	619
16	475	321	524	661	637	613	635	537	817	467	865	615
17	429	321	555	636	711	615	673	544	706	524	881	635
18	537	321	544	754	615	623	735	893	665	518	824	636
19	607	321	523	730	652	634	736	747	804	515	839	589
20	573	557	466	661	656	641	696	601	826	550	843	581
21	537	657	429	636	603	645	688	628	847	541	754	580
22	473	716	441	699	520	662	634	713	865	507	740	555
23	529	666	450	677	532	684	663	770	883	474	727	537
24	546	644	436	657	549	678	686	805	747	588	712	512
25	526	620	432	646	605	656	686	837	767	646	700	505
26	533	634	424	635	550	626	700	871	791	660	689	497
27	635	635	432	653	709	618	698	562	810	662	619	605
28	643	643	452	699	827	612	694	613	650	609	704	703
29	634	637	474	730	610	610	723	571	797	553	654	588
30	808	637	462	765		586	749	858	731	497	658	668
31	900		452	737		592		885		519	671	
Min	429	321	424	428	520	494	533	536	646	467	542	497
Max	900	877	812	765	827	738	749	893	895	848	881	703
EOM	900	637	452	737	827	592	749	749	731	519	671	668



**Appendix A (Table 17 of 38)**  
**Big Thompson River above Lake Estes, CO**

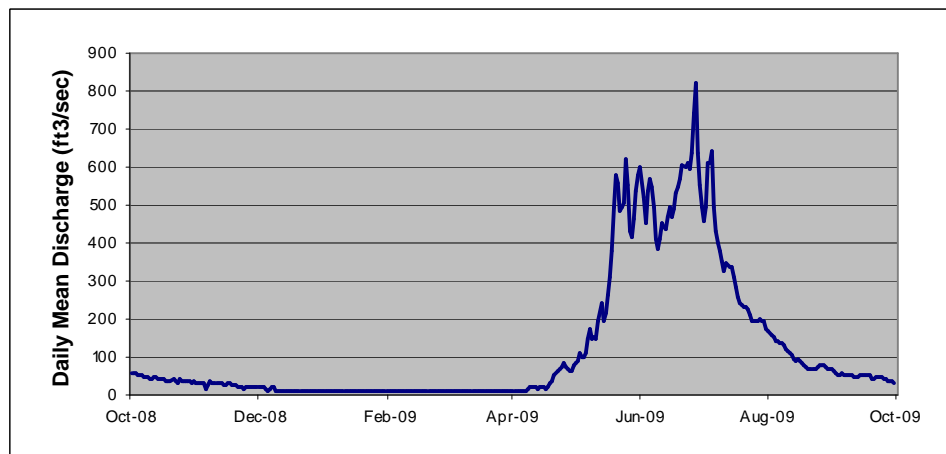
**Location.** --Lat 40°22'42", long 105°30'48", Larimer County, Hydrologic Unit 10190006, 600 feet downstream from bridge on state highways 7 and 36 in Estes Park, Colorado, downstream from Black Canyon Creek, and 0.3 miles northwest of Estes Powerplant.

**Gage.**-- Water-stage recorder with satellite telemetry. 15 foot Parshall flume with overflow weirs and supplemental outside gage. Datum of gage at 7492.5 feet.

**Remarks.**— Drainage area is 137 mi<sup>2</sup>. Station consists of data collection platform as primary record with graphic chart recorder as backup. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. The station is shutdown during winter (November 26 through April 8). Values for the off-season are estimated. This record contains operational data which could be subject to future revisions and changes. The official record for this station is published by the State of Colorado, Department of Water Resources.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	56	33	21	13	13	13	13	86	600	460	169	61
2	55	32	23	13	13	13	13	91	519	492	158	57
3	56	34	20	13	13	13	13	109	452	611	151	55
4	55	33	13	13	13	13	13	101	536	613	144	54
5	54	31	13	13	13	13	13	99	569	641	140	56
6	52	16	16	13	13	13	13	110	547	496	139	55
7	50	24	23	13	13	13	9	150	493	434	136	54
8	47	36	21	13	13	13	18	174	413	398	133	52
9	45	33	13	13	13	13	20	147	383	379	123	53
10	44	32	13	13	13	13	19	150	412	351	116	51
11	45	31	13	13	13	13	19	146	455	326	108	49
12	47	30	13	13	13	13	19	197	439	346	103	49
13	45	31	13	13	13	13	18	244	439	336	93	53
14	43	27	13	13	13	13	19	193	468	335	89	54
15	44	24	13	13	13	13	19	215	497	312	95	51
16	42	32	13	13	13	13	22	265	469	283	90	55
17	40	29	13	13	13	13	16	310	490	260	86	52
18	39	28	13	13	13	13	21	376	532	244	80	51
19	38	25	13	13	13	13	33	493	547	235	73	44
20	38	24	13	13	13	13	39	577	570	233	70	42
21	41	21	13	13	13	13	55	558	604	234	68	46
22	37	20	13	13	13	13	65	483	602	227	66	47
23	32	21	13	13	13	13	67	494	610	209	68	45
24	40	17	13	13	13	13	75	503	596	196	72	45
25	37	22	13	13	13	13	82	619	636	193	78	45
26	37	22	13	13	13	13	74	552	740	197	80	43
27	35	23	13	13	13	13	69	431	820	197	80	39
28	35	21	13	13	13	13	61	414	636	199	72	37
29	34	21	13	13		13	65	464	554	194	68	36
30	34	21	13	13		13	78	535	496	193	68	34
31	35		13	13		13		579		174	66	
Min	32	16	13	13	13	13	9	86	383	174	66	34
Max	56	36	23	13	13	13	82	619	820	641	169	61
Mean	43	26	14	13	13	13	35	318	538	323	99	49
ac-ft	2641	1565	888	798	721	798	2101	19539	31929	19799	6104	2906





**Appendix A (Table 18 of 38)**  
**Olympus Dam, CO**

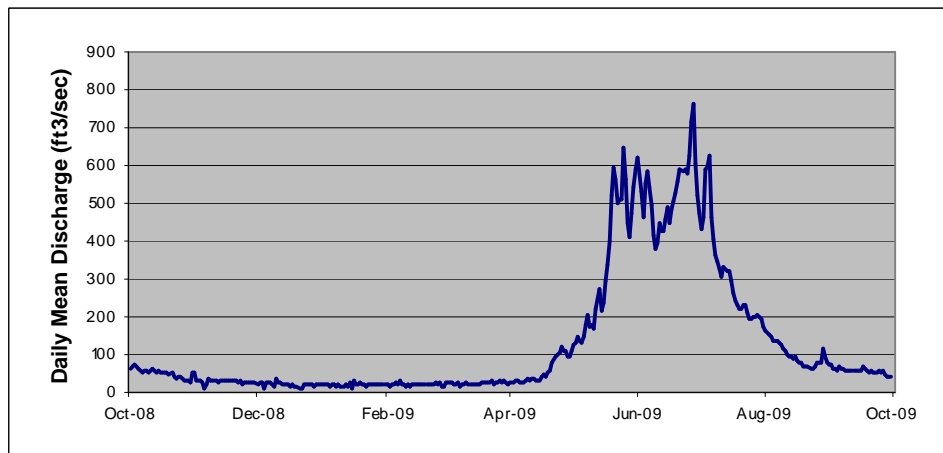
**Location.** --Lat 40°22'31", long 105°29'15", Larimer County, Hydrologic Unit 10190006, 1.5 miles east of Estes Park, Colorado, on the Big Thompson River.

**Gage.**—Water-stage recorders with satellite telemetry. Inflow computed daily based on the change in content from midnight to midnight at Marys Lake and Lake Estes, daily average releases from Olympus Dam, and daily average discharge at Olympus Tunnel and Adams Tunnel.

**Remarks.**— Olympus Dam was constructed between 1947 and 1949. Impoundment began on November 1948. Total capacity at maximum water surface elevation of 7475.0 feet is 3,070 acre-feet. Inflow is computed based on change-in-storage and outflow. Records are complete and reliable, but have not been revised. This record contains operational data which could be subject to future revisions and changes.

**Inflow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	66	52	23	20	20	28	27	125	620	432	166	71
2	68	32	26	23	18	26	25	132	531	463	155	66
3	72	31	24	22	23	26	29	149	463	592	146	62
4	70	29	10	21	23	25	30	139	552	597	138	60
5	65	26	26	18	24	23	26	133	582	624	137	66
6	57	10	27	19	21	23	29	145	544	464	135	66
7	55	23	28	20	31	25	28	177	497	403	131	62
8	59	36	23	18	22	16	29	204	415	364	124	60
9	57	34	14	22	21	24	35	172	378	349	115	60
10	55	34	36	17	15	22	34	179	396	328	111	57
11	59	34	26	18	20	24	35	170	445	308	102	58
12	62	29	24	21	18	23	37	221	428	332	92	58
13	56	31	22	18	21	23	32	274	429	323	95	59
14	53	29	21	28	21	22	30	216	458	320	88	59
15	57	30	19	13	19	21	32	238	487	297	93	59
16	54	32	22	32	21	23	42	293	446	266	86	67
17	50	30	18	23	19	22	49	335	486	242	81	61
18	53	30	20	18	18	25	40	401	505	233	79	56
19	53	29	18	25	19	24	50	519	527	223	68	51
20	49	29	14	22	19	24	60	592	556	223	66	57
21	54	30	12	19	22	28	79	562	592	230	68	54
22	41	25	13	18	23	28	97	503	582	232	64	55
23	35	31	19	21	23	29	98	510	589	211	65	53
24	44	21	20	23	24	23	108	511	577	195	70	57
25	41	25	21	23	20	27	123	648	624	195	80	54
26	39	26	23	19	28	27	113	563	714	198	80	56
27	32	26	19	20	16	30	108	448	764	201	80	45
28	30	27	18	20	15	28	95	413	606	205	115	44
29	30	24	21	20		30	97	476	520	199	95	45
30	28	25	22	20		25	112	542	473	197	77	43
31	52		22	23		22		589		172	72	
Min	28	10	10	13	15	16	25	125	378	172	64	43
Max	72	52	36	32	31	30	123	648	764	624	166	71
Mean	52	29	21	21	21	25	58	341	526	310	99	57
ac-ft	3163	1723	1294	1273	1159	1516	3420	20947	31257	19046	6085	3404



**Appendix A (Table 19 of 38)  
Olympus Dam, CO**

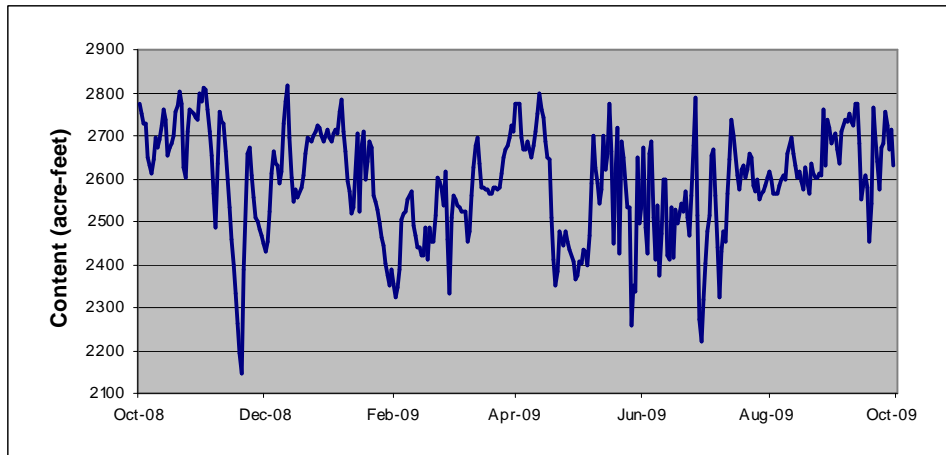
**Location.** --Lat 40°22'31", long 105°29'19", Larimer County, Hydrologic Unit 10190006, 1.5 miles east of Estes Park, Colorado, on the Big Thompson River.

**Gage.**-- Water-level recorder with satellite telemetry. Elevation of gage is 7490 feet from topographic map.

**Remarks.**-- Constructed between 1947 and 1949. Impoundment began in November, 1948. Active capacity between elevations 7,450.25 and 7,474.00 is 2,476 acre-feet. Used as afterbay storage for Estes Powerplant and forebay for Olympus Tunnel. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	2775	2813	2432	2696	2354	2508	2775	2405	2670	2403	2616	2696
2	2750	2806	2452	2688	2322	2563	2777	2400	2488	2475	2597	2706
3	2730	2762	2522	2703	2347	2553	2694	2437	2424	2516	2567	2665
4	2727	2711	2611	2715	2389	2536	2667	2432	2659	2655	2566	2633
5	2647	2655	2664	2706	2504	2534	2667	2397	2684	2669	2566	2711
6	2631	2566	2633	2757	2521	2525	2686	2467	2511	2563	2586	2737
7	2611	2484	2630	2784	2524	2524	2667	2591	2413	2440	2599	2733
8	2645	2636	2589	2708	2551	2455	2647	2699	2539	2323	2606	2750
9	2696	2754	2614	2662	2569	2475	2679	2626	2376	2432	2597	2733
10	2671	2732	2727	2592	2491	2561	2711	2589	2470	2478	2659	2722
11	2691	2728	2780	2571	2467	2625	2752	2544	2596	2454	2696	2777
12	2723	2662	2817	2521	2440	2676	2797	2572	2596	2567	2660	2773
13	2759	2599	2694	2532	2439	2696	2759	2698	2419	2645	2630	2681
14	2735	2532	2601	2704	2419	2633	2742	2623	2410	2737	2603	2553
15	2653	2459	2547	2524	2421	2577	2684	2660	2530	2701	2616	2591
16	2671	2395	2574	2672	2486	2577	2648	2773	2416	2606	2594	2609
17	2681	2331	2554	2711	2410	2572	2643	2664	2529	2574	2575	2579
18	2699	2262	2580	2599	2488	2572	2509	2447	2497	2621	2625	2455
19	2756	2194	2608	2642	2455	2567	2411	2613	2541	2631	2591	2541
20	2768	2146	2659	2686	2455	2567	2349	2718	2524	2601	2566	2766
21	2801	2387	2696	2670	2513	2579	2384	2426	2569	2621	2635	2694
22	2773	2660	2689	2563	2603	2577	2476	2686	2511	2657	2613	2638
23	2626	2670	2686	2546	2592	2572	2460	2650	2465	2648	2603	2572
24	2601	2608	2699	2529	2579	2580	2445	2534	2559	2586	2604	2671
25	2710	2554	2710	2497	2539	2611	2478	2534	2676	2571	2613	2682
26	2759	2511	2722	2462	2614	2647	2452	2259	2789	2597	2609	2756
27	2750	2499	2716	2443	2459	2665	2437	2351	2516	2549	2761	2725
28	2742	2481	2701	2400	2331	2679	2408	2339	2273	2566	2630	2667
29	2735	2465	2688	2373		2694	2367	2647	2222	2569	2739	2715
30	2796	2450	2701	2349		2723	2375	2496	2320	2582	2718	2628
31	2780		2715	2389		2711		2539		2604	2682	
Min	2601	2146	2432	2349	2322	2455	2349	2259	2222	2323	2566	2455
Max	2801	2813	2817	2784	2614	2723	2797	2773	2789	2737	2761	2777
EOM	2780	2450	2715	2389	2331	2711	2375	2375	2320	2604	2682	2628



**Appendix A (Table 20 of 38)**  
**Big Thompson River below Olympus Dam, CO**

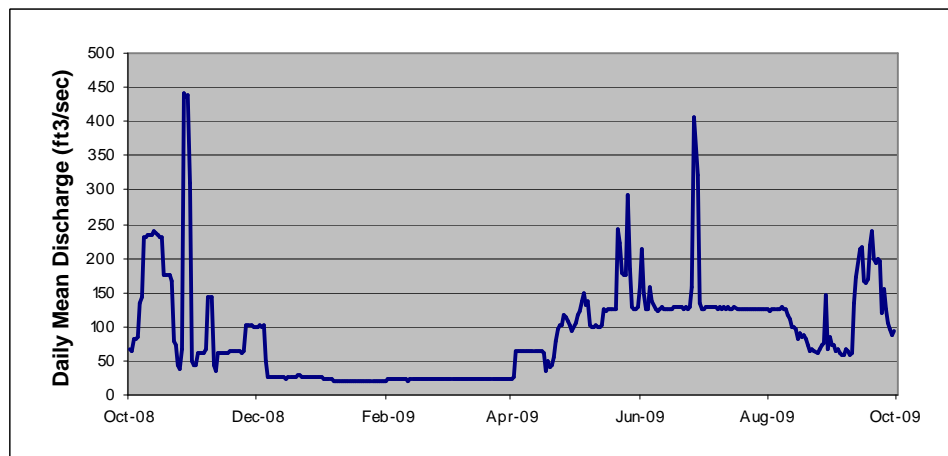
**Location.** --Lat 40°22'35", long 105°29'06", Larimer County, Hydrologic Unit 10190006, 600 feet downstream from Olympus Dam and 100 feet upstream of Dry Gulch, 2.0 miles east in Estes Park.

**Gage.**-- Water-stage recorder with satellite telemetry. 15 foot Parshall flume with overflow weirs in a concrete shelter with a supplemental outside gage. Datum of gage at 7492.50 feet.

