BAGNELL DAM AND OSAGE POWER PLANT
OSAGE POWER PLANT STATION
Spanning Osage River on Business Route 54
Lake Ozark
Miller County
Missouri

HAER No. MO-117-B

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Midwest Regional Office
601 Riverfront Drive
Omaha, Nebraska 68102-4226

HISTORIC AMERIC42AN ENGINEERING RECORD

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Location: Spanning Osage River on Business Route 54
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UTM References:

	East End:		West End:	
Zone	Easting	Northing	Easting	Northing
15	533095	4228452	532947	4228318

Quad: Bagnell Quadrangle, Missouri – 7.5 Minute Series, 1983

Construction: 1929-31

Designer: Stone and Webster Engineers

Present Owner: AmerenUE, Lake Ozark, Missouri

Present Occupant: AmerenUE, Lake Ozark, Missouri

Present Use: Dam and Power Plant

Significance: This property is listed on the National Register of Historic Places for significance related to social history and engineering. The construction of the dam and power plant in 1930-31 began the production of hydroelectric power in mid-Missouri and created the Lake of the Ozarks, a regional tourist attraction that dramatically changed social and economic aspects of central Missouri.

Project Information: Bagnell Dam was recorded in 2010 by R. Gail White, White and Borgognoni Architects, Carbondale, Illinois, and by Benjamin Halpern, Halpern Photography, Champaign, Illinois. As a result of relicensing requirements, the historic structures will be altered for required technological upgrades and enhanced safety.

I. Physical Description of the Osage Power Plant Station:

The Osage Power Plant is located inside of and on the south side of Bagnell Dam. Its substructure is of mass and reinforced concrete founded on limestone rock. Its superstructure is concrete block, brick, and steel framing. The power house section contains eight individual main generating units located side-by-side, and two service units in tandem. Along the east riverbank, adjoining the power station, is a gravity wall provided to protect the east shore from erosion in the area near the generating units' discharges, and also to support the embankment under the walkway entering the power station.

The power station is immediately downstream from the headworks with the electrical bay built over the penstocks, between the generators and the headworks wall. The power plant uses the energy extracted from moving water, as the water passes from the reservoir through the penstocks to drive turbines and generate electricity. The eight main generators, each of which has a capacity of 21,500 kilowatts, produce electricity to meet the needs of approximately 45,000 households; however, at peak generation, the Osage Plant has been able to produce 220,000 kilowatts, enough power to meet the household needs of 225,000 people. The two smaller generators, one-tenth the size of the main units, produce power for the plant itself. These house power generators can be started without an outside source of electricity and provide start-up power in case of failure at Ameren's electrical systems. This start-up capability is referred to as "Black-Start."

The portion of the power station containing the scroll cases and draft tubes was originally constructed for an initial installation of six main units and two station service units, with provisions for two future additional main units. The two additional main units were installed in 1953.

The Power House portion of the facility is a 511' long, multi-story structure which is integral with the gravity type dam. The Power House contains the hydro-electric generating equipment and controls. The linear, hard edge composition, and stylized decoration of the exterior of the Power House (such as at the dentils, string courses at the parapets, and lookouts at the stair towers) are consistent with the design of the rest of the facility and reflect the influence of the Art Deco style on this industrial structure.

On the south side of the dam and power station, operating decks are located at elevations 595' MSL, and 599.75 feet MSL. Steel pipe guardrails along the outer edge of the operating deck at elevation 595' MSL, span between the concrete buttresses bracing the outer wall of the structure which houses the water wheel units. A wall of poured concrete runs along the outer edge of the operating deck at 599.75' MSL. The wall has two continuous reveals near the top of the wall. A 150-ton gantry crane at the operating deck at 595' MSL is used in maintenance and

repairs of the water wheels.

The exterior walls and decks of the areas located at elevation 600' MSL are poured concrete. The structural framing system is poured concrete. The flat roof is constructed of concrete and forms the operating deck at elevation 619' MSL for the transformers and getaway structures. The cornice/guardwall is ornamented with stylized dentils, reflecting the influence of the Art Deco style on the building. Five groups of fenestration are located in the south wall of the Power House at elevation 595' MSL. These consist of three bays of four windows and two doors; one bay of three windows and one door; and one bay of two windows and one door. The openings do not have trim or other articulation. The windows currently have aluminum sashes, which replaced the original multiple light, steel sashes.

Above elevation 619' MSL, the concrete retaining wall portion of the structure is braced with stepped buttresses. The shoulders of the buttress are stepped, or set back, where the depth of the buttresses reduces.

The upper portion of the Power House, along with the adjoining East Retaining Section, the spillway, and the west retaining section, supports a 20' wide roadway (U.S. Highway 54, Business Route), and a 3' wide sidewalk along the south side of the roadway at elevation 669' MSL. The guardrail along the south side of the sidewalk is constructed of poured concrete. The guardrail has thickened piers in line with the buttresses below. The south face of each pier has a trapezoidal shaped medallion of formed as part of the concrete. Two reveals near the top of the wall extend between each of the piers.

Triangular-shaped lookout towers project from the south side of the sidewalk at the east and west ends of the power house. These lookout towers have standing seam metal roofing. The parapets and surface trim are stepped and set back, reflecting the Art Deco influence on the design. On the north side of the highway, a 70-ton gantry crane travels along rails to operate the head gates.

The following operations, maintenance, and control areas are located within the Power House structure.

- Control Room/Switch Room – elevation 600' MSL
- Electrical Bay/Switchgear Bay – elevation 600' MSL
- Office Bay – Administrative offices for the Osage Power Plant are located on the elevation 600' MSL operating deck
- Control Room - elevation 600' MSL
- Engineering offices - elevation 600' MSL
- Main Operating Floor – elevation 581' MSL

- Machine Shop – elevation 574' MSL
- Air Compressors Room – elevation 562' MSL
- Pump Room – elevation 549' MSL
- Drainage Sump – elevation 533' MSL

The Office Bay is composed of the public entrance, restrooms, clerical office, conference room, superintendent's office, and locker room. Walls and ceilings of the entry are painted plaster. Flooring is 12" square vinyl composition tile. Bases are clear-finish wood with built-up rectangular profiles. Doors are one-over-one panel design; some have glass lights in the upper panel. Wood trim and chair rails are plain rectangular profiles with eased edges and clear-finish. The electrical bays, control room, engineering office, and conference/work room adjoin the Office Bay and are separated from each other by hallways containing stairways. The corridors have painted plaster walls, exposed aggregate concrete floors, and exposed concrete roof structure. Equipment areas typically have exposed concrete walls, ceilings, and floors.

The stairs are of open pan steel construction with painted square steel balusters and clear finish wood rails. Lighting throughout the interior spaces is a mixture of pendant fixtures with ribbed glass and milk glass shades, surface mounted utility fixtures, and fluorescent fixtures.

In 1953, generating units #7 and #8 were added to the facility. At that time, the area currently occupied by the engineering office and work/conference room at elevation 600' MSL were added to the Power House. The exterior of the addition continued the design of the original Power House exterior. In the engineering office, the walls are painted plaster, floors are 9" composition tile, and ceilings are 24" square acoustical tile. At the conference/work room area, the walls are faced with acoustical panels, the flooring is carpet and the ceilings are 24" square acoustical tile. In the corridors, the walls are painted plaster, floors are smooth concrete, and the ceilings are exposed concrete structure.

The intake, or headworks, for the power station contains all the necessary head gates, appurtenances, stop logs, and trash racks for operation of this type of hydroelectric plant. A concrete skimmer wall extending about 30' below the maximum headwater level was also constructed as an integral part of the headworks. The head gates for each main unit are of structural steel, are of the fixed roller type, and allow a clear opening, measuring 23' x 26'. Structural steel head gates of the fixed roller type, each with a clear opening 7' x 12'-6", serve the station service units. The head gates were manufactured by the M. H. Treadwell Manufacturing Company.

Vertical trash racks are installed between the skimmer wall and the head gates. The guides for these vertical trash racks are so arranged as to allow the trash racks to be replaced by stop logs in order that any unit may be unwatered as necessary. A motor-operated rake has also

been provided for cleaning the trash racks. The trash racks were manufactured by the Stupp Brothers Bridge & Iron Company.

The four main divisions of the water passages to and from the turbines are:

1. The intake
2. The penstock
3. The spiral casing (scroll case)
4. The draft tube

Lake water enters through the head gates, into the plate-steel-lined penstocks and then into the plate-steel-lined scroll case, the passage that encircles and narrows and admits water to all sides of the turbine. Both the penstock and scroll case are surrounded by reinforced concrete. The draft tubes are of the elbow type and have plate steel liners for the upper end of the vertical section. The draft tubes discharge directly into the river with provision for stop logs at the draft exits for dewatering each unit.

Water from the lake enters the penstocks through rectangular openings 26’ x 23’. The intakes for the turbines are approximately 60’ below the normal water surface. The openings may be closed by lowering the head gates with the gantry crane after the turbine gates have been closed. The head gate consists of two steel bulkheads which, when permanently bolted together, make the dimensions of one unit about 27’ x 27’. The head gate slot is provided with rails which serve as guides. Wheels mounted on the head gate roll upon a downstream pair of guide rails to limit the amount of compression given to the rubber seals that are mounted around the edges of the gate. The rubber seals bear against brass sealing plates that are installed around the penstock entrance. A bottom rubber seal with its compression stops bears upon a steel channel imbedded in concrete at the bottom of the head gate slot. The head gate is normally lowered at any time there is required maintenance within the penstock, spiral casing, or draft tube; or on the turbine or governor.

A by-pass, or filler gate, is opened to fill the penstock, after the turbine gates are pressure closed and the unwatering valve is closed and locked. The filler gate is a 3’ x 3’ sliding steel gate that is positioned by a stem or shaft that extends to a motor driven valve stand in the filler gate tunnel at elevation 660’ MSL. A venting channel from the penstock to above full lake level allows air to escape as the penstock is filled with water.

The water intake is provided with a strainer made up of two parts. The first is a skimmer wall that prevents floating debris from entering the intake for all lake levels within the design range of elevation 630’ MSL to elevation 660’ MSL plus 9’ of excess. The second is a set of seven trash racks which, when used with one stop log in the storage position, provide a screened

entrance to the penstock to prevent the entry of submerged debris. Each of the five lowest racks is a steel framing about 11' x 30', covered with vertical steel bars space 6" apart. The two upper racks have wood timbers with 4" openings between timbers, rather than steel, to reduce the problem of corrosion as the racks are alternately exposed to water and the atmosphere as the lake elevation varies. A trash rake, a device with steel fingers that enter the rack slots, is used to clean the upstream side of the racks as debris accumulates.

The penstocks, or passages that convey water from the intake structure to the scroll cases, are concrete for a few feet adjacent to the entrance, but change to a riveted plate steel liner embedded in concrete for the remainder of the distance to the entrance to the spiral casing. The upper end of the steel liner makes a gradual transition from a rectangular to circular cross-section, reducing in size gradually, until at the entrance to the spiral casing, the inside diameter is 18'-6". Each of the openings to the penstocks can be closed by lowering a head gate, consisting of two bolted steel bulkheads.

Spiral casings encircle the speed rings of the turbines for the purpose of admitting the water pressure to all sides of the turbines. The spiral casings become progressively smaller over their length in order to keep the average water velocity below maximum design values. Two manholes are provided for access to the casing interior, one on the top downstream side, the other on a side at the elevation of the centerline of the turbine setting.

Draft tubes discharge water from the bottom of each turbine to the downstream side of the dam. The draft tubes are flared from the entrance to the elevation of the minimum tailwater in order to recover some of the energy remaining in the water discharging from the runner. This upper portion of the draft tubes is lined with a smooth steel liner to reduce turbulence to a minimum and to prevent erosion of the draft tube entrance due to turbulence in the water leaving the runner. The gradual enlargement of the tube is continued, as it turns to a horizontal direction and issues to the river through the discharge openings.

Each of the eight main units is a vertical shaft water wheel of the Francis Type rated at 33,500 horsepower (HP) with a 4,000 cfs discharge, under a design head of 90' and a rotating speed of 112.5 revolutions per minute (RPM). Both of the station service units are vertical shaft water wheels of the Francis Type also, with a rating of 3,025 HP with a 350 cfs discharge, under a design head of 90' and a rotating speed of 327.3 RPM. The main water-wheel units were furnished by the Allis-Chalmers Manufacturing Company.

In 2002, the original water wheels #3 and #5 were removed and replaced with new turbines manufactured by American Hydro. One of these original turbines is now displayed in the visitor's overlook above Bagnell Dam. The other turbine is on display on the west end of the dam in an area provided by the City of Lake Ozark. As of 2010, a total of six of the original

water wheels have been replaced. The replacement wheels have three different designs with numbers for flow and horsepower.

The amount of water that passes through the turbine is controlled by positioning the guide vanes (wicket gates). The guide vanes act as the machine throttle. The positioning of the guide vanes is achieved by connecting links connected to a shifting ring located concentric to the machine shaft. The opening and closing of the turbine gates is controlled by a governor, varying the gates automatically to regulate machine speeds.

The water wheels are located inside plate-steel scroll cases encased in concrete, and discharge into reinforced-concrete draft tubes with short plate-steel liners directly below the runners. An inspection and drainage tunnel is located upstream from the draft tubes and directly below the scroll cases.

Steel covers for the eight main turbine-generators are located above the generators and turbines on the lower operating deck (elevation 600') on the downstream side of the dam. A 150-ton capacity traveling electric gantry crane is located above the lower operating deck. It is used to lift the steel covers over the generators and water wheels and to remove components for maintenance or replacement.

Each water wheel is direct connected to an umbrella-type, 13,800-volt, three-phase, sixty cycle, vertical shaft generator. Each generator has a continuous capacity of 23,888 KVA, at 90 percent power factor, 112.5 RPM, 60 degrees Centigrade temperature rise, or 27,500 kw 100 percent power factor, at 80 degrees Centigrade temperature rise. The two station service units are vertical shaft generators rated at 3000 KVA, 70 percent power factor, 2400 volt, three phase, 60 hertz, 327.3 RPM. The generators were furnished by Westinghouse Electric and Manufacturing Company.

Each main generator has a closed water-cooled air circulating system. The air discharging out through the windings is carried through metal housings around the generators and passed through air coolers located at each side of the generator along the longitudinal center line of the generator room thence up to the closed chamber over the top of the generator and back down and out through the windings. The bottom of the intake opening for each main unit is located at elevation 584' MSL. The bottom of the intake opening for each station service unit is at elevation 590' MSL.

The step-up transformers and getaway structure for the transmission lines are located over the electrical bay with the transformers under the highway bridge and

a transformer transfer track between the getaway structure columns and the transformers. On the getaway structure are mounted the line disconnecting switches, carrier-current coupling condensers, and lightning-arrester equipment.

Electrical current produced at the Osage Power Plant Station is generated by three-phase alternators. Three-phase current is a better source of power for motors and is more economical to transmit, making its use an advantage, to both the customer and the producer. Transmission of power from the Osage Plant is over a three-phase system. The main transformers convert the 13,800 volt current produced by the generators to 138,000 volts for transmission to customers. The main transformers were manufactured by the General Electric Company. Additional engineering data for the Osage Power Plant Station is provided in supplementary material that follows this report.

In addition to energy and capacity, the Osage Power Plant Station provides ancillary services to the AmerenUE system. The facility provides load following capabilities, quick-start capacity, Black-Start capability in the event the electrical system is down, and voltage support. The structure is in good condition, but will be altered for required technological upgrades and enhanced safety.

II. History of the Osage Power Plant Station:

Union Electric began construction of the Osage hydro-electric development on August 6, 1929. Clearing of timber for the reservoir began at that time, although a few men had already begun work to prepare housing and administration offices.[1] The layout for the cofferdam for the spillway and west abutment areas located on the flood plain of the Osage River on the west side of the valley was begun on September 30, 1929.[2] The spillway cofferdam was unwatered on March 1, 1930.[3]

The construction sequence was to cofferdam the spillway and west abutment areas, and then to complete the excavation for that part of the work. Although earth excavation was started before the spillway cofferdam was completed and unwatered, the major portion of the work, except for the diversion channel, was done in the dry. The west abutment and spillway were

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[1]Carole Tellman Pilkington, "The Story of Bagnell Dam," *Lake Area Chamber of Commerce*, 1989, 8-9.

[2]Pilkington, 15.

[3]Cally Lence and Gail White, "Bagnell Dam and Osage Power Plant," National Register of Historic Places Nomination, U.S. Department of the Interior, National Park Service, Washington, D.C., listed August 27, 2008, 16.

then completely concreted except for notches and sluiceways, the bottoms of which were located at the normal river level to provide for later river diversion. The excavation for the diversion channel was carried on simultaneously with the work on the west abutment and spillway portions of the dam. The river was diverted through the temporary notches and sluiceways in the spillway when the concrete in these parts of the structure was completed to a sufficient height. The main power station cofferdam, which extended across the original channel of the river, was then closed and unwatered, after which the erection of the permanent power station structure begun.

