BISHOP CREEK HYDROELECTRIC SYSTEM, PLANT 6, POWERHOUSE NO. 6	HAER CA-145-6-B
Bishop Creek	*HAER CA-145-AB*
Bishop vicinity
Inyo County
California

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

Bishop Creek Hydroelectric System, Plant 6, Powerhouse No. 6
Bishop Creek, Bishop vicinity, Inyo County, California
HAER No. CA-145-6-B

Location: The Bishop Creek Hydroelectric Powerhouse No. 6 (Powerhouse No. 6) is located on the southeast side of California State Route 168 in Inyo County, California. From the intersection of California State Route 168 (West Line Road) and U.S. Route 395 (Three Flags Highway) in the Town of Bishop, California, Powerhouse No. 6 is located approximately 4.03 miles southwest on California State Route 168, 0.21 miles south on Plant 6 Road, and 0.06 miles southeast on a private access road.

The approximate center of Powerhouse No. 6 is located at UTM Zone 11S, easting 370443.99m, northing 4134703.92m. Distances and coordinates were obtained on January 17, 2012, by plotting location using Google Earth. The coordinate datum is World Geodetic System 1984.

Present Owner: Southern California Edison Company
P.O. Box 800
Rosemead, California 91770

Present Use: Powerhouse No. 6 is a hydroelectric power generating facility that uses impulse water wheels to generate electricity for transmission to distant customers, as it was originally designed and constructed to do. Powerhouse No. 6 is one in a chain of five similar power generating facilities located in the Bishop Creek system.

Significance: Powerhouse No. 6, a reinforced concrete industrial building constructed in 1913 by the Southern Sierras Power Company, a subsidiary of the Nevada-California Power Company, and reconstructed after it was destroyed by fire in 1938, is significant because it is one of three Utilitarian/early twentieth-century industrial powerhouses in the Bishop Creek Hydroelectric System.

The Bishop Creek Hydroelectric System Historic District is significant for its position in the expansion of hydroelectric power generation technology, its role in the development of eastern California, and its contribution to the development of long-distance power transmission and distribution. The System is significant under National Register of Historic Places criterion A (broad patterns of history) and C (distinctive characteristics of period and type of engineering and construction). The Period of Significance for the

Bishop Creek Hydroelectric System is identified as 1905-1938.

Historian: Matthew Weintraub, Senior Architectural Historian
Galvin Preservation Associates
231 California Street
El Segundo, CA 90245

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 Powerhouse No. 6 recording project was undertaken by Galvin Preservation Associates (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. As recommended by Justine Christianson (NPS), the report describes how water flows in and out of the powerhouse to produce electricity, and a vital component of the report documents changes in operating machinery that have occurred over time. 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. Jeff McCarthy, Supervisor of Operations (SCE), and Keith Inderbieten, Hydro System Operator (SCE), provided research assistance. James Sanderson produced the large format photographs. The field team consisted of Andrea Galvin (GPA), Matthew Weintraub (GPA), Crystal West (SCE), Neil Sliger (SCE), James Sanderson (photographer) and Matthew Pegler (photographer assistant).

Researchers can be directed to also see:
HAER No. CA-145-6-Bishop Creek Hydroelectric System, Plant 6.

PART I. HISTORICAL INFORMATION

A. Physical History of Building:

The physical history of Powerhouse No. 6 was determined by reviewing available original construction drawings which were limited to a general plan of the plant,[1] a powerhouse foundation plan,[2] and a generator foundation plan.[3] Also, drawings for the reconstruction of Powerhouse No. 6 following a fire and later expansion/ alterations which occurred after its original construction were reviewed.[4] These plans were retained by the power companies that successively owned and operated the plant (currently SCE). In addition, articles describing construction and operation of the powerhouse which originally appeared in the trade journals *Journal of Electricity Power and Gas*[5] and *Electrical World*[6] and reprinted by SCE were reviewed. They included a series of articles written by Charles O. Poole, who served as chief engineer of the Nevada-California Power Company. The building itself provided physical evidence of its history and development via field inspection,[7] as did historical photographs and contemporary drawings in the possession of SCE. Further information was found in previously completed HAER documentation[8] and evaluations of eligibility for listing in the National Register of Historic Places.[9] These sources provided thorough and detailed information regarding the historic design, construction, improvement and operation of the building.

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[1] SCE, "General Plan Bishop Creek Plant No. 6," October 15, 1912, first revised September 1, 1931, most recent revision April 14, 2006.

[2] SCE, "Foundation Plan Power House No. 6," September 6, 1912, revised October 31, 1938.

[3] SCE, "Generator Foundation Plan Power Plant No. 6," September 16, 1912, revised September 2, 1931 and November 28, 1939.

[4] Nevada-California Electric Corporation (NCEC), "Plans for Reconstruction of Bishop Creek Plant 6 Building After Fire of March 1938," Sheet 1 of 7, March 25, 1938, revised November 27, 1939; NCEC, "Plans for Reconstruction of Bishop Creek Plant 6 Building After Fire of March 1938," Sheet 2 of 7, March 28, 1938, revised December 15, 1939; SCE, "General Details Control Room Addition. Bishop Creek Plant No. 6," September 12, 2005, revised April 14, 2006.

[5] Rudolph W. Van Norden, "System of Nevada-California Power Company and the Southern Sierras Power Company. Part 1 – Power Plants," *Properties and Power Developments of the Nevada-California Power Company and the Southern Sierras Power Company*. Reprinted from the *Journal of Electricity Power and Gas*, Volume XXXI, Numbers 1-2, July 5-12, 1913, p. 1-20.

[6] C. O. Poole, "Power house and equipment of station No. 6 of the Nevada-California Power Company – All water leaving station used for irrigation purposes," *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*, 1915, p. 32-34. Reprinted from *Electrical World*, New York, 1914.

[7] Field inspections were conducted on October 20 and December 7, 2011.

[8] Thomas T. Taylor, "Bishop Creek Hydroelectric System," HAER No. CA-145, Historic American Engineering Record, National Park Service, U.S. Department of the Interior, 1994, p. 6-7.

[9] Robert Clerico and Ana Beth Koval, "An Architectural and Historical Evaluation of Structures Associated with the Bishop Creek Hydroelectric Power System, Inyo County, California," Southern California Edison Company, December 1986, p. 54-60; Valerie Diamond, Stephan G. Helmich, and Robert A. Hicks, "Evaluation of the Historic Resources of the Bishop Creek Hydroelectric System," Southern California Edison Company, July 1988, p. A-10-14.

Overview

Powerhouse No. 6 was originally constructed in 1913 by the Southern Sierras Power Company, a subsidiary of the Nevada-California Power Company. It was one of the last two powerhouses to be constructed in the Bishop Creek system, along with Powerhouse No. 3 which was built at the same time. Powerhouse No. 6 is the lowest plant in the system at an elevation of 4,461 feet. The powerhouse is a single-story, reinforced concrete industrial building altered from its original Mission Revival architectural style. It contains a large rectangular room that houses a single rotating generator driven by a pair of impulse water wheels. In 1914, the water wheel-driven generator operated with a capacity of 2,000 kilowatts (kw). The building was reconstructed in 1938 after it was partially destroyed by fire. Currently, Powerhouse No. 6 continues to operate as a hydroelectric powerhouse in the Bishop Creek system. The powerhouse plant is situated on the northwest bank of the lower stretch of Bishop Creek, below Bishop Creek Canyon. The plant originally consisted of the powerhouse (extant), a small utility building (not extant), a residential building (not extant), and a garage (not extant).

In 1913, the *Journal of Electricity Power and Gas* provided this general description of Powerhouse No. 6, which was completed that same year:

> It has already been stated that No. 6 and No. 3 were plants operated by the Southern Sierras Company and were the newest plants, both having been built at the same time…The powerhouse building of No. 6 measures 30 x 42 ft. inside and is a replica of Nos. 2 and 3, although smaller than either one. The operating hydraulic head is 258 ft. and like No. 5 there is but one generating unit. This plant is very simple in design and in operation and particularly suitable to a system of the sort to which it is connected. The main generating unit is placed at the center of the building, its shaft parallel to its greatest length.[10]

1. **Date of Construction:**
   Construction of Powerhouse No. 3 commenced in 1912, based on foundation plan drawings dated September 1912 and a general plan drawing of the plant dated October 1912. Construction was completed and the powerhouse was operational in 1913. The building was reconstructed in 1938 after it was substantially destroyed by fire, as indicated by reconstruction plans dated March 1938.

2. **Architect/Engineer:**
   The engineer of the original construction of Powerhouse No. 6 was probably R. G. Manifold of Manifold & Poole, Los Angeles. Manifold apparently served as engineer for the construction of Powerhouse No. 3 which was constructed that same year. Manifold's business partner, Charles O. Poole served as chief engineer of the Nevada-California Power Company. In addition, the Sierras Construction

[10] Van Norden, "System of Nevada-California Power Company," p. 16.

Co. was listed in construction plans and may have employed architects. Other architects and/or engineers are not known.