**Remarks.**— Drainage area is 155 mi<sup>2</sup>. Area at site used between 29-Jan-1934 and 21-Mar-1951 was 162 mi<sup>2</sup>. Station consists of data collection platform and digital recorder as primary record. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Record is complete and reliable. This record contains operational data which could be subject to future revisions and changes. The official record for this station is published by the State of Colorado, Department of Water Resources.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	68	45	99	26	23	22	23	105	159	127	125	73
2	66	45	102	23	24	22	27	118	215	128	124	64
3	83	60	100	23	24	22	64	123	150	128	125	69
4	82	62	103	23	23	22	64	138	127	128	125	62
5	85	61	49	22	23	22	63	148	127	128	125	58
6	135	62	26	20	22	22	63	131	157	128	126	58
7	144	66	26	21	22	22	63	138	138	128	127	66
8	231	142	26	20	22	23	64	103	125	127	127	64
9	231	142	26	20	23	22	63	99	124	128	127	60
10	235	43	25	20	22	22	63	100	126	127	117	60
11	234	34	25	20	22	22	64	101	128	128	111	134
12	234	61	26	19	22	23	64	100	127	127	101	174
13	239	61	25	20	23	23	64	99	127	127	98	212
14	236	61	25	20	23	23	65	101	126	126	96	216
15	233	60	25	20	23	23	64	125	126	127	82	166
16	232	63	25	19	23	22	60	124	127	128	92	163
17	230	61	25	20	23	22	36	125	128	127	85	170
18	175	63	25	19	23	22	49	124	128	125	87	219
19	176	64	26	19	23	22	40	126	129	126	81	239
20	176	63	30	21	23	22	44	126	129	126	72	198
21	167	63	29	21	23	22	56	244	128	126	64	194
22	79	64	26	21	23	22	78	223	126	125	68	199
23	73	64	26	21	23	22	95	178	128	127	63	196
24	44	62	26	21	23	23	102	174	127	124	63	121
25	37	64	26	21	22	23	103	174	128	127	68	154
26	66	102	25	20	22	23	116	292	157	127	74	126
27	441	102	26	21	23	23	113	183	407	125	76	106
28	435	101	26	21	22	23	109	128	322	125	145	98
29	437	101	25	21		23	101	126	136	127	67	88
30	309	101	25	20		23	94	126	125	126	85	94
31	51		26	20		23		130		125	73	
Min	37	34	25	19	22	22	23	99	124	124	63	58
Max	441	142	103	26	24	23	116	292	407	128	145	239
Mean	183	72	36	21	23	23	69	140	150	127	97	130
ac-ft	11213	4249	2227	1268	1266	1384	4108	8577	8920	7777	5940	7726



**Appendix A (Table 21 of 38)**  
**Olympus Tunnel near Estes Park, CO**

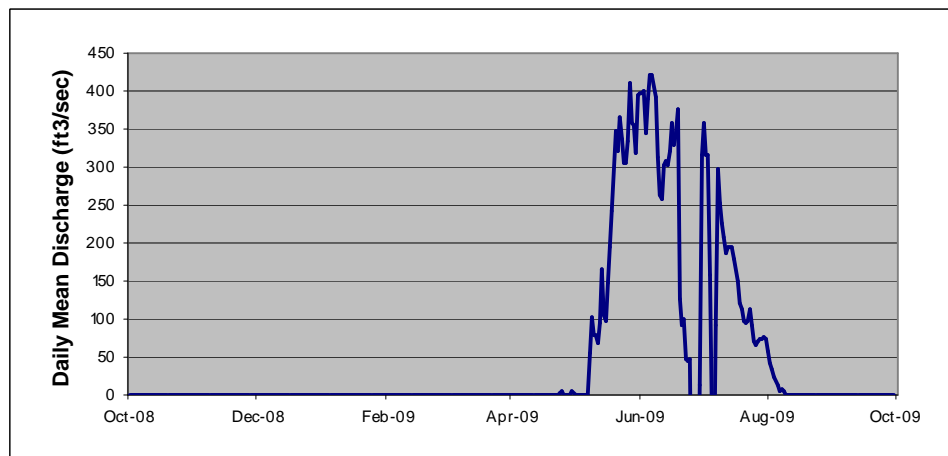
**Location.** --Lat 40°22'24", long 105°29'00", Larimer County, Hydrologic Unit 10190006, southeast of Estes Park, Colorado.

**Gage.**-- Water-stage recorder and satellite telemetry. Elevation of gage is 7460 from topographic map.

**Remarks.**— Constructed between 1949 and 1952. The tunnel is 7.2 miles long, between Estes Park and the Pole Hill Canal. Its diameter is 9.75 feet and maximum capacity is 550 cubic feet per second. The hydropower diversion operation, also known as the skim operation, diverts water from the Big Thompson River through Olympus Tunnel for power generation at three power plants down the foothills, before returning it to the Big Thompson River near the canyon mouth. The skim daily value is determined based on the data from the stream gages in the system. Period of record includes from 01-Oct-2008 through 30-Sep-2009. Records are complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Hydropower Diversion (Skim), Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	0	0	0	0	398	358	59	0
2	0	0	0	0	0	0	0	0	398	316	41	0
3	0	0	0	0	0	0	0	0	400	316	33	0
4	0	0	0	0	0	0	0	0	346	286	23	0
5	0	0	0	0	0	0	0	0	389	248	13	0
6	0	0	0	0	0	0	0	0	420	196	6	0
7	0	0	0	0	0	0	0	0	420	182	9	0
8	0	0	0	0	0	0	0	56	393	298	5	0
9	0	0	0	0	0	0	0	102	313	252	1	0
10	0	0	0	0	0	0	0	79	262	226	0	0
11	0	0	0	0	0	0	0	79	258	209	0	0
12	0	0	0	0	0	0	0	69	303	188	0	0
13	0	0	0	0	0	0	0	96	309	196	0	0
14	0	0	0	0	0	0	0	166	303	196	0	0
15	0	0	0	0	0	0	0	106	320	196	0	0
16	0	0	0	0	0	0	0	98	358	179	0	0
17	0	0	0	0	0	0	0	148	328	151	0	0
18	0	0	0	0	0	0	0	194	342	122	0	0
19	0	0	0	0	0	0	0	241	377	114	0	0
20	0	0	0	0	0	0	0	348	248	97	0	0
21	0	0	0	0	0	0	0	320	242	95	0	0
22	0	0	0	0	0	0	0	367	275	98	0	0
23	0	0	0	0	0	0	0	336	257	113	0	0
24	0	0	0	0	0	0	3	304	255	92	0	0
25	0	0	0	0	0	0	4	304	225	71	0	0
26	0	0	0	0	0	0	0	333	153	67	0	0
27	0	0	0	0	0	0	0	410	0	70	0	0
28	0	0	0	0	0	0	0	359	125	74	0	0
29	0	0	0	0	0	0	0	355	264	75	0	0
30	0	0	0	0	0	0	4	319	370	77	0	0
31	0	0	0	0	0	0	0	396	0	73	0	0
Min	0	0	0	0	0	0	0	0	0	67	0	0
Max	0	0	0	0	0	0	4	410	420	358	59	0
Mean	0	0	0	0	0	0	0	180	302	169	6	0
ac-ft	0	0	0	0	0	0	22	11058	17921	10357	376	0



**Appendix A (Table 22 of 38)  
Olympus Tunnel, CO**

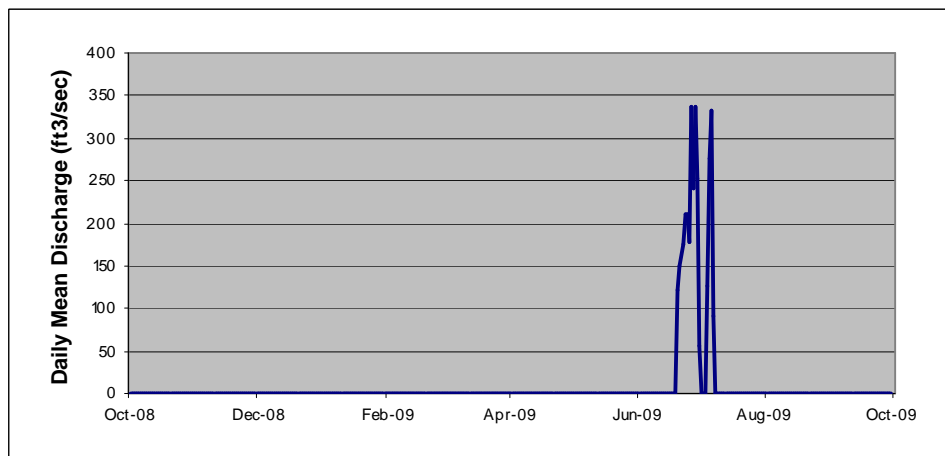
**Location.** --Lat 40°22'24", long 105°29'00", Larimer County, Hydrologic Unit 10190006, southeast of Estes Park, Colorado.

**Gage.**-- Water-stage recorder and satellite telemetry. Elevation of gage is 7460 from topographic map.

**Remarks.**— Constructed between 1949 and 1952. The tunnel is 7.2 miles long, between Estes Park and the Pole Hill Canal. Its diameter is 9.75 feet and maximum capacity is 550 cubic feet per second. The right to divert native run-off is determined by the State of Colorado. Period of record from 01-Oct-2008 through 30-Sep-2009. Record is complete and reliable.

**Priority Diversion Flow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	127	0	0
5	0	0	0	0	0	0	0	0	0	277	0	0
6	0	0	0	0	0	0	0	0	0	333	0	0
7	0	0	0	0	0	0	0	0	0	91	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	121	0	0	0
21	0	0	0	0	0	0	0	0	150	0	0	0
22	0	0	0	0	0	0	0	0	176	0	0	0
23	0	0	0	0	0	0	0	0	210	0	0	0
24	0	0	0	0	0	0	0	0	210	0	0	0
25	0	0	0	0	0	0	0	0	178	0	0	0
26	0	0	0	0	0	0	0	0	336	0	0	0
27	0	0	0	0	0	0	0	0	242	0	0	0
28	0	0	0	0	0	0	0	0	336	0	0	0
29	0	0	0	0	0	0	0	0	252	0	0	0
30	0	0	0	0	0	0	0	0	55	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
Min	0	0	0	0	0	0	0	0	0	0	0	0
Max	0	0	0	0	0	0	0	0	336	333	0	0
Mean	0	0	0	0	0	0	0	0	76	27	0	0
ac-ft	0	0	0	0	0	0	0	0	4487	1639	0	0



**Appendix A (Table 23 of 38)  
Olympus Tunnel, CO**

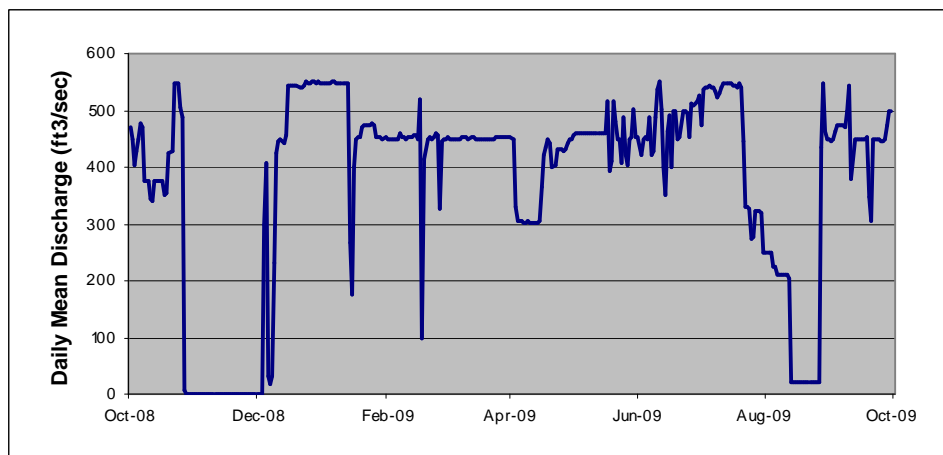
**Location.** --Lat 40°22'24", long 105°29'00", Larimer County, Hydrologic Unit 10190006, southeast of Estes Park, Colorado, on the Big Thompson River.

**Gage.**-- Water-stage recorder with satellite telemetry. Elevation of gage is 7460 from topographic map.

**Remarks.**— Constructed between 1949 and 1952. The tunnel is 7.2 miles long, between Estes Park and the Pole Hill Canal. Its diameter is 9.75 feet and maximum capacity is 550 cubic feet per second. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Records are complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	470	2	0	547	449	451	453	456	453	473	249	447
2	451	2	0	549	448	452	450	460	420	538	250	447
3	402	2	0	549	450	450	329	460	449	542	248	462
4	427	2	299	549	449	450	306	460	452	541	225	472
5	451	2	406	549	449	449	306	459	450	543	224	472
6	476	1	33	550	450	450	305	460	488	540	209	472
7	472	1	18	551	459	450	302	461	422	540	210	472
8	376	1	32	549	452	450	303	459	429	534	211	471
9	377	1	231	548	453	452	304	459	487	521	211	498
10	376	1	424	548	451	452	302	459	536	530	211	543
11	343	1	446	547	452	451	302	459	550	541	210	379
12	342	1	448	547	453	451	302	459	502	546	203	449
13	376	1	445	547	452	451	302	459	399	547	23	448
14	376	1	443	266	455	452	303	458	350	546	22	448
15	376	1	455	177	457	448	304	459	465	548	22	448
16	376	1	545	401	451	449	364	459	492	544	22	448
17	376	1	543	450	520	450	420	515	401	544	22	448
18	352	1	543	452	99	448	437	392	497	541	22	453
19	355	1	544	452	415	449	443	410	498	546	22	348
20	424	1	544	469	448	449	443	514	449	540	22	304
21	429	1	541	475	451	449	400	482	454	445	22	449
22	549	1	542	475	451	449	402	450	499	329	22	449
23	548	0	544	475	452	450	430	450	499	330	22	451
24	546	0	549	473	461	450	431	407	494	327	22	449
25	504	0	549	476	458	451	431	486	451	274	22	447
26	487	0	549	474	328	452	429	421	512	276	22	446
27	7	0	550	453	445	453	431	402	510	324	434	450
28	2	0	550	452	451	453	441	449	513	324	546	472
29	2	0	547	453		451	450	452	517	324	463	497
30	2	0	550	449		451	449	502	526	318	448	497
31	2		549	452		453		451		251	450	
Min	2	0	0	177	99	448	302	392	350	251	22	304
Max	549	2	550	551	520	453	453	515	550	548	546	543
Mean	356	1	401	481	436	451	376	456	472	460	171	451
ac-ft	21881	52	24590	29506	24172	27658	22333	27977	28045	28250	10517	26799



**Appendix A (Table 24 of 38)  
Pinewood Reservoir near Loveland, Colorado , CO**

**Location.** --Lat 40°22', long 105°17.9', Larimer County, Hydrologic Unit 10190006, 10 miles southwest of Loveland, Colorado.

**Gage.**-- Water-level recorder with satellite telemetry. Elevation of gage is 6,600 feet from topographic map.

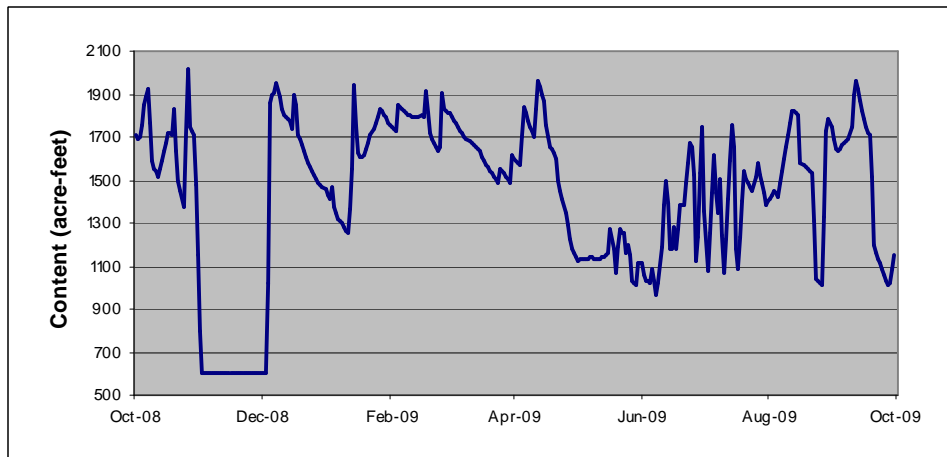
**Remarks.**-- Constructed between 1951 and 1952. Impoundment began in January 4, 1954. Active capacity between elevations 6,550.00 and 6,580.00 is 1,570 acre-feet. Used as the forebay storage for Flatiron Powerplant. Recorder was operated from 01-Oct-2008 to 30-Sep-2009.

Record is complete and reliable. The gage is capable of measuring the water surface elevation down to 6555.70 feet, a content of 604 acre-feet.