Because of the depth and permeable nature of the layer of gravel in the valley bottom a cofferdam with watertight cutoff down to rock was built on the west portion of the dam site and in the river channel. Single lines of steel sheetpiling were driven across the floodplain, while a self-supporting cellular type construction cofferdam was used in the river channel. During the first step of the construction program when the flood plain on the west side of the river was closed by the spillway and west abutment cofferdam, a sluiceway capable of flooding the entire excavated area within twenty four hours was installed in the river end of the cofferdam. This precaution was taken to prevent erosion of the slopes of the earth prism supporting the steel sheeting if the cofferdam were overtopped. As soon as the critical flood period of the year was passed in May 1930, work was started on the power station cofferdam, restricting the river channel to a clear width of 200'. As soon as the concrete in the west abutment and spillway section had been completed to Elevation 585' MSL, the ordinary high stage of the river, the spillway cofferdam was removed, the diversion channel opened and the river returned through the slots and sluiceways in the spillway section of the dam.[4]

Erection of the Power House steel structure began on December 10, 1930. Less than one year later, on August 6, 1931, the generator tests started, and on September 3, 1931, the water wheel tests started. By October 16, 1931, the first commercial operation of the Osage Power Plant began.[5] At this time, the Osage Plant was connected to the St. Louis system, the expansion of which allowed Union Electric to sell power to St. Louis and Rivermines customers at less cost. Soon thereafter, electrification came to the lake area. The first distribution pole was set on the south side of the Osage River. The first power line extended from the spillway structure to an H-frame structure on the south bank. The line was energized on December 24, 1931, and served twenty-four customers.[6]

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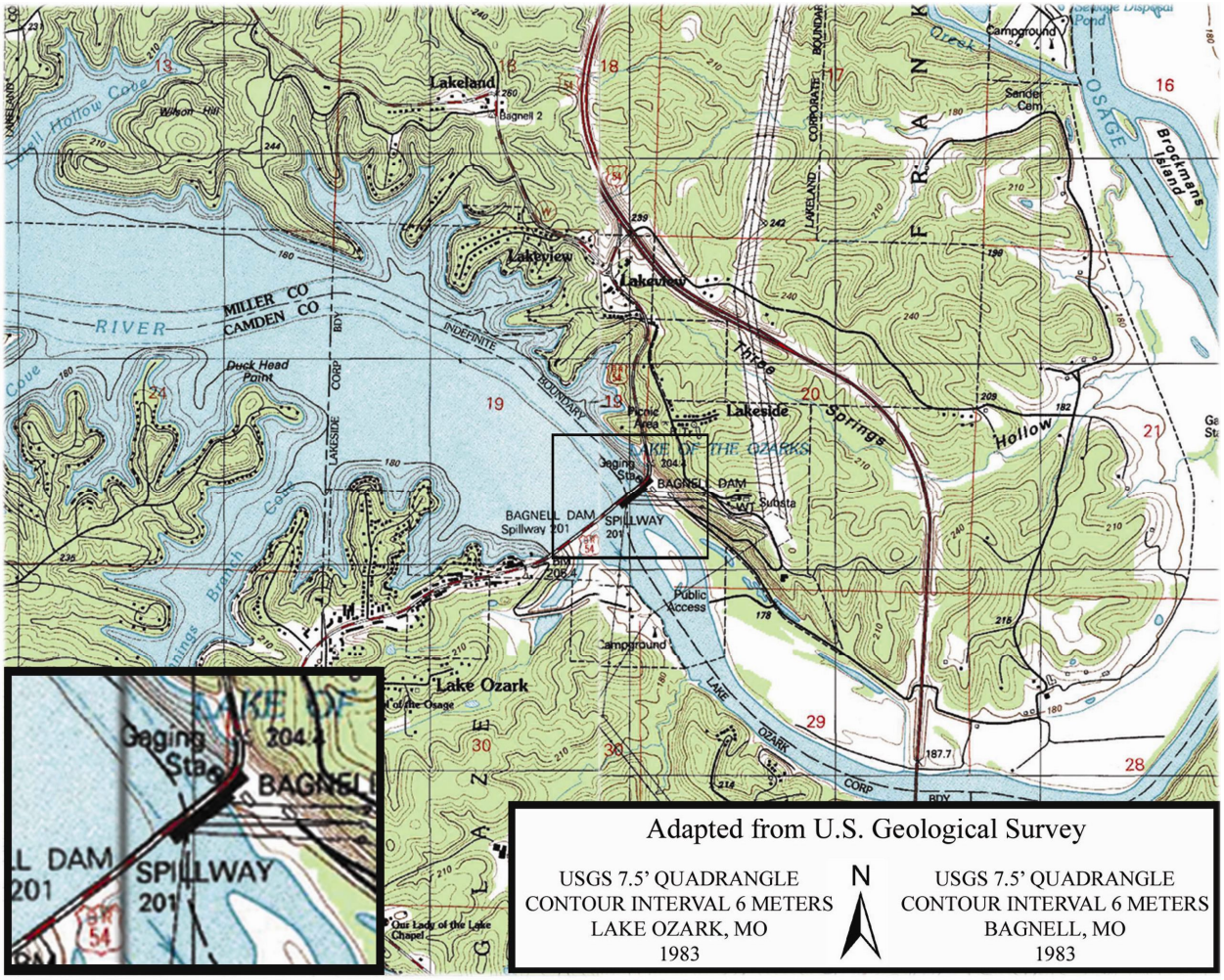
[4]A.W. Clark, "Construction Features of Osage Hydro-Electric Development," In *Engineering News-Record*, March 26, 1931, 525-526.

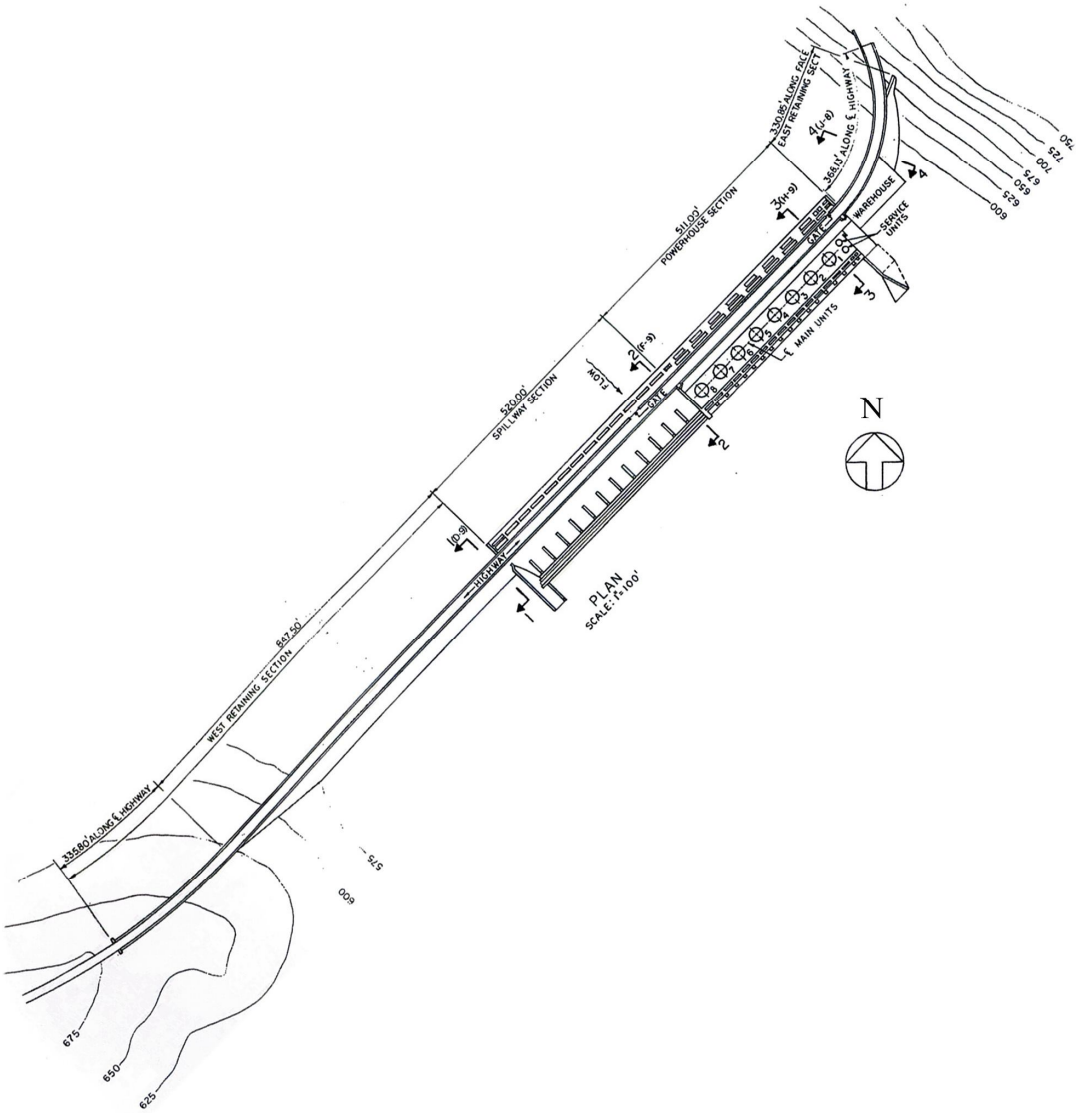
[5]Pilkington, 15.

[6]Lorraine Burke, *50th Anniversary Bagnell Dam 1931-1981*, Lake of the Ozarks Area Council of the Arts, 1981, 36.

Map of Location within the State of Missouri
Bagnell Dam and Osage Power Plant
Adapted from http://www.lib.utexas.edu/maps/united_states/missouri_90.jpg



Map of Vicinity of Lake Ozark
Bagnell Dam and Osage Power Plant
Adapted from U.S. Geological Survey, Lake Ozark and Bagnell Quads,
http://store.usgs.gov/b2c_usgs/usgs/maplocator



Sketch Map
Bagnell Dam and Osage Power Plant
Adapted from Construction Drawing 7649-X-501752
Original on file at AmerenUE, St. Louis, Missouri

Primary Engineering Features of the Osage Power Plant Station

Civil/Structural Features	
Length of West Non-Overflow Section	1181’
Permanent Crest Elevation of West Non-Overflow Section	669’*
Length of Gated Spillway Section	520’
Permanent Crest Elevation of Gated Spillway Section	638’*
Type and Number of Gates Within Gated Spillway Section	12 Tainter gates (34’ x 22’) (sill - 638*)
Length of Powerhouse (Integral with Dam)	511’
Width of Powerhouse (at the base)	150.5’
Height of Powerhouse	148’
Length of East Non-Overflow Section	331’
Permanent Crest Elevation of East Non-Overflow Section	669’ (original); 674’ (revised)*
Gross Flow Area Upstream of Trash Racks (per unit)	1,058 square feet
Clear Trash Rack Spacing	6”
Max Velocity at Trash Racks	3.8’ per second

*UED=Union Electric Datum which is equal to USGS datum.

Primary Engineering Features of the Osage Power Plant Station (continued)

Impoundment Features	
Total Drainage Area of Osage River	15,300 square miles
Total Length of Drainage Area	250 miles
Drainage Area Upstream of Bagnell Dam (located at river mile 81.7)	13,944 square miles
Normal Maximum Water Surface Elevation	660’*
Surface Area at Normal Maximum Water Surface Elevation	54,000 acres
Impoundment Length (Lake of the Ozarks)	93 miles (river mile 81.7 to 174.5)
Shoreline Length	1,150 miles
Gross Storage at Normal Maximum Water Surface Elevation	2,000,000 acre-feet
Normal Operating Range Normal Operation Range (elevation)	10’ 660’ - 650’*
Useable Storage (elevation 650) (elevation 645)	468,000 acre-feet 668,000 acre-feet
Minimum Reservoir Elevation (Emergency)	645’*

*UED=Union Electric Datum which is equal to USGS datum.

Primary Engineering Features of the Osage Power Plant Station (continued)

Main Turbine Features (Original 1930 and 1953, Eight Main Turbines, Two House Turbines)	*Main Turbine*	*House Turbines*
Runner Manufacturer Orientation and Type	Allis-Chalmers Vertical Francis	Allis-Chalmers Vertical Francis
Design Head	90’	90’
Rated Capacity	33,500 HP	3,025 HP
Rated Turbine Discharge	4,000 cfs	350 cfs
Runner Diameter	133”	40”
Runner Operation Speed	112.5 rpm	327 rpm
Runner Tip Speed	65.3 fps	57.1 fps

Primary Engineering Features of the Osage Power Plant Station (continued)

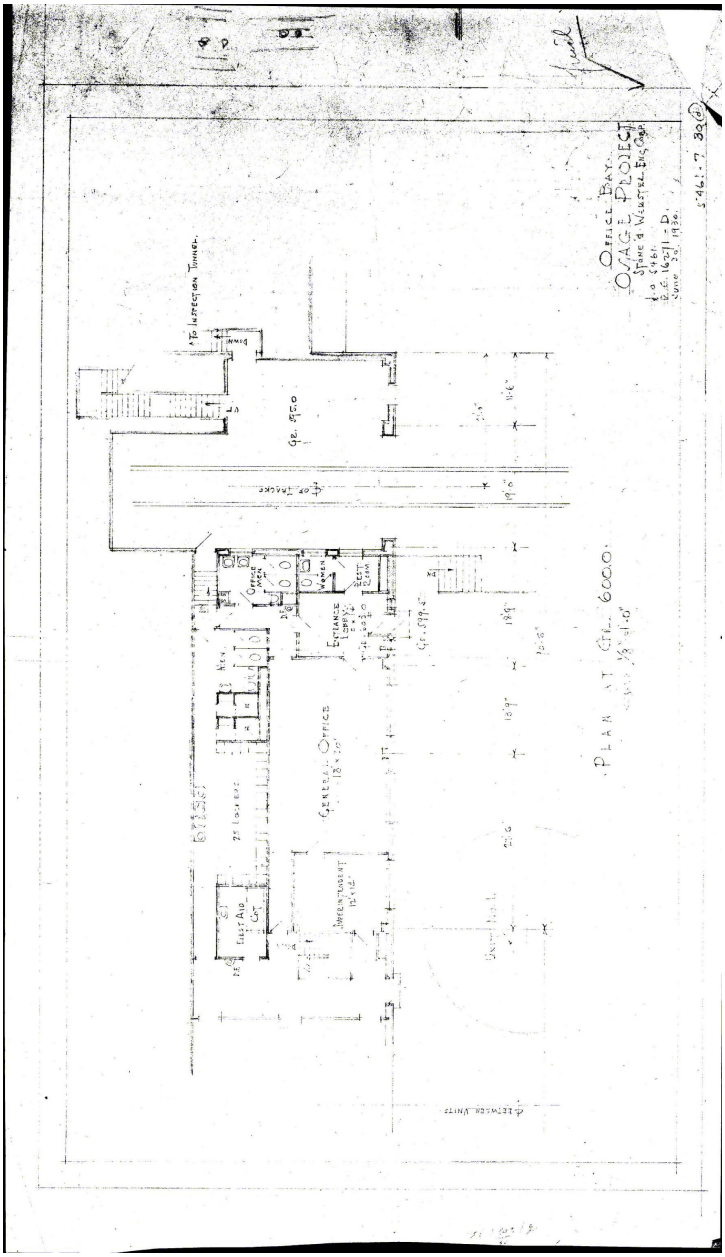
Generator Features *(Eight Main Generators, Two House Generators)*	*Main Generators*	*House Generators*
Generator Manufacturer Nameplate Rating	Westinghouse Electric & Mfg. Company 21.5 MW	Westinghouse Electric & Mfg. Company 2.1 MW
MVA Rating	23.8 MVA	3.0 MVA
Power Factor	90	70
Voltage	13,800 volts	2,400 volts
Current	1,150 amps	722 amps
Cycles/Phases	60/3	60/3
Exciter Manufacturer Capacity Voltage Current	ABB solid sate 250 volts 1,000 amp	Westinghouse 35 kW 250 volts 118 amp
Station Output at Maximum Discharge	200 MW	4.2 MW

Primary Engineering Features of the Osage Power Plant Station (continued)

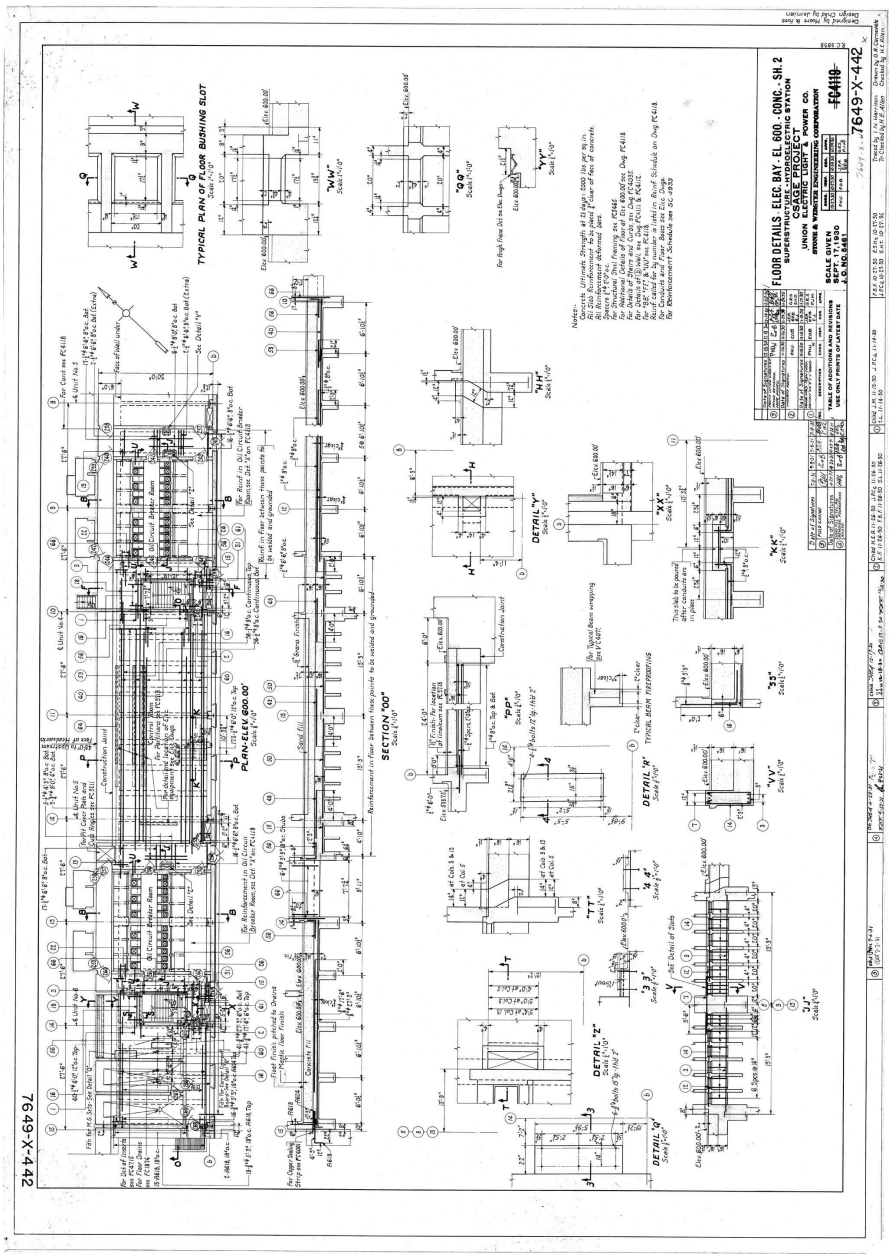
Appurtenant Equipment Features	
Step-Up Transformers Number Low Side Voltage High Side Voltage MVA Rating	 Four 3-phase transformers service the eight main generators (one set of 3 single phase transformers per 2 generators) 13.8kV 138.0 kV 60 MVA
Station Service Transformers Number Low Side Voltage High Side Voltage MVA Rating	 One 3-phase transformer services the two house generators 2.4 kV 13.8 kV 3.75 MVA
Governor Type and Pressure	Voith 160 psi
Powerhouse Crane	150 ton - Whiting Corporation
Gantry Cranes on Dam	70 ton - Whiting Corporation
Crest Gates	Mississippi Valley Structural Steel Co.
Head Gates	M. H. Treadwell Mfg. Company
Trash Racks	Stupp Bros. Bridge & Iron Company

Information taken from Initial Consultation Document, Osage Project (FERC No. 459), AmerenUE and Duke Engineering and Services, Inc. January 2001.