3. **Builder/Contractor/Supplier:**
The original builder of Powerhouse No. 6 was the Sierras Construction Co., which is listed on construction drawings, dated 1908. The powerhouse was reconstructed after a fire by The Nevada-California Electric Corporation of Riverside, California (which succeeded the Nevada-California Power Company) as indicated by reconstruction plans dated 1938. Other builders, contractors and material suppliers are not known.

4. **Original Plans:**
The powerhouse was designed as rectangular in plan with exterior wall-to-wall dimensions of 34'6" x 46'6". It was constructed of reinforced concrete and finished in stucco on the exterior. The powerhouse was built three bays wide and three bays long as defined by regularly spaced columns that extended to the interior. At long side walls, columns were spaced 12'6" apart; at end walls, they were separated by a distance of 8'6". Concrete walls between columns were 6" thick. Columns, or "pilasters", were four-cornered and shouldered with flat slopes. Pilasters at the sides were integrated with concrete cornices, while pilasters at the ends terminated in well-defined drainage slopes. The powerhouse roof was a moderately pitched gable supported by a Fink steel truss system and sheathed in corrugated sheet metal. End walls terminated in two-level curvilinear stepped parapets with square-profile coping that obscured the gable ends.

The east side wall contained the original powerhouse's two entrances: a man-door located off-center in the northern bay; and a large square service opening in the southern bay which allowed for large machinery to be moved in and out of the building. The building was fenestrated in a regular pattern with wood sash: large square windows, 12-light-over-6-light, in side wall bays (three windows on the west side and one window at the center of the east side); and tall rectangular windows, 16-light-over-4-light, in the end bays. Gable ends contained large circular windows divided into 9-light grids.

The powerhouse was built with a complex concrete substructure 10'0" feet deep that was designed to house an impulse wheel-driven generator. At the interior, the generator room that occupied the structure was open in plan. The generator room housed a single generator driven by a pair of flanking water wheels situated at the center of the room and related equipment such as valves, pumps, governors, exciters, and switchboard panels. The interior long walls contained recessed bays formed by the post-and-beam construction and filled by curtain-wall panels. The building was open vertically through the trusses. A 20-ton overhead traveling crane furnished by the Cyclops Iron Works of San Francisco spanned the width of the room. The rolling crane ran on rails mounted on concrete beams that formed parallel ledges along the long side walls below the level of the trusses.

5. **Alterations and Additions:**
The powerhouse structure was extensively rebuilt after a fire in March 1938. The fire affected the roof, upper walls, and interior electrical machinery. Following the fire, the damaged upper portion of the building (from just below the eaves to the roof) was wrecked and rebuilt. The intact concrete foundation, lower walls and pilasters were retained and provided a structural base for the newer construction. The newer upper portion was constructed of matching reinforced concrete and tied securely to the intact lower portion. The rebuilt structure was capped by a new gable roof supported by two Fink steel trusses. The reconstructed powerhouse included several alterations and additions to its original design. The most visible change involved the elimination of the original curvilinear parapets and termination of the end walls as gable ends with galvanized sheet metal cornices, which was more expedient than restoring the parapets. The corner pilasters were finished with squared tops rather than the original sloped profile. The original circular window openings in the gable ends were filled and replaced with blank stucco wall. A new roof with 2" solid redwood sheathing covered with a layer of Johns-Manville Rigid Asbestos Shingle and Ridge Roll was built. (The original corrugated metal roof was previously replaced with asbestos shingles on wood sheathing in 1928. Asbestos shingles were salvaged from the existing roof and used in the construction of the newer roof). The formerly straight ridgeline was altered by installation of a centrally located, gable-roofed, sheet metal monitor with chain-operated, center-pivot factory sash, 8-light panels flanking 6-light panels on both sides. Factory steel sash glazed with double-sided obscure glass and operable central panels were installed in existing window openings, 6-light x 5-light at side walls, 4-light x 5-light at the ends.[11]

At the northwest corner of the building, where more extensive fire damage had occurred, the reconstruction involved wrecking and repouring all or most of three 6" concrete curtain walls (two bays at the north end and one bay at the west side) and addition of a steel I-beam for structural reinforcement beneath a damaged concrete crane beam. Also, a new "switch cell" addition was constructed adjacent to the central and west bays at the north end of the powerhouse. The small shed-roofed wing extended out 7'0" from the original powerhouse and measured 21'6" along its long side. It was built with reinforced concrete walls 6" thick and capped by a 4" slab covered by "20 yr." roofing. It varied in height from 12'6" at the top of north wall to 14'0" where it met the powerhouse wall. The shed roof projected 6" beyond the north wall. The addition was accessed by two "Kalamein" metal paneled doors, 3'0" x 6'8" with wire glass in the upper parts, symmetrically located at the corners of the east and west walls.

[11] Original wood windows were previously replaced by steel sash in 1928.

Since the powerhouse was reconstructed, altered, and expanded in 1938, few structural and/or material changes have occurred other than minor internal partitioning. A small battery room and an adjacent water closet were constructed within the northeast corner of the powerhouse. In 2005, a windowed control office was enclosed along the north wall, measuring 11'10" wide and projecting 7'4" into the generator room. Recently, the control room window was removed and filled in by a matching wall.

B. Historical Context:

The following historical context was included in previously completed documentation which established the eligibility of the Bishop Creek Hydroelectric System for listing in the National Register of Historic Places.[12]

The turn of the twentieth century saw a dramatic change in technological history. The production of cheap, dependable hydroelectric power, and the ability to transport the power over great distances, was perfected at this time. In short order, drainages with sufficient flow for hydroelectric power generation began to be developed. By 1923, the only suitable streams draining the east slope of the Sierra Nevada which were not being used for electricity production were the Carson and Walker river systems. The first hydroelectric power generation along Bishop Creek was a small plant operated by the Bishop Light and Power Company. The facility was reported to be a half mile west of the Standard Flouring Mills (present site of Plant 6) and two and a half miles from the town of Bishop. The plant consisted of a Stanley polyphase generator (capable of 150 horsepower) driven by a 48-inch Pelton wheel. The power was generated for local use.

Through the efforts of Loren B. Curtis, an engineer, and Charles M. Hobbs, a banker and financier, the Nevada Power, Mining and Milling Company was incorporated on December 24, 1904. The first facility built by the Nevada Power, Mining and Milling Company was put into operation in September, 1905, supplying hydroelectric power to the mining communities of Tonopah and Goldfield, Nevada. Executives of the power company had purchased controlling interest in the locally operated facilities in Tonopah and Goldfield, so that, when production began, there was a market ready for their product. The original transmission line extended east across Owens valley, the White Mountains, Fishlake Valley, and the Silver Peak Range to the town of Silver Peak in Clayton Valley. Here the line split, diverging northeast to Tonopah and due east to Goldfield. The line distance from Bishop Creek to Goldfield was 95 miles, and that to Tonopah was 118 miles. This was a new record for long distance transmission. On January 5, 1907, the Nevada-California Power Company, successor to the Nevada power, Mining and Milling Company, was incorporated; most of the original corporate officers remained with the new company.

[12] Clerico and Koval, "An Architectural and Historical Evaluation," p. 5-12.

Between 1905 and 1913, four more generating plants were placed on line, in tandem along Bishop Creek, and additional generators were placed in existing plants. As a result of this additional power generation, the "Tower Line" from Bishop to San Bernardino was completed in 1912 and put into operation, again creating a new record for long distance transmission (239 miles). The directors of the Nevada Power, Mining and Milling Company were well aware of the vicissitudes of the boom-bust mining industry and took steps to secure a more constant market for their product. In 1911, the Southern Sierra Power Company was incorporated with the main purpose of creating and servicing the power needs of southeast California. From then until 1918, several smaller power companies were purchased by the new company. The development of southern California's Imperial Valley corresponds directly with Bishop Creek's production of cheap, reliable electricity.

By the end of 1913, the Bishop Creek system was essentially complete with all five plants operating. In descending order down the drainage, the Bishop Creek facility then consisted of:

> Power Plant 2: Three Westinghouse generators, each capable of 2,000 kw of power (total output of 6,000 kw). Units 1 and 2 were driven by Pelton wheels and unit 3 by a Doble wheel.
>
> Power Plant 3: Three Crocker-Wheeler generators, each capable of 2,250 kw of power (total output of 6,750 kw). All three units were direct connected to Henry impulse wheels.
>
> Power Plant 4: Five generating units consisting of: two National Electric Company, 750 kw, generators connected to Pelton wheels; one Bullock, 1,500 kw, generator driven by a Pelton wheel; one Allis-Chalmers, 1,500 kw, connected to a Pelton wheel; and one Allis-Chalmers, 1,500 kw, machine driven by a Doble wheel (total output of 6,000 kw).
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> Power Plant 5: Two generating units, one of which was a 1,500 kw, Allis-Chalmers machine driven by a Doble wheel and the other a 1,850 kw unit connected to a Pelton-Francis wheel (total output of 3,350 kw).
>
> Power Plant 6: A single generator capable of 2,250 kw driven by a Pelton-Doble wheel.

It is interesting to note that Power Plant 1 was to have been built at the present site of Intake No.2, but the plant was never built due to the vulnerability of the site to avalanches. The plant number designators were not adjusted accordingly, so that there is no Power Plant 1, nor has there ever been.