The reservoir was drained to that level on November 4, 2008, and remained at that level until December 4, 2008. This record contains operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	1709	802	604	1435	1748	1807	1602	1128	1111	1360	1413	1693
2	1694	605	604	1413	1734	1795	1581	1130	1055	1080	1429	1648
3	1701	605	604	1463	1724	1779	1569	1131	1032	1258	1453	1635
4	1753	605	1023	1370	1851	1764	1704	1131	1026	1436	1440	1647
5	1848	605	1855	1343	1839	1747	1835	1131	1017	1612	1425	1659
6	1886	605	1896	1322	1828	1730	1810	1133	1089	1439	1487	1671
7	1925	605	1908	1309	1817	1716	1779	1139	1031	1350	1544	1685
8	1764	605	1947	1296	1814	1702	1751	1137	967	1509	1601	1694
9	1592	605	1889	1282	1807	1689	1727	1136	1021	1247	1657	1746
10	1556	605	1826	1267	1802	1677	1697	1137	1190	1065	1710	1900
11	1545	605	1807	1250	1796	1670	1833	1136	1387	1227	1763	1963
12	1518	605	1797	1366	1796	1662	1961	1134	1497	1410	1817	1921
13	1550	605	1786	1554	1792	1652	1930	1139	1395	1584	1817	1869
14	1590	605	1772	1939	1797	1646	1900	1142	1180	1759	1807	1820
15	1633	605	1740	1742	1804	1633	1870	1149	1180	1649	1798	1781
16	1676	605	1895	1623	1796	1610	1754	1158	1285	1178	1579	1742
17	1714	605	1851	1611	1913	1591	1702	1268	1182	1084	1568	1723
18	1715	604	1713	1611	1807	1573	1652	1177	1272	1234	1560	1711
19	1713	604	1688	1617	1717	1559	1640	1069	1386	1401	1549	1511
20	1829	604	1664	1644	1689	1546	1622	1186	1387	1543	1539	1195
21	1632	604	1636	1674	1672	1532	1600	1268	1387	1505	1529	1159
22	1494	604	1608	1707	1652	1516	1492	1256	1487	1488	1310	1135
23	1445	604	1583	1737	1636	1503	1450	1249	1580	1469	1036	1116
24	1374	604	1560	1762	1655	1488	1409	1165	1676	1449	1027	1089
25	1698	604	1540	1794	1906	1549	1350	1198	1658	1516	1019	1061
26	2017	604	1519	1832	1832	1543	1286	1154	1524	1576	1016	1029
27	1742	604	1503	1821	1817	1534	1223	1028	1120	1526	1328	1009
28	1723	604	1488	1805	1814	1517	1180	1020	1238	1483	1730	1025
29	1708	604	1474	1790		1502	1158	1015	1536	1441	1785	1088
30	1479	604	1468	1770		1487	1138	1114	1749	1380	1761	1155
31	1148		1459	1760		1619		1111		1399	1742	
Min	1148	604	604	1250	1636	1487	1138	1015	967	1065	1016	1009
Max	2017	802	1947	1939	1913	1807	1961	1268	1749	1759	1817	1963
EOM	1148	604	1459	1760	1814	1619	1138	1138	1749	1399	1742	1155



**Appendix A (Table 25 of 38)  
Flatiron Reservoir, CO**

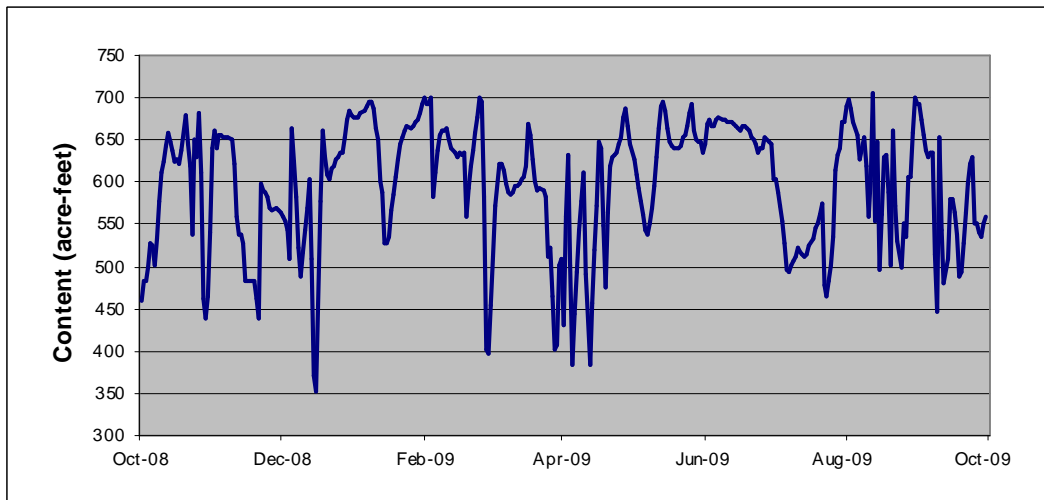
**Location.** --Lat 40°22.1', long 105°13.3', Larimer County, Hydrologic Unit 10190006, 8 miles southwest of Loveland, Colorado.

**Gage.**-- Water-level recorder with satellite telemetry. Elevation of gage is 5,600 feet from topographic map.

**Remarks.**-- Constructed between 1951 and 1953. Impoundment began in January, 1954. Active capacity between elevations 5,462.00 and 5,472.80 is 436 acre-feet. Used as the afterbay storage for Flatiron Powerplant. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Record is complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	461	639	559	678	694	453	431	628	645	604	689	692
2	484	661	554	678	692	513	559	608	668	588	699	673
3	484	640	544	676	701	573	632	594	674	573	688	656
4	498	656	510	681	583	621	501	578	667	553	671	637
5	528	656	663	685	611	623	383	561	667	529	657	630
6	525	654	624	690	637	613	445	544	674	496	628	634
7	502	653	582	694	656	599	492	539	677	494	639	634
8	533	652	524	694	662	588	543	551	675	501	652	514
9	577	651	490	687	662	585	578	570	673	506	620	447
10	611	622	518	665	665	589	611	597	671	513	560	654
11	625	558	542	650	650	595	491	629	672	522	610	544
12	644	538	568	601	640	596	384	664	673	518	707	480
13	657	538	604	587	634	599	457	689	670	514	554	509
14	649	527	510	527	629	604	521	696	667	512	648	580
15	638	484	372	529	635	607	573	685	664	515	496	581
16	625	484	352	536	633	619	648	663	660	526	563	563
17	626	484	578	567	635	670	640	649	665	534	631	538
18	622	484	661	585	558	655	549	644	667	546	631	489
19	637	484	629	605	592	628	474	640	664	552	588	493
20	679	461	609	628	620	601	564	640	660	562	502	529
21	644	438	604	646	638	592	620	644	652	574	661	565
22	618	597	616	652	660	592	630	654	651	478	573	599
23	537	591	619	661	676	590	632	657	647	465	530	623
24	651	587	627	667	701	584	636	667	636	482	498	631
25	629	583	630	663	695	513	647	681	640	502	552	551
26	683	569	634	665	582	521	654	694	640	536	535	552
27	612	566	634	672	402	464	676	660	654	615	606	540
28	461	569	653	675	396	402	686	651	648	631	606	536
29	439	568	674	681		406	666	648	645	640	659	551
30	464	563	684	692		501	646	647	603	671	701	559
31	542		680	699		508		634		671	693	
Min	439	438	352	527	396	402	383	539	603	465	496	447
Max	683	661	684	699	701	670	686	696	677	671	707	692
EOM	542	563	680	699	396	508	646	646	603	671	693	559





**Appendix A (Table 26 of 38)**  
**Flatiron Powerplant Unit #3 Pump, CO**

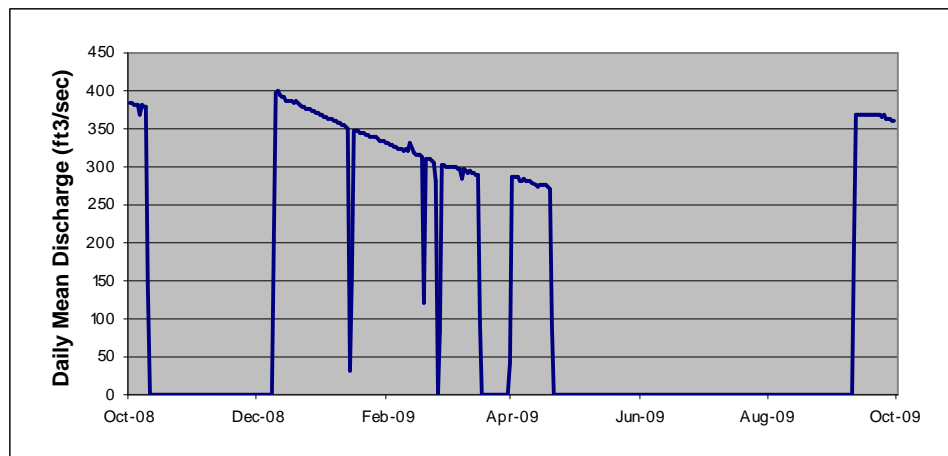
**Location.** --Lat 40°21'53", long 105°14'09", Larimer County, Hydrologic Unit 10190006, 9 miles west of Loveland, Colorado

**Gage.**-- There is no flow meter or gage in place. Flow is estimated by converting Megawatt-hours to cubic feet per second from calibrated tables.

**Remarks.**-- Constructed between 1951 and 1953. The Powerplant consists of three generating units. Unit #3 can be used to pump water from Flatiron Reservoir to Carter Lake. The maximum capacity is approximately 480 cubic feet per second, but the efficiency varies according to the water surface levels at Carter Lake and Flatiron Reservoir. Discharges are obtained by converting the electric energy needed to pump into flow using an efficiency curve. Record is complete and fair. Record complete for period between 01-Oct-2008 and 30-Sep-2009. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	384	0	0	369	332	300	288	0	0	0	0	0
2	383	0	0	366	330	301	287	0	0	0	0	0
3	383	0	0	366	329	300	288	0	0	0	0	0
4	383	0	0	363	327	300	286	0	0	0	0	0
5	382	0	0	364	326	300	283	0	0	0	0	0
6	368	0	0	361	324	299	281	0	0	0	0	0
7	381	0	0	360	325	298	283	0	0	0	0	0
8	379	0	0	359	323	284	281	0	0	0	0	0
9	380	0	202	358	322	297	282	0	0	0	0	0
10	147	0	396	356	323	294	283	0	0	0	0	0
11	0	0	399	355	320	293	280	0	0	0	0	197
12	0	0	394	354	332	294	276	0	0	0	0	368
13	0	0	393	350	319	293	274	0	0	0	0	368
14	0	0	392	31	315	291	275	0	0	0	0	368
15	0	0	387	158	316	291	276	0	0	0	0	370
16	0	0	386	348	315	290	276	0	0	0	0	368
17	0	0	387	348	313	98	276	0	0	0	0	369
18	0	0	385	347	121	0	274	0	0	0	0	368
19	0	0	386	346	311	0	271	0	0	0	0	368
20	0	0	383	343	310	0	91	0	0	0	0	368
21	0	0	380	344	311	0	0	0	0	0	0	367
22	0	0	379	342	309	0	0	0	0	0	0	369
23	0	0	380	341	305	0	0	0	0	0	0	368
24	0	0	377	340	281	0	0	0	0	0	0	366
25	0	0	376	339	0	0	0	0	0	0	0	367
26	0	0	375	339	85	0	0	0	0	0	0	363
27	0	0	374	336	303	0	0	0	0	0	0	364
28	0	0	373	335	302	0	0	0	0	0	0	364
29	0	0	372	335	0	0	0	0	0	0	0	362
30	0	0	371	334	0	0	0	0	0	0	0	361
31	0	0	369	331	0	41	0	0	0	0	0	0
Min	0	0	0	31	0	0	0	0	0	0	0	0
Max	384	0	399	369	332	301	288	0	0	0	0	370
Mean	115	0	278	333	290	157	180	0	0	0	0	239
ac-ft	7068	0	17064	20424	16095	9630	10715	0	0	0	0	14182



**Appendix A (Table 27 of 38)**  
**Charles Hansen Feeder Canal 930 Section, CO**

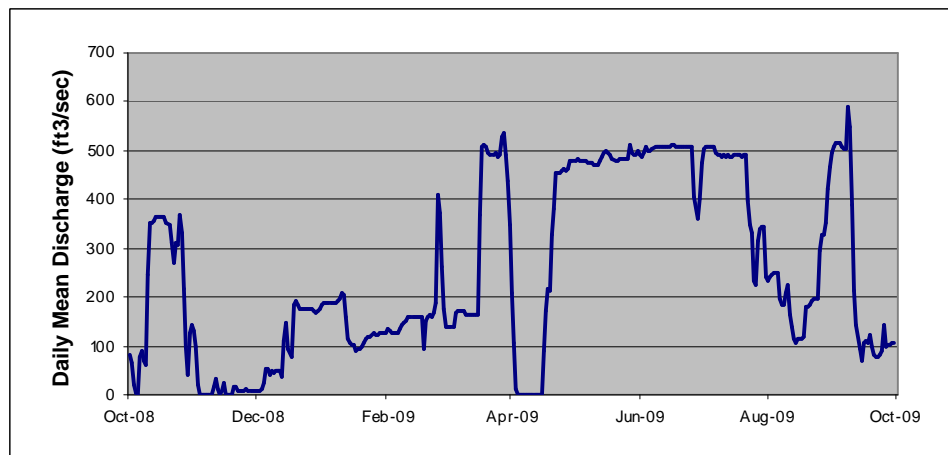
**Location.** --Lat 40°22'26", long 105°13'52", Larimer County, Hydrologic Unit 10190006, 8 miles southwest of Loveland, Colorado.

**Gage.**-- Water-stage recorder with satellite telemetry. Elevation of gage is 5470 feet from topographic map.

**Remarks.**-- Constructed between 1949 and 1953. The canal is 3.8 miles long and has a maximum capacity of 930 cubic feet per second. The canal is used to move Colorado-Big Thompson Project water and diverted native water to the Big Thompson River and/or Horsetooth Reservoir. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Record is complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Flow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	84	133	8	185	134	140	208	480	490	505	235	507
2	67	98	7	190	131	138	107	481	487	506	240	516
3	21	22	12	188	129	139	10	479	496	506	247	516
4	3	2	26	189	126	139	0	480	506	509	249	514
5	2	2	53	190	128	167	0	480	500	508	250	509
6	79	2	53	190	127	172	0	480	499	506	198	502
7	91	2	39	190	135	172	0	474	502	495	182	504
8	70	2	50	192	142	172	0	474	507	490	185	591
9	63	1	47	197	147	172	0	474	507	489	207	549
10	248	17	48	207	151	165	0	473	508	489	224	388
11	352	34	49	205	158	164	0	472	509	489	165	212
12	352	12	50	159	159	163	0	472	509	489	139	142
13	357	1	38	113	159	163	0	479	509	489	113	96
14	365	7	112	105	159	164	0	487	509	487	108	71
15	363	24	145	102	159	164	0	495	507	489	113	105
16	366	1	93	103	160	164	89	499	511	489	113	109
17	365	1	76	91	160	368	173	493	511	491	113	106
18	366	1	186	94	93	506	219	489	508	490	119	122
19	354	1	194	93	153	510	213	484	508	489	181	97
20	347	14	184	98	158	508	326	480	509	491	181	83
21	311	15	177	108	162	497	382	480	509	493	186	76
22	271	8	174	116	159	490	454	481	506	398	193	76
23	312	9	175	117	169	492	454	484	507	349	197	83
24	305	9	176	120	190	496	453	482	507	332	196	92
25	370	9	176	126	409	486	459	483	508	235	295	142
26	331	14	177	123	373	491	461	481	509	227	326	98
27	219	8	177	122	264	529	457	511	403	314	328	103
28	98	7	172	125	175	536	465	496	360	342	353	103
29	39	8	167	126		490	479	491	402	344	422	105
30	127	9	171	126		437	479	492	476	344	468	106
31	144		178	127		349		501		241	496	
Min	2	1	7	91	93	138	0	472	360	227	108	71
Max	370	133	194	207	409	536	479	511	511	509	496	591
Mean	221	16	109	142	170	314	196	484	493	436	227	241
ac-ft	13543	936	6714	8746	9442	19291	11665	29713	29264	26760	13908	14297



**Appendix A (Table 28 of 38)  
Dille Tunnel near Drake, CO**

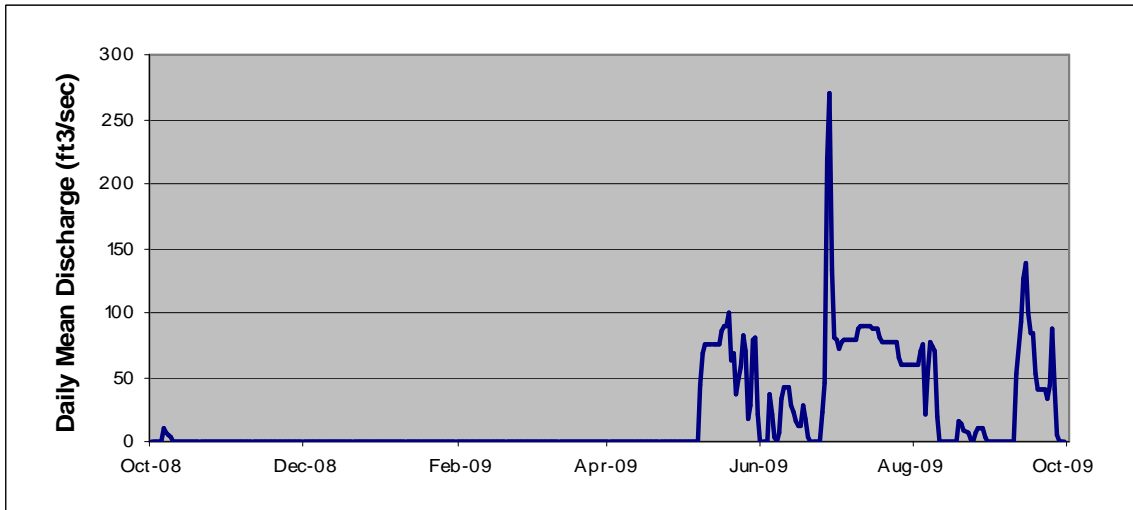
**Location.** --Lat 40°25'02", long 105°14'35", Larimer County, Hydrologic Unit 10190006, 11 miles west of Loveland, Colorado, on the Big Thompson River.

**Gage.**-- Water-stage recorder with satellite telemetry at Parshall Flume. Elevation of gage is 5520 feet from topographic map.