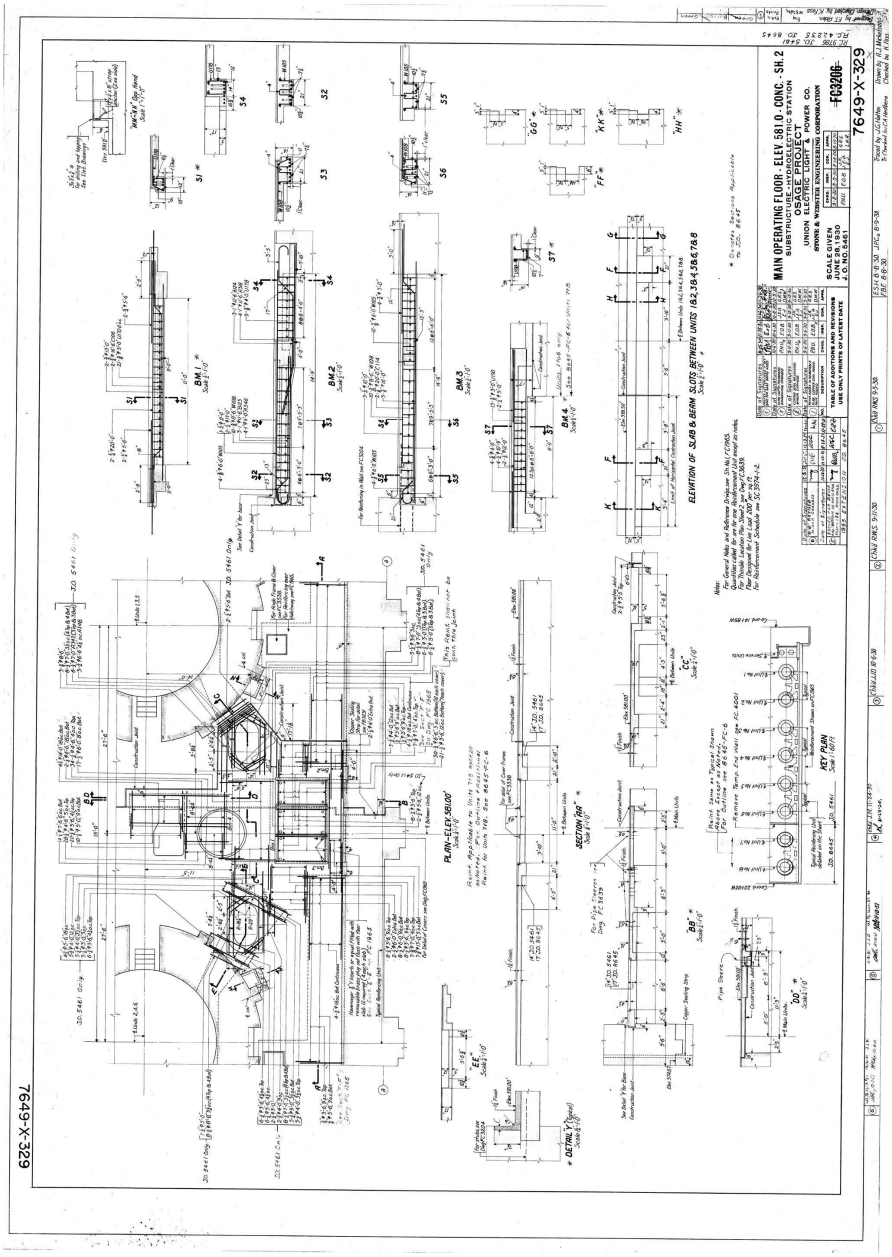
Reduced copy of historic aerial photographs, dated February 20, 1973
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic plan, dated June 30, 1930
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic floor details, dated July 7, 1931
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic plans and details, dated December 8, 1951
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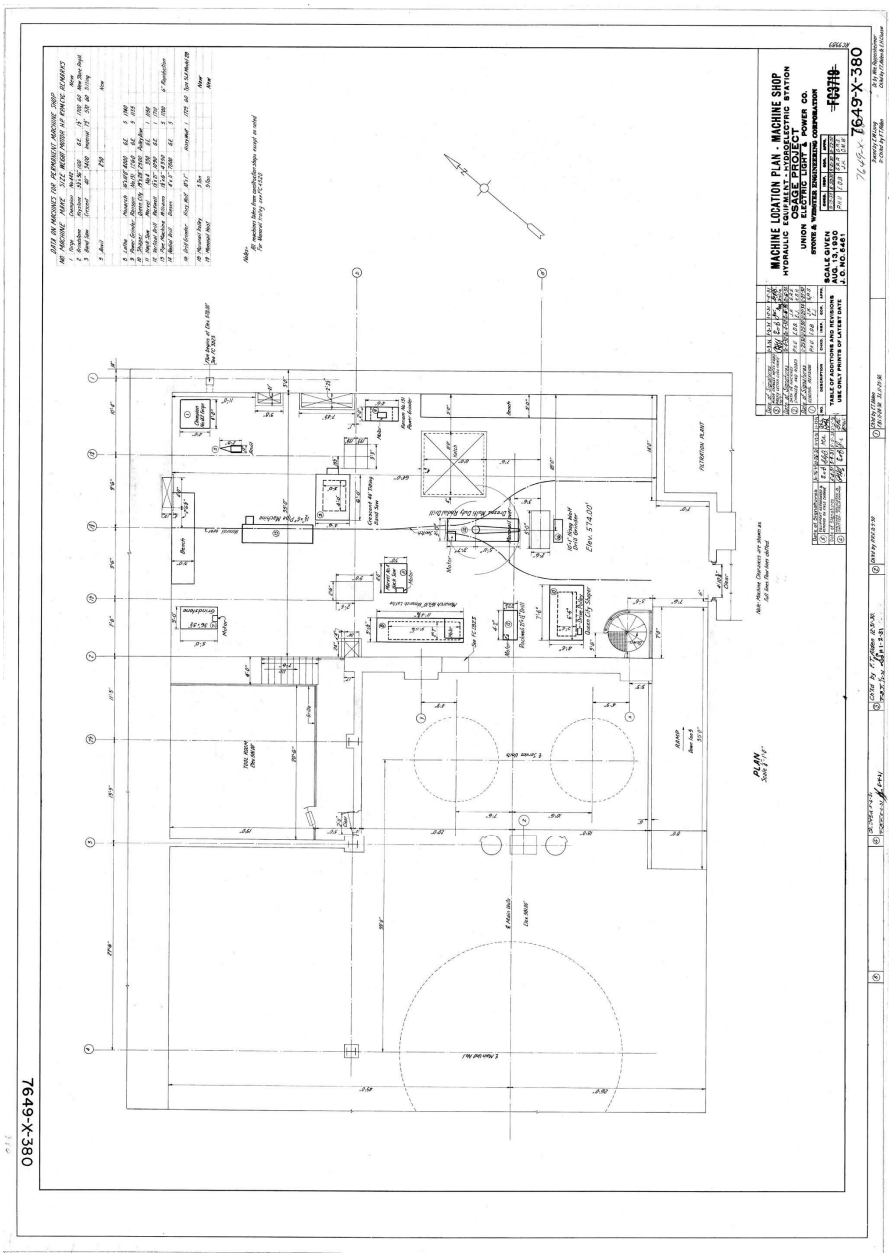
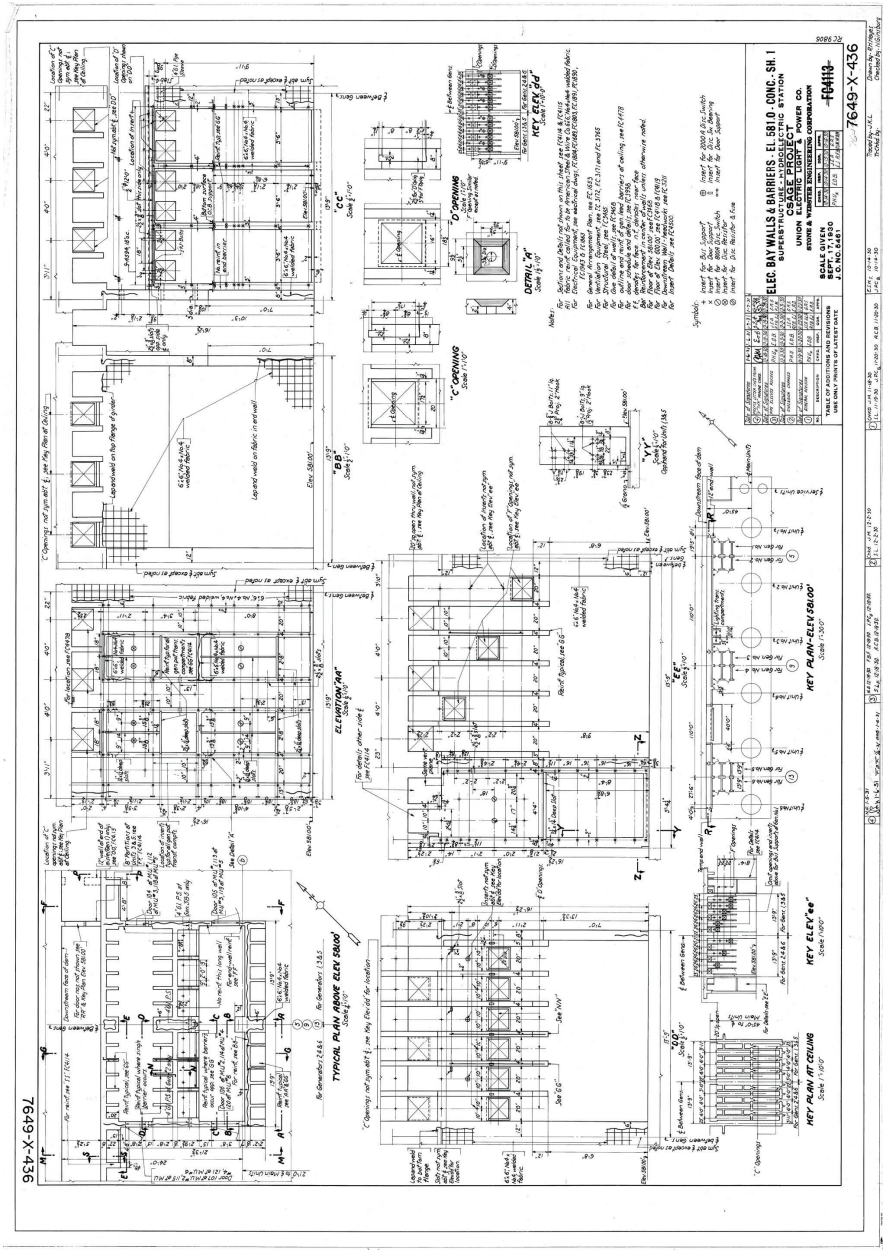
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic machine location plan, dated May 4, 1931
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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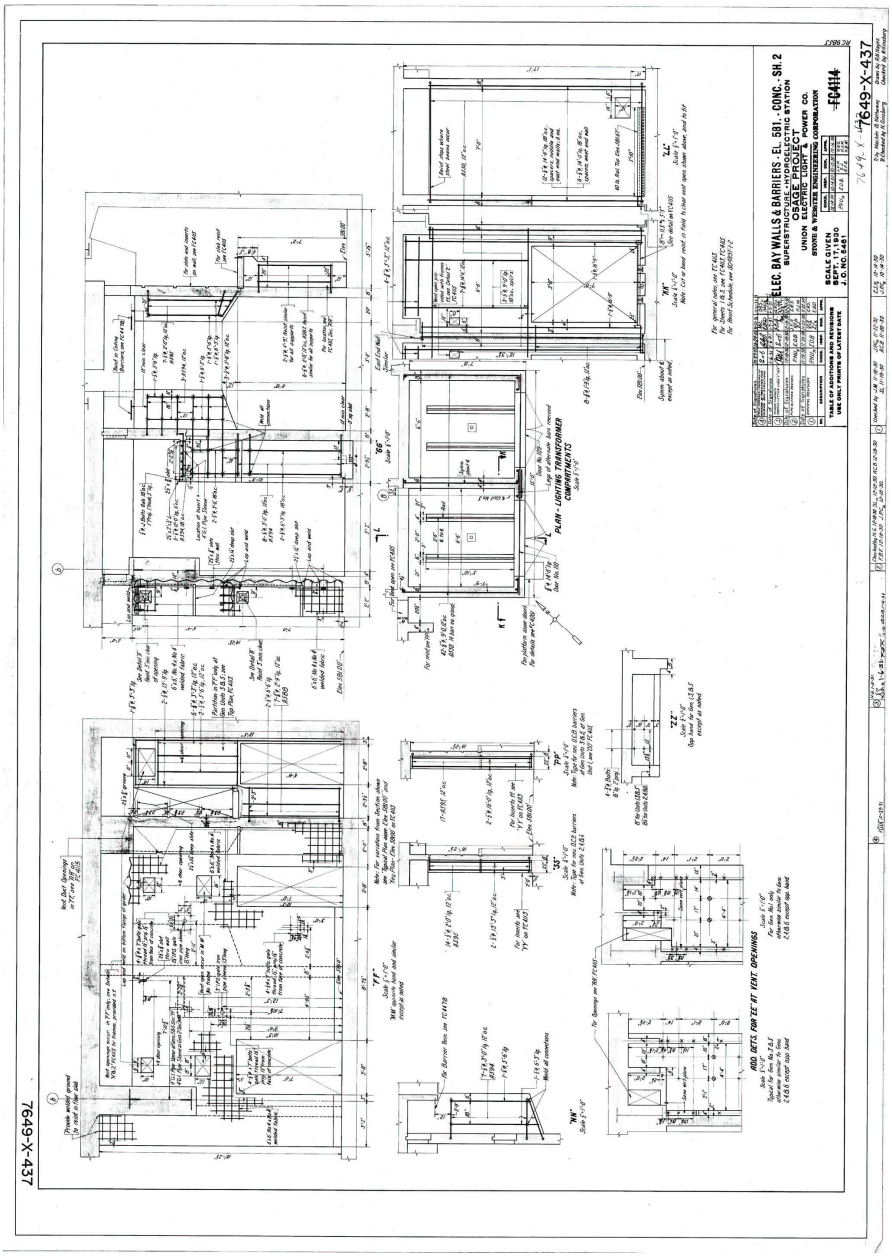
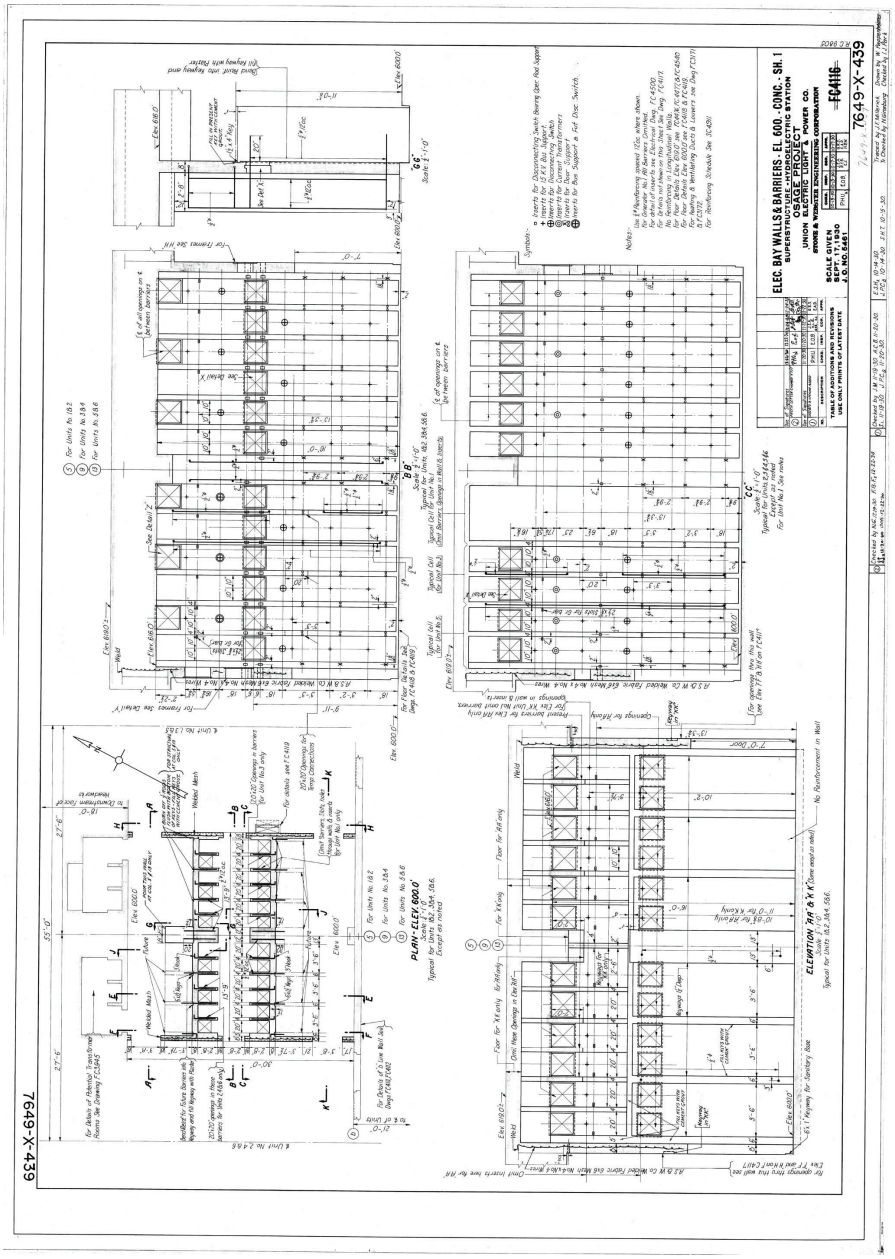
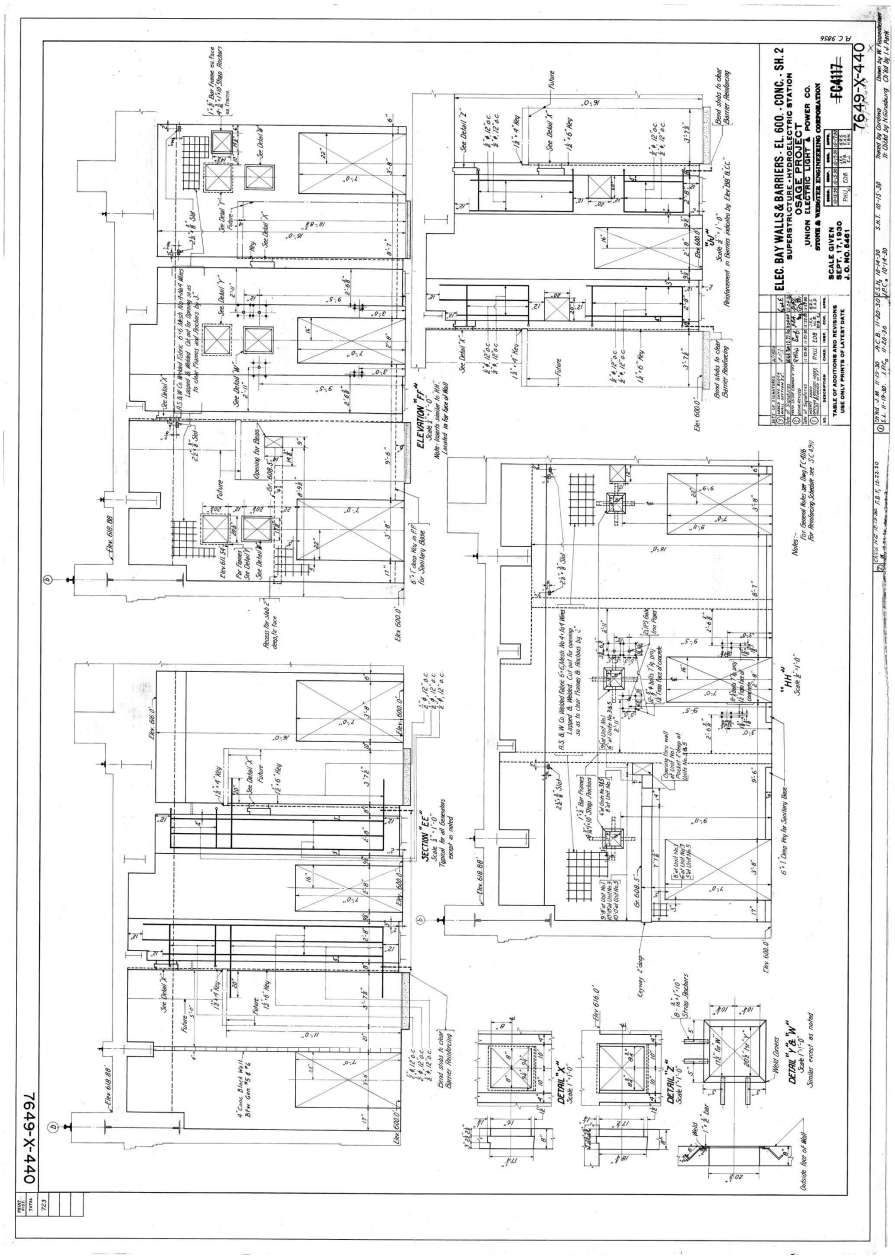
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic details and plans, dated October 29,1931
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic plan and elevation, dated December 22, 1930
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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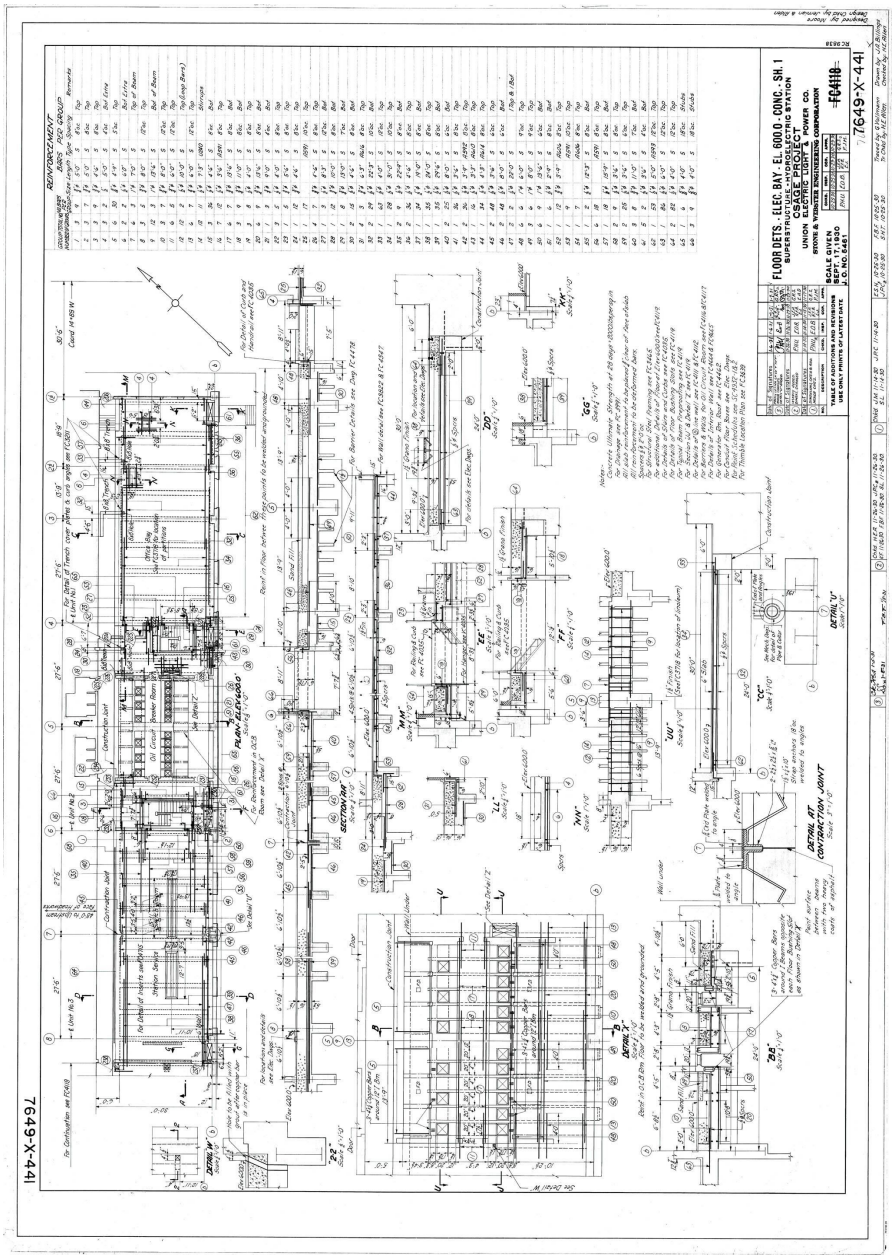
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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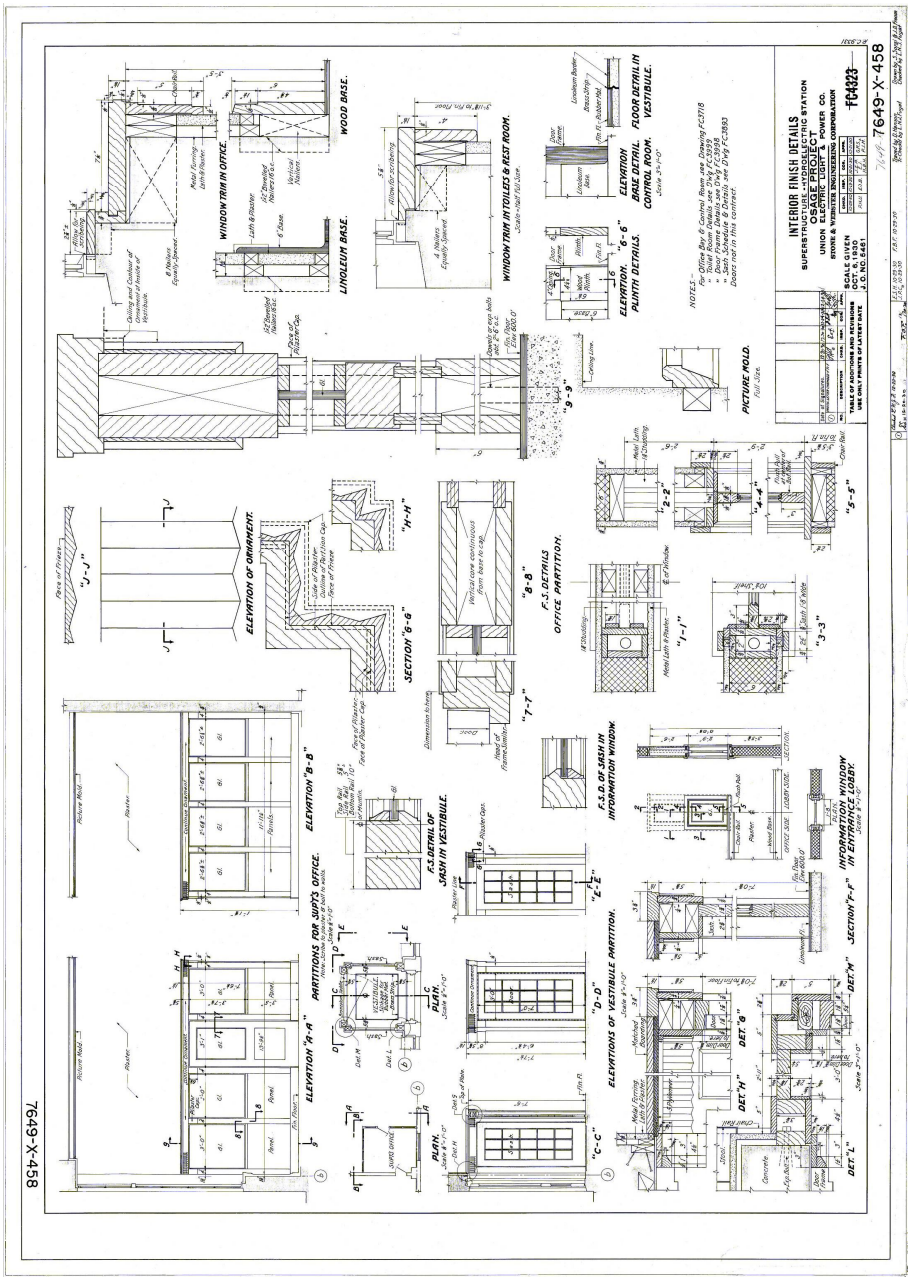
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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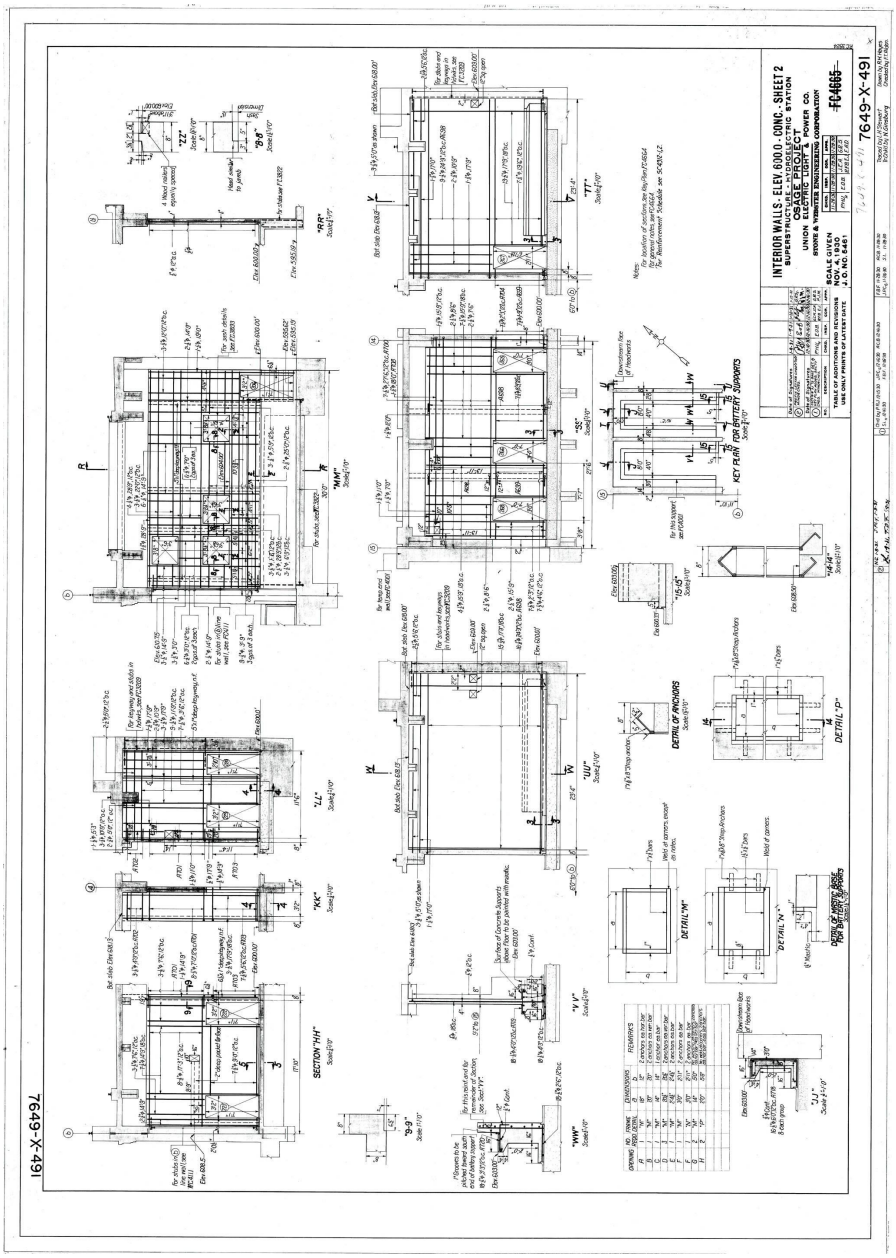
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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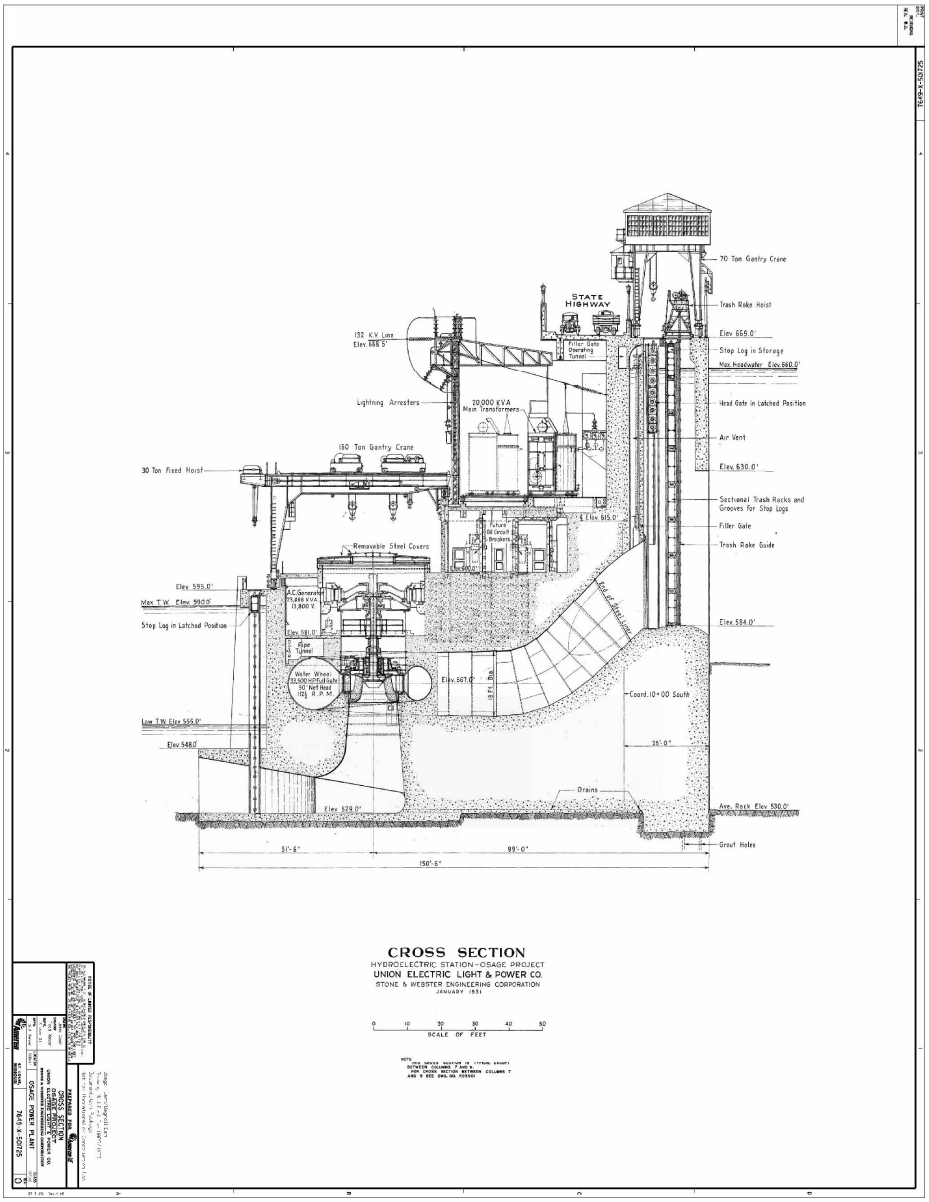
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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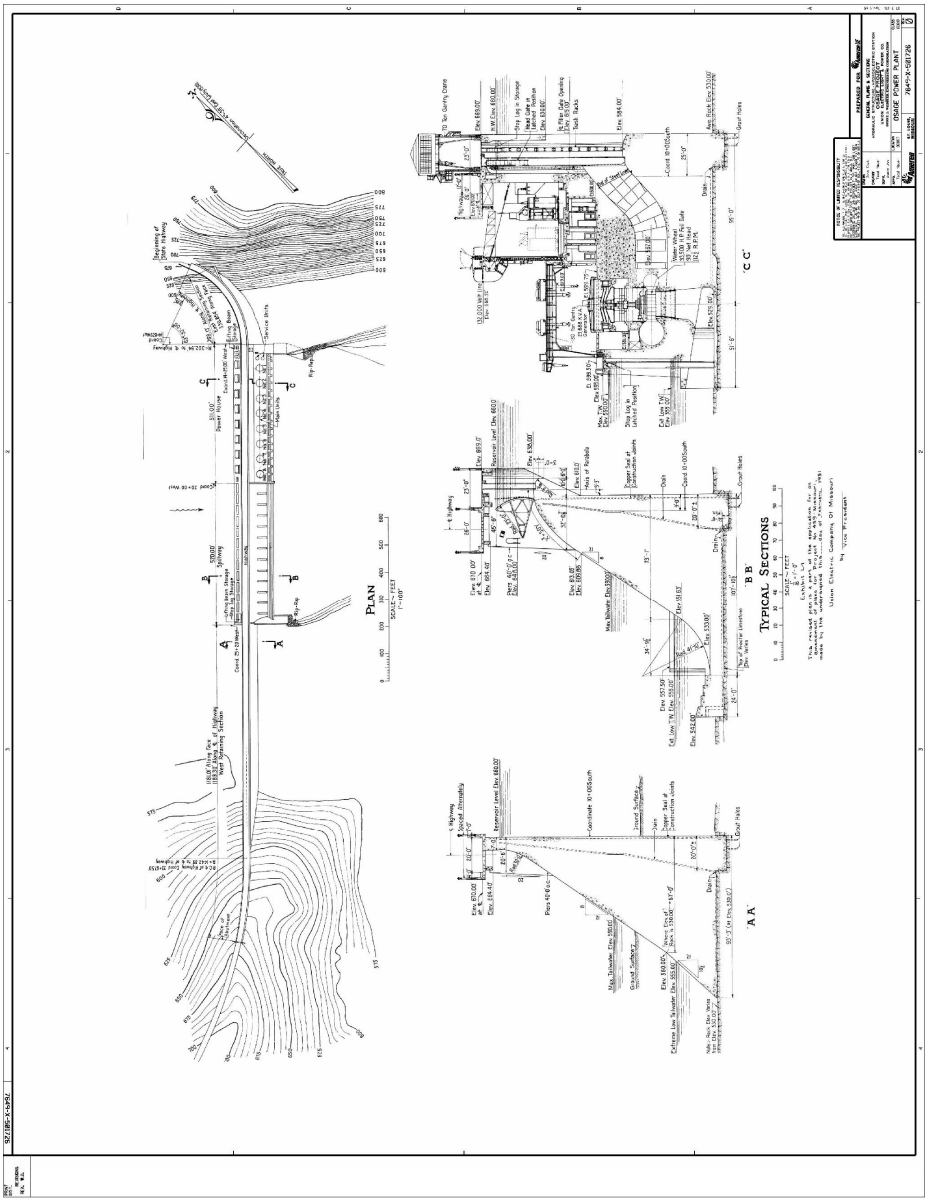
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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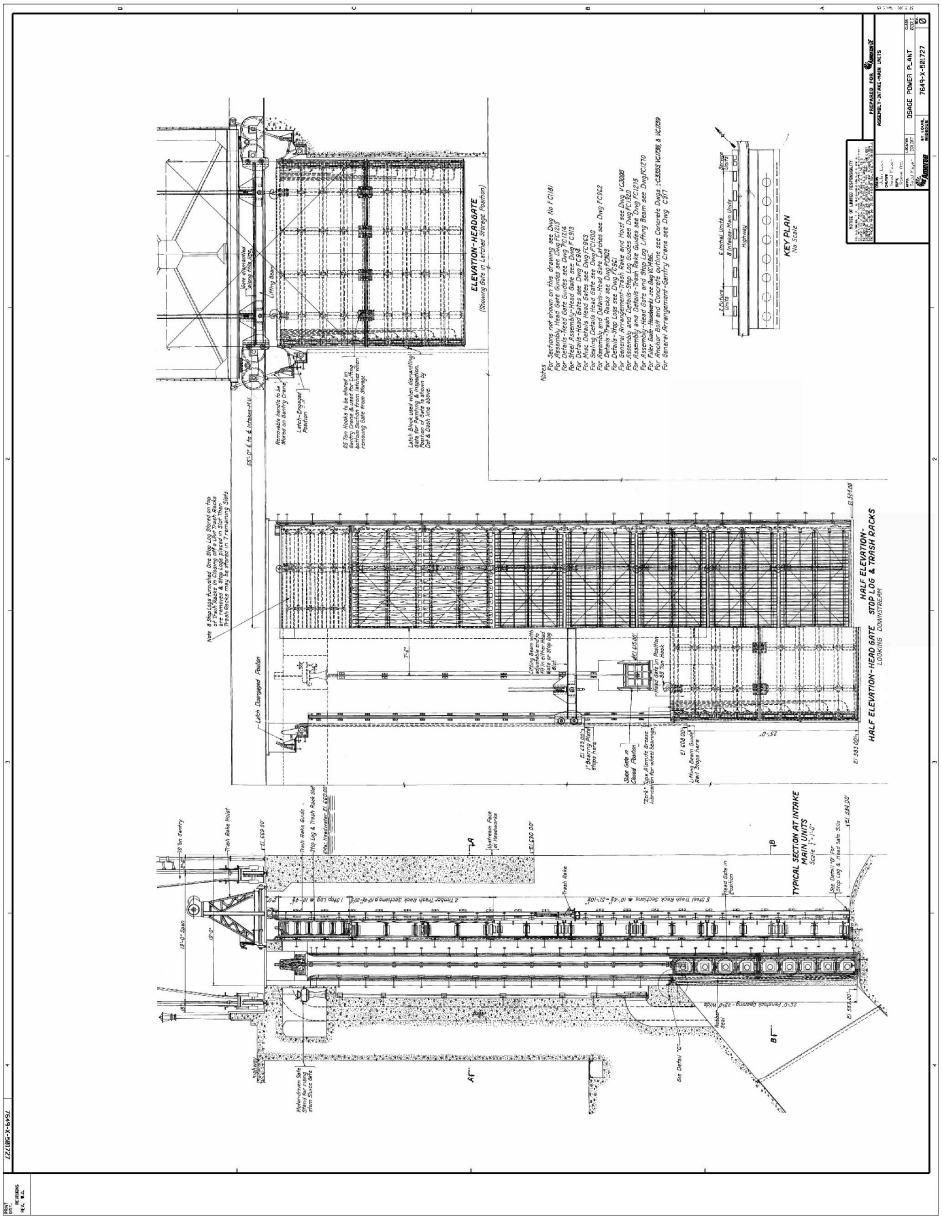
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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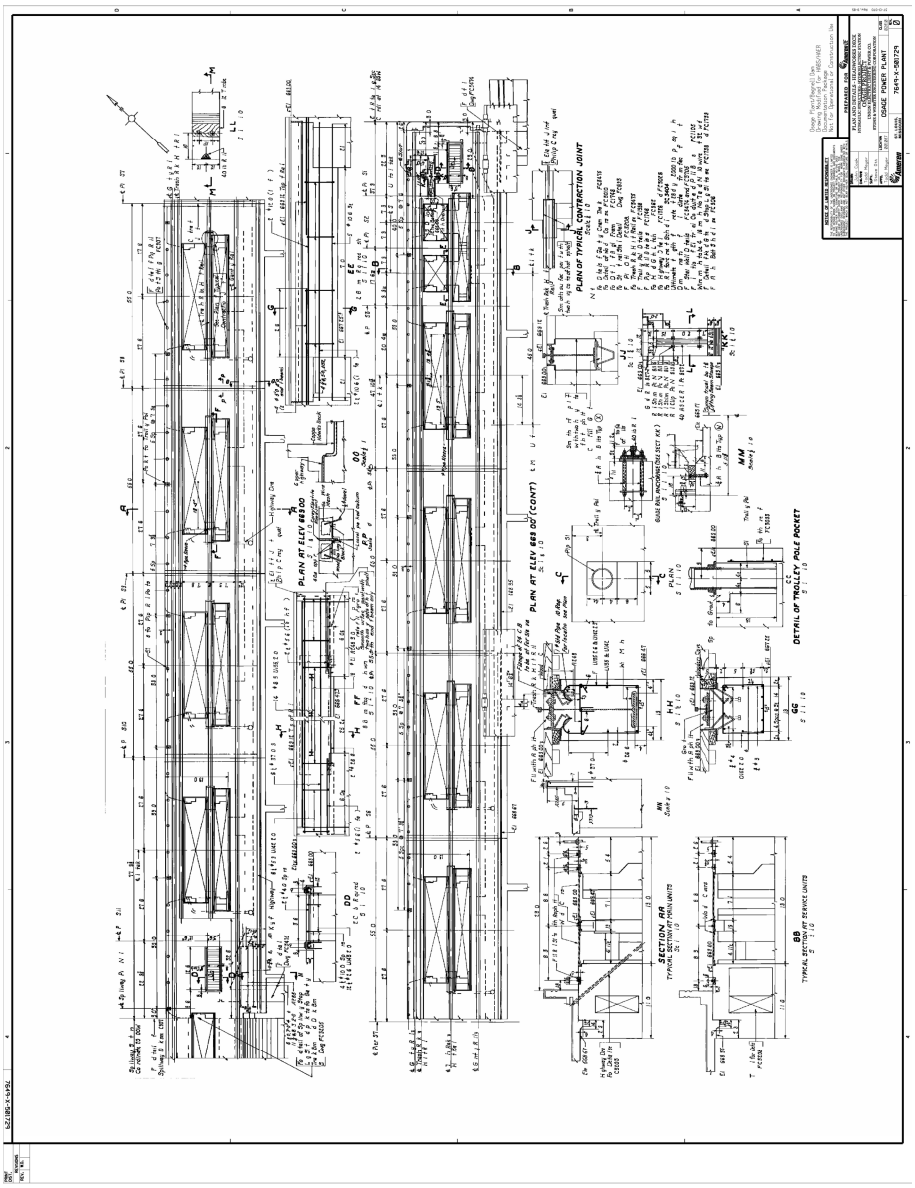
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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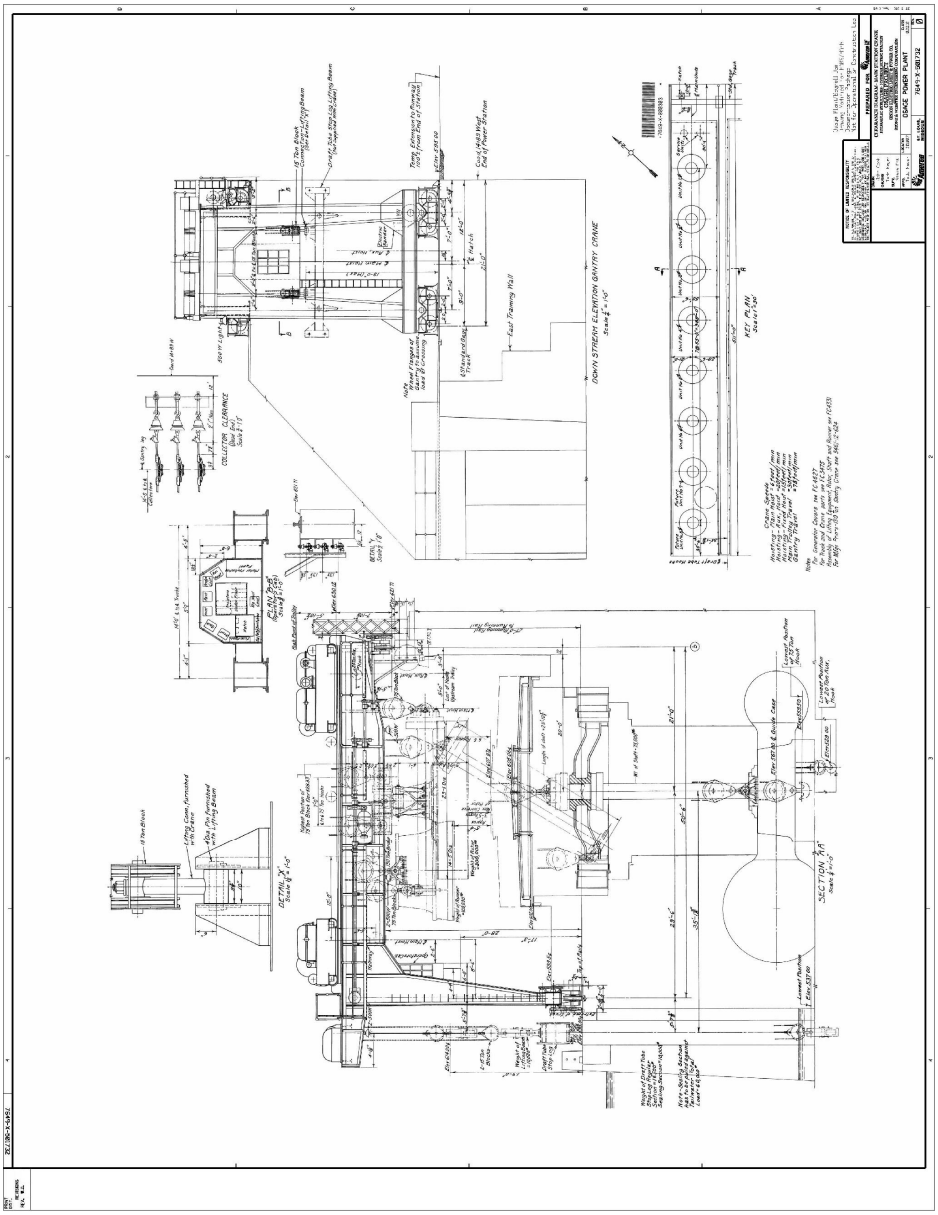
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