In 1936, the Nevada-California Electric Corporation again was reorganized to become an operating company. The corporation became California Electric Power Co. and continued to operate under this name until 1964, when the company known as Calectric was subsumed by Southern California Edison Company. Since 1964, as a result of acquisition through merger consolidation, Southern California Edison (SCE) has owned and operated the Bishop Creek plants.

PART II: SITE INFORMATION

A. General Description of Building:

The following description of Powerhouse No. 6 incorporates information included in previously completed HAER documentation[13] and evaluations of eligibility for listing in the National Register of Historic Places.[14] This information was verified and new information was gathered via field inspection to inform the building description.[15]

Overview

Powerhouse No. 6 is a one-story, reinforced concrete industrial building resting on a deep concrete foundation and topped by a redwood gable roof covered in asbestos shingles. It reflects a Utilitarian, early twentieth century industrial style that resulted from its alteration from the original Mission Revival architectural style. A small shed-roofed addition was appended to the north end of the original structure. The main volume houses a single hydroelectric power generation unit driven by a pair of impulse water wheels which are mounted in the concrete foundation.

Exterior

Powerhouse No. 6 is a one-story, rectangular-in-plan, reinforced concrete building resting on a concrete foundation. A tan, rough-textured stucco covers the exterior. Structural pilasters subdivide the walls into panels. The building is three bays wide and three bays long. The exterior pilasters are shouldered with flat-slope transitions. Pilasters at side walls have squared tops and terminate at the eaves, while pilasters at end walls terminate on the façades in well-defined drainage slopes. The building is topped by a medium-pitched gabled roof covered with asbestos shingles. The transition from the roof eaves to exterior walls is accomplished with metal box cornices. A line of clay tiles (or similar) caps the ridgeline. A rectangular, gabled rooftop monitor straddles the ridge midway. The monitor roof is sheathed in asbestos shingles and a ridgeline of clay tile (or similar) and it has boxed metal eaves. The monitor contains center-pivot 6-light metal-framed windows flanked by 8-light windows on both sides. A reinforced concrete wing with shed roof slab adjoins the original building on the north end at the central and western bays.

The bays on the long walls which do not contain entrances have large 30-light metal framed windows with 8-light center-hinged portions in the lower center. The bays on the south end contain similar 8-light-over-8-light-over-4-light metal-framed windows with center-hinged 8-light portions in the lower center. A smaller 8-light window is found at the north corner of the east side. Window openings have stuccoed projecting lugsills. Metal grates secure all operable windows. Three entrances at the east side of the building include: a large roll-up metal door with a hinged security grate in the first bay (counting from south to north); a glazed metal door with security grate in the third bay; and a metal

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[13] Taylor, "Bishop Creek Hydroelectric System," p. 6-7.
[14] Clerico and Koval, "An Architectural and Historical Evaluation," p. 54-60; Diamond, Helmich, and Hicks, "Evaluation of the Historic Resources," p. A-10-14.
[15] Field inspections were conducted on October 20 and December 7, 2011.

door with wire glass in the fourth bay (north wing). At the west side, the north wing contains an identical door in a symmetrical location.

Interior
The main rectangle of the building is open in plan and without partitions, except for a rectangular enclosed operators office in the center of the north end and a small water closet and a battery room in the northeast corner. The floor is poured concrete with areas of metal foundation plates bolted into place. A single water-wheel/generator assembly, containing two wheels and a direct-connected revolving generator, is mounted in pits at the center of the room, with the axis of spin aligned along the north-south centerline of the building. The generator room also contains water valves and governors on the west side of the building, and other support equipment around the periphery. Walls are finished in smooth stucco and subdivided into bays by structural pilasters that extend from the exterior to the interior. The three bays along the west wall and the central bay on the east wall each contain a large square metal-framed window. The three bays on the south end each contain a similar rectangular window. An overhead traveling crane is mounted on rails supported by a post-and-beam system that is integrated into the structural system of the long walls. The generator room is open vertically through the Fink steel trusses and the underside of the redwood roof sheathing is exposed. The small windowless operators office contains a small desk, switchboard and other electronic equipment. The north wing addition houses circuit breakers and transformer cabinets. Built-in wood cabinetry is located along the center of the east wall of the powerhouse between the man-door and the service door.

Forming a symmetrical line along the middle of the generator room are found the original water wheel housings at the sides, the original generator housing and rotor at the center, and original shaft mountings. The wheel housings are irregular in shape with each containing a rounded end and a squared end with a gooseneck extension, made of riveted cast iron, and bolted to the floor over the operating water wheels. "Cast on the sides of the waterwheel casing is the compound name, Pelton-Doble, which shows that somebody got history inverted when he constructed the old adage, 'the best of friends must part.'"[16] The generator housing is donut-shaped with an open interior, also made of cast iron, and suspended around the stator core and rotor. Small metal nameplates bolted to the outer rim of the circular generator in symmetrical locations read: ALLIS-CHALMERS CO., MILWAUKEE, WIS., U.S.A.; and provide machine specifications.

1. **Character:**
   In 1913, the *Journal of Electricity Power and Gas* noted characteristics that were fundamental to later plants constructed in the Bishop Creek system, including Powerhouse No. 6:

[16] Van Norden, "System of Nevada-California Power Company," p. 16-17.

> Throughout, standards of design have been adopted which show a careful thought and a thorough understanding of the many intricate problems incident to the development of such a system. A fearlessness in good engineering common sense to get the best results with a freedom of method so successful in the best types of so-called "Western" practice…[17]

Powerhouse No. 6 remains an example of "good engineering common sense" from the early twentieth century. Although the physical reconstruction of the powerhouse in 1938 obscured its original identity as an example of Mission Revival architecture, the building retained an enhanced Utilitarian appearance in keeping with the character of the Bishop Creek system. It retains the significant majority of exterior features that convey its historic architectural character (in rebuilt form), including (but not limited to) cladding and roofing materials, roof shape, façade details, and windows and entrances. In addition, the building retains the significant majority of interior features that convey its original historic character, including (but not limited to) a generally open floor plan, centrally located double-wheel/generator assembly, perimeter walls with recessed bays, natural lighting provided by large windows, and overhead travelling crane. The overall design of the reconstructed powerhouse is intact. Relatively minor changes generally limited to construction of small interior partitions have occurred since the powerhouse was rebuilt and expanded in 1938. Powerhouse No. 6 continues to operate and it serves as an excellent example of a Utilitarian, early twentieth century California hydroelectric power plant.[18]

2. **Condition of Fabric:**
Powerhouse No. 6 is in good physical condition. The reinforced concrete walls are intact and the exterior stucco facing does not contain noticeable cracks or damage, with few attachments and/or piercings. The asphalt shingles and redwood roofing are intact. Likewise, the interior is in good condition. The concrete perimeter walls and foundation appear to be sound. Windows and doors are operable. Some older fixtures such as the built-in cabinetry and the lavatory are intact.

B. Site Layout:
The terrain surrounding Powerhouse No. 6 consists of high desert foothills covered with natural vegetation. The plant is located on a graded level area on the northwest bank of Bishop Creek, which runs in a broad flood channel in this location. To the northwest, topography rises moderately towards Plant 6 Road and California State Route 168. To the

[17] Van Norden, "System of Nevada-California Power Company," p. 5.
[18] The reconstruction of Powerhouse No. 6 after a fire in March 1938 occurred during the identified Period of Significance for the Bishop Creek system, 1905-1938. The reconstruction is significant and contributory because it is characteristic of operational improvements that occurred in the Bishop Creek system during the early twentieth century.

southeast is found Bishop Creek and the terrain rises moderately at the opposite bank. The powerhouse stands with its long axis running approximately north-south. An L-shaped stone retaining wall is found directly to the northwest of the powerhouse. The upper terraced area located to the west contains transformers and chain-link perimeter fencing. Plant 6 is located near the former site of the Standard Flour Mill which was in operation during the latter part of the nineteenth century and which may have been incorporated into power plant buildings that are not extant. Originally, the power plant complex included a powerhouse (extant), a small utility building (not extant), a residential building (not extant), and a garage (not extant). The latter three buildings were removed sometime after 1988. Also, the original highway (California State Route 168) followed the northwest bank of Bishop Creek directly past all the powerhouse sites including Plant 6 (apparently along the route of the current Plant 6 Road). The new highway, which bypasses the powerhouses, was constructed to the northwest in 1965-1966.

PART III: OPERATIONS AND PROCESS

A. Operation:

This section describes the process that creates hydroelectric power at Powerhouse No. 6, in the context of Power Plant 6 and the chain of power plants that comprise the Bishop Creek Hydroelectric System. This section is divided into two subsections: (1) Basic Components of Hydroelectric Systems, which provides a general background for understanding the operations of hydroelectric plants; and (2) Operation of Power Plant 6, which describes how water moves through the power plant in order to drive turbines and generate electricity that is transmitted long distances.

