

RUSH CREEK HYDROELECTRIC SYSTEM, RUSH MEADOW DAM
(Rush Creek Meadows Dam)
(Waugh Dam)

HAER CA-166-H
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June Lake vicinity
Mono County
California

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
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Rush Creek Hydroelectric System, Rush Meadow Dam HAER No. CA-166-H

(Rush Creek Meadows Dam) , (Waugh Dam)

Location: The Rush Meadow Dam is located approximately 6.0 air miles southeast of the approximate center of the town of June Lake in Mono County, California, and approximately 3.4 air miles southeast of the Rush Creek Powerhouse, which is situated on the west side of California State Route 158 (the June Lake Loop). The dam is located in the Ansel Adams Wilderness in the Inyo National Forest. From the Rush Creek Powerhouse, the dam site is accessible by incline railroads, the Agnew Tram and the Gem Tram, and by boat across Agnew Lake and Gem Lake, controlled by Southern California Edison Company. Public access to the dam site from the highway is provided by a foot/equestrian trail. There is no automobile access to the site.

The approximate center of the crest of the Rush Meadow Dam is located at UTM Zone 11S, easting 307789.00m, northing 4180431.00m. Distances and coordinates were obtained on November 6, 2012, by plotting location using Google Earth. The coordinate datum is World Geodetic System 1984.

Significance: The Rush Meadow Dam, constructed in 1918 and 1924-1925, is a contributing element of the Rush Creek Hydroelectric System historic district. It is significant for its position in the development of hydroelectric generation on the eastern slope of the Sierra Nevada. The district is significant under National Register of Historic Places Criterion A (broad patterns of history) and Criterion C (distinctive characteristics of period and type of engineering and construction that represent the work of a master). The Period of Significance for the district is 1915-1925.¹

Description: The Rush Meadow Dam is a concrete radial-arch structure. The crest is 463.0' long and located at 9,418.6' in elevation. The radius of the outside of the arch is 165'. The dam is 50' high at its tallest point over the incised streambed, and 11.4' thick at its base. The upstream side of the dam is vertical, while the downstream side is stepped. The first eight steps are each 5' high and 2.2' deep, while the top step, which comprises the crest, is 10' tall and 2.5' thick. The north end of the dam abuts the rocky canyon wall; the south end is buttressed.²

¹ James C. Williams and Roger A. Hicks, Evaluation of the Historic Resources of the Lee Vining (FERC Project Number 1388) and Rush Creek (FERC Project Number 1389) Hydroelectric System, Mono County, California (Fair Oaks, California: Theodoratus Cultural Research, Inc., 1989), A-76.

² Southern California Edison Company, Rush Creek Meadows Dam (1988), Southern California Edison Company database (SCE Drawing No. 5204740-0).

The south end of the dam tangentially adjoins a wing wall with a vertical upstream side and a 0.4:1 slope on the downstream side. The wing wall contains the spillway, which is a wide notch 55' wide and 3' lower than the crest, at an elevation of 9,415.61'.³ Metal pipe handrails are installed along a runway atop the crest of the dam. A geomembrane layer covers the upstream face of the dam.

The concrete inlet chamber is located off-center at the base of the upstream side of the dam. The upstream face of the inlet chamber is tilted at a 1:1 slope and contains a pair of 6' wide metal screens. Behind the screens, two slide gates installed in the dam face control the flow of water into steel outlet pipes located at 9,368.6' in elevation. The north outlet is a 29³/₈" inside-diameter (i.d.) square steel pipe. The south outlet is a 29³/₈" i.d. square steel pipe, which transitions to a 27⁵/₈" i.d. pipe, which telescopes to a 29¹/₈" round steel pipe. On the downstream side, both outlet pipes discharge into the streambed from their points of termination at the lowest step of the dam.⁴

The Rush Meadow Dam spans the upper reach of Rush Creek canyon. The dam is aligned along a generally north-south axis. It impounds Waugh Lake, a former natural alpine meadow, which is located on the west side of the dam at 9,416' in elevation. The reservoir has a storage capacity of 5,277 acre-feet.⁵ The dam maintains minimum instream flows within Rush Creek, and it replenishes Gem Lake, located downstream to the east, which is the forebay for the hydroelectric system.⁶

History:

The Nevada-California Power Company, under the control of the Nevada-California Electric Corporation, originally constructed the Rush Meadow Dam in 1918. The dam was constructed in order to increase the water storage on the Rush Creek Hydroelectric System. It was the third dam to be built in the system, in addition to the Agnew Lake Dam and the Gem Lake Dam. Company engineer R. G. Manifold used a standard single-arch design for the Rush Meadow Dam, in contrast to the controversial multiple-arch design that was

³ Southern California Edison Company, Rush Creek Meadows Dam.