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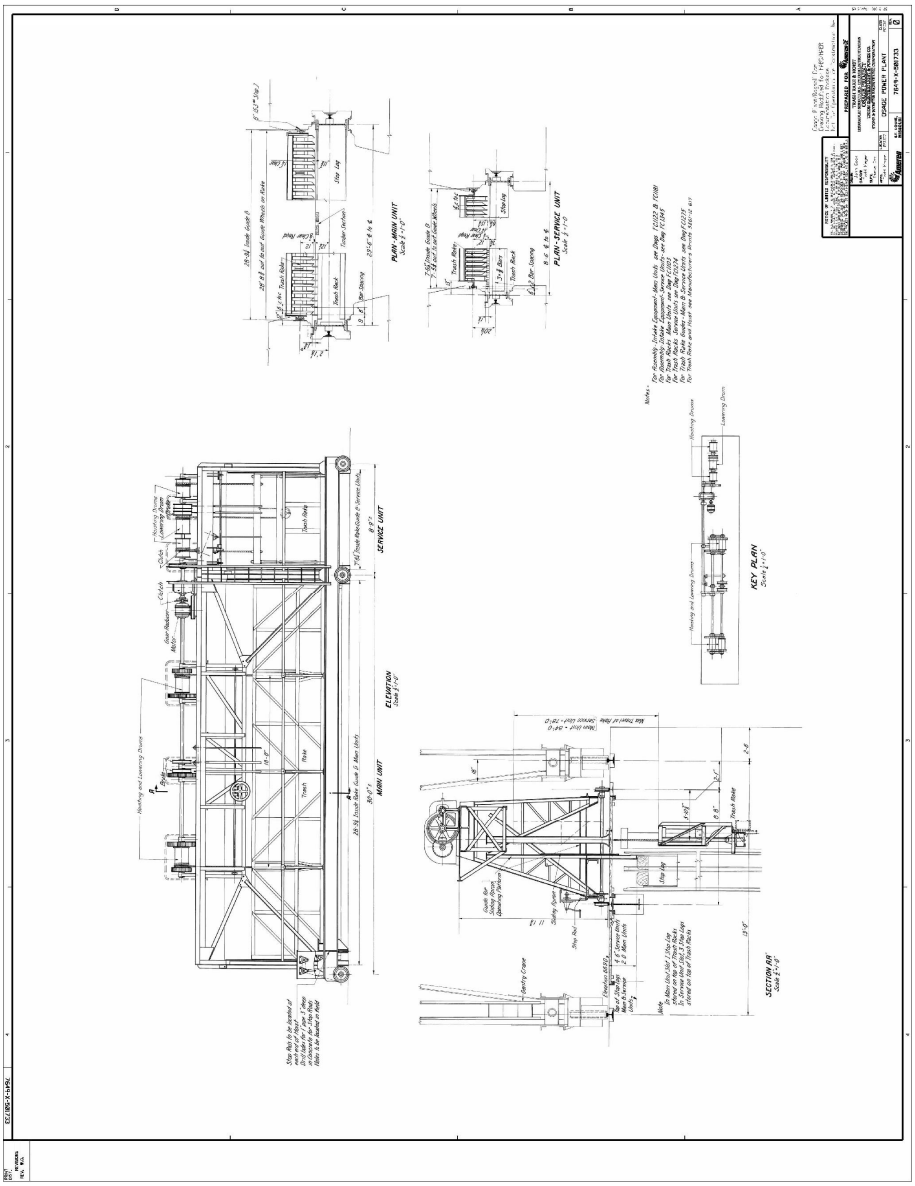
Original on file at AmerenUE, St. Louis, Missouri