Basic Components of Hydroelectric Systems

In a hydroelectric power generating unit, the force of moving water is used to spin a turbine (or "water wheel"). A turbine is connected via a shaft to a rotor, the moving part of an electric generator. The movement of the turbine spins the rotor within the generator and sweeps coils of wire past the generator's stationary coil, or stator, which produces electricity. Once electricity is produced, transformers raise the voltage to allow transmission over long distances through power lines.[19]

The following explanation of hydroelectric systems was included in a previously completed evaluation of eligibility for listing in the National Register of Historic Places.[20]

There are two basic types of hydroelectric systems. The first of these, low-head hydro, uses a large volume or mass of water from relatively low dams in order to turn the angled surfaces of screw-shaped turbines. The other type, high-head hydro, uses streams with relatively low volume flows, where water is diverted away from the natural stream course and elevated by artificially reduced fall far above the natural stream through a man-made canal or pipeline. At some point downstream the water is directed downslope were it achieves a very high pressure. The water at the base of the slope is directed against a bucketed wheel which receives an energy impulse by its impact.

The basic features of a high-head hydro system, of which the Bishop Creek Hydroelectric System is an example, are outlined below.

1. Water from a stream channel is separated from the natural stream using a diversion dam, headgates, screens and a spillway. The headgate regulates the flow of water, while the screens prevent debris from entering the water conduit. The reservoir behind the intake dam acts as the principal regulator of the water flow, allowing excess water to escape into the natural water channel. The dam,

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[19] U.S. Department of the Interior, Bureau of Reclamation Power Resources Office, "Reclamation: Managing Power in the West – Hydroelectric Power," July 2005, unpaginated. Found at http://www.usbr.gov/power/edu/pamphlet.pdf, accessed on January 30, 2012.

[20] Diamond, Helmich, and Hicks, "Evaluation of the Historic Resources," p. 10-11.

headgate, and regulating and cleaning apparatus are all known collectively as the *intake.*

2. Following intake, water is conducted by flumes or canal systems, pipes, tunnels or siphons (pipes in the case of Bishop Creek). The length of the system varies greatly, depending on the area's topography and amount of water-pressure desired. Sluices and sandboxes are usually built into the system to allow sand and gravel, which could clog or damage the downstream equipment, to settle out of the water. *Flowlines* generally incorporate pressure-relief valves, installed at regular intervals along their length. These open and permit outside air to enter the line to prevent the line from collapsing should there be an accidental break in the pipe. A large vacuum would normally be formed by the sudden acceleration of water through a break, which could easily destroy either wood or steel pipe.

3. At the end of the canal system, a pipe is installed as nearly vertical as conditions will allow providing the water pressure needed to operate the water wheel(s). This pressure pipe is known as a *penstock.* At the top of this pipe is a small reservoir, expansion tank or standpipe (standpipe in the case of Bishop Creek) which helps to regulate and smooth the flow of water within the penstock.

4. A *powerhouse* is located at the bottom of the penstock. This consists of a building within which is housed the power generation and distribution equipment. The machinery within the building includes water wheels, generators, batteries and exciters. Exciters provide direct current to energize the electromagnets within the larger alternating current generator(s). The powerhouse also includes the distribution equipment used to initiate transmission of electricity. This equipment consists of switches, circuit breakers and related controls which are connected to a nearby transformer. The transformer increases voltage so that power can be transmitted over long distances. The powerhouse also contains a variety of other apparatus used in the operation of the system. This often includes a small generating unit to operate the powerhouse lights and equipment, as well as telephone links with other system components. Other buildings associated with the operation of the hydro system are usually located in close proximity to the powerhouse(s). These may include such facilities as administrative headquarters, garages, housing for system personnel, equipment storage sheds, pump houses, and machine shops.

5. Where there is more than one power-generating source, it is not uncommon for there to be a *control station* where the transmission of energy may be monitored and regulated. If electrical generating facilities are close by, many functions may be automated or operated from a centralized control point; the control station may serve this additional function.

6. *Transmission lines* carry power to users. Normally a step-down transformer is used near the point-of-use to reduce the voltage to normal house currents.

Operation of Power Plant 6

At Plant 6, the static head of water (or vertical drop in elevation from intake to water wheel) is only 230 feet, which is the lowest operating head in the Bishop Creek system. The water that operates Plant 6 is delivered from distant Intake No. 6, an equalizing pond located to the southwest directly below the tailrace of Plant 5. Water is transferred from the intake over a distance of 7,336 feet by Flowline No. 6, a metal pipeline (originally a redwood stave pipe) which runs along the higher terrain of the broad alluvial fan that characterizes lower Bishop Creek. The water is conveyed from the flowline to the powerhouse via Penstock No. 6, a metal pipeline that begins at the height of the flowline and descends from the southwest, thereby using gravity to deliver water at substantial velocity to the plant. The penstock approaches Powerhouse No. 6 below grade and enters the foundation perpendicular to the south side of the building. There, it splits into two separate feeder pipes in a “Y” configuration, with each pipe directed to one of the dual water wheels located within the powerhouse. The 30-inch penstock feeder pipes pass through control pits located along the west side of the generator room. These control pits contain the machinery that regulates the flow of water from the penstock to the impulse water wheels, including gate valves located directly on top of the feeder pipes, and nozzles, power needles, stream deflectors, and the controlling mechanisms located in line with the water wheels.

In the concrete floor of the powerhouse, a single power generation unit consisting of two identical impulse water wheels and a direct-connected generator is shaft-mounted with its axis of spin aligned horizontally and parallel to the centerline of the building. The impulse wheels are mounted in pits located in front of the control pits, from which extremely high-velocity jets of water are directed at the wheels. The wheel pits are 7’0” deep below the floor surface at their shallowest points and slope gradually down to the east and into tailrace channels within the substructure. Metal casings are bolted to the concrete floor over the water wheels. The wheel cases are rounded at one end and rectangular at the other end which contains power needle/nozzle machinery. The pair of impulse wheels flank the direct-connected rotating generator, which is suspended over an open pit 9’3-¾” deep. Shaft bearings and housings are bolted to the concrete foundation to either side of the generator. The common centerline of the wheels, generator, and shaft is located 18’0” from the west wall and 14’0” from the east wall. The center-to-center distance between the impulse wheels is 17’2”.

Currently, Powerhouse No. 6 operates with solid-state exciter units which consist of non-moving electrical machinery housed within metal cabinets. The exciters are used to produce direct current that is used to energize electromagnets within the main power generation units. Originally, the powerhouse contained a water-driven exciter with an impulse wheel/generator assembly similar to those found at main power generation units but smaller. The exciter was located in the northwest corner of the generator room. Water reached the impulse wheel of the exciter from a dedicated penstock feeder pipe that entered the substructure at the northwest corner.

Within the foundation, separate tailrace channels run southward from the water wheel pits, converge in a reverse “Y” and exit the south side of the substructure. The individual tailrace channels are 66” wide and are contained within concrete side walls 12” thick. The main tailrace is a concrete-lined conduit 10’0” wide that spills into an equalizing pond. Water leaves the Plant 6 tailrace and exits the facilities of the Bishop Creek Hydroelectric System. From that point, water is conveyed downstream for irrigation use.

B. Machines:

This section provides an inventory of extant machinery within Powerhouse No. 6, including descriptions of purposes, manufacturer names and dates of installation (as available), and information regarding changed and removed machinery (as available). This section is divided into several subsections beginning with a general description of the power generation unit, followed by detailed descriptions of individual machines and sets of machines. The individual machinery is described in the following order: turbines (water wheels); generators; governors; exciters; and additional machinery.

Power Generation Unit

Powerhouse No. 6 contains a single power generation unit (No. 1) that operates with two impulse wheels and a total or four water nozzles, which compensates for the low-head conditions of the plant. The water wheels are mounted on a common shaft and direct connected on either side of a large, centrally located rotating generator. Each impulse wheel is activated by two nozzles, an upper nozzle and a lower nozzle, that play on different locations around the wheel rim at the same time. This two-nozzle configuration includes additional piping and machinery not included in typical single-nozzle units and which is contained within the squared ends and gooseneck extensions of customized wheel housings. The dual-wheel, four-nozzle unit at Powerhouse No. 6, which is unique in the Bishop Creek system, was described as follows in 1913 by the *Journal of Electricity Power and Gas*:

> The generator rated at 2000 k.v.a. was built by the Allis-Chalmers Company. There are two pedestal bearings mounted on the concrete foundation, the armature ring being carried on sliding floor plates. The unit has a star connected armature giving 2200 volts and the speed is 164 r.p.m. This low speed was selected, notwithstanding the requirement for a heavier generator, to permit of a sufficient waterwheel diameter to efficiently handle the large streams necessary in using but two runners. The waterwheels are mounted on either end of the generator shaft and are housed in cast iron cases. Each wheel has two needle nozzles, the one horizontal delivering its stream at the lowest point of the wheel, while the other points downward, its delivery pipe being carried up from the main

> feedpipe through a large cast iron gooseneck. The needles in the nozzles are controlled, each by its own hand wheel."[21]

Turbines (Water Wheels)
The identical wheels that were originally furnished for the unit were believed to be among the first ever produced by the newly merged Pelton-Doble company. According to SCE records, the wheel located to the north is the original Pelton-Doble-manufactured cast-iron water wheel with 16 buckets, designed to operate at 164 rotations per minute (rpm). Also according to SCE records, in 2010, the water wheel located to the south was replaced by a new Norcan Hydraulics-manufactured stainless steel wheel with 29 buckets and a slightly larger radius. The wheel replacement occurred within the original cast iron housing, which is extant at both wheels.