⁴ Southern California Edison Company, Rush Creek Meadows Dam.

⁵ Southern California Edison Company, Southern California Edison Hydro Generation Division (Draft) (Rosemead, California: Southern California Edison Company, 1994), 15.

⁶ State Water Resources Control Board, In the Matter of Water Quality Certification for Southern California Edison Rush Meadows Dam Geomembrane Liner Installation Project (2009), 1.
http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/docs/rushmeadows/rushmeadows_cert.pdf.

used for the other dams.⁷

The Rush Meadow Dam was constructed at an elevation of 9,500', one and a half miles above the head of Gem Lake. As with the earlier dam developments on Rush Creek, transporting building materials to the Rush Meadow Dam site was difficult and expensive. It involved railroads, trucks, tractors, tramlines, boats, and mule packs. Also as occurred in the earlier dam developments, local deposits of gravel and sand were used to mix concrete. These were found in the meadow above the dam.⁸

The first phase of construction was completed in September 1918. At that time, the structure was 27.3' high and comprised of six equal steps on the downstream side. The crest was 400' long and 5.4' thick. The dam had a storage capacity of 1,081 acre-feet. In 1924, the Southern Sierras Power Company (which owned the dam at the time) undertook a second phase of development that had been planned since its original construction. That year, the dam was raised to 42.3'; and the following year the dam was raised to its current height and storage capacity.⁹ At some point during its construction, the spillway design changed from a curving inclined wall to a flat inclined wall.¹⁰

Since that time, minimal alterations to the Rush Meadow Dam have occurred as a result of maintenance and improvement projects. Deteriorated concrete was repaired in 1928, 1947, 1951, 1960, and 1966. At the intake, the manual lift gates were replaced with hydraulic lift gates in 1950. The outlet pipes were replaced in 1954, and 12' of outlet pipe were removed after a portion broke loose in 1984.¹¹ In 1966, ten post-tension anchors were installed in a 28' span at the south end of the dam to provide stability. These anchors consisted of ¾" Stressteel special grade bars, drilled vertically through the top step of the dam and 12' deep into the bedrock.¹²

Between 2003 and 2005, ten new vertical anchors were installed in

⁷ Valerie H. Diamond and Roger A. Hicks, *Historic Overview of the Rush Creek and Lee Vining Creek Hydroelectric Projects* (Fair Oaks, California: Theodoratus Cultural Research, Inc., 1988), 24.

⁸ Diamond and Hicks, *Historic Overview*, 24.

⁹ Diamond and Hicks, *Historic Overview*, 24-25.

¹⁰ Nevada-California Power Company, *Rush Creek Meadows Dam* (1918, revised 1962), Southern California Edison Company database (SCE Drawing No. 435120).

¹¹ Williams and Hicks, *Evaluation*, A-76.

¹² Southern California Edison Company, *Additional Dam Reinforcement* (1965, last revised 2010), Southern California Edison Company database (SCE Drawing No. 586762-4).

the spillway wing wall. They augmented an existing framework of eight slanted anchors and three horizontal anchors in the spillway wall.¹³ The new anchor rods were installed vertically through the concrete wall in depths from approximately 4' to 22'6", and the minimum embedment depth in the bedrock below varied from 12'6" to 16'6", plus 5' to 9' of minimum bonding length at the bottoms of the anchors.¹⁴ Also at that time, spalled and loose concrete at the downstream face of the dam, adjacent to the outlet, was repaired.¹⁵