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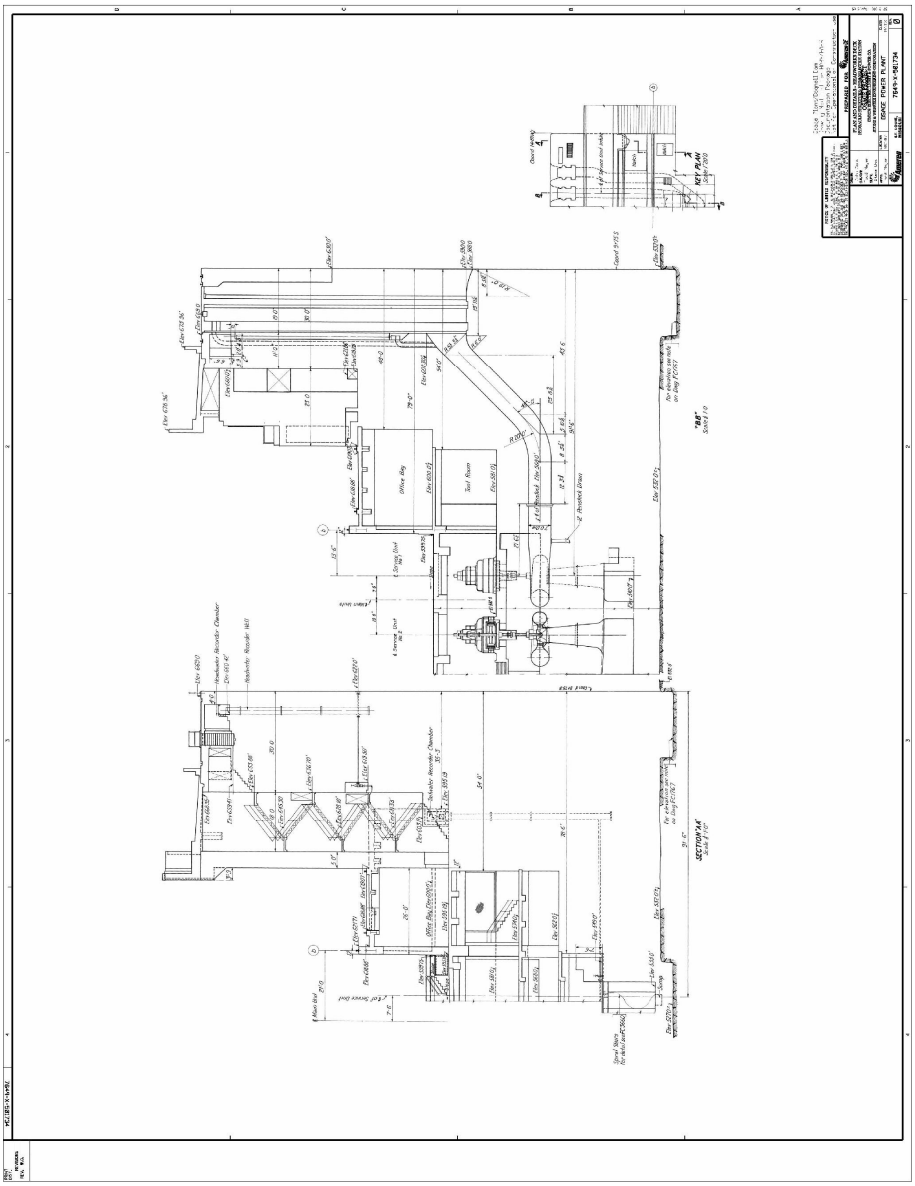
Original on file at AmerenUE, St. Louis, Missouri