Generators
Directly between the water wheels, the generator furnished by Allis-Chalmers is suspended on the common shaft within an open pit. The revolving field, alternating current generator operates at 164 rpm (in tandem with direct-connected water wheels). As originally designed, the 2,000-kw generator was wound for 2,200 volts. It was serviced in 1927 with no change in operating specifications. In January 1978, a new winding supplied by Larson-Hogue (National Electric Coil Co.) was installed, and the rewinding was completed by Allis Chalmers in 1979, again with no change in operating specifications. This rewinding occurred around the original rotors which are extant and within the original generator housings which are extant.

Governors
Originally, a Lombard-Doble type Q governor was installed on the unit and operated deflecting hoods over the nozzle tips. All of the deflectors were operated together by the governor, while each of the needles had separate hand-operated controls. In approximately 1930, the original governor was replaced by a newer Woodward-manufactured type LR governor with automatic starting and stopping mechanism. Consistent with the original desing, the newer Woodward governor controlled only the stream deflectors, and water wheel nozzles remained hand controlled. The Woodward governor with bell-shaped head and bronzed stylized meter is not extant. Currently, a governor of a different type and with solid-state electrical components is installed on the older cast-iron mounting located approximately between the wheels and immediately west of the generator.

Exciters
Originally, the powerhouse contained a water-driven exciter that provided the direct current initially needed to energize the electromagnets within the larger generator. The original exciter operated as an independent generating unit with impulse turbines. The exciter, including impulse water wheel, housing, and generator, was located in the

[21] Van Norden, "System of Nevada-California Power Company," p. 16-17.

southwest corner of the powerhouse. The original exciter machinery and operation was described in the *Journal of Electricity Power and Gas* in 1913:

> The exciter in one unit is placed at the opposite end of the building from the switchboard. It consists of a four-pole (with interpoles), Allis-Chalmers, 120 volt 50 kw., d.c. generator, operating at 860 r.p.m., one 66 h.p., 2200 volt induction motor of the same make, driven by a two-runner, needle nozzle, Doble-Pelton water wheel with gate valves of the same make. The nozzle needles are operated from a stand in front of the switchboard, connection being made and motion transferred through and endless bicycle chain running over sprocket wheels fixed to the valve spindle, the chain passing over both sprockets and turning them simultaneously.[22]

Recently, the original water-driven exciter machinery was removed and solid-state exciter machinery was installed. Currently, a contemporary Basler Electric-manufactured excitation cabinet is mounted along the north wall adjacent to other electrical cabinets and panels. The former exciter pit was filled with concrete to match the existing floor surface.

Additional Machinery

Other notable details of operating machinery within the powerhouse include: removal of the original Westinghouse marble five-panel switchboard from near the center of the north end of the building, and installation of a new switchboard within the small operators office that was constructed as an internal addition in approximately the same location; installation of an air compressor in the southwest corner of the building in the approximate location vacated by the removed water-driven exciter; and installation of various electrical conduits, panels, and boxes along perimeter walls and on machinery housings, which support electronic sensors, controls, and automation.

C. Technology:

This section describes the technology of impulse turbines, also known as Pelton wheels, which are used to create hydroelectric power at Powerhouse No. 6.

Impulse Turbines (Pelton Wheels)

The “Pelton” or impulse wheel, the prime converter used for generating electrical energy on the Bishop Creek System, was designed and perfected in northern California during the last quarter of the nineteenth century (1872-1890). The Pelton wheel was named for its inventor Lester Allan Pelton who was based in California. All impulse water wheels are basically variations on the earliest Pelton concept, although impulse water wheels in the Bishop Creek System were also manufactured by the Doble, Henry, and Worthington companies as well as the Pelton company. With the application of a technology which

[22] Van Norden, “System of Nevada-California Power Company,” p. 17.

evolved from the water monitor used in hydraulic mining, impulse wheels are driven by extremely high-velocity jets of water playing on buckets at the periphery of a high-strength iron or steel wheel. These wheels depend not on the mass of water falling the distance of the diameter of the wheel but on the velocity of the impacting jet of water. Impulse water wheels are especially well suited to high-head (high-pressure) but relatively low-volume water power resources. These wheels are also adaptable to streams with highly variable flow regimes. Current-day Pelton wheels, which are considered over 80-percent efficient, have bucket shapes which are slightly revised from those used originally on Bishop Creek – an improvement which increases the efficiency of energy transfer by a small percentage.[23]

The operation of an impulse turbine involves precise control over the high-velocity stream of water that strikes the wheel's buckets. This is accomplished by adjusting the position of a "power needle" that is located at the end of a penstock "nozzle" and that can variously restrict or permit water passage. Water passing through the end nozzle and past the power needle is directed with a "stream deflector" to strike the buckets at the proper angle for the desired rotation. Some impulse wheels are fitted with multiple nozzles and power needles, in which water under high pressure is directed against the wheel at multiple locations at the same time, which provides greater control and efficient use of water. After turning with the wheel, the water in the buckets falls to the bottom of the wheel housing and flows out. A typical impulse wheel turns the flow of water approximately 170 degrees from the point it receives the water pulse to the point that it drops the water into the tailrace.[24]

In the Bishop Creek system, which is typified by high-head, low-volume conditions, 12 of the 14 power generation units contained within four of its five powerhouses are driven by impulse turbines. Impulse turbines are installed in the three highest powerhouses at Plants 2, 3, and 4 and in the lowest powerhouse at Plant 6, which utilizes a dual-wheel, four-nozzle configuration with its single power generation unit in order to compensate for the low-head conditions found at the lower reaches of Bishop Creek. Other impulse turbines in the Bishop Creek system are configured with single nozzles, with the exceptions of Unit No. 2 at Plant 2 and Unit No. 5 at Plant 4, which operate with primary and auxiliary nozzles that provide greater control. The only powerhouse in the Bishop Creek system that does not use impulse wheels is located at Plant 5 which contains two units with reaction turbines.

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[23] Diamond, Helmich, and Hicks, "Evaluation of the Historic Resources," p. 11-12.
[24] U.S. Department of the Interior, "Reclamation: Managing Power in the West – Hydroelectric Power," unpaginated.

PART IV: SOURCES OF INFORMATION

A. Primary Sources:

Clerico, Robert and Ana Beth Koval. "An Architectural and Historical Evaluation of Structures Associated with the Bishop Creek Hydroelectric Power System, Inyo County, California." Prepared for Southern California Edison Company, Rosemead, CA: Intermountain Research, December 1986. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

Diamond, Valerie, Stephen G. Helmich, and Robert A. Hicks. "Evaluation of the Historic Resources of the Bishop Creek Hydroelectric System." Prepared for Southern California Edison Company, Rosemead, CA: Theodoratus Cultural Research, Inc., July 1988. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

Myers, William A. *Iron Men and Copper Wires: A Centennial History of the Southern California Edison Company*. Glendale, California: Trans-Anglo Books, 1986.

Poole, C. O. "Hydroelectric Development on Bishop Creek, Cal." Pages 3 -7 in *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*. Reprinted in 1915 from *Electrical World*, New York. 1914. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

________. "Power house and equipment of station No. 6 of the Nevada-California Power Company – All water leaving station used for irrigation purposes." Pages 32-34 in *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*. Reprinted in 1915 from *Electrical World*, New York, 1914. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

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_________. "Southern California Edison Hydro Generation Division." October 25, 1983. Appended April 26, 1988 and October 11, 1990. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

Taylor, Thomas T. "Bishop Creek Hydroelectric System." HAER No. CA-145. Historic American Engineering Record, National Park Service, U.S. Department of the Interior, 1994.

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Van Norden, Rudolph, W. "System of Nevada-California Power Company and the Southern Sierras Power Company. Part 1 – Power Plants." Pages 1-20 in *Properties and Power Developments of the Nevada-California Power Company and the Southern Sierras Power Company*. Reprint from the *Journal of Electricity Power and Gas*. Volume XXXI. Numbers 1-2. July 5-12, 1913, by Technical Publishing Company (San Francisco). Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

Drawings available from Southern California Edison Company (located in SCE company archives at 4000 Bishop Creek Road, Bishop, California):

Nevada-California Electric Corporation. "Plans for Reconstruction of Bishop Creek Plant 6 Building After Fire of March 1938." March 25, 1938; revised November 27, 1939, Sheet 1 of 7, SCE Drawing No. 434557-1.

_________. "Plans for Reconstruction of Bishop Creek Plant 6 Building After Fire of March 1938." March 28, 1938; revised December 15, 1939, Sheet 2 of 7, SCE Drawing No. 434558-1.

Southern California Edison Company. "Foundation Plan Power House No. 6." September 6, 1912; revised October 31, 1938, SCE Drawing No. 571396.

_________. "General Arrangement Lighting Plan." September 12, 2006; revised April 14, 2006, Sheet 1 of 2, SCE Drawing No. 5323733-1.

_________. "General Details Control Room Addition. Bishop Creek Plant No. 6." September 12, 2005; revised April 14, 2006, SCE Drawing No. 5323735-1.

_________. "Generator Foundation Plan Power Plant No. 6." September 16, 1912; revised September 2, 1931 and November 28, 1939, SCE Drawing No. 571028.