**Remarks.**-- Constructed in 1950. Maximum capacity is 600 cubic feet per second. Dille Tunnel diverts water from the Big Thompson River for power generation and water supply. The hydropower diversion operation, also known as the skim operation, diverts water from the Big Thompson River through Dille Tunnel for power generation at the Big Thompson Power Plant, where the diverted water is returned to the river. The skim daily value is determined based on the data from the gage. Recorder was operated from 01-Oct-2008 to 09-Dec-2008, and from 03-Apr-2009 to 30-Sep-2009. There were no diversions between 09-Dec-2008 and 03-Apr-2009. Record is complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Hydropower Diversion Flow (Skim), Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	0	0	0	0	0	80	60	0
2	0	0	0	0	0	0	0	0	0	73	60	0
3	0	0	0	0	0	0	0	0	0	78	71	0
4	0	0	0	0	0	0	0	0	37	80	76	0
5	0	0	0	0	0	0	0	0	21	80	21	0
6	11	0	0	0	0	0	0	0	4	80	53	0
7	8	0	0	0	0	0	0	0	0	80	77	0
8	6	0	0	0	0	0	0	44	7	80	74	0
9	3	0	0	0	0	0	0	69	34	80	70	0
10	0	0	0	0	0	0	0	75	43	88	19	0
11	0	0	0	0	0	0	0	75	43	90	0	53
12	0	0	0	0	0	0	0	75	43	90	0	93
13	0	0	0	0	0	0	0	75	28	90	0	127
14	0	0	0	0	0	0	0	75	23	90	0	139
15	0	0	0	0	0	0	0	75	16	88	0	100
16	0	0	0	0	0	0	0	86	13	88	0	85
17	0	0	0	0	0	0	0	90	13	88	0	85
18	0	0	0	0	0	0	0	90	28	81	0	52
19	0	0	0	0	0	0	0	100	18	78	15	40
20	0	0	0	0	0	0	0	63	4	78	14	40
21	0	0	0	0	0	0	0	68	0	78	8	41
22	0	0	0	0	0	0	0	38	0	78	7	41
23	0	0	0	0	0	0	0	49	0	77	2	33
24	0	0	0	0	0	0	0	59	0	77	0	44
25	0	0	0	0	0	0	0	83	23	78	7	87
26	0	0	0	0	0	0	0	70	46	65	10	40
27	0	0	0	0	0	0	0	18	220	60	11	5
28	0	0	0	0	0	0	0	28	271	60	10	0
29	0	0	0	0	0	0	0	80	134	60	3	0
30	0	0	0	0	0	0	0	81	82	60	0	0
31	0	0	0	0	0	0	0	21	0	60	0	0
Min	0	0	0	0	0	0	0	0	0	60	0	0
Max	11	0	0	0	0	0	0	100	271	90	77	139
Mean	1	0	0	0	0	0	0	51	38	78	22	37
ac-ft	55	0	0	0	0	0	0	3134	2259	4761	1323	2188



**Appendix A (Table 29 of 38)  
Dille Tunnel near Drake, CO**

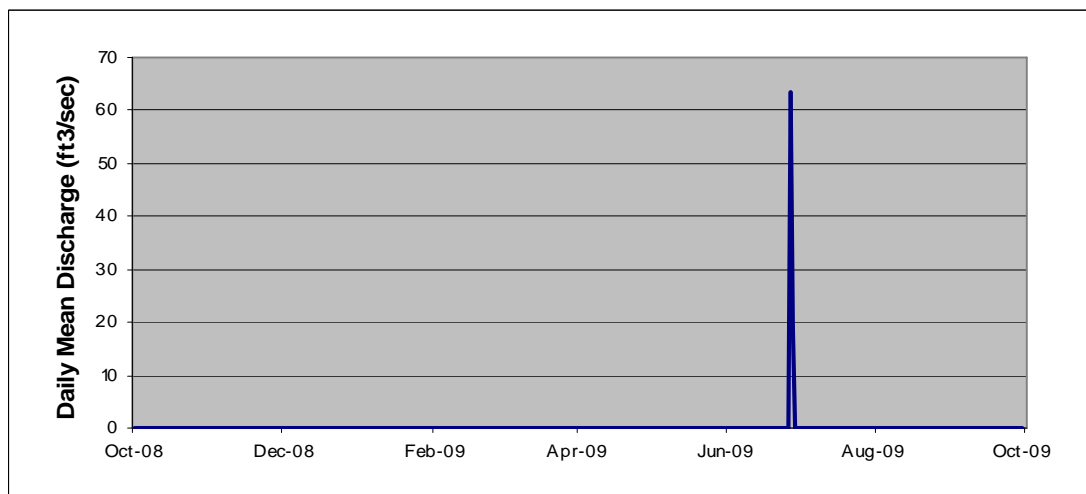
**Location.** --Lat 40°25'02", long 105°14'35", Larimer County, Hydrologic Unit 10190006, 11 miles west of Loveland, Colorado, on the Big Thompson River.

**Gage.**-- None.

**Remarks.**-- Constructed in 1950. Maximum capacity is 600 cubic feet per second. Dille Tunnel diverts water from the Big Thompson River for power generation and water supply. The right to divert native run-off is determined by the state of Colorado. Recorder was operated from 01-Oct-2008 to 09-Dec-2008, and from 03-Apr-2009 to 30-Sep-2009. There were no diversions between 09-Dec-2008 and 03-Apr-2009. Record is complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Priority Diversion Flow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	64	0	0	0
28	0	0	0	0	0	0	0	0	19	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
Min	0	0	0	0	0	0	0	0	0	0	0	0
Max	0	0	0	0	0	0	0	0	64	0	0	0
Mean	0	0	0	0	0	0	0	0	3	0	0	0
ac-ft	0	0	0	0	0	0	0	0	164	0	0	0



**Appendix A (30 of 38)**  
**Dille Tunnel near Drake, CO**

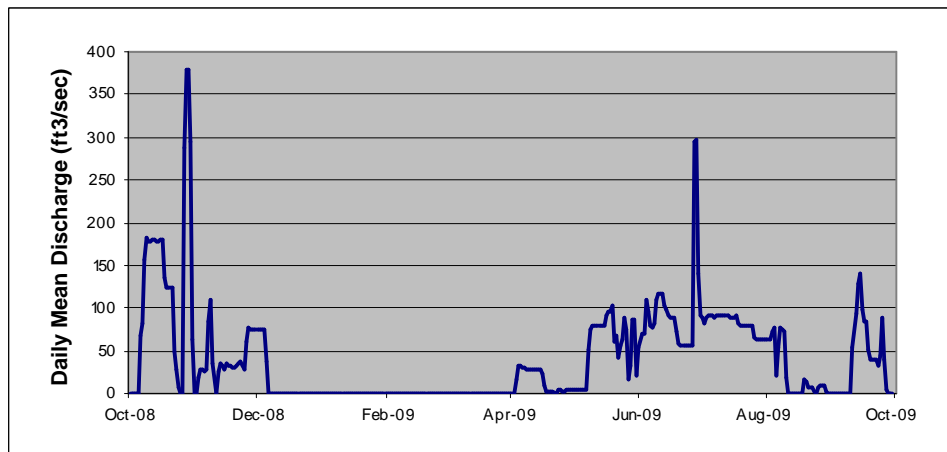
**Location.** --Lat 40°25'02", long 105°14'35", Larimer County, Hydrologic Unit 10190006, 11 miles west of Loveland, Colorado, on the Big Thompson River.

**Gage.**-- Water-stage recorder with satellite telemetry at Parshall Flume. Elevation of gage is 5520 feet from topographic map.

**Remarks.**— Constructed in 1950. Maximum capacity is 600 cubic feet per second. Dille Tunnel diverts water from the Big Thompson River for power generation and water supply. Recorder was operated from 01-Oct-2008 to 09-Dec-2008, and from 03-Apr-2009 to 30-Sep-2009. There were no diversions between 09-Dec-2008 and 03-Apr-2009. Record is complete and reliable, although data has not been revised. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	75	0	0	0	0	5	53	90	62	0
2	0	0	75	0	0	0	0	5	70	82	62	0
3	0	19	75	0	0	0	17	5	70	88	74	0
4	0	28	75	0	0	0	34	5	110	90	78	0
5	0	28	37	0	0	0	32	6	96	91	20	0
6	67	27	0	0	0	0	31	6	79	90	54	0
7	81	28	0	0	0	0	31	6	76	90	77	0
8	158	85	0	0	0	0	29	50	82	90	74	0
9	182	111	0	0	0	0	28	75	110	90	72	0
10	178	35	0	0	0	0	28	80	118	90	19	0
11	179	0	0	0	0	0	28	80	118	90	0	55
12	179	25	0	0	0	0	28	80	118	91	0	94
13	179	36	0	0	0	0	28	80	103	90	0	129
14	179	33	0	0	0	0	28	80	98	90	0	140
15	179	29	0	0	0	0	28	80	91	90	0	99
16	180	36	0	0	0	0	24	91	88	90	0	85
17	179	33	0	0	0	0	10	95	88	90	0	85
18	136	32	0	0	0	0	2	95	88	82	0	51
19	124	31	0	0	0	0	2	103	73	80	15	40
20	124	31	0	0	0	0	2	61	58	80	13	40
21	124	32	0	0	0	0	1	68	55	80	8	41
22	50	35	0	0	0	0	1	42	55	80	7	41
23	29	38	0	0	0	0	4	55	55	79	2	33
24	8	33	0	0	0	0	5	64	55	79	0	45
25	0	28	0	0	0	0	3	88	56	80	8	88
26	0	60	0	0	0	0	3	75	56	66	10	39
27	287	76	0	0	0	0	4	17	296	62	10	5
28	380	76	0	0	0	0	5	33	296	62	10	0
29	380	76	0	0	0	0	5	86	140	62	3	0
30	294	76	0	0	0	0	5	86	92	62	0	0
31	64		0	0	0	0		21		62	0	
Min	0	0	0	0	0	0	0	5	53	62	0	0
Max	380	111	75	0	0	0	34	103	296	91	78	140
Mean	127	39	11	0	0	0	15	56	98	82	22	37
ac-ft	7765	2327	673	4	3	4	885	3409	5829	5028	1351	2205



**Appendix A (Table 31 of 38)  
Big Thompson Power Plant, CO**

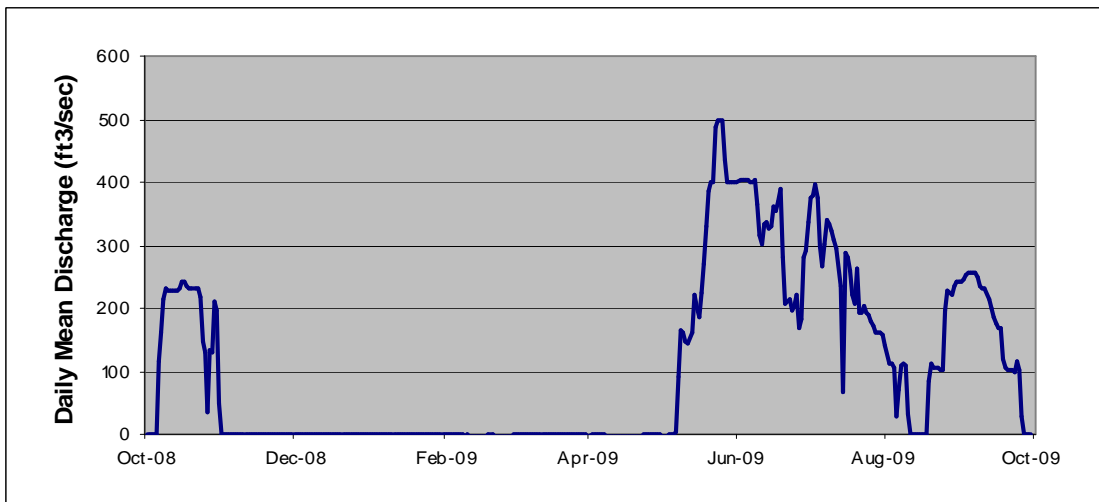
**Location.** --Lat 40°25'16", long 105°13'26", Larimer County, Hydrologic Unit 10190006, 9 miles west of Loveland, Colorado, on the Big Thompson River.

**Gage.**-- Flow meter with satellite telemetry. Elevation of gage is 5280 feet from topographic map.

**Remarks.**-- Initial operation in 1959. Maximum capacity is 400 cubic feet per second. Power plant returns hydropower diversions to the Big Thompson River downstream of the Big Thompson River canyon mouth. Power plant is also used to deliver Colorado-Big Thompson project and Windy Gap Project water to the Big Thompson River. The plant is winterized from November through April each year. Record is complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	0	0	0	-1	0	-2	-2	401	375	141	242
2	0	0	0	0	-1	0	0	-2	403	379	112	244
3	0	0	0	0	-1	0	0	-2	404	396	113	252
4	0	0	0	0	-1	0	0	-1	403	377	105	257
5	0	0	0	0	-1	0	0	0	402	300	29	256
6	117	0	0	0	-1	0	0	0	400	267	72	256
7	162	0	0	0	-1	0	-1	3	401	300	108	255
8	216	0	0	0	-1	0	-2	90	402	342	111	248
9	232	0	0	0	-2	0	-2	165	366	334	108	234
10	229	0	0	0	-2	0	-2	160	317	323	30	230
11	229	0	0	0	-2	0	-2	149	302	309	1	231
12	229	0	0	0	-2	0	-2	143	334	294	1	213
13	230	0	0	0	-2	0	-2	163	335	233	1	201
14	229	0	0	0	-2	0	-2	222	326	66	1	186
15	230	0	0	0	-2	0	-2	198	330	289	1	174
16	243	0	0	0	-2	0	-2	186	361	282	1	169
17	243	0	0	0	-2	0	-2	225	353	258	1	167
18	233	0	0	0	-2	0	-2	271	370	222	1	120
19	230	0	0	0	-1	0	-2	328	391	207	86	105
20	230	0	0	0	-1	0	-2	385	280	262	112	101
21	230	0	0	0	-2	0	-2	401	206	192	106	101
22	230	0	0	0	-2	0	-2	401	215	192	105	100
23	216	0	0	0	-2	0	-1	486	197	202	101	100
24	147	0	0	0	-2	0	0	498	202	193	103	115
25	131	0	0	0	-2	0	0	498	221	190	197	103
26	36	0	0	0	-2	0	0	498	168	180	230	27
27	132	0	0	0	-2	0	0	436	182	171	226	0
28	131	0	0	0	-2	0	1	401	282	162	220	0
29	211	0	0	0		0	0	400	291	161	235	0
30	197	0	0	0		0	-1	399	337	160	243	0
31	50		0	0		0		399		157	243	
Min	0	0	0	0	-2	0	-2	-2	168	66	1	0
Max	243	0	0	0	-1	0	1	498	404	396	243	257
Mean	161	0	0	0	-2	0	-1	242	319	251	101	156
ac-ft	9886	0	0	0	-90	0	-72	14850	18974	15395	6229	9281



**Appendix A (Table 32 of 38)**  
**Charles Hansen Feeder Canal Wasteway, CO**

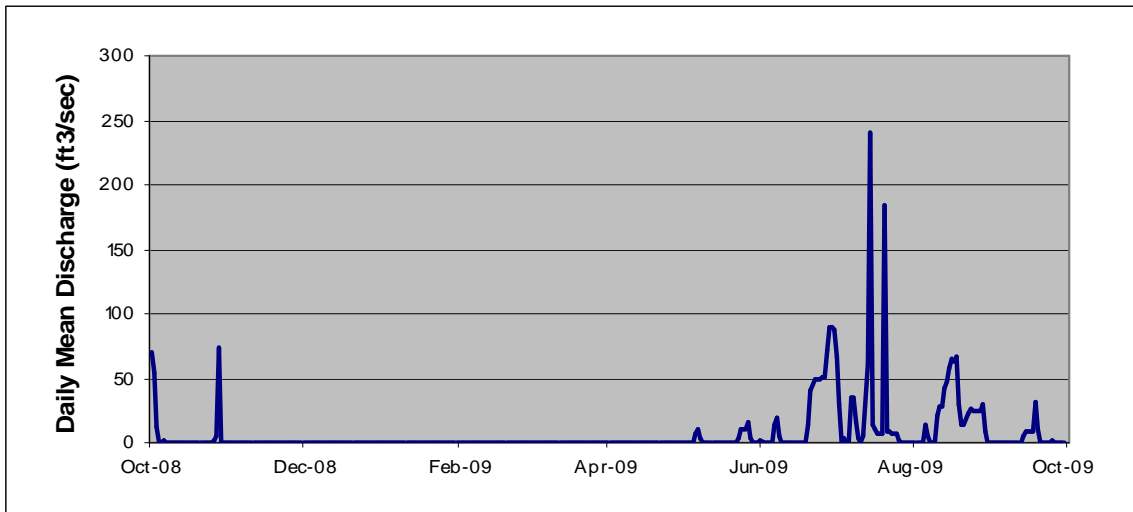
**Location.** --Lat 40°25'13", long 105°13'28", Larimer County, Hydrologic Unit 10190006, 9 miles west of Loveland, Colorado, on the Big Thompson River.

**Gage.**-- Water-stage recorder with satellite telemetry at 15 foot Parshall Flume. Elevation of gage is 5465 feet from Designer's Operating Criteria.