In the summer and fall of 2009, the ten original post-tension anchors at the south end of the dam, which had corroded, were replaced. Ultimately, the top 12" of the existing anchors were removed, and the remaining sections were abandoned in place and grouted over. MCS Construction of Clovis, California, installed ten new anchors at the south end of the dam. They included triple corrosion protection – grout, a plastic sleeve over the anchor rod, and the galvanized surface of the anchors – and watertight caps. The loads of the new anchors were approximately three times higher than the original anchors installed in 1966.¹⁶ The new anchors, Williams R71 type, were located 4'8" apart. The rods varied in total length between approximately 61' and 66', and they were embedded in bedrock to a minimum depth of 34'.¹⁷

As part of that project, MCS Construction also repaired deteriorated concrete at the central portion of the dam. In addition, ACE Restoration, Inc. of Fullerton, California, repaired a large diagonal crack on the downstream face, which had occurred shortly after construction and which extended approximately 85' in length above the foundation.¹⁸ Other work at that time included installation of a photovoltaic facility and antenna support at the crest of the dam.¹⁹

Also in the summer and fall of 2009, a geomembrane liner was installed on the upstream face of the dam to prevent leakage and

¹³ Southern California Edison Company, Rush Creek Meadows Dam 2003 Modifications, Spillway Modifications, Plan & Elevation (2005), Southern California Edison Company database (SCE Drawing No. 5301440-1).

¹⁴ Southern California Edison Company, Rush Creek Meadows Dam 2003 Modifications.

¹⁵ Southern California Edison Company, Rush Creek Meadows Dam 2003 Modifications.

¹⁶ John C. Stoessel et al., "Remote Rehabilitation," *Civil Engineering: The Magazine of the American Society of Civil Engineers* 81 (2011): 63-64.

¹⁷ Southern California Edison Company, Rush Meadows Dam 2009 Anchor Installation Plan and Elevation (2009, revised 2010), Southern California Edison Company database (SCE Drawing No. 5377835-2); Southern California Edison Company, Rush Meadows Dam 2009 Anchor Installation, Anchor and Walkway Details (2009), Southern California Edison Company database (SCE Drawing No. 5377836-0).

¹⁸ Stoessel et al., "Remote Rehabilitation," 64.

¹⁹ Southern California Edison Company, Additional Dam Reinforcement.

extend the life of the dam by approximately 30 years.²⁰ CARPI USA, Inc. of Roanoke, Virginia, designed and installed the geomembrane liner, a polyvinyl chloride geocomposite that provided a waterproof seal of the entire dam face.²¹

Sources:

Primary Sources:

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²⁰ State Water Resources Control Board, In the Matter of Water Quality Certification, 1.

²¹ Stoessel et al., "Remote Rehabilitation," 64.

_____. Rush Creek Meadows Dam 2004 Modifications. 2005. Southern California Edison Company database (SCE Drawing No. 5301437-0).

_____. Rush Meadows Dam 2009 Anchor Installation, Anchor and Walkway Details. 2009. Southern California Edison Company database (SCE Drawing No. 5377836-0).

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_____. Rush Meadows Reservoir. Not dated. (SCE Drawing No. 220907-1)

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Project Information:

The Historic American Engineering Record (HAER) is a long-range program that documents and interprets historically significant engineering sites and structures throughout the United States. HAER is part of Heritage Documentation Programs (Richard O'Connor, Manager), a division of the National Park Service (NPS), United States Department of the Interior. The Rush Meadow Dam recording project was undertaken by Galvin Preservation Associates Inc. (GPA) for the Southern California Edison Company (SCE) in cooperation with Justine Christianson, HAER Historian (NPS). SCE initiated the project with the intention of making a donation to NPS. Archaeologist Crystal West (SCE) oversaw the project and provided access to the site. Historian Andrea Galvin (GPA) served as project leader. Architectural Historian Matthew Weintraub (GPA) served as the project historian. James Sanderson (GPA) produced the large format photographs. The field team consisted of Andrea Galvin (GPA), James Sanderson (GPA), and Crystal West (SCE).

Researchers may also refer to:

- HAER No. CA-166-A, Rush Creek Hydroelectric System, Powerhouse Exciters (January 15, 1995)
- HAER No. CA-166-B, C, D, E, Rush Creek Hydroelectric Worker Cottages (Buildings 103, 104, 105, 108) (September 30, 1997)
- HAER No. CA-166-F, Rush Creek Hydroelectric System, Agnew Lake Dam (January 14, 2013)
- HAER No. CA-166-G, Rush Creek Hydroelectric System, Gem Lake Dam (January 14, 2013)