_________. "General Plan Bishop Creek Plant No. 6." October 15, 1912; first revised September 1, 1931; most recent revision April 14, 2006, SCE Drawing No. 571025-9.

_________. "Powerhouse No. 6 on Bishop Creek Overview and Area Map." November 18, 2003, SCE Drawing No. 5305827-0.

Southern Sierras Power Company. "Bishop Creek Plant No. 6." May 31, 1929; first revised August 13, 1929; most recent revision April 25, 1963, SCE Drawing No. 124280-4.

_________. "Installation Details for Woodward Type LR Governor Plant 6 Bishop Creek." May 9, 1930; first revised May 13, 1930; most recent revision November 17, 1939, SCE Drawing No. 571035-5.

B. Secondary Sources:

Poole, C. O. "Hydraulic and electric features of stations No. 2 and No. 3 of the Nevada-California Power Company – Tailrace water of former discharges directly into intake of latter." Pages 19-26 in *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*. Reprinted in 1915 from *Electrical World*, New York, 1914. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

________. "Hydraulic and electric features of stations Nos. 4 and 5 of the Nevada-California Power Company – Static head at the former station, 1100ft." Pages 27-31 in *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*. Reprinted in 1915 from *Electrical World*, New York 1914. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

White, David R. M. "Management Plan for Historic and Archaeological Resources Associated with the Historic and Archaeological Preservation Plan for the Bishop Creek Hydroelectric Project (FERC Project 1394), Inyo County, California." Prepared for the Southern California Edison Company, Rosemead, California: March 1989. Located in SCE company archives at 4000 Bishop Creek Road, Bishop, California.

C. Likely Sources Not Yet Investigated:

An inquiry was made to The Huntington Library, Arts Collections, and Botanical Gardens (The Huntington) located in San Marino, California, regarding the availability of construction drawings for Bishop Creek plants that may be stored in the Southern California Edison Records, 1848-1989 (SCE Records). According to The Huntington personnel and finding aids, the SCE Records do not contain indexed construction drawings. However, a vast volume of materials is indexed in the SCE Records in a variety of categories that include: Administrative Records; Department/Division Records; Financial Records; Generation, Distribution, and Transmission Records; Project Records; Research Files; Topical Records; and Oversize Materials. These materials could potentially yield additional information related to the historical development of Bishop Creek power plants. This information could be gathered by conducting a thorough review of materials indexed in the SCE Records.

In addition, the Huntington maintains a Digital Library that includes a Southern California Edison Photographs and Negatives Collection (SCE Photograph Collection). This SCE Photograph Collection contains numerous historical photographic images of SCE facilities that could potentially yield additional information related to the historical development of Bishop Creek power plants. This information could be gathered by conducting a thorough review of photographic images indexed in the SCE Photograph Collection.

Other potential sources of information that could be investigated include current and former power company employees, who may have knowledge of the historical development of Bishop Creek power plants which may not be contained in available documents, drawings, or other materials. This information could be gathered by contacting and conducting interviews with individuals who potentially have this knowledge.

Appendix A: Images

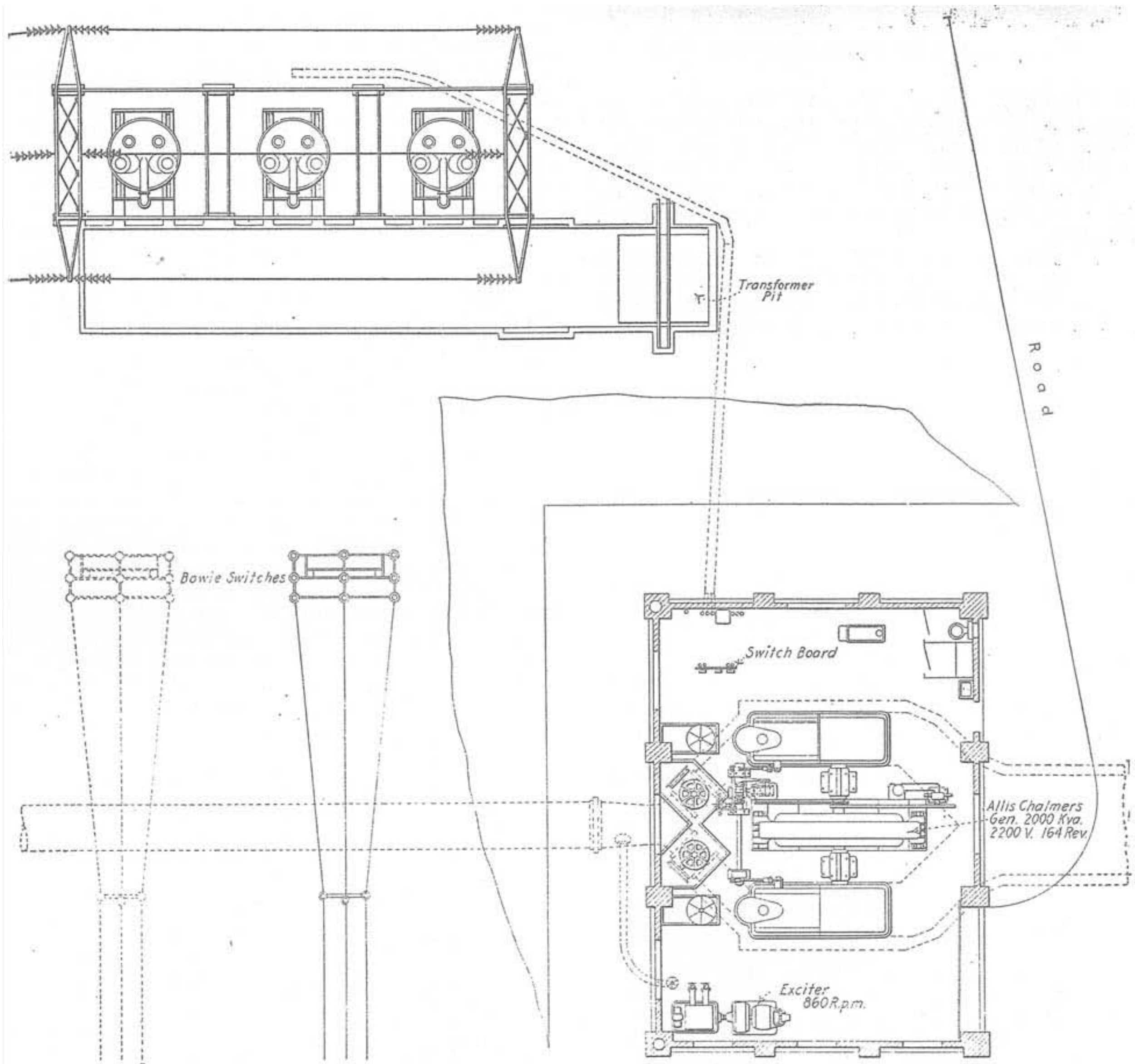

Figure 1: General plan of Plant No. 6. Poole, C. O., "Power house and equipment of station No. 6 of the Nevada-California Power Company – All water leaving station used for irrigation purposes," *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power* Company, 1915, Figure 53, p. 33; reprinted from *Electrical World*, New York, 1914.