**Remarks.**-- Constructed between 1949 and 1953. Maximum capacity is 400 cubic feet per second. The structure is used to return diverted water and to deliver Colorado-Big Thompson Project and Windy Gap Project water to the Big Thompson River. The structure is winterized between November and April. Record is complete and reliable. These data are provisional operations data and are subject to further revision and change.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	71	0	0	0	0	0	0	0	1	67	0	0
2	54	0	0	0	0	0	0	0	0	29	0	0
3	13	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	3	0	0
5	0	0	0	0	0	0	0	0	0	0	13	0
6	2	0	0	0	0	0	0	7	14	0	5	0
7	0	0	0	0	0	0	0	10	20	36	0	0
8	0	0	0	0	0	0	0	3	5	34	0	0
9	0	0	0	0	0	0	0	0	0	16	0	0
10	0	0	0	0	0	0	0	0	0	3	21	0
11	0	0	0	0	0	0	0	0	0	0	28	0
12	0	0	0	0	0	0	0	0	0	5	28	0
13	0	0	0	0	0	0	0	0	0	62	42	6
14	0	0	0	0	0	0	0	0	0	241	48	9
15	0	0	0	0	0	0	0	0	0	15	58	9
16	0	0	0	0	0	0	0	0	0	10	64	9
17	0	0	0	0	0	0	0	0	0	8	64	9
18	0	0	0	0	0	0	0	0	0	7	66	31
19	0	0	0	0	0	0	0	0	0	7	29	11
20	0	0	0	0	0	0	0	0	14	183	14	0
21	0	0	0	0	0	0	0	0	41	9	14	0
22	0	0	0	0	0	0	0	0	49	9	23	0
23	0	0	0	0	0	0	0	3	49	7	27	0
24	0	0	0	0	0	0	0	11	49	7	25	0
25	0	0	0	0	0	0	0	11	50	7	25	1
26	3	0	0	0	0	0	0	10	51	2	24	0
27	5	0	0	0	0	0	0	16	72	0	24	0
28	73	0	0	0	0	0	0	4	89	0	30	0
29	0	0	0	0	0	0	0	0	90	0	9	0
30	0	0	0	0	0	0	0	0	88	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
Min	0	0	0	0	0	0	0	0	0	0	0	0
Max	73	0	0	0	0	0	0	16	90	241	66	31
Mean	7	0	0	0	0	0	0	2	23	25	22	3
ac-ft	440	0	0	0	0	0	0	148	1350	1518	1348	168



**Appendix A (Table 33 of 38)**  
**Charles Hansen Feeder Canal 550 Section, CO**

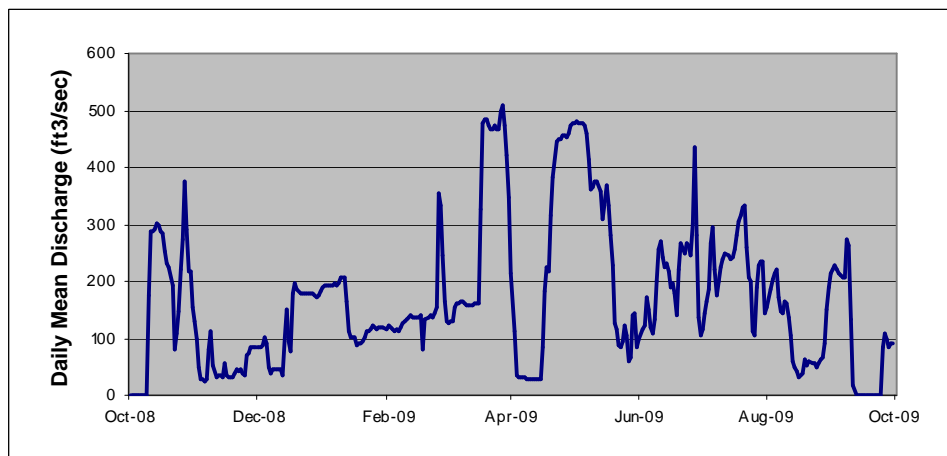
**Location.** --Lat 40°25'25", long 105°13'34", Larimer County, Hydrologic Unit 10190006, 9 miles west of Loveland, Colorado.

**Gage.**-- Water-stage recorder with satellite telemetry. Elevation of gage is 5460 feet from topographic map.

**Remarks.**-- Constructed between 1949 and 1953. The canal is 9.4 miles long and has a maximum capacity of 550 cubic feet per second. The canal is used to convey Colorado-Big Thompson Project water and move native runoff to Horsetooth Reservoir. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Record is complete and reliable. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0	129	85	188	123	130	214	479	97	116	153	222
2	0	99	84	193	121	128	114	480	114	144	188	227
3	0	48	87	192	117	129	34	478	121	164	202	220
4	0	28	102	192	114	130	33	477	170	187	216	214
5	0	27	91	193	114	154	32	479	152	266	222	212
6	0	26	49	193	113	162	31	473	118	296	173	206
7	0	28	37	195	119	163	31	459	109	220	147	209
8	0	82	47	194	125	164	29	412	134	175	143	274
9	0	113	44	198	130	165	28	361	200	201	166	264
10	175	52	44	208	133	160	28	366	256	223	161	132
11	287	31	46	205	138	159	28	374	271	240	137	19
12	288	36	47	166	139	159	29	376	242	249	107	0
13	292	36	36	113	138	159	28	358	226	247	58	0
14	301	33	101	103	138	160	28	309	230	240	49	0
15	297	55	151	100	138	160	28	340	218	242	42	0
16	287	35	93	101	139	160	84	369	189	255	32	0
17	285	32	76	89	139	326	184	332	197	280	35	0
18	253	31	179	90	80	478	224	282	177	305	38	0
19	232	30	196	90	132	484	216	229	140	315	62	0
20	224	38	186	93	136	483	316	125	222	331	53	0
21	194	46	180	103	140	474	381	115	267	332	58	0
22	80	41	177	112	137	466	447	89	249	259	56	1
23	110	44	178	113	145	467	448	86	268	208	54	1
24	147	40	179	115	154	472	450	95	263	200	51	1
25	220	34	180	122	353	466	455	123	247	114	56	83
26	275	71	180	118	333	466	455	107	302	104	62	108
27	374	75	181	116	244	500	454	61	436	190	67	100
28	293	83	176	118	164	510	461	65	281	230	92	85
29	217	84	171	118		474	475	142	138	234	150	90
30	217	85	175	118		422	477	144	104	236	189	93
31	155		182	117		348		83		146	213	
Min	0	26	36	89	80	128	28	61	97	104	32	0
Max	374	129	196	208	353	510	477	480	436	332	222	274
Mean	168	53	121	141	150	299	208	280	205	224	111	92
ac-ft	10310	3152	7410	8643	8311	18370	12360	17162	12159	13757	6797	5472





**Appendix A (34 of 38)**  
**Horsetooth Reservoir near Fort Collins, CO**

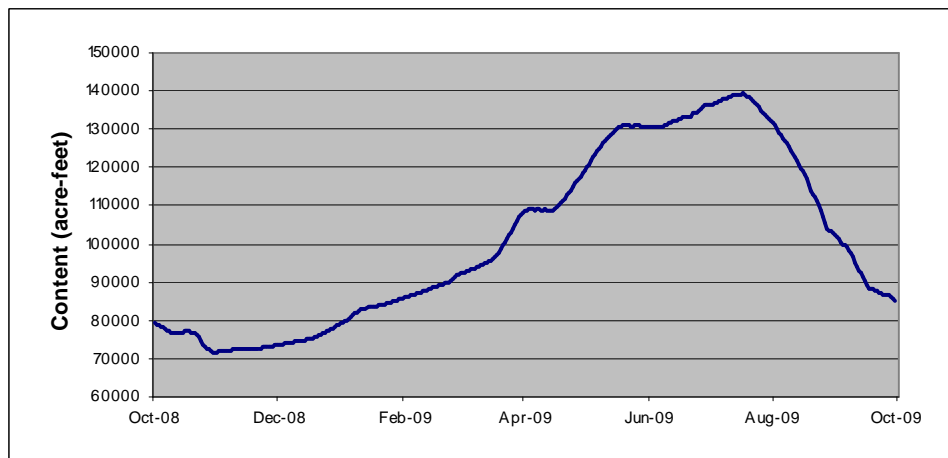
**Location.**—Lat 40°36'00", long 105°10'05", Larimer County, Hydrologic Unit 10190007, at Horsetooth Dam outlet works, 4.8 miles west of Fort Collins, Colorado.

**Gage.**— Water level recorder with satellite telemetry. Elevation of gage is 5300 from topographic map.

**Remarks.**—Reservoir is formed by four earth-fill dams. Construction completed in 1949. Impoundment began in 1951. Horsetooth Reservoir is one of two terminal reservoirs for Colorado-Big Thompson Project diversions. Transmountain diversions are stored at Horsetooth Reservoir before final delivery. Maximum capacity is 156,735 acre-feet at elevation 5430.00 ft, with 142,038 acre-feet of active storage. Recorder was operated from 01-Oct-2008 to 05-Dec-2008, and from 14-Jan-2009 and 30-Sep-2009. Volumes between those two periods were estimated with a few visual readings included in between values (Dec 15, Dec 17, Dec 31, Jan 5, Jan 6 and Jan 11). Record is incomplete but fair. This record contains operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	79458	71741	73569	79272	85989	92357	108669	120024	130638	136576	131877	101829
2	79071	72083	73775	79559	86168	92543	108854	120909	130712	136632	131173	101114
3	78770	71946	73858	79846	86317	92699	108972	121814	130786	136746	130141	100403
4	78457	72028	74067	80135	86482	92915	108988	122617	130620	137068	129258	99984
5	78157	72083	74136	80466	86676	93148	108955	123386	130823	137409	128526	99823
6	77844	72056	74206	81090	86781	93397	108921	124211	130694	137579	127596	99341
7	77517	72001	74275	81439	86976	93647	108972	125040	130823	137959	127014	98396
8	77220	72151	74345	81786	87187	93881	108955	125653	130804	138035	126414	97535
9	76739	72329	74414	82137	87322	94099	108888	126251	130915	138188	125509	96457
10	76513	72370	74483	82487	87577	94380	108904	126923	131248	138435	124301	95086
11	76626	72438	74552	82809	87744	94568	108955	127468	131599	138644	123045	93834
12	76697	72480	74622	82985	87970	94882	108888	128126	131803	138873	121832	93070
13	76767	72576	74692	83161	88197	95086	108871	128654	131988	139045	120554	92234
14	76810	72507	74804	83337	88423	95369	108837	129094	132192	139064	119811	91232
15	76937	72535	74915	83470	88606	95557	108753	129516	132452	139141	119335	90220
16	77007	72590	74971	83573	88878	95857	109072	130049	132620	139217	118264	89349
17	77036	72631	75013	83676	89030	96425	109629	130546	132973	139313	116812	88501
18	77021	72672	75278	83750	89091	96979	110152	130860	133029	139102	115475	88499
19	76979	72713	75544	83853	89258	97870	110558	131081	133029	138721	114144	88181
20	76923	72741	75810	83956	89502	98764	111083	131118	133159	138302	112806	87819
21	76782	72713	76077	84148	89654	99662	111781	131063	133496	137997	112071	87593
22	76415	72810	76344	84326	89883	100500	112634	130971	134056	137523	111475	87322
23	75516	72824	76612	84473	90051	101310	113423	130842	134243	136992	110168	87172
24	74580	72838	76880	84651	90311	102252	114144	130823	134543	136405	108636	86931
25	73844	72893	77149	84770	90939	103117	114990	130915	134843	135651	107147	86856
26	73113	72975	77418	84962	91416	104100	115873	130971	135388	134880	105651	86781
27	72645	73099	77702	85155	91879	105040	116742	130952	136028	134318	104199	86706
28	72562	73264	77986	85304	92157	106016	117545	130841	136424	133738	103624	86362
29	72151	73430	78271	85453		106864	118351	130786	136519	133253	103394	85855
30	71578	73458	78628	85661		107647	119159	130842	136538	132750	102921	85319
31	71483		78985	85766		108300		130731		132248	102414	
Min	71483	71741	73569	79272	85989	92357	108669	120024	130620	132248	102414	85319
Max	79458	73458	78985	85766	92157	108300	119159	131118	136538	139313	131877	101829
EOM	71483	73458	78985	85766	92157	108300	119159	119159	136538	132248	102414	85319



**Appendix A (35 of 38)**  
**Charles Hansen Supply Canal below Horsetooth Reservoir, CO**

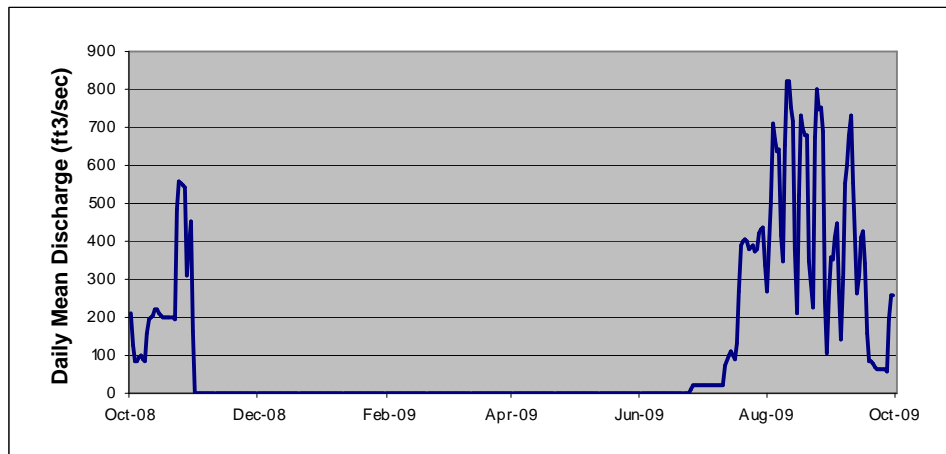
**Location.** --Lat 40°36'01", long 105°10'18", Larimer County, Hydrologic Unit 10190007, 4 miles west of Fort Collins, Colorado.

**Gage.**-- Water-stage recorder with satellite telemetry at concrete control. Elevation of gage is 5280 feet from topographic map.

**Remarks.**-- Constructed between 1950 and 1952. The canal is 5.1 miles long and has a maximum capacity of 1500 cubic feet per second. The canal is used to deliver Colorado-Big Thompson Project and Windy Gap Project water stored at Horsetooth Reservoir. Recorder was operated from 01-Oct-2008 to 30-Sep-2008 by the Northern Colorado Water Conservancy District. Record is complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Discharge, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	212	1	0	0	0	0	0	0	0	22	269	355
2	124	1	0	0	0	0	0	0	0	21	498	409
3	83	0	0	0	0	0	0	0	0	22	713	445
4	82	0	0	0	0	0	0	0	0	22	668	266
5	93	0	0	0	0	0	0	0	0	22	635	144
6	99	0	0	0	0	0	0	0	0	22	640	306
7	90	0	0	0	0	0	0	0	0	22	416	554
8	85	0	0	0	0	0	0	0	0	22	348	601
9	159	0	0	0	0	0	0	0	0	20	654	679
10	194	0	0	0	0	0	0	0	0	19	823	731
11	201	0	0	0	0	0	0	0	0	19	822	552
12	205	0	0	0	0	0	0	0	0	74	754	263
13	221	0	0	0	0	0	0	0	0	98	713	312
14	223	0	0	0	0	0	0	0	0	111	378	409
15	211	0	0	0	0	0	0	0	0	98	210	427
16	203	0	0	0	0	0	0	0	0	90	522	344
17	202	0	0	0	0	0	0	0	0	130	732	157
18	202	0	0	0	0	0	0	0	0	270	693	83
19	202	0	0	0	0	0	0	0	0	387	681	84
20	202	0	0	0	0	0	0	0	0	398	680	81
21	199	0	0	0	0	0	0	0	0	403	349	68
22	197	0	0	0	0	0	0	0	0	399	227	66
23	485	0	0	0	0	0	0	0	0	378	674	66
24	556	0	0	0	0	0	0	0	0	383	798	65
25	555	0	0	0	0	0	0	0	10	387	750	65
26	547	0	0	0	0	0	0	0	22	372	752	61
27	542	0	0	0	0	0	0	0	21	377	687	59
28	309	0	0	0	0	0	0	0	19	419	242	195
29	388	0	0	0	0	0	0	0	22	433	104	257
30	453	0	0	0	0	0	0	0	23	439	269	257
31	162		0	0		0		0		336	360	
Min	82	0	0	0	0	0	0	0	0	19	104	59
Max	556	1	0	0	0	0	0	0	23	439	823	731
Mean	248	0	0	0	0	0	0	0	4	201	550	279
ac-ft	15223	4	0	0	0	0	0	0	230	12308	33783	16552



**Appendix A (36 of 38)**  
**Carter Lake near Berthoud, Colorado, CO**

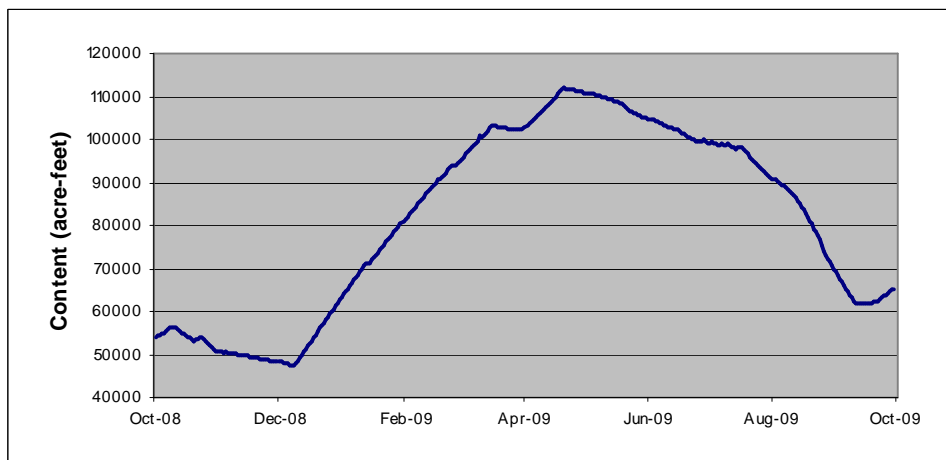
**Location.** --Lat 40°19' 28" , long 105°12' 41" , Larimer County, Hydrologic Unit 10190006, on Dam #1, 7 miles northwest of Berthoud, Colorado, and 10 miles west of Loveland, Colorado.