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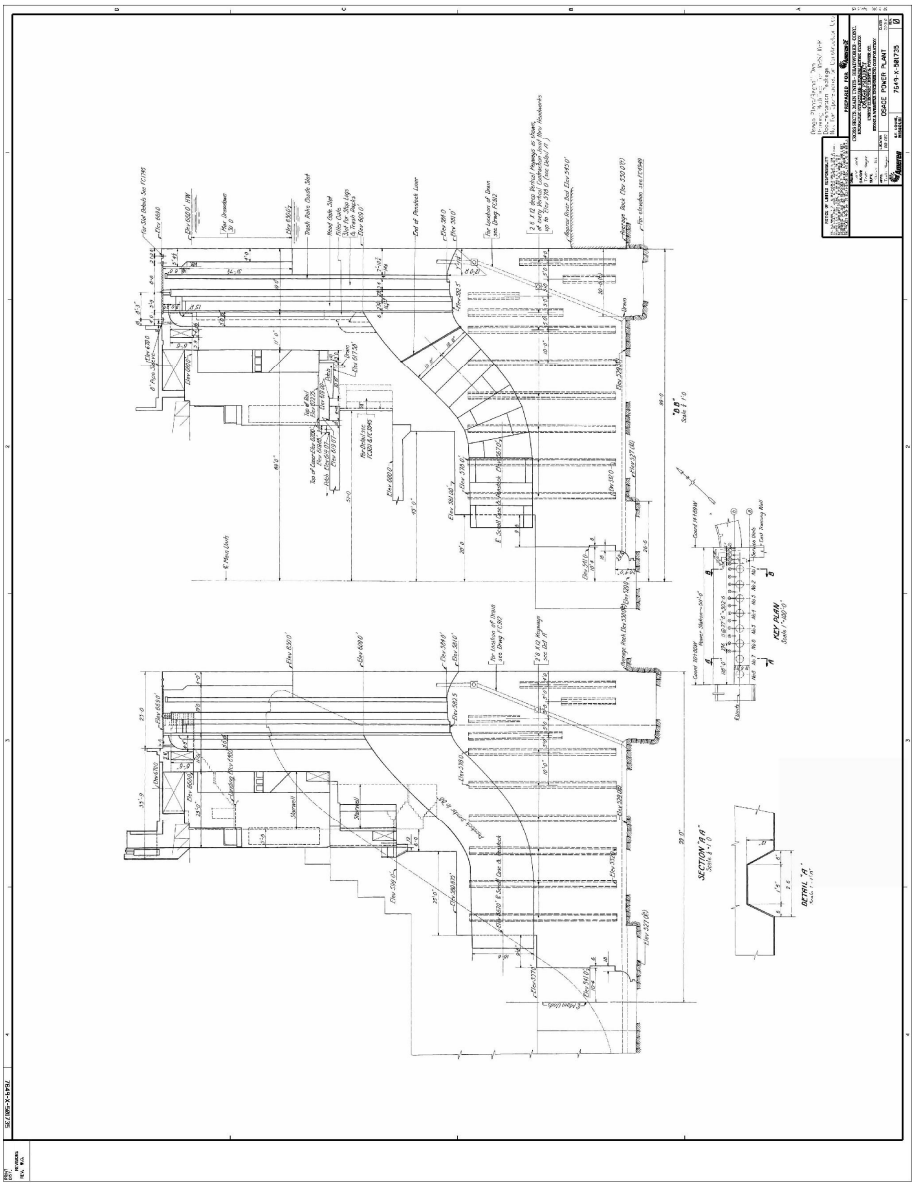
Original on file at AmerenUE, St. Louis, Missouri



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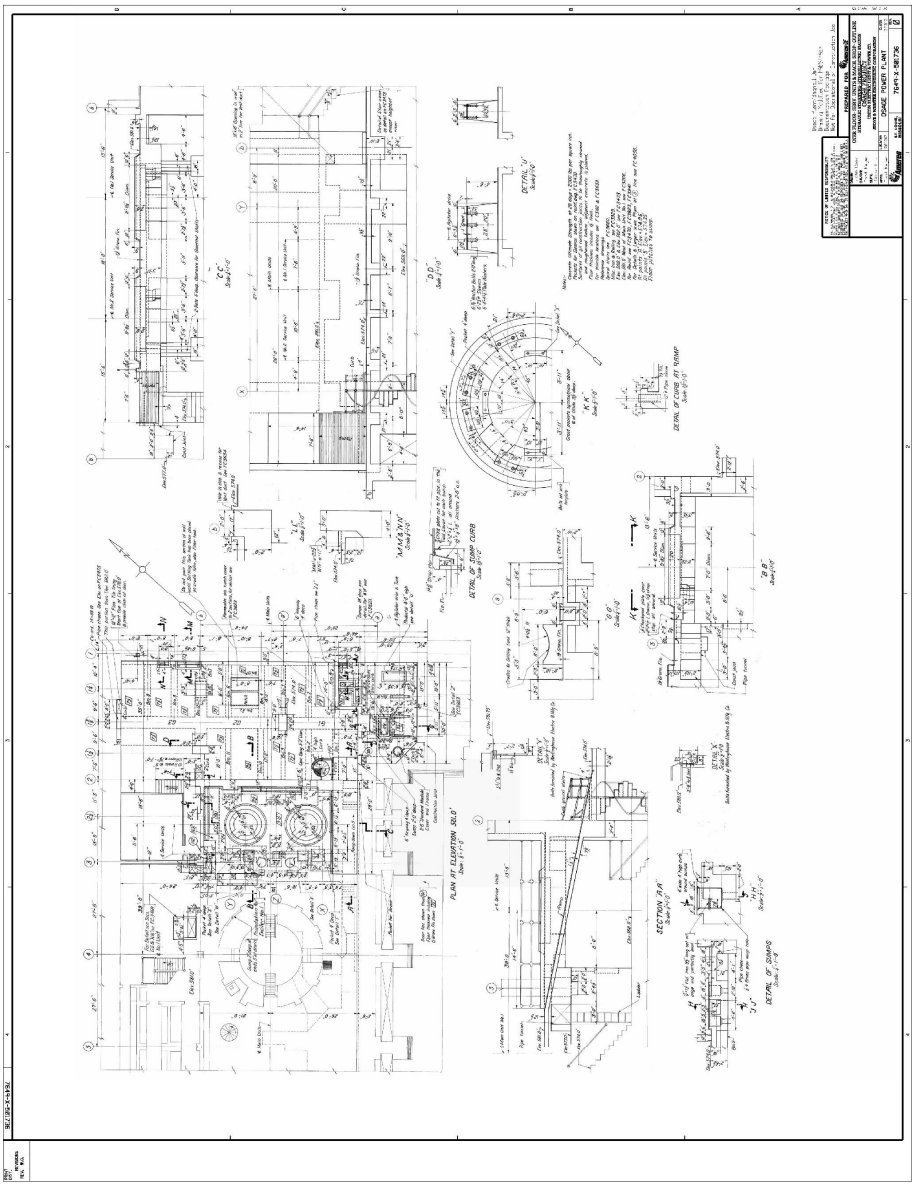
Original on file at AmerenUE, St. Louis, Missouri



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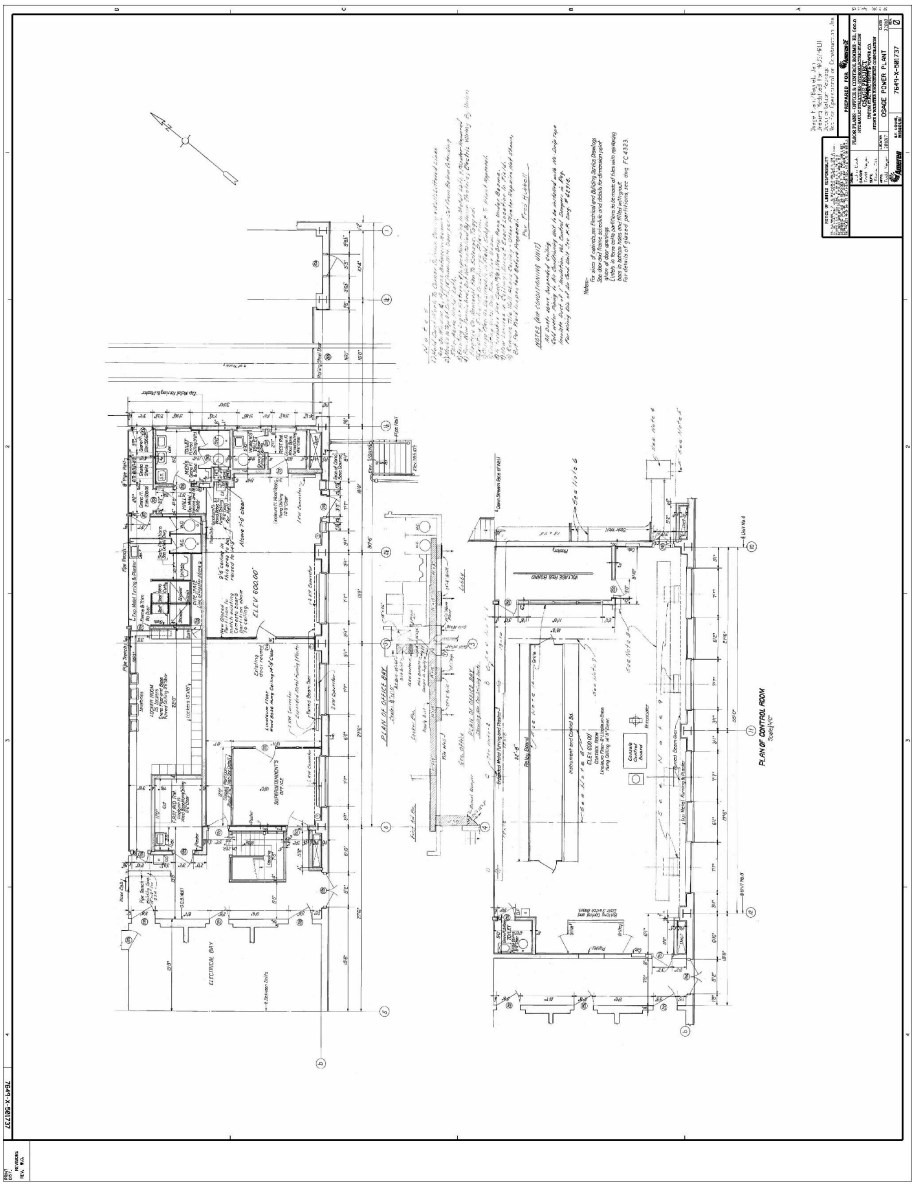

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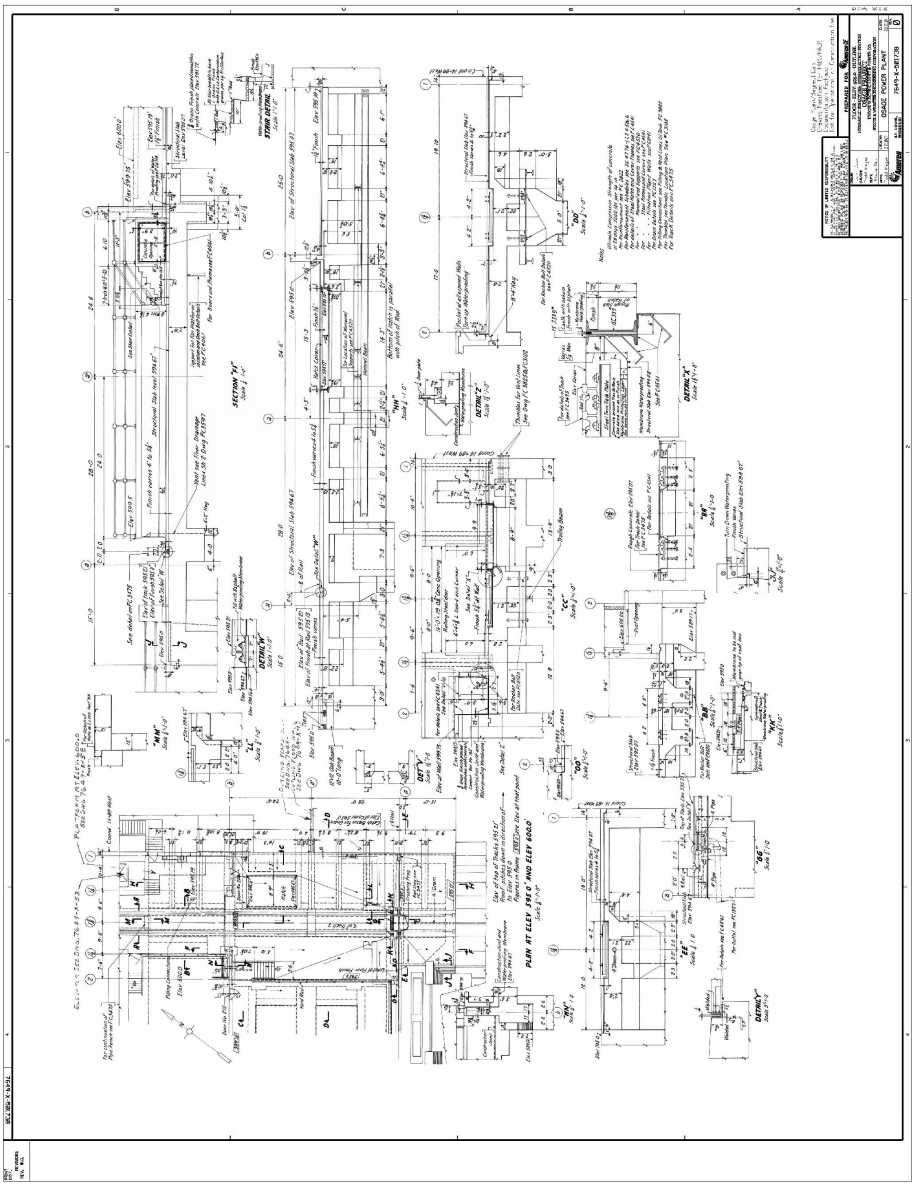

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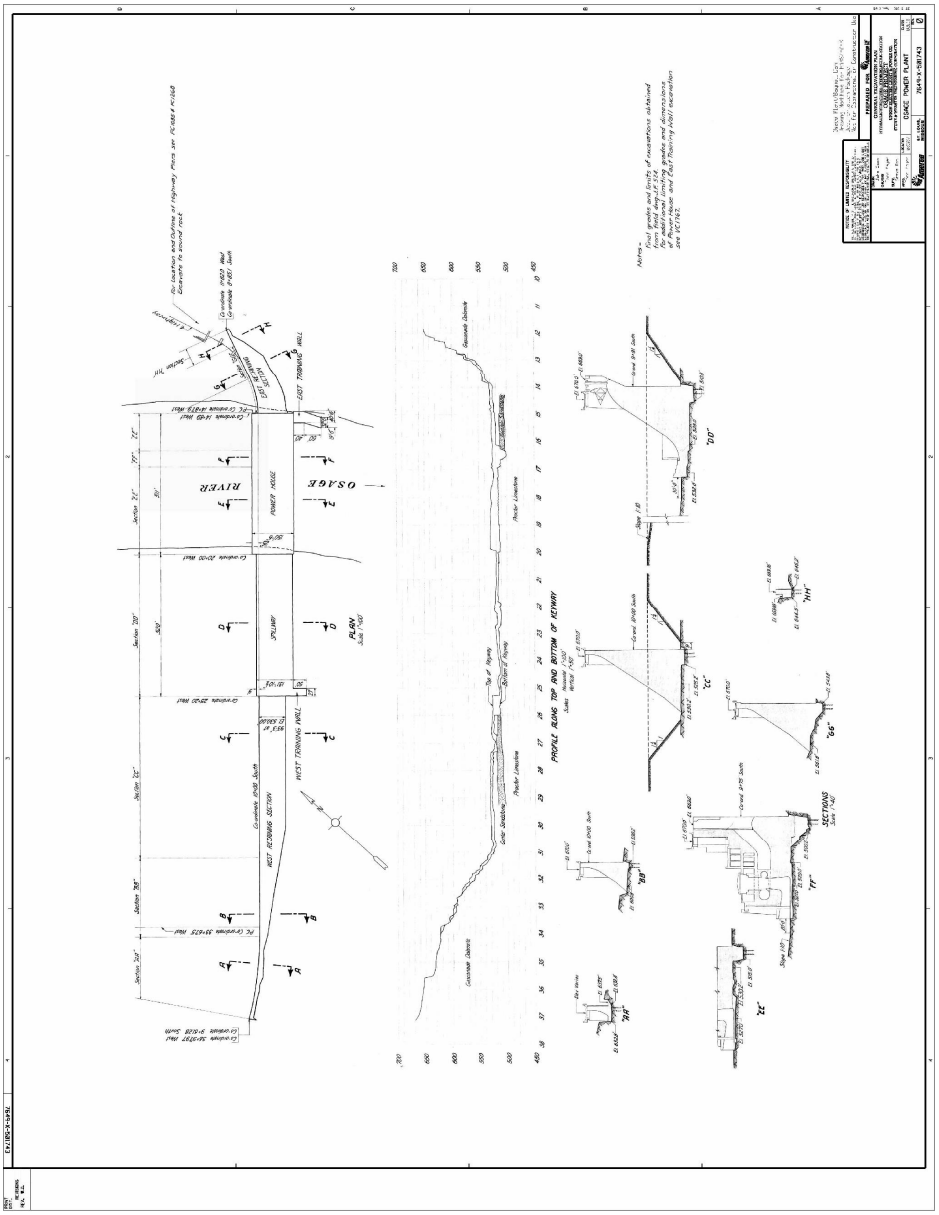

Reduced copy of historic plan, dated December 19, 1930
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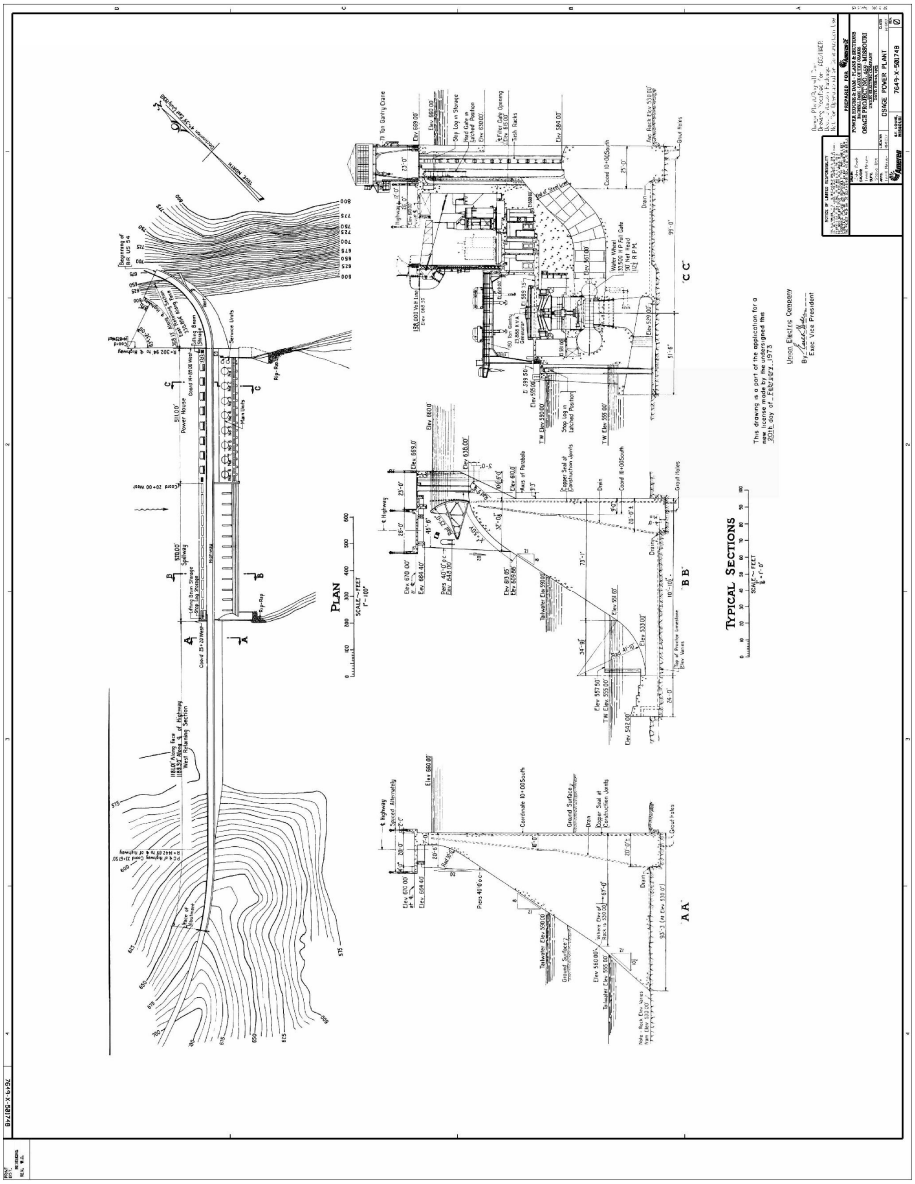