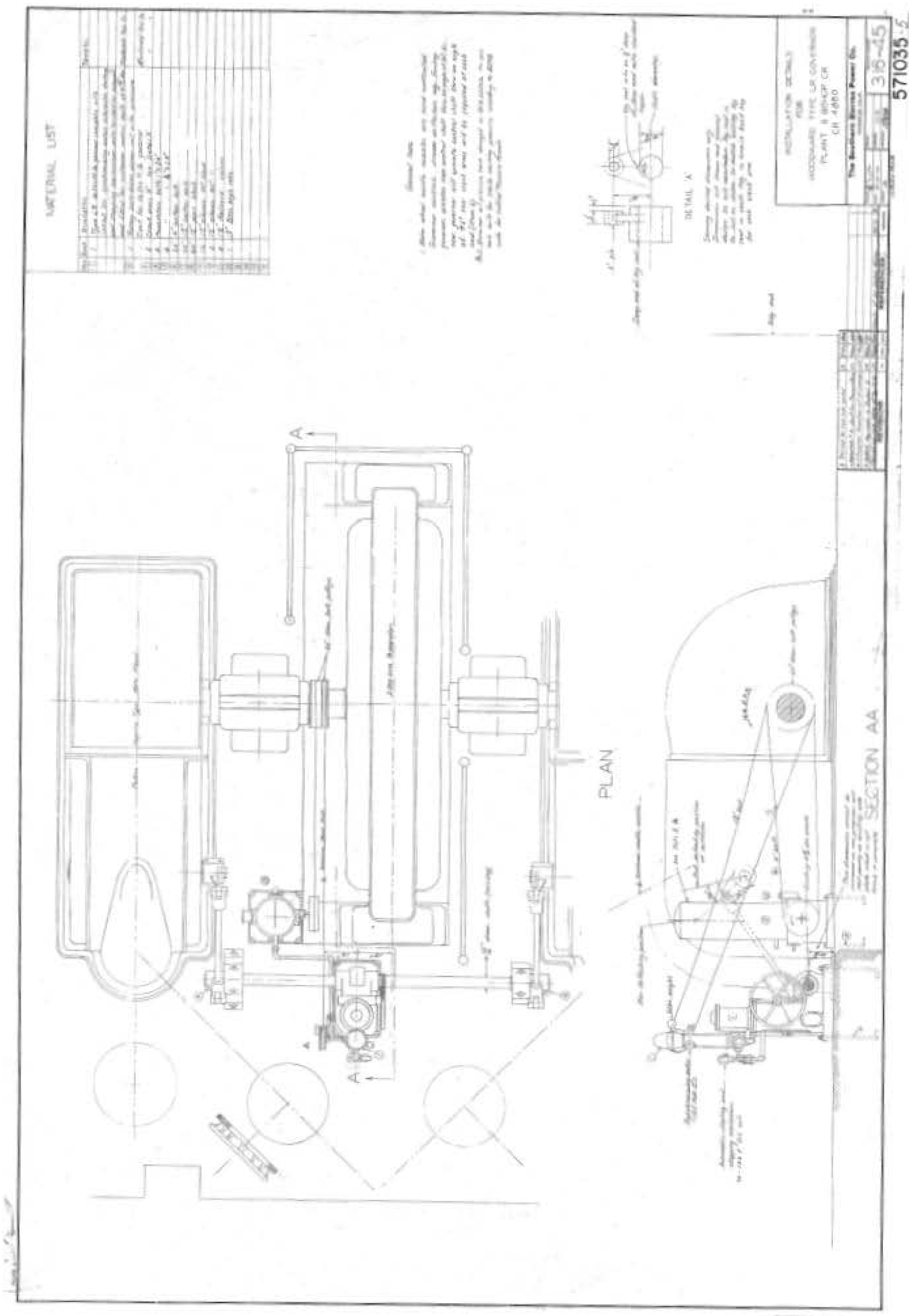

Figure 2: The Southern Sierras Power Company, "Installation Details for Woodward Type LR Governor Plant 6 Bishop Creek," May 9, 1930; first revised May 13, 1930; most recent revision November 17, 1939. SCE Drawing No. 571035-5.

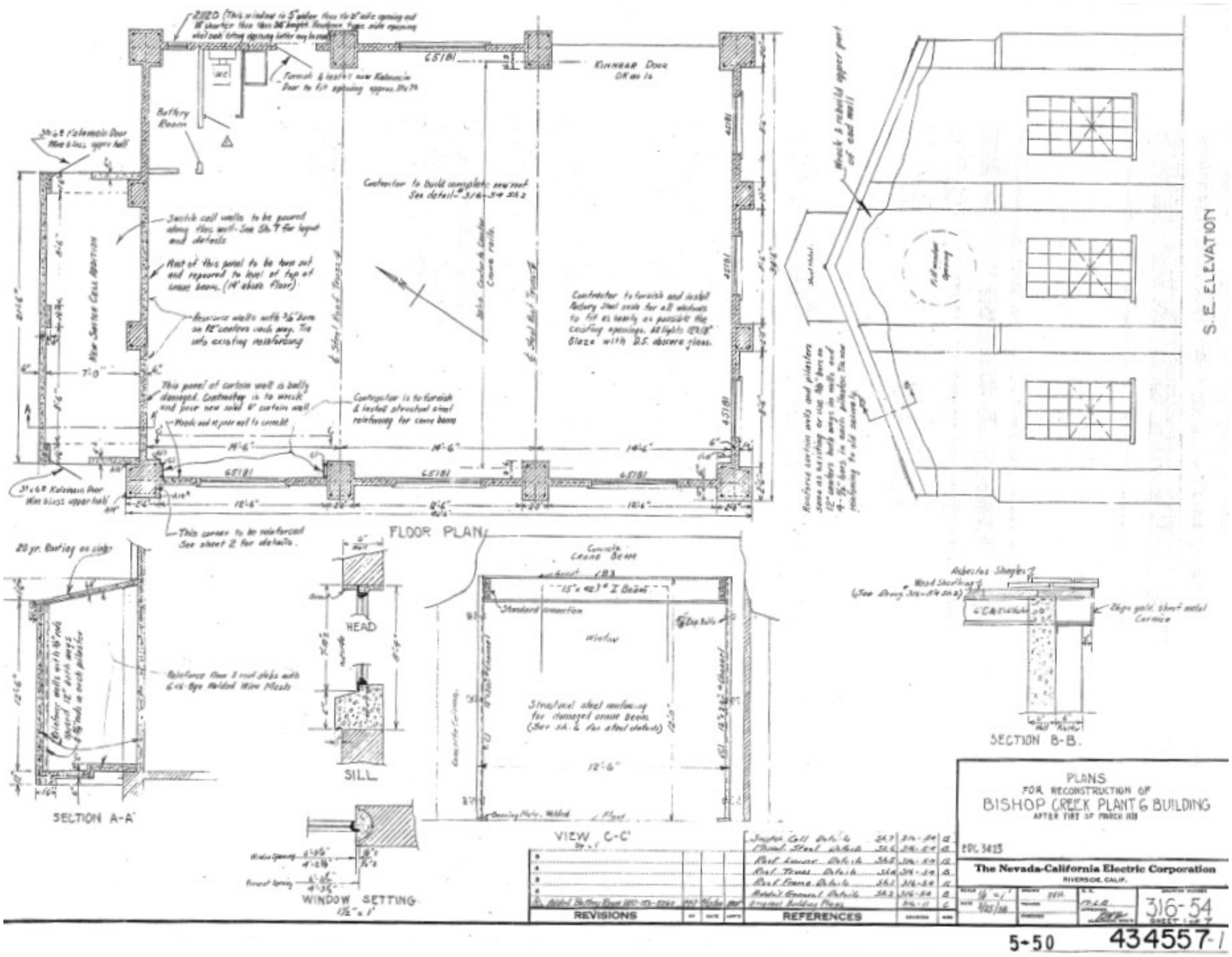

Figure 3: The Nevada-California Electric Corporation, "Plans for Reconstruction of Bishop Creek Plant 6 Building After Fire of March 1938," Sheet 1 of 7, March 25, 1938; revised November 27, 1939. SCE Drawing No. 434557-1.

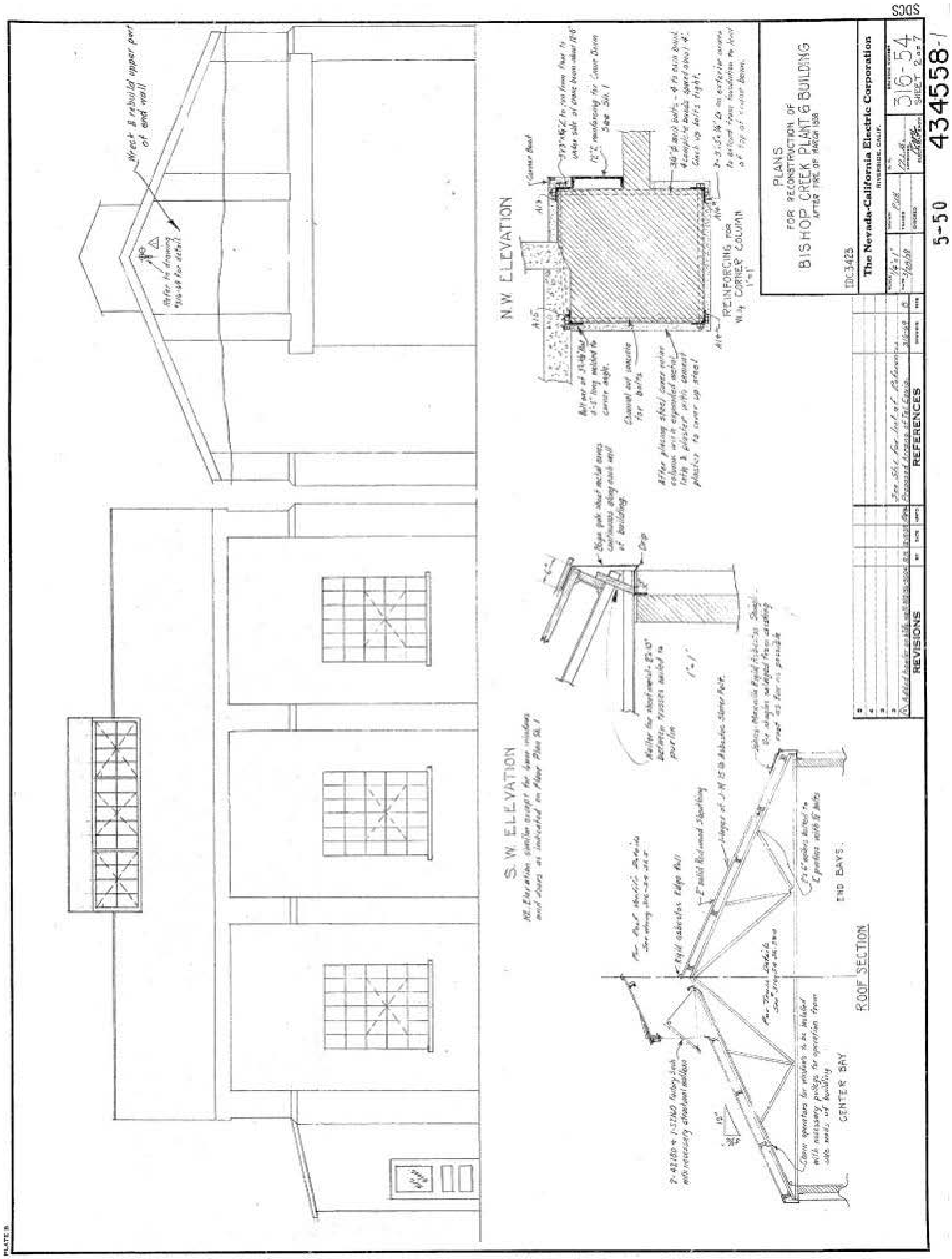

Figure 4: The Nevada-California Electric Corporation, "Plans for Reconstruction of Bishop Creek Plant 6 Building After Fire of March 1938", Sheet 2 of 7, March 28, 1938; revised December 15, 1939. SCE Drawing No. 434558-1.