**Gage.**--Water level recorder with satellite telemetry. Elevation of gage is 5770 from topographic map.

**Remarks.**--Reservoir is formed by three earth-fill dams. Construction completed in 1952. Carter Lake is one of two terminal reservoirs for Colorado-Big Thompson Project water diversions. Transmountain water diversions are stored at Carter Lake before final delivery. Maximum capacity is 112,200 acre-feet at elevation 5759.00 ft, with 108,900 acre-feet of active capacity. Recorder was operated from 01-Oct-2008 to 30-Sep-2009. Record is complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Storage, Acre-Feet, 2400-hour Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	53820	50748	48251	63437	81487	95488	102711	110802	104647	99160	90800	69166
2	54281	50661	48165	64003	82054	96030	103267	110745	104536	99434	90471	68381
3	54547	50575	48081	64580	82683	96584	103722	110677	104424	99138	90153	67610
4	54725	50445	47945	65292	83252	97128	104167	110563	104167	98919	89835	66831
5	55081	50488	47749	65874	83821	97673	104725	110506	103978	98700	89496	66094
6	55269	50359	47564	66591	84402	98066	105239	110369	103689	98722	89147	65274
7	55698	50333	47563	67215	84922	98667	105743	110199	103666	98864	88661	64514
8	56120	50229	47521	67803	85442	99051	106191	110052	103389	98645	88271	63861
9	56345	50057	47817	68498	86006	99599	106640	109915	103189	98832	87798	63249
10	56300	50014	48506	69166	86549	100710	107158	109824	102988	98886	87430	62432
11	56075	49971	49146	69769	87210	100655	107664	109711	102823	98667	87000	62020
12	55716	49885	49936	70500	87766	101096	108002	109518	102711	98372	86549	62020
13	55403	49799	50618	70979	88313	101604	108567	109200	102467	98208	85766	61973
14	55081	49713	51233	70979	88871	102047	109031	109110	102212	97869	84975	61973
15	54770	49713	51904	71244	89359	102578	109484	109031	102102	97957	84196	61908
16	54547	49610	52684	71863	89993	103099	109995	108861	101737	98285	83718	61927
17	54148	49498	53255	72512	90577	103211	110802	108623	101549	98142	82818	62020
18	53838	49395	54060	73205	90684	103099	111315	108432	101184	97651	81983	62020
19	53564	49361	54610	73691	91226	103021	111714	108149	100964	97215	81057	62067
20	53202	49275	55367	74307	91759	102966	111863	107833	100633	96584	80279	62114
21	53387	49146	56138	74906	92293	102767	111829	107439	100545	95976	79125	62236
22	53670	48933	56714	75566	92946	102745	111748	107011	100214	95434	78377	62441
23	53794	48847	57391	76189	93504	102656	111691	106584	99830	94764	77624	62779
24	53882	48804	58073	76823	94020	102545	111486	106415	99720	94268	76723	63108
25	53387	48693	58693	77357	93783	102434	111429	106247	99380	93913	75358	63531
26	52859	48633	59426	77894	94074	102489	111315	106023	99325	93354	73991	63861
27	52377	48549	60070	78573	94516	102378	111372	105776	99720	92818	73058	64240
28	51930	48464	60662	79122	94980	102323	111201	105687	99775	92347	72160	64675
29	51477	48387	61396	79734		102268	111053	105318	99358	91972	71452	65007
30	51060	48344	61973	80318		102267	110916	105183	99105	91492	70657	65293
31	50825		62582	80892		102157		104949		91066	69896	
Min	50825	48344	47521	63437	81487	95488	102711	104949	99105	91066	69896	61908
Max	56345	50748	62582	80892	94980	103211	111863	110802	104647	99434	90800	69166
EOM	50825	48344	62582	80892	94980	102157	110916	110916	99105	91066	69896	65293



**Appendix A (37 of 38)**  
**Saint Vrain Canal below Carter Reservoir, CO**

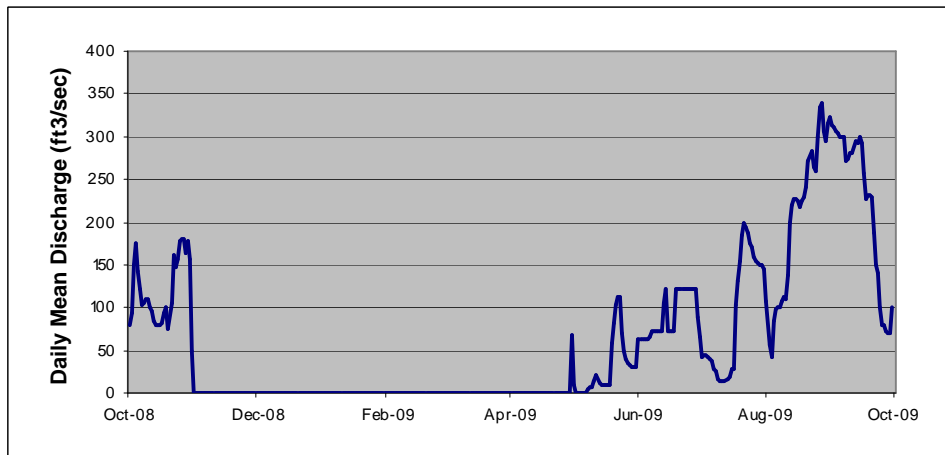
**Location.** --Lat 40°19'27", long 105°12'35", Larimer County, Hydrologic Unit 10190006, downstream from Carter Reservoir Dam #1, 7 miles northwest of Berthoud, Colorado, and 10 miles west of Loveland, Colorado.

**Gage.**-- Water-stage recorder with telephone telemetry. Data provided by the Northern Colorado Water Conservancy District. Elevation of gage is 5,590 feet from topographic map.

**Remarks.**-- Constructed between 1952 and 1954. The canal is 9.8 miles long and has a maximum capacity of 625 cubic feet per second. The canal is used to deliver Colorado-Big Thompson Project and Windy Gap Project water as well as diverted native water from conveyance contract holders. Record was provided by the Northern Colorado Water Conservancy District for the period 01-Oct-2008 to 30-Sep-2009. Record is complete and fair. This record contains operational data which could be subject to future revisions and changes.

**Flow, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	79	0	0	0	0	0	0	8	62	41	108	313
2	94	0	0	0	0	0	0	0	62	45	56	310
3	150	0	0	0	0	0	0	0	62	45	43	307
4	175	0	0	0	0	0	0	0	62	42	83	305
5	142	0	0	0	0	0	0	0	62	40	99	298
6	122	0	0	0	0	0	0	0	65	37	100	298
7	103	0	0	0	0	0	0	0	72	28	100	300
8	106	0	0	0	0	0	0	4	72	25	107	272
9	110	0	0	0	0	0	0	8	72	17	111	273
10	110	0	0	0	0	0	0	8	72	13	110	281
11	100	0	0	0	0	0	0	15	72	14	138	281
12	95	0	0	0	0	0	0	20	72	15	200	294
13	85	0	0	0	0	0	0	13	105	17	220	293
14	80	0	0	0	0	0	0	10	122	18	228	300
15	80	0	0	0	0	0	0	10	72	27	227	292
16	80	0	0	0	0	0	0	10	72	27	224	258
17	82	0	0	0	0	0	0	10	72	102	217	227
18	94	0	0	0	0	0	0	10	72	130	225	232
19	100	0	0	0	0	0	0	58	122	154	230	232
20	76	0	0	0	0	0	0	82	122	185	240	229
21	106	0	0	0	0	0	0	103	122	198	272	187
22	162	0	0	0	0	0	0	113	122	193	283	149
23	147	0	0	0	0	0	0	113	122	187	265	141
24	157	0	0	0	0	0	0	71	122	175	260	100
25	177	0	0	0	0	0	0	50	122	170	300	79
26	180	0	0	0	0	0	0	40	122	160	334	79
27	180	0	0	0	0	0	0	35	122	155	340	73
28	163	0	0	0	0	0	0	32	122	152	306	70
29	178	0	0	0	0	0	0	31	89	150	294	70
30	157	0	0	0	0	0	67	31	66	150	315	100
31	49	0	0	0	0	0	0	31	0	144	322	0
Min	49	0	0	0	0	0	0	0	62	13	43	70
Max	180	0	0	0	0	0	67	113	122	198	340	313
Mean	120	0	0	0	0	0	2	30	90	92	205	221
ac-ft	7362	0	0	0	0	0	132	1814	5341	5653	12587	13155



**Appendix A (38 of 38)**  
**Colorado-Big Thompson Project, CO**

**Location.** -- Larimer , Grand, Summit, Boulder, Weld counties in Colorado, hydrologic units 14010001, 14010002 and 10190006, 10190007, on the Colorado River, Big Thompson River and Cache La Poudre River basins.

**Remarks.**— This table presents a summation of all the daily deliveries of Colorado-Big Thompson Project and Windy Gap Project water through the Saint Vrain Canal, the Charles Hansen Supply Canal, the Dixon Canal ,the Charles Hansen Feeder Canal and small deliveries upstream from Flatiron Reservoir. These values include metered water. The Colorado-Big Thompson Project is a transmountain water diversion system. The water diverted is used for irrigation, municipal and industrial purposes, to generate hydroelectric power and to provide recreation for the public. This record contains operational data which could be subject to future revisions and changes. Period of record is between 01-Oct-2008 and 30-Sep-2009. Data was provided by the Northern Colorado Water Conservancy District. Record is complete and reliable.

**Total Daily Water Deliveries, Cubic Feet per Second, Daily Mean Values**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	457	51	51	51	56	60	65	132	274	215	540	1074
2	374	51	51	51	56	60	65	124	265	219	655	1115
3	355	51	51	51	56	60	65	124	254	224	795	1162
4	368	51	51	51	56	60	65	124	253	223	787	1006
5	345	51	51	51	56	60	65	124	253	221	778	874
6	431	51	51	51	56	60	65	131	256	218	794	1116
7	446	51	51	51	56	60	65	134	263	209	653	1292
8	496	51	51	51	56	60	65	138	265	210	603	1258
9	588	51	51	51	56	60	65	135	264	197	815	1308
10	634	51	51	51	56	60	65	132	263	189	947	1358
11	630	51	51	51	56	60	65	139	263	190	977	1204
12	628	51	51	51	56	60	65	144	263	245	1000	950
13	633	51	51	51	56	60	65	137	296	278	1010	971
14	633	51	51	51	56	60	65	134	313	291	789	1054
15	635	51	51	51	56	60	65	134	263	289	662	1046
16	647	51	51	51	56	60	65	134	263	279	884	944
17	648	51	51	51	56	60	65	134	270	408	1063	753
18	650	51	51	51	56	60	65	145	253	573	1161	732
19	652	51	51	51	56	60	65	207	293	713	1192	752
20	628	51	51	51	56	60	65	237	293	778	1216	708
21	656	51	51	51	56	60	65	260	293	799	926	635
22	712	51	51	51	56	60	65	319	286	768	793	588
23	944	51	51	51	56	60	72	333	282	731	1112	577
24	974	51	51	51	56	60	75	275	282	726	1254	487
25	973	51	51	51	56	60	75	252	267	742	1343	435
26	877	51	51	51	56	60	75	213	261	725	1410	401
27	964	51	51	51	56	60	75	183	261	713	1372	378
28	799	51	51	51	56	60	75	210	258	734	976	491
29	876	51	51	51		60	75	238	226	739	813	574
30	912	51	51	51		60	141	233	205	738	976	596
31	384		51	51		60		232		642	1089	
Min	345	51	51	51	56	60	65	124	205	189	540	378
Max	974	51	51	51	56	60	141	333	313	799	1410	1358
Mean	643	51	51	51	56	60	69	181	267	459	948	861
ac-ft	39495	3055	3155	3152	3094	3679	4122	11080	15839	28168	58186	51156

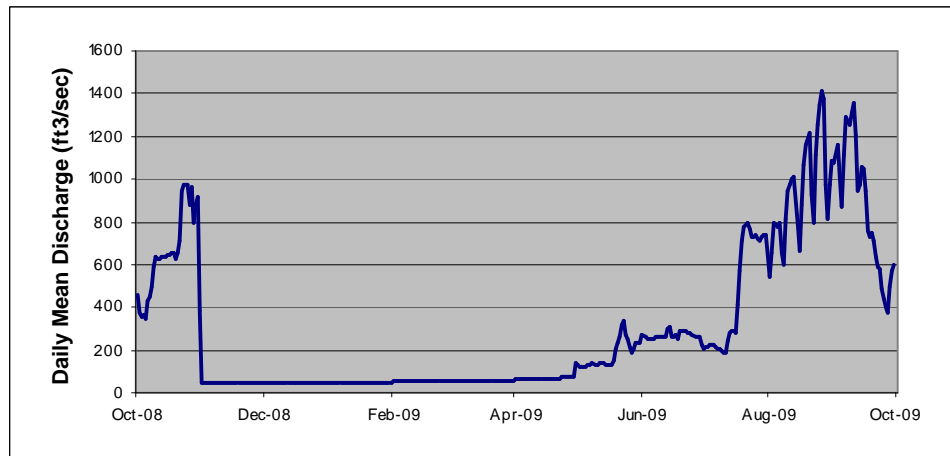


TABLE 1

WESTERN DIVISION – PICK-SLOAN MISSOURI BASIN PROGRAM  
PERTINENT RESERVOIR DATA

(Data in Acre-feet)					
Reservoir	Dead Storage 1/	Active Storage 2/	Total Storage	Normal Minimum Storage	Limitation on normal minimum storage
Green Mountain	6,860	146,779	153,639	47,684	Minimum elevation for rated power output
Willow Creek	1,486	9,779	10,553	6,675	Elevation of pump canal head-works
Lake Granby	74,190	465,568	539,758	74,190	Lowest outlet elevation
Shadow Mountain	506	16,848	17,354	16,026	Minimum permissible Grand Lake elevation; 8,366 ft.
Grand Lake	3/	511	1,015	504	Legislation limits fluctuation
Marys Lake	42	885	927	308	Minimum elevation for power generation
Lake Estes	409	2,659	3,068	740	Minimum elevation to release 550 ft <sup>3</sup> /s
Pinewood Lake	416	1,765	2,181	613	Minimum elevation for power generation
Flatiron	125	635	760	324	Minimum elevation to release 550 ft <sup>3</sup> /s
Carter Lake	3,306	108,924	112,230	306	Lowest outlet elevation
Horsetooth	7,003	149,732	156,735	17,600	Elevation on highest delivery works
Total	94,343	903,373	998,220	167,970	

1/ Storage capacity below elevation of lowest outlet

2/ Total storage minus dead storage

3/ Not determined

TABLE 2

**COLORADO-BIG THOMPSON PROJECT**

WATER YEAR 2009	MONTHLY SUMMARY OF BLUE RIVER OPERATIONS												TOTAL	
	INI	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG		SEP
UNDEPLETED RUNOFF ABOVE GREEN MTN. RESERVOIR		15,200	12,300	11,200	10,800	9,200	12,650	22,650	114,100	145,700	78,100	33,100	20,100	485,100
UNDEPLETED RUNOFF ABOVE DILLON RES.		7,100	6,600	6,000	6,000	5,200	6,700	10,600	68,400	86,400	41,300	16,700	10,200	271,200
PERCENT OF TOTAL UN- DEPLETED RUNOFF ORI- GINATING ABOVE DILLON		0.467	0.537	0.536	0.556	0.565	0.530	0.468	0.599	0.593	0.529	0.505	0.507	0.559
DEPLETIONS BY 1929 COLORADO SPRINGS RIGHT		0	0	0	0	0	0	23	376	500	82	49	0	1030
DEPLETIONS BY 1948 COLORADO SPRINGS RIGHT		-1789	-305	0	0	0	0	116	3586	4057	1067	694	0	7426
INFLOW TO DILLON		8,900	6,900	6,000	6,000	5,150	6,600	10,450	64,400	81,850	40,100	15,900	10,200	262,450
DILLON STORAGE (1000 AF)	252.1	245.5	238.7	233.7	229.2	225.0	222.8	225.8	260.1	259.4	256.6	248.2	242.9	
ROBERTS TUNNEL DIVERSIONS		7,400	6,550	4,500	4,300	3,900	4,300	2,000	4,400	0	2,800	9,300	8,500	57,950
DILLON OUTFLOW TO THE RIVER		6,900	6,200	6,400	6,300	5,500	4,400	5,400	25,200	81,700	39,100	13,700	5,900	206,700
TOTAL DEPLETIONS BY DENVER		2,000	700	-500	-200	-300	2,200	5,000	38,800	100	1,000	2,200	4,300	55,300
RUNOFF ORIGINATING BETWEEN DILLON AND														
GREEN MTN RESERVOIR		8,200	5,800	5,400	4,800	4,100	6,100	12,200	46,700	60,500	37,500	16,700	10,100	218,100
ACTUAL INFLOW TO GREEN MTN RESERVOIR		14,900	11,900	11,700	11,000	9,500	10,500	17,500	71,300	141,100	75,950	30,200	15,800	421,350
GREEN MTN RESERVOIR STORAGE (1000 AF)	109.5	75.6	72.6	69.0	65.3	62.0	63.3	72.3	115.7	151.9	152.8	136.3	106.6	
TOTAL GREEN MTN OUTFLOW		48,500	14,900	15,300	14,800	12,800	9,100	8,300	27,300	104,000	74,100	45,800	44,900	419,800