Reduced copy of historic plans and sections, dated February 20, 1973
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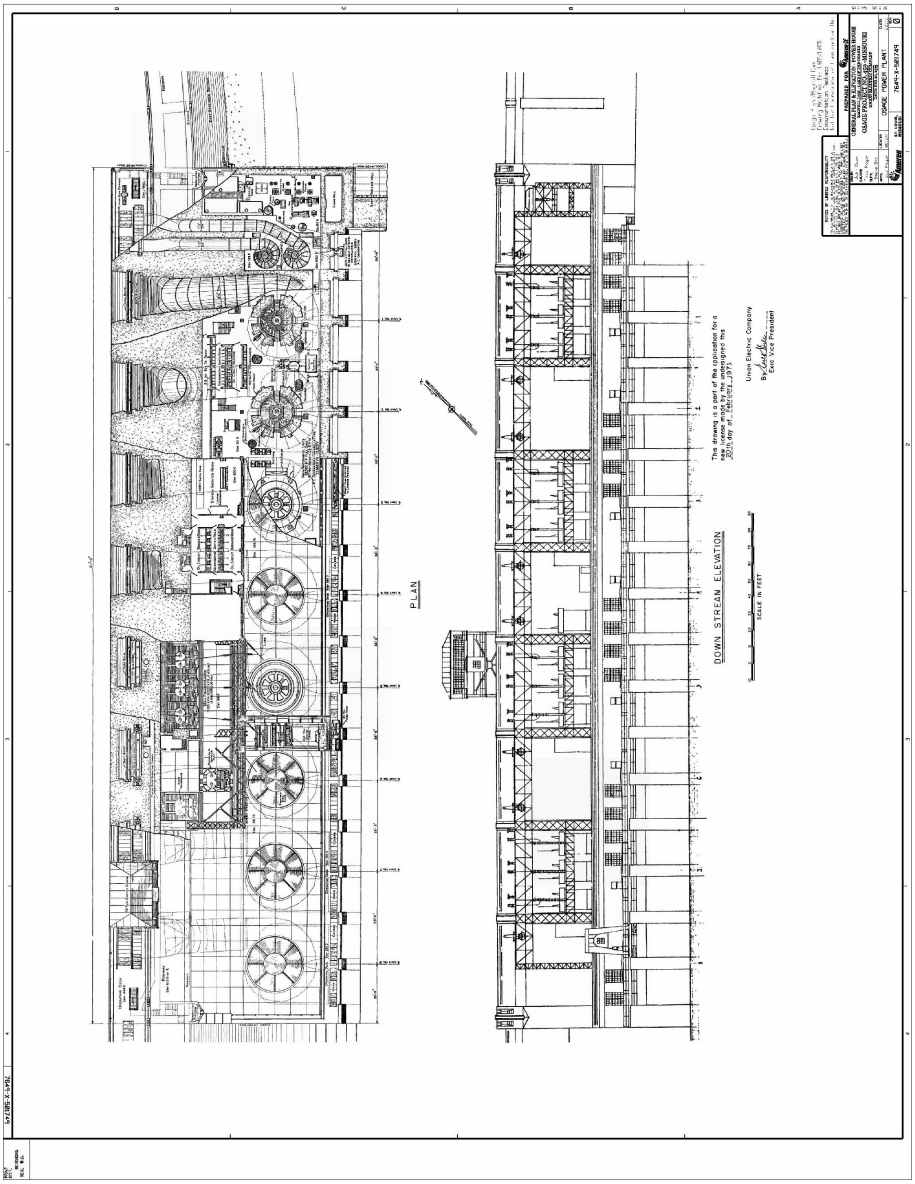

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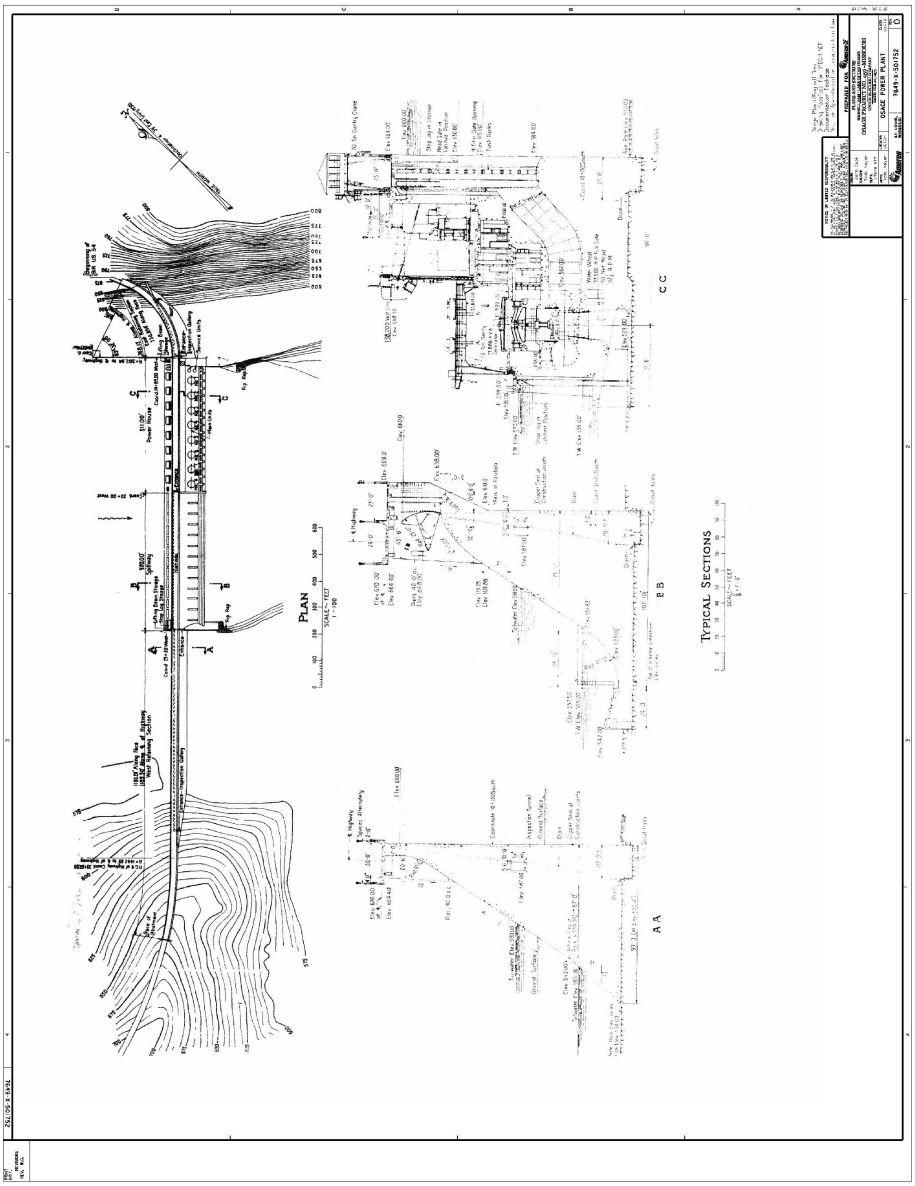

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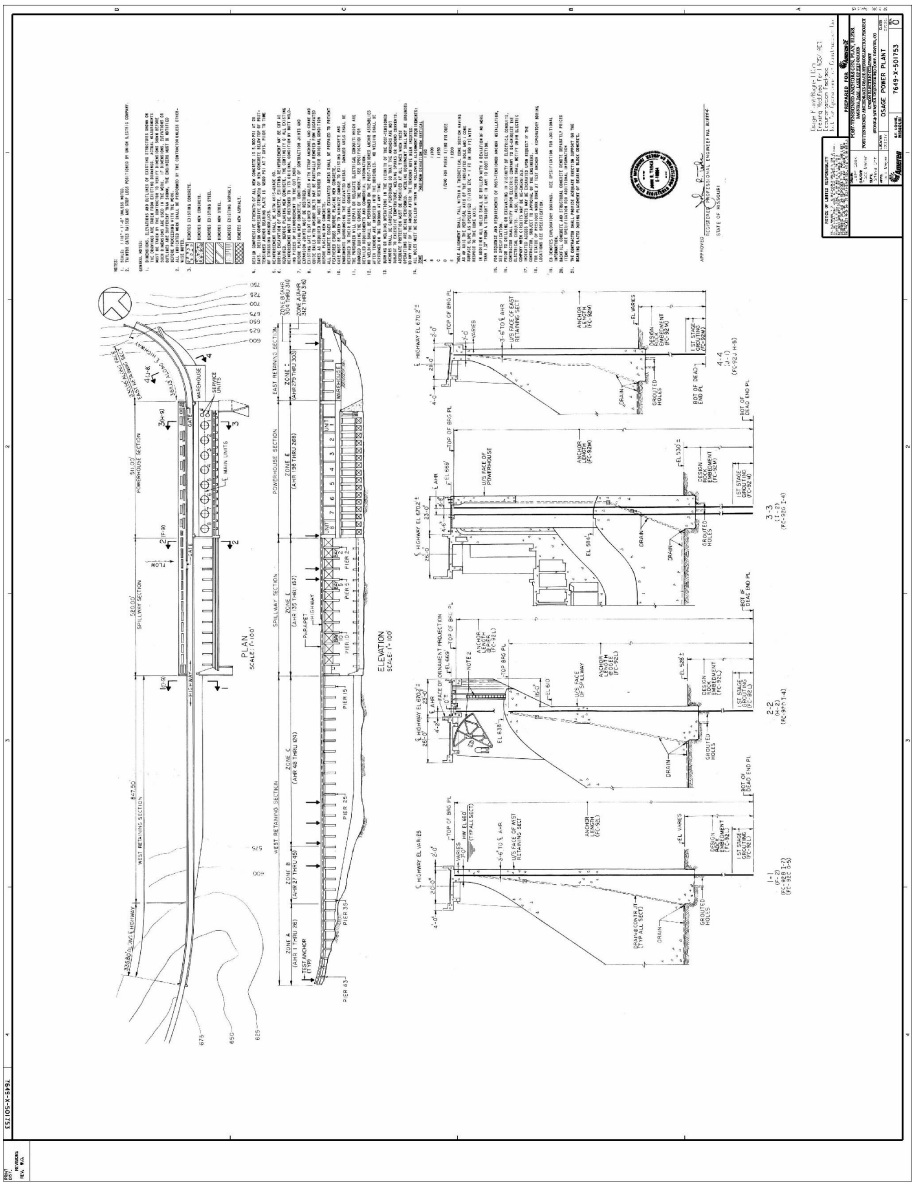
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic plans and elevations, dated March 17, 1982
Modified by AmerenUE for HAER documentation on January 6, 2010
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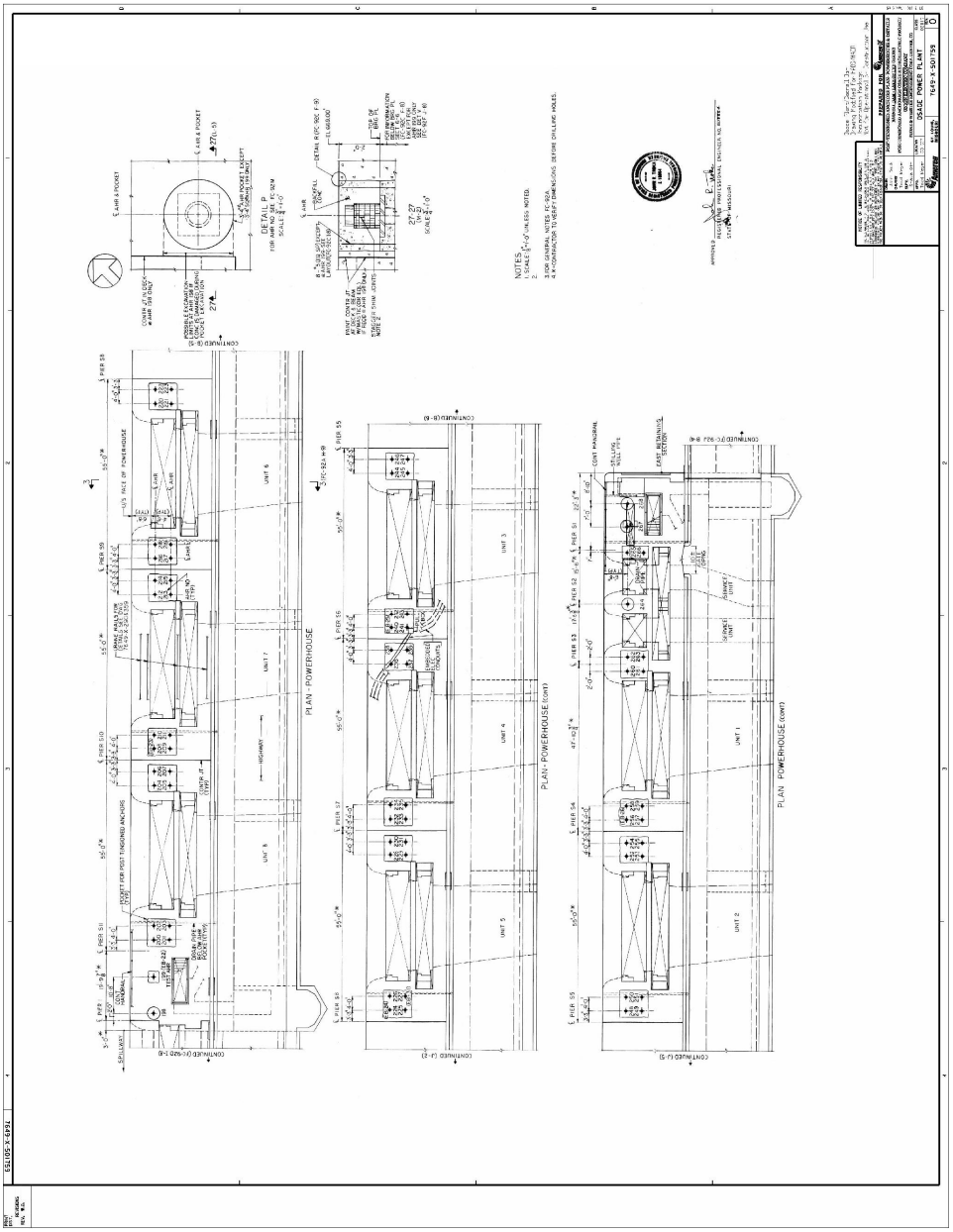

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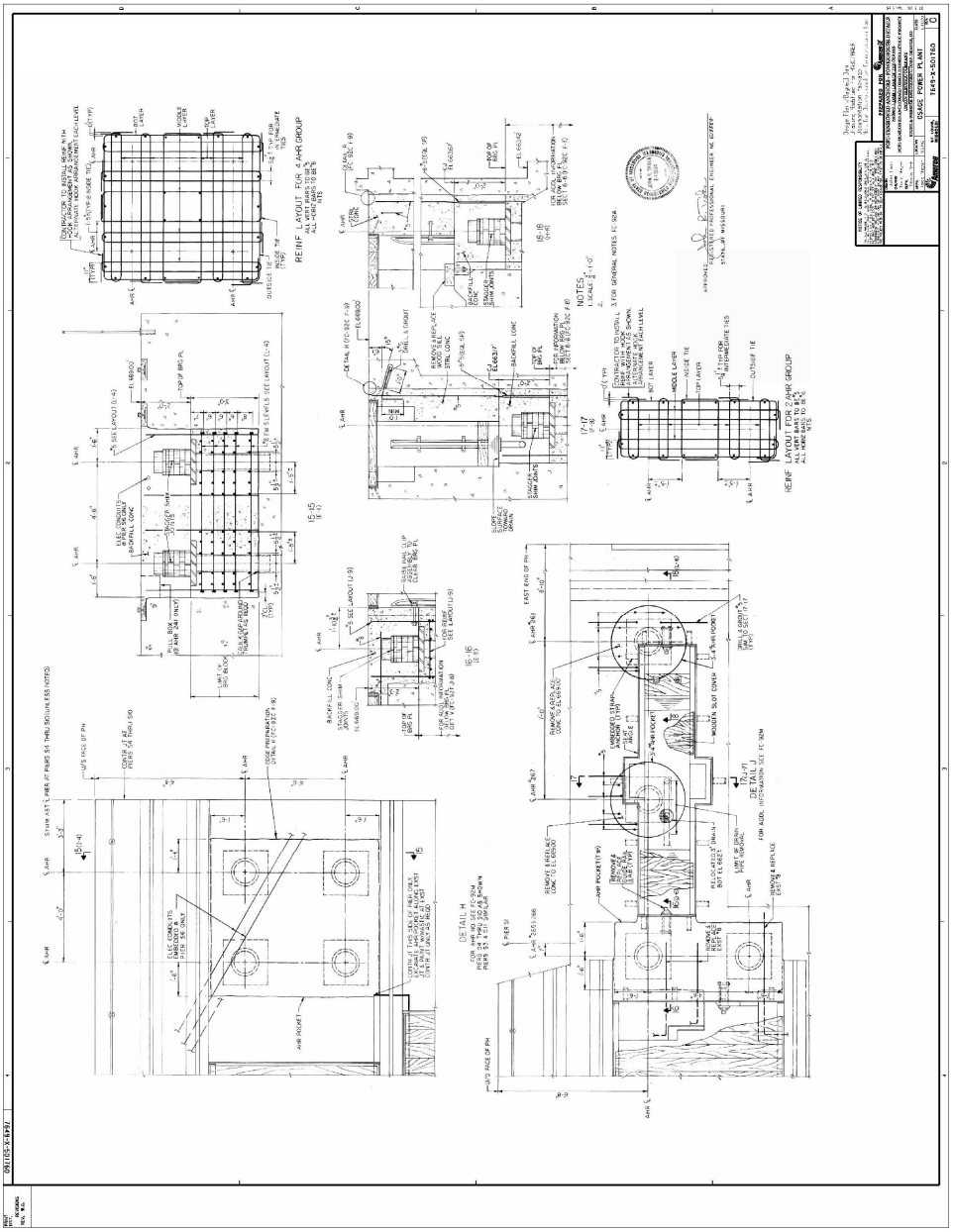
Original on file at AmerenUE, St. Louis, Missouri