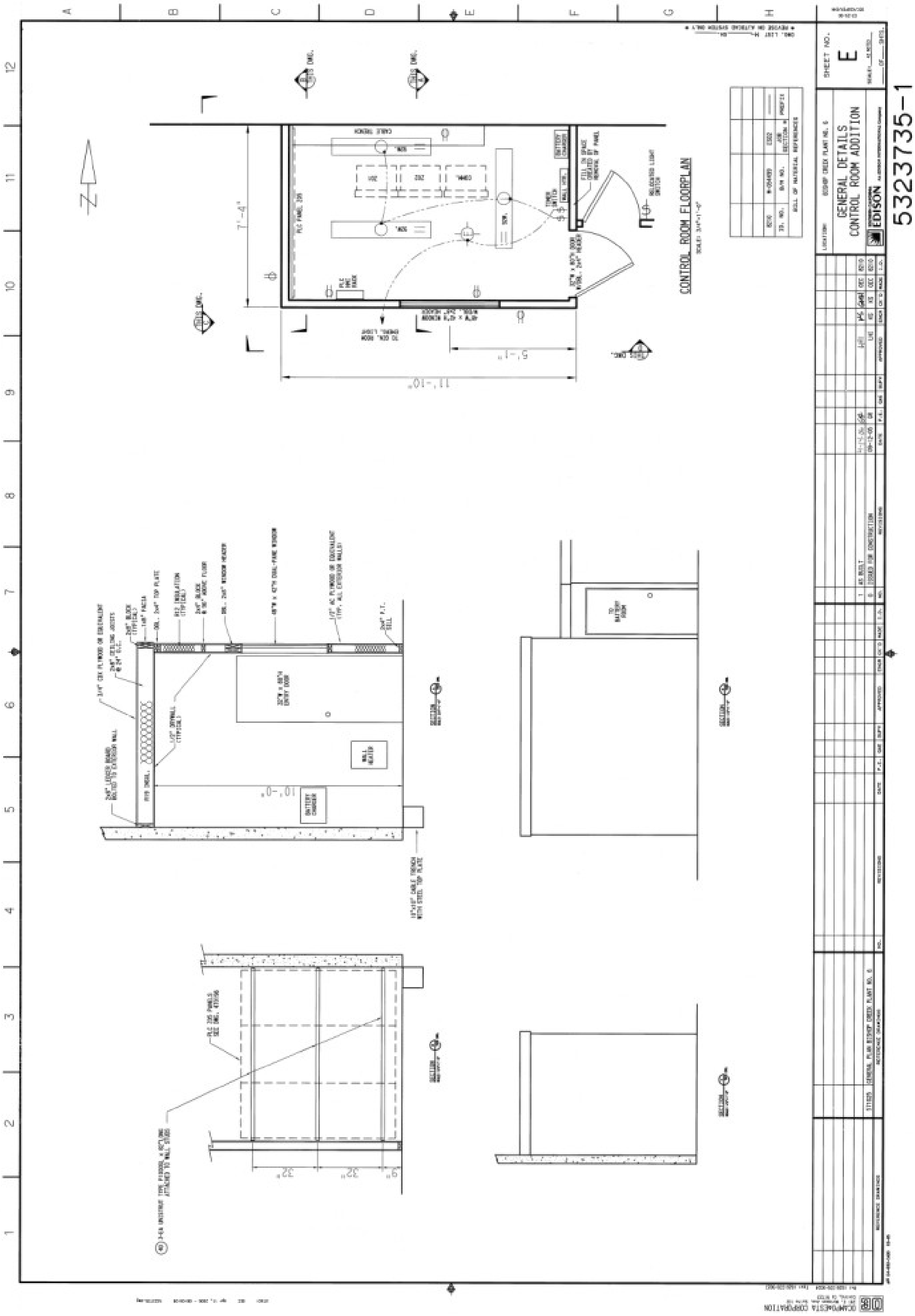

Figure 5: Southern California Edison Company, "General Details Control Room Addition, Bishop Creek Plant No. 6," September 12, 2005; revised April 14, 2006. SCE Drawing No. 5323735-1.

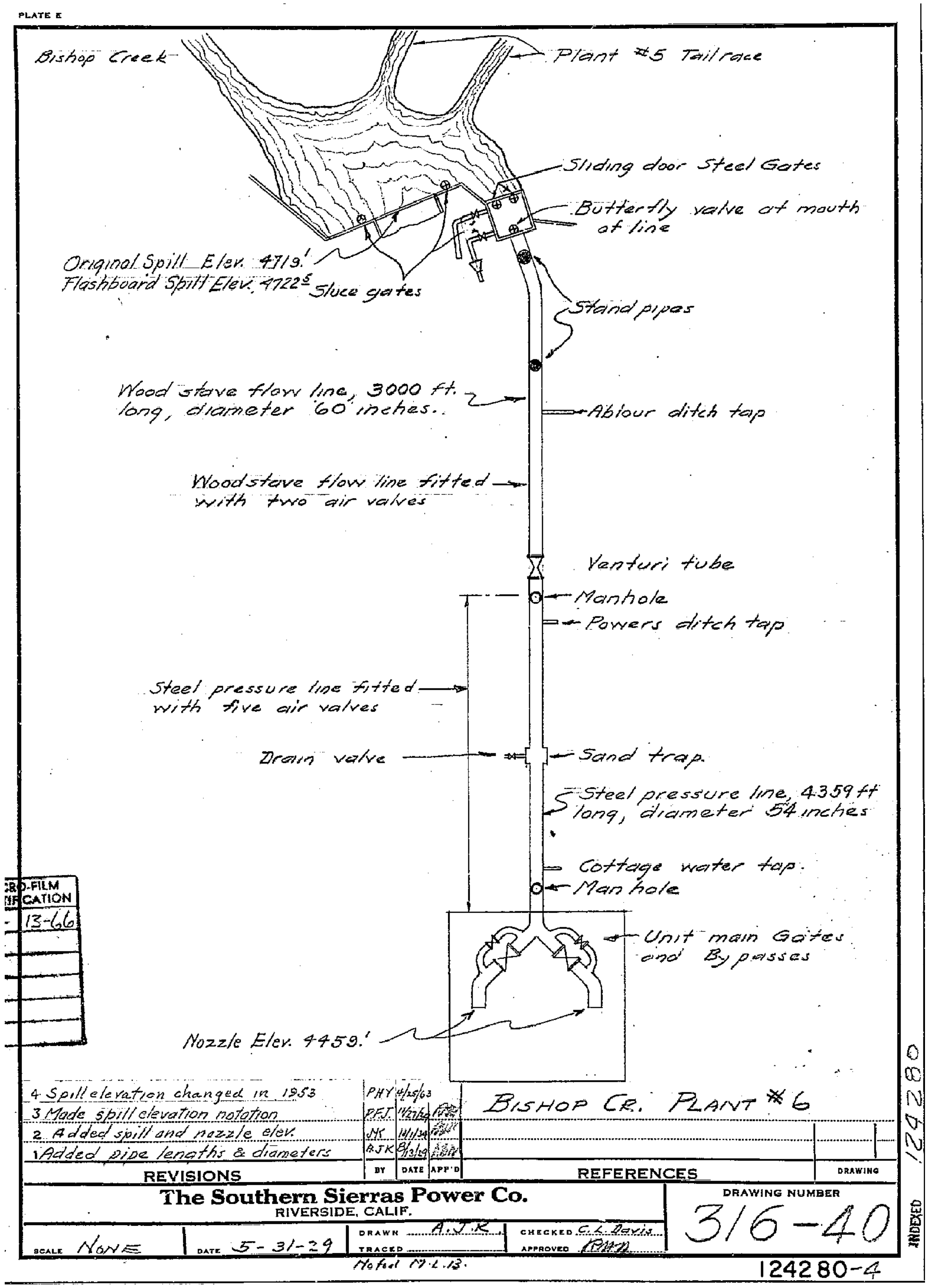

Figure 6: The Southern Sierras Power Company, "Bishop Creek Plant No. 6," May 31, 1929; first revised August 13, 1929; most recent revision April 25, 1963. SCE Drawing No. 124280-4.