PICK-SLOAN MISSOURI BASIN PROGRAM  
WESTERN DIVISION WATER AND POWER SYSTEM  
COLORADO-BIG THOMPSON PROJECT

2009 ACTUAL OPERATIONS

	WATER IN 1000 ACRE-FEET				ENERGY IN GWH								
	INITIAL OR TOTAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
GREEN MOUNTAIN RESERVOIR													
Depleted Watershed Inflow	421.4	14.9	11.9	11.7	11.0	9.5	11.5	17.5	71.3	141.1	76.0	30.2	15.8
Turbine Release	384.7	48.5	14.9	15.3	14.8	12.8	9.1	8.2	25.9	79.3	65.2	45.8	44.9
Bypass	35.1	0.0	0.0	0.0	0.0	0.0	0.0	0.06	1.4	24.7	8.9	0.0	0.0
Spill	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 of Month Content	109.5	75.6	72.6	69.0	65.3	62.0	63.3	72.3	115.7	151.9	152.8	136.3	106.6
Kwh/AF		179.4	140.9	150.3	141.9	132.8	98.9	109.8	185.3	214.4	211.7	187.8	191.5
Generation	71.5	8.7	2.1	2.3	2.1	1.7	0.9	0.9	4.8	17.0	13.8	8.6	8.6
WILLOW CREEK RESERVOIR													
Inflow	71.8	1.3	1.3	1.1	1.0	0.9	1.6	8.0	33.4	15.2	4.9	1.8	1.3
Release to River	13.0	1.5	0.9	0.4	0.4	0.4	0.4	0.4	5.8	1.5	0.6	0.3	0.4
Pumped to Granby	54.2	0.0	0.0	0.0	0.0	0.0	0.0	8.4	25.7	14.2	3.9	0.9	1.1
End of Month Content	6.2	5.9	6.3	7.0	7.6	8.1	9.2	8.2	9.7	8.9	9.0	9.3	8.9
Pump Energy	11.5	0.0	0.0	0.0	0.0	0.0	0.0	1.7	5.6	3.0	0.8	0.2	0.2
GRANBY - SHADOW MOUNTAIN - GRAND LAKE													
Natural Watershed Inflow	280.96	5.8	3.6	4.06	4.6	3.2	5.2	16.7	81.4	100.8	39.3	10.7	5.6
Total Inflow into Granby	317.9	5.3	3.8	4.8	3.5	2.6	4.9	19.2	108.0	118.3	32.0	8.6	6.9
Granby Fish Release	27.9	1.3	1.3	1.3	1.3	1.2	1.3	1.2	4.2	4.1	4.9	1.9	3.9
Granby Seepage	4.1	0.4	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.3	0.6	0.6	0.5
Granby Spill	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
Adams Tunnel	242.6	30.3	2.0	25.6	29.5	24.4	27.7	22.9	16.0	5.4	17.1	10.6	31.1
Granby End of Month content	408.3	380.2	380.0	356.8	330.3	307.7	283.2	283.8	384.0	495.3	511.7	506.3	474.8
SM-GL End of Month Content	17.8	17.8	17.7	17.8	17.7	17.7	17.8	17.7	17.5	17.4	17.6	17.7	17.7
Pumped from Granby	203.2	30.2	2.1	26.4	28.4	23.8	27.5	16.4	1.2	0.0	6.8	8.5	31.8
Granby Pump Kwh/AF		152.3	142.9	159.1	169.0	168.1	167.3	170.7	166.7	0.0	132.4	141.2	144.6
Granby Pump Energy	32.2	4.6	0.3	4.2	4.8	4.0	4.6	2.8	0.2	0.0	0.9	1.2	4.6



**TABLE 3**  
**PAGE 2 OF 3**

PICK-SLOAN MISSOURI BASIN PROGRAM  
WESTERN DIVISION WATER AND POWER SYSTEM  
COLORADO-BIG THOMPSON PROJECT

2009 ACTUAL OPERATIONS

WATER IN 1000 ACRE-FEET

\*\*\*    \*\*\*    \*\*\*    \*\*\*    \*\*\*

ENERGY IN GWH

INITIAL OR TOTAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
<b>MARYS LAKE – ESTES – FLATIRON</b>													
Adams Tunnel Water	242.6	30.3	2.0	25.6	29.5	24.4	27.7	22.9	16.0	5.4	17.1	10.6	31.1
Marys Lake Generation	40.0	5.4	0.0	1.8	5.4	4.4	5.1	4.1	2.8	9.7	2.9	1.7	5.7
Estes Generation	109.0	13.4	0.8	11.2	13.2	11.4	13.2	10.3	7.1	2.2	7.6	4.4	14.2
Divertible Big-Thompson	49.8	0.1	0.1	0.0	0.0	0.0	0.0	1.1	13.7	23.5	11.3	0.0	0.0
Diverted Big-Thompson Water	45.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	22.0	11.2	0.2	0.0
Olympus Tunnel	272.1	21.9	0.0	24.6	29.6	24.2	27.7	22.4	28.0	28.1	28.3	10.5	26.8
Pole Hill Generation	188.1	15.7	0.0	10.0	21.5	17.5	20.2	15.7	20.5	20.7	20.4	6.5	19.4
Flatiron 1 & 2 Generation	235.7	17.7	0.4	18.9	24.8	22.3	25.8	20.5	25.9	24.3	22.7	7.5	24.9
Flatiron 3 Turbine Release	3.4	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Flatiron 3 Kwh/AF Gen.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	0.0
Flatiron 3 Generation	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Flatiron 3 Pumping	95.3	7.1	0.0	17.1	20.5	16.1	9.6	10.7	0.0	0.0	0.0	0.0	14.2
Flatiron 3 Kwh/AF Pump		295.8	0.0	292.4	312.2	335.4	354.2	364.5	0.0	0.0	0.0	0.0	302.8
Flatiron 3 Pump Energy	30.5	2.1	0.0	5.0	6.4	5.4	3.4	3.9	0.0	0.0	0.0	0.0	4.3
<b>CARTER LAKE</b>													
Pumped from Flatiron	101.9	9.4	0.0	17.1	20.5	16.1	9.6	10.7	0.0	1.0	3.3	0.0	14.2
Release to Flatiron	3.4	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Irrigation Delivery	71.2	10.2	1.8	1.3	1.2	1.3	1.5	1.9	4.7	5.7	10.0	15.5	16.2
Evaporation & Seepage	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.3	0.3	0.2
End of Month Content	53.4	50.8	48.3	62.6	80.9	95.0	102.2	118.8	104.9	99.1	91.1	69.9	65.3
<b>BIG THOMPSON POWERPLANT</b>													
Diverted Dille Tunnel Water	29.5	7.9	2.3	0.7	0.0	0.0	0.0	0.9	3.4	5.8	5.0	1.3	2.2
Irrigation Delivery	38.57	11.1	0.01	0.02	0.01	0.01	0.02	0.2	1.1	3.6	2.7	7.2	12.6
Turbine Release	73.7	9.9	0.0	0.0	0.0	0.0	0.0	0.0	14.0	19.0	15.3	6.2	9.3
Generation	10.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.9	2.3	0.8	1.3
<b>HORSETOOTH RESERVOIR</b>													
Hansen Feeder Canal Inflow	114.8	9.7	3.2	7.4	8.6	8.3	18.4	12.2	16.3	8.7	12.1	5.5	4.5
Irrigation Delivery	94.0	17.0	0.4	1.2	1.2	1.0	1.2	1.5	3.8	2.7	13.9	31.3	18.8
Evaporation	3.1	0.3	0.2	0.0	0.0	0.0	0.0	0.1	0.5	0.4	0.6	0.6	0.4
End of Month Content	80.0	71.5	73.5	79.0	85.8	92.2	108.3	119.2	130.7	136.5	132.2	102.4	85.3
<b>TOTAL CBT DELIVERY</b>	<b>203.8</b>	<b>38.3</b>	<b>2.2</b>	<b>2.5</b>	<b>2.4</b>	<b>2.3</b>	<b>2.7</b>	<b>3.6</b>	<b>9.6</b>	<b>12.0</b>	<b>26.6</b>	<b>54.0</b>	<b>47.6</b>

**TABLE 3**  
**PAGE 3 OF 3**

PICK-SLOAN MISSOURI BASIN PROGRAM  
WESTERN DIVISION WATER AND POWER SYSTEM  
COLORADO-BIG THOMPSON PROJECT

2009 ACTUAL OPERATIONS

WATER IN 1000 ACRE-FEET

\*\*\*      \*\*\*      \*\*\*      \*\*\*      \*\*\*

ENERGY IN GWH

	INITIAL OR TOTAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
<b>BASE GENERATION</b>													
Green Mountain	71.5	8.7	2.1	2.3	2.1	1.7	0.9	0.9	4.8	17.0	13.8	8.6	8.6
Flatiron 3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Big Thompson	10.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.9	2.3	0.8	1.3
TOTAL	82.9	10.1	2.1	2.3	2.1	1.7	0.9	0.9	6.9	19.9	16.1	10.0	9.9
<b>LOAD FOLLOWING GENERATION</b>													
Marys Lake	40.0	5.4	0.0	1.8	5.4	4.4	5.1	4.1	2.8	0.7	2.9	1.7	5.7
Estes	109.0	13.4	0.8	11.2	13.2	11.4	13.2	10.3	7.1	2.2	7.6	4.4	14.2
Pole Hill	188.1	15.7	0.0	10.0	21.5	17.5	20.2	15.7	20.5	20.7	20.4	6.5	19.4
Flatiron 1 & 2	235.7	17.7	0.4	18.9	24.8	22.3	25.8	20.5	25.9	24.3	22.7	7.5	24.9
TOTAL	572.8	52.2	1.2	41.9	64.9	55.6	64.3	50.6	56.3	47.9	53.6	20.1	64.2
<b>PUMP ENERGY</b>													
Willow Creek	11.5	0.0	0.0	0.0	0.0	0.0	0.0	1.7	5.6	3.0	0.8	0.2	0.2
Granby	32.2	4.6	0.3	4.2	4.8	4.0	4.6	2.8	0.2	0.0	0.9	1.2	4.6
Flatiron 3	30.5	2.1	0.0	5.0	6.4	5.4	3.4	3.9	0.0	0.0	0.0	0.0	4.3
TOTAL	74.2	6.7	0.3	9.2	11.2	9.4	8.0	8.4	5.8	3.0	1.7	1.4	9.1
TOTAL GENERATION	655.7	62.3	3.3	44.2	67.0	57.3	65.2	51.5	63.2	67.8	69.7	30.1	74.1
TOTAL GENERATION MINUS PUMP	581.5	55.6	3.0	35.0	55.8	47.9	57.2	43.1	57.4	64.8	68.0	28.7	65.0

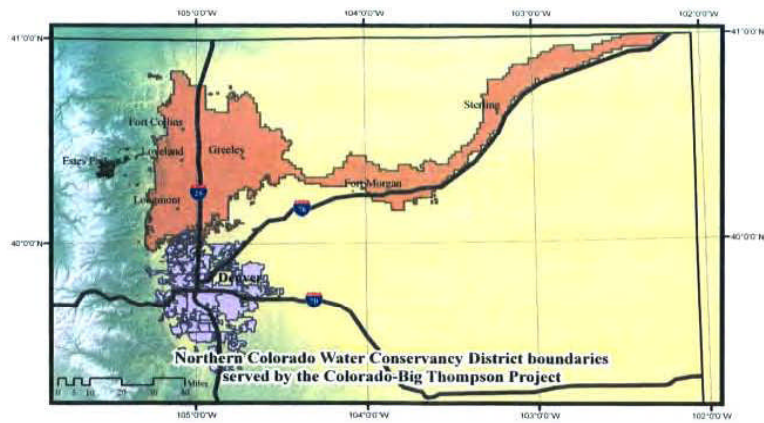
**TABLE 4**

**COLORADO-BIG THOMPSON PROJECT**  
**FLOOD DAMAGE PREVENTED IN WATER YEAR 2009**

	Cumulative Total Prior to WY 2009	WY 2009	Cumulative Total Current
Granby, Willow Creek, Shadow Mountain and Grand Lake	\$296,200	\$0.00	\$296,200
Green Mountain	\$106,100	\$10,500.00	\$116,600
Total	\$402,300	\$10,500.00	\$412,800

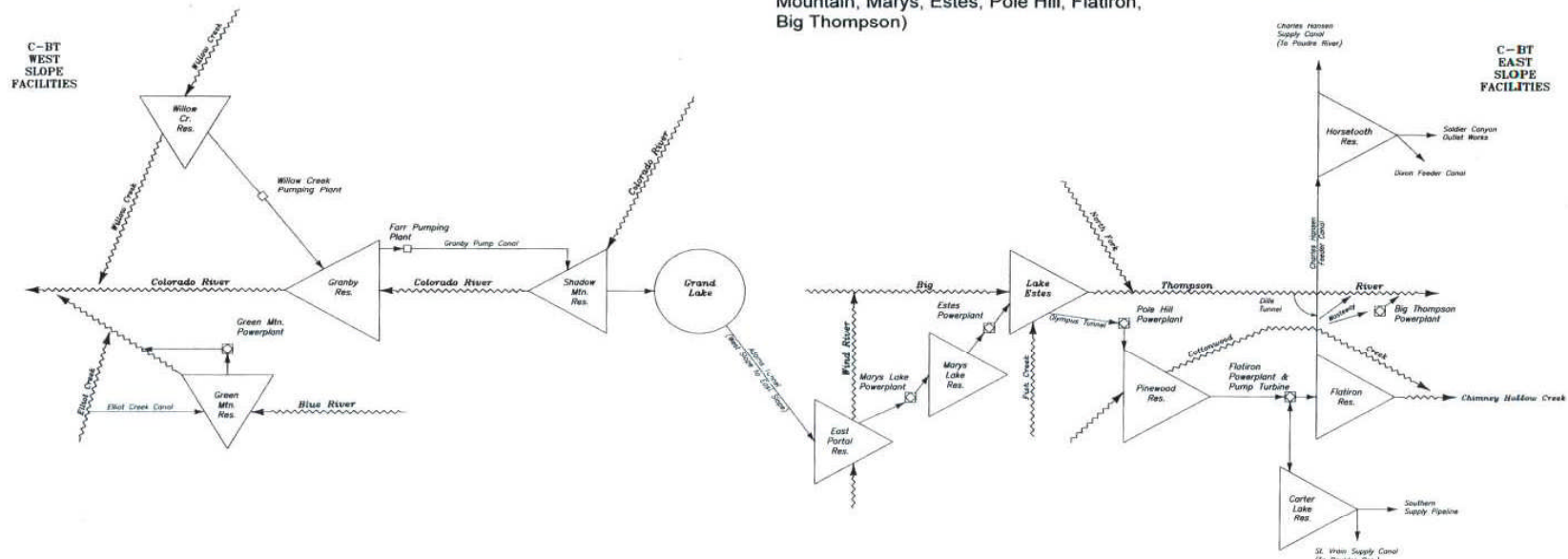


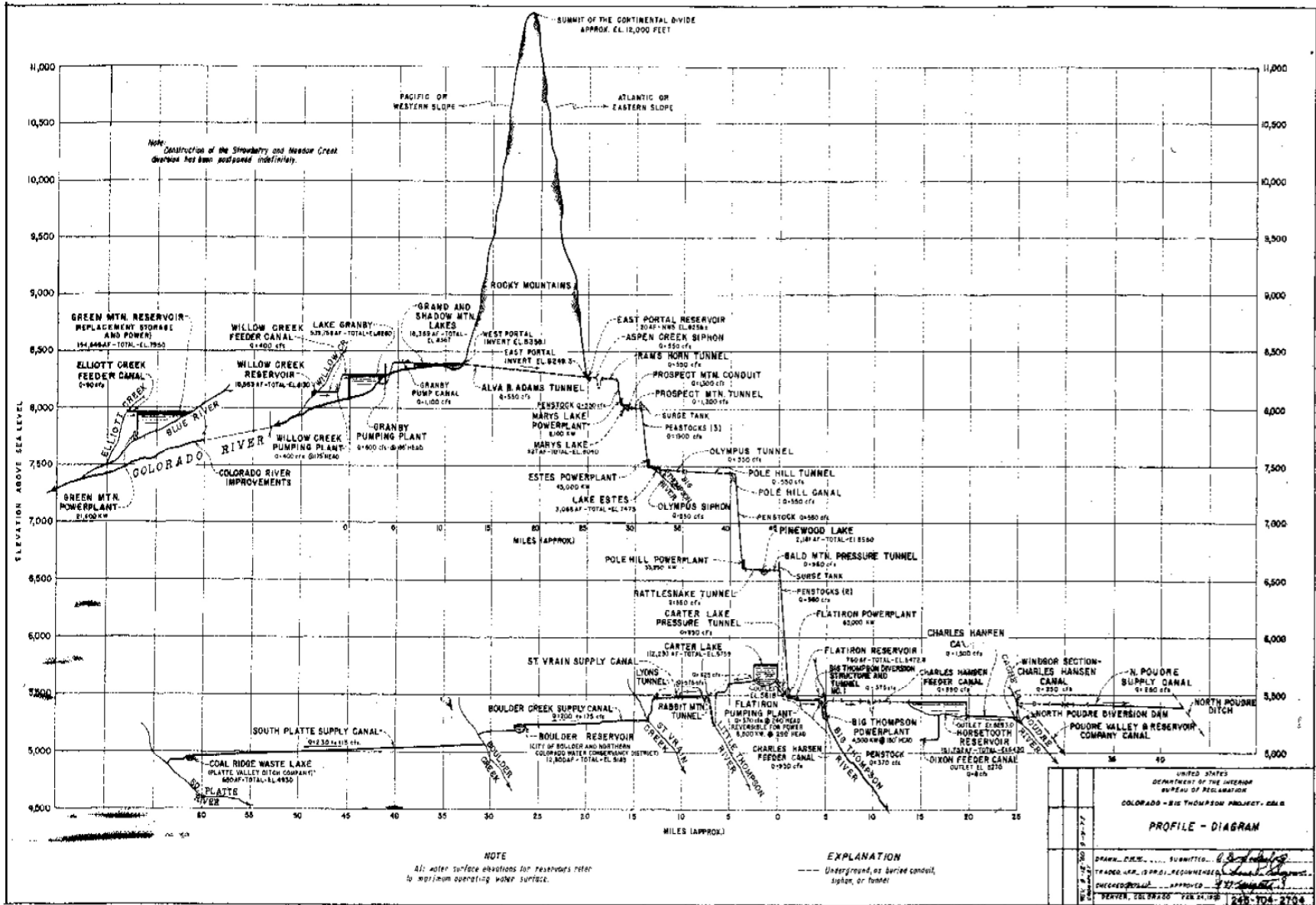




## Colorado-Big Thompson Facts

- A trans-mountain, trans-basin water diversion, storage, and delivery project
- Signed into law by President Roosevelt in 1937
- Construction period: 1938-1952
- Ten major reservoirs (Green Mountain, Willow Creek, Granby, Shadow Mountain, Marys Lake, Estes, Pinewood, Carter, Flatiron and Horsetooth)
- Twenty major dams and dikes
- Twenty-two tunnels, canals and other conduits covering about 130 miles
- Six hydroelectric powerplants (Green Mountain, Marys, Estes, Pole Hill, Flatiron, Big Thompson)
- Water right allows for diversion of up to 310,000 acre-feet of water a year
- Average annual diversion over life of project is 260,000 acre-feet
- Water falls over 2000 feet from Continental Divide to Colorado's eastern Plains, providing for hydroelectric power generation.
- Together, all six powerplants generate approximately 759 million kilo-Watt hours of electricity a year—enough to power 58,300 American homes for a year.
- The C-BT provides water to 29 cities and towns, including 620,000 irrigated acres and a population of 725,000 people





## **WESTERN DIVISION POWER SYSTEM WATER YEAR 2009 – GENERATION AND PUMP ENERGY SUMMARY**

The total hydropower generation produced by Colorado-Big Thompson Project (C-BT) powerplants during water year 2009 was 109 percent of average. The Western Division Power System's (System) gross power generation for the water year was 2656.0 giga-watt hours (GWh) or 100 percent of average. The System's total generation (gross generation minus the energy used for pumping at Farr Plant, Willow Creek Pump, Flatiron Unit #3 and Mount Elbert's) was 2300.2 GWh.

Total generation is the gross generation less the energy used for pumping; gross generation also includes one-half of the Yellowtail generation. The total System load includes firm energy deliveries, C-BT use energy, support energy, plant station service, and an estimate of transmission system losses. The Western Division Power System boundaries are illustrated in Exhibit 1. Table 1 in this section includes the total generation for every powerplant in the system. Table 3 shows monthly generation and pumping energy, by plant, as well as monthly System loads for the water year. The total energy that was required to operate the pumps in the System is included in Table 2. The numbers included in this section were provided by Western Area Power Administration (WAPA).

Inflow for the C-BT collection system over the west slope was high during the spring and summer of WY 2009, especially for Green Mountain Reservoir. The snowpack recorded was not as high as the previous year but it was sufficiently high to fill almost every reservoir in the C-BT. Diversions through the Adams Tunnel were high during the winter and early spring in order to fill Carter Lake and Horsetooth Reservoir. The system was limited to 460 ft<sup>3</sup>/sec due to the outage of Flatiron Powerplant's Unit #1 therefore diversions were kept at or below that flow rate. That is 90 ft<sup>3</sup>/sec short of the C-BT's maximum capacity. But the high flows kept the powerplants in the system operating uninterrupted during those months. Pumping at the Willow Creek Canal, the Farr Plant, and the Flatiron Powerplant was high as the C-BT continued diverting water from the west from December through late May. The energy used at those three plants to pump C-BT water during water year 2009 totaled 74.7 GWh. That represents 118 percent of the 30-year average. The total energy used from the System to pump water during water year 2009 totaled (including Mount Elbert) 355.8 GWh or 145 percent of average. Mount Elbert's total energy used to pump water was 281.6 GWh. The average energy used according to the 10-year average is 182.1 GWh.

The Western Area Power Administration's in Loveland Area Office sold 2,942,729 mega-watt hours (MWh) of power during water year 2009 for a total of \$90,724,758 (numbers provided by WAPA). Energy deficits were covered by a combination of scheduled interchange energy, use of the Mount Elbert pumped storage plant, and power purchases. The Western Area Power Administration's Loveland Area Office power purchases totaled 674,359 MWh during water year 2009 for which they paid a total of \$47,652,000 (numbers provided by WAPA).

TABLE 1

**WESTERN DIVISION SYSTEM  
GROSS GENERATION - WATER YEAR 2009**  
(Energy in GWh)

Powerplant	Accumulated Gross Generation <u>1/</u>		
	WY 2009	Yearly Avg. <u>2/</u>	Percent of Avg.
Green Mountain	71.5	51.9	138
Marys Lake	40.0	37.3	107
Estes	109.0	100.3	109
Pole Hill	188.1	172.3	109
Flatiron 1 & 2	235.7	226.7	104
Big Thompson	10.8	10.9	99
Seminole	161.7	132.5	122
Kortes	171.1	140.3	122
Fremont Canyon	171.2	239.6	71
Alcova	83.6	118.1	71
Glendo	69.1	80.3	86
Guernsey	15.1	19.4	78
Boysen	67.6	69.3	98
Heart Mountain	18.7	15.2 <u>3/</u>	123
Buffalo Bill	84.4	69.4 <u>3/</u>	122
Shoshone	22.5	20.4 <u>3/</u>	110
Spirit Mountain	16.7	14.0 <u>3/</u>	119
Mt. Elbert	233.4	169.0 <u>4/</u>	138
Yellowtail <sup>4/</sup>	885.8	959.0 <u>5/</u>	92
Total	2656.0	2645.9	100

1/ October-September

2/ 1976-2005 average

3/ 1995-2005 average

4/ 1990-1999 average

5/ 1971-1990 average; one-half of the Yellowtail energy is dedicated to the Western Division System through marketing arrangement. The other half is marketed through the Eastern Division System.



**TABLE 2**

**WESTERN DIVISION SYSTEM  
PUMP ENERGY-WATER YEAR 2009**

Pumping Plant	October-September Pump Energy		
	WY 2009 (GWh)	Avg. <u>1</u> / (GWh)	Percent of Avg.
Willow Greek	11.5	5.7	202
Granby (Farr Plant)	32.2	30.6	105
Flatiron Unit #3	30.5	26.8	114
Mt. Elbert	281.6	182.1 <u>2</u> /	155
Total	355.8	245.2	145

1/ 1976-2005 average

2/ 1990-1999 average

TABLE 3

**PICK-SLOAN MISSOURI BASIN PROGRAM WESTERN DIVISION POWER SYSTEM  
WATER YEAR 2009 OPERATIONS  
GROSS GENERATION LESS PUMPING IN GIGAWATT-HOURS**

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Mt. Elbert *	0.0	0.0	1.9	7.2	6.1	7.3	7.1	6.3	6.4	4.1	0.4	0.2	46.9
Green Mtn.	8.7	2.1	2.3	2.1	1.7	0.9	0.9	4.8	17.0	13.8	8.6	8.6	71.5
Willow Cr. pump	0.0	0.0	0.0	0.0	0.0	0.0	1.7	5.6	3.0	0.8	0.2	0.2	11.5
Farr pump	4.6	0.3	4.2	4.8	4.0	4.6	2.8	0.2	0.0	0.9	1.2	4.6	32.2
Marys Lake	5.4	0.0	1.8	5.4	4.4	5.1	4.1	2.8	0.7	2.9	1.7	5.7	40.0
Estes	13.4	0.8	11.2	13.2	11.4	13.2	10.3	7.1	2.2	7.6	4.4	14.2	109.0
Pole Hill	15.7	0.0	10.0	21.5	17.5	20.2	15.7	20.5	20.7	20.4	6.5	19.4	188.1
Flatiron 1&2	17.7	0.4	18.9	24.8	22.3	25.8	20.5	25.9	24.3	22.7	7.5	24.9	235.7
Flatiron 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6
Flatiron 3 pump	2.1	0.0	5.0	6.4	5.4	3.4	3.9	0.0	0.0	0.0	0.0	4.3	30.5
Big Thompson	1.4	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.9	2.3	0.8	1.3	10.8
Seminole	4.7	4.5	4.3	4.3	4.0	4.2	15.1	22.9	29.7	26.6	24.7	16.7	161.7
Kortes	5.4	5.3	5.4	5.4	4.7	5.1	17.3	26.1	27.1	24.8	26.2	18.3	171.1
Fremont Canyon	0.3	5.5	6.1	5.8	5.2	7.0	30.3	22.1	26.6	24.9	23.8	13.6	171.2
Alcova	2.9	2.7	2.9	3.0	2.7	3.5	13.2	10.9	13.5	11.6	10.9	5.8	83.6
Glendo	0.0	0.0	0.0	0.0	0.0	0.0	1.2	17.2	2.6	22.4	20.2	5.5	69.1
Guernsey	0.0	0.0	0.0	0.0	0.0	0.0	1.2	4.3	1.4	1.9	4.3	2.0	15.1
Pilot Butte **	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
Boysen	3.5	3.6	3.9	3.9	3.3	3.9	3.1	9.4	10.9	9.5	7.4	5.2	67.6
Shoshone	2.0	1.9	2.0	2.0	0.5	1.3	2.0	2.0	2.2	2.3	2.3	2.0	22.5
Buffalo Bill	4.8	3.4	2.4	2.5	3.2	3.0	7.1	13.2	12.9	13.2	10.9	7.8	84.4
Spirit Mtn.	0.7	0.0	0.0	0.0	0.0	0.0	0.6	2.5	3.2	3.2	3.4	3.1	16.7
Diamond Cr. pump	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
Heart Mtn.	0.8	0.0	0.0	0.0	0.0	0.0	1.1	3.5	3.4	3.5	3.2	3.2	18.7
Yellowtail/2	30.6	26.2	25.8	26.3	21.9	22.5	29.7	43.7	78.1	70.8	34.1	33.6	442.9
Fry-Ark	0.0	0.0	1.9	7.2	6.1	7.3	7.1	6.3	6.4	4.1	0.4	0.2	46.9
CBT	55.6	3.0	35.0	55.8	47.9	57.2	43.1	57.4	64.8	68.0	28.7	65.0	581.5
North Platte	13.3	18.0	18.7	18.5	16.6	19.8	78.3	103.5	100.9	112.2	110.1	61.9	671.8
Bighorn	42.4	35.1	34.1	34.7	28.9	30.7	43.6	74.3	110.7	102.5	61.3	54.9	652.8
TOTAL GEN	111.3	56.1	89.6	116.1	99.5	115.0	172.1	241.4	282.7	286.7	200.4	182.0	1953.0
TOTAL LOAD	162.5	162.3	177.2	172.6	137.1	149.2	176.3	184.8	211.2	262.2	211.2	156.8	2163.4
SURPLUS/DEFICIT	-51.2	-106.3	-87.6	-56.5	-37.6	-34.2	-4.2	56.6	71.5	24.5	-10.8	25.2	-210.4

TABLE 6

## WESTERN DIVISION - PICK-SLOAN MISSOURI BASIN PROGRAM

POWERPLANT DATA

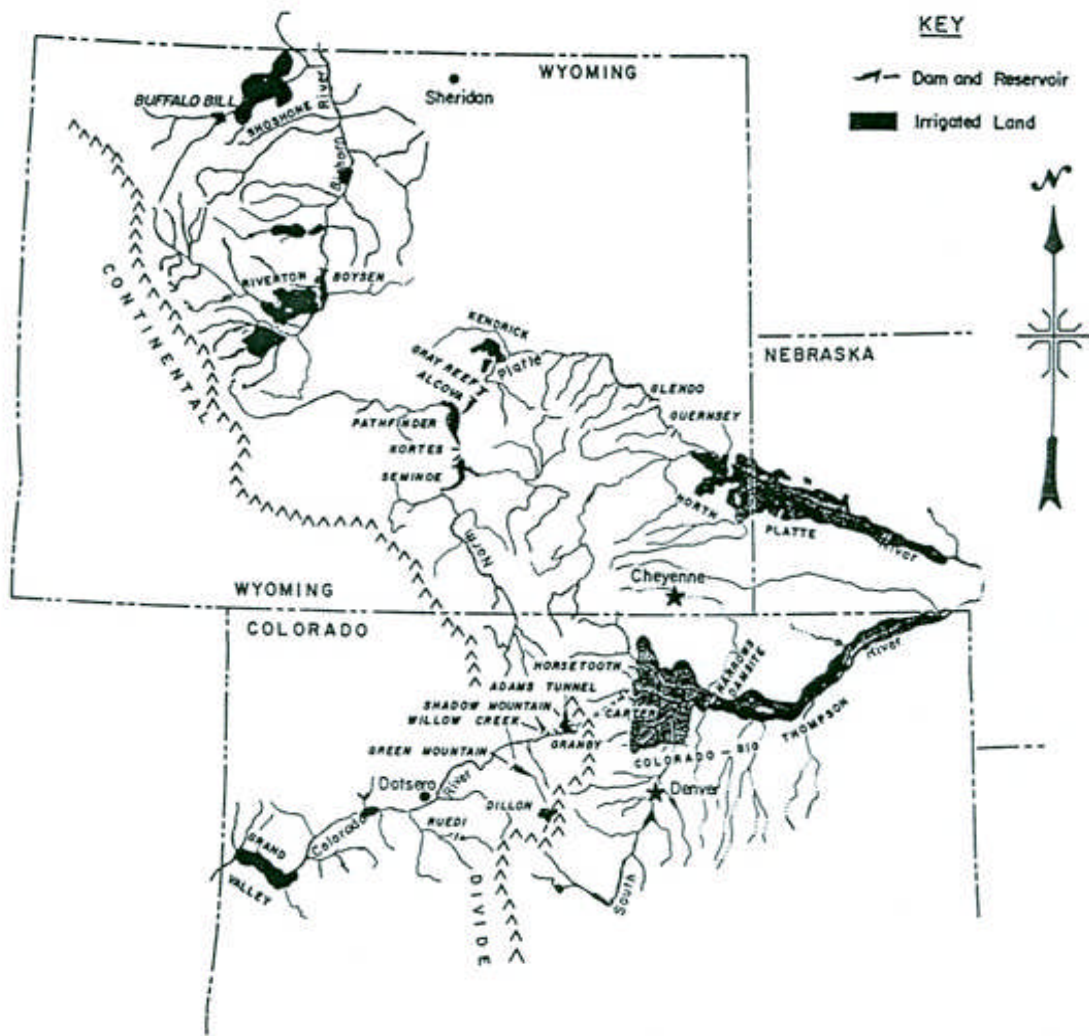
Facility	No. Units	Capacity Each Unit	Total Installed Capacity	Normal Operating Head (ft)	Output at Rated Head (ft <sup>3</sup> /s)
Green Mountain	2	13,000	26,000	192-262	1,660
Marys Lake	1	8,100	8,100	202-217	550
Estes	3	16,500	49,500	551-571	1,300
Pole Hill	1	33,250	33,250	830-838	550
Flatiron	2	43,000	86,000	1,096 - 1,118	1,070
(Flatiron <u>1</u> /)	1	8,500	8,500	158-287	440
Big Thompson	1	5,300	5,300	183- 184	350
Seminole	3	15,000	45,000	97-227	2,850
Kortes	3	12,000	36,000	192-204	2,700
Fremont Canyon	2	33,000	66,000	247-363	2,200
Alcova	2	18,000	36,000	153-165	2,200
Glendo	2	19,000	38,000	73-156	2,800
Guernsey	2	2,400	4,800	89-91	820
Pilot Butte <sup>2</sup> /	2	800	1,600	---	---
Boysen	2	7,500	15,000	72-112	2,415
Shoshone <sup>3</sup> /	1	3,000	3,000	---	---
Buffalo Bill <sup>3</sup> /	3	6,000	18,000	---	---
Heart Mountain	1	5,000	5,000	265-275	355
Mt. Elbert	2	103,000	206,000	447-477	6,400
Yellowtail	4	72,000	288,000	327-440	8,500
TOTAL	34	-----	979,050	-----	-----

**TABLE 7**

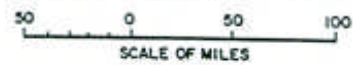
**WESTERN DIVISION - PICK-SLOAN MISSOURI BASIN PROGRAM**

**PUMPING PLANT DATA**

Facilities	<u>Pumping Units</u>		<u>Plant Rating</u>		Kwh to Pump 1-Acre-ft at Maximum Head
	No	Capacity (ft <sup>3</sup> /s)	Normal Operating Head (ft)	Installed (Hp)	
Granby	3	600	92-186	18,000	227
Willow Creek	2	400	167-169	18,000	227
Flatiron	11/	440	173-287	13,000	391
Mt. Elbert	2	5,690	447-477	340,000	620



PICK-SLOAN MISSOURI BASIN PROJECT  
**WESTERN DIVISION**  
WATER RESOURCE MAP



MAP NO. X-700-121  
JUNE 1, 1976

### LAP GROSS GENERATION LESS PUMPING WATER YEAR 2009