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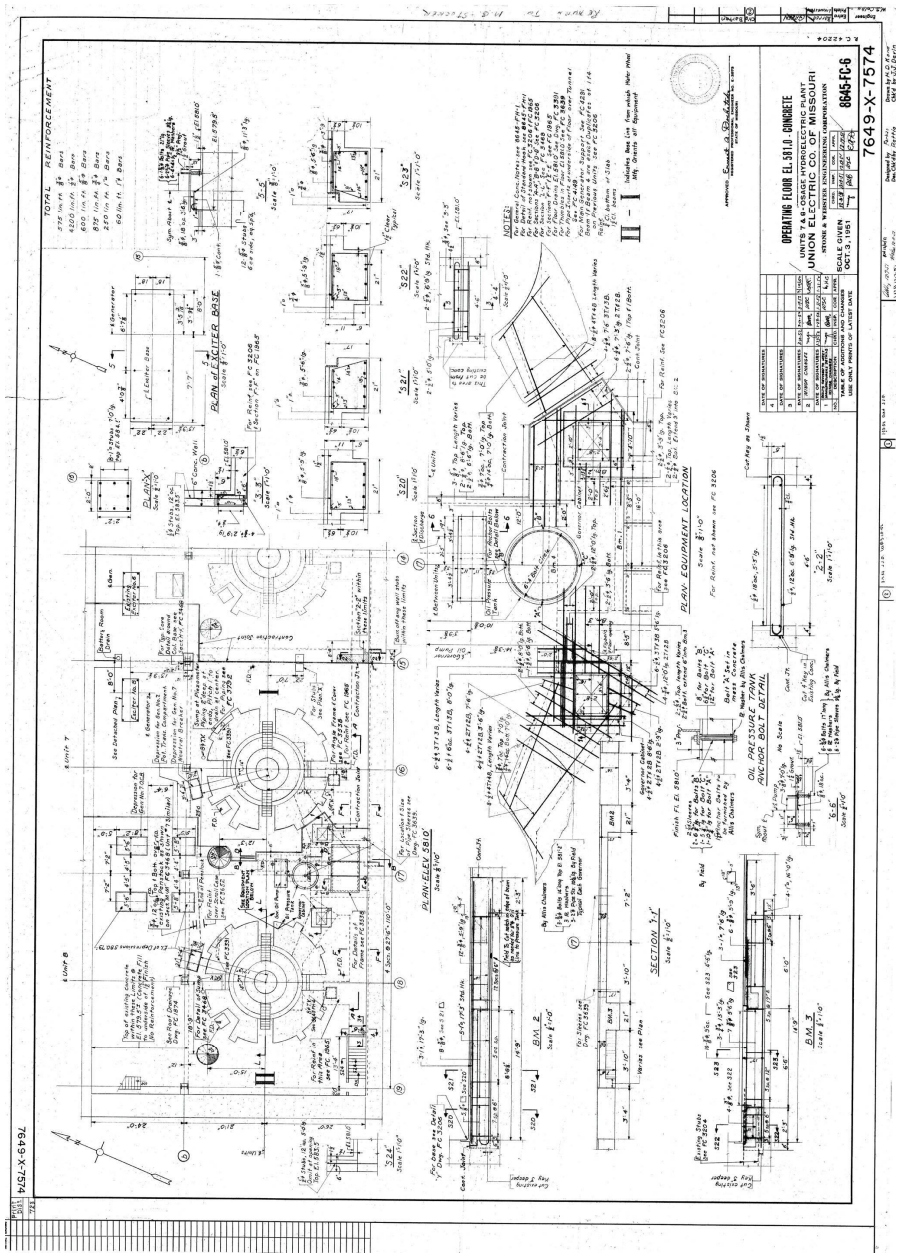

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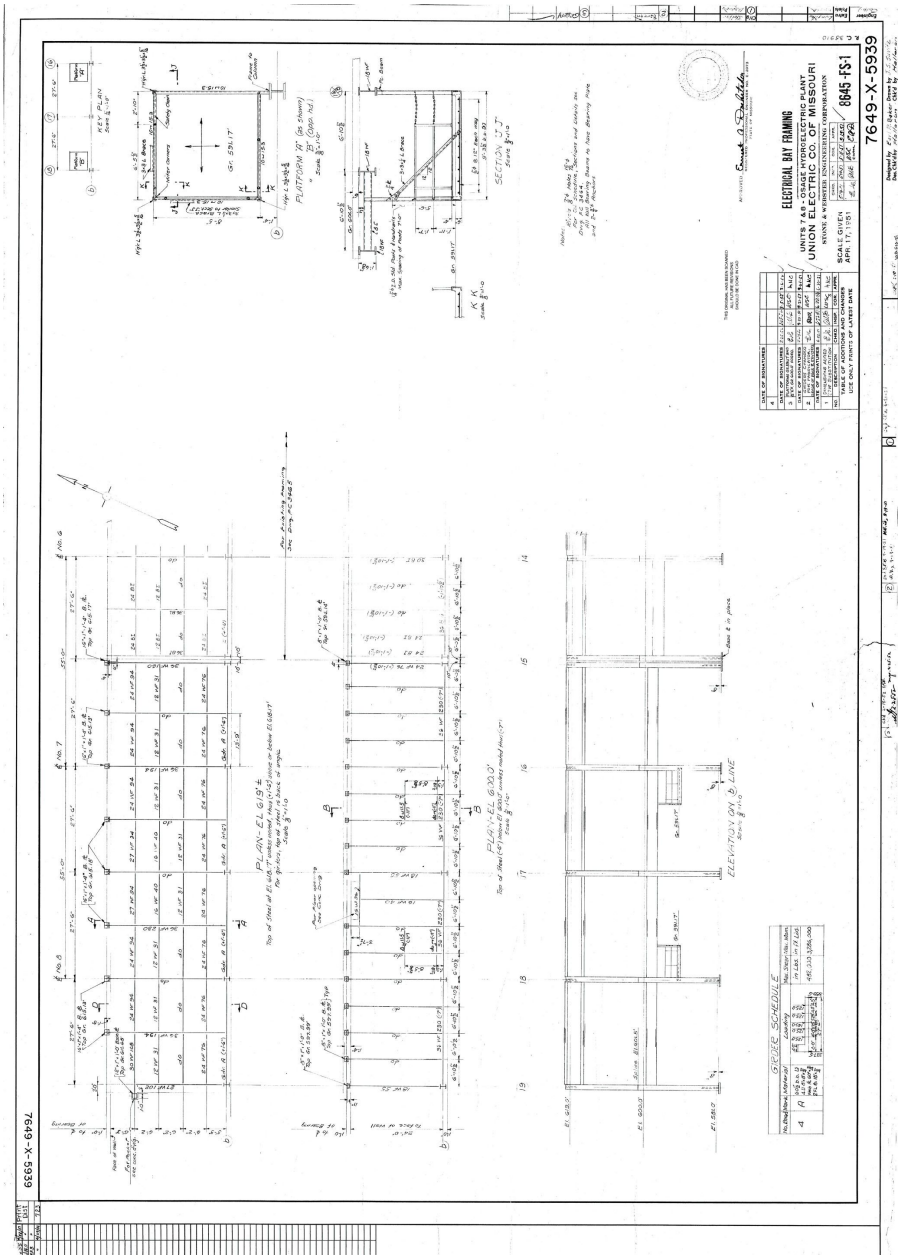

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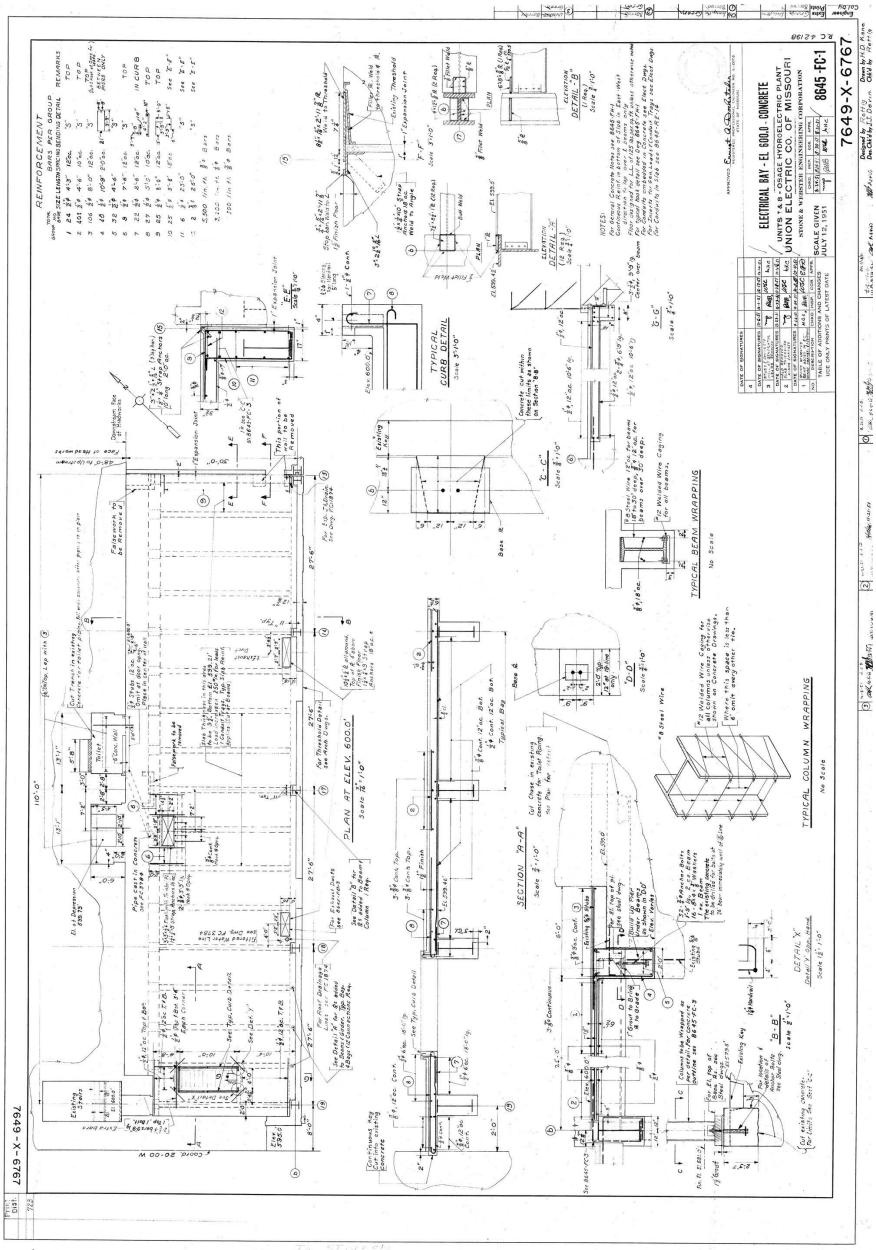

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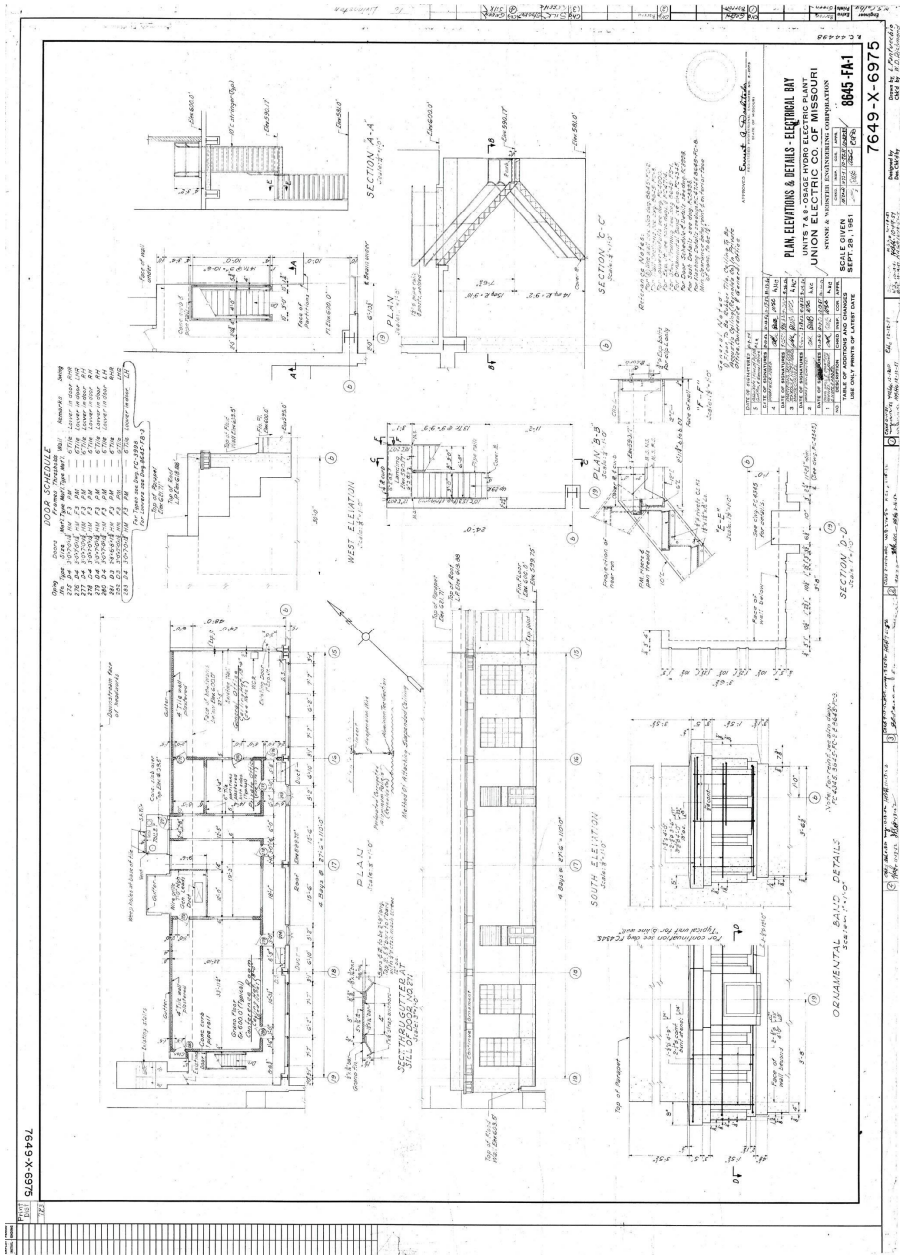
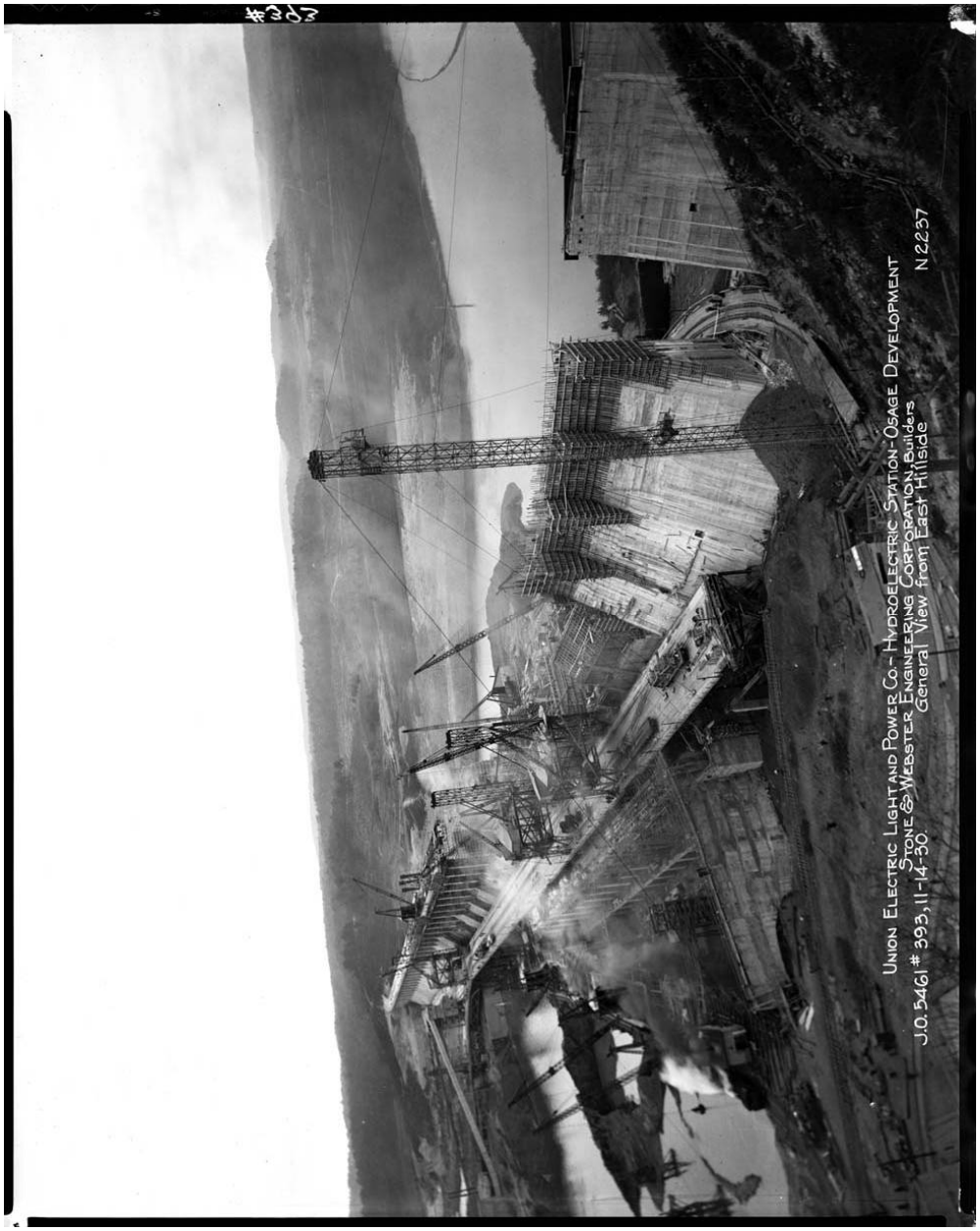
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri



Reduced copy of historic plans, elevations, and sections, dated November 13, 1951
Modified by AmerenUE for HAER documentation on January 6, 2010
Original on file at AmerenUE, St. Louis, Missouri

UNION ELECTRIC LIGHT & POWER CO. HYDROELECTRIC STATION OF OSAGE DEVELOPMENT
J.O. 5461 #325, 9-25-30 ENGINEERING CORPORATION, St. Louis
General View from East Hillside
N 2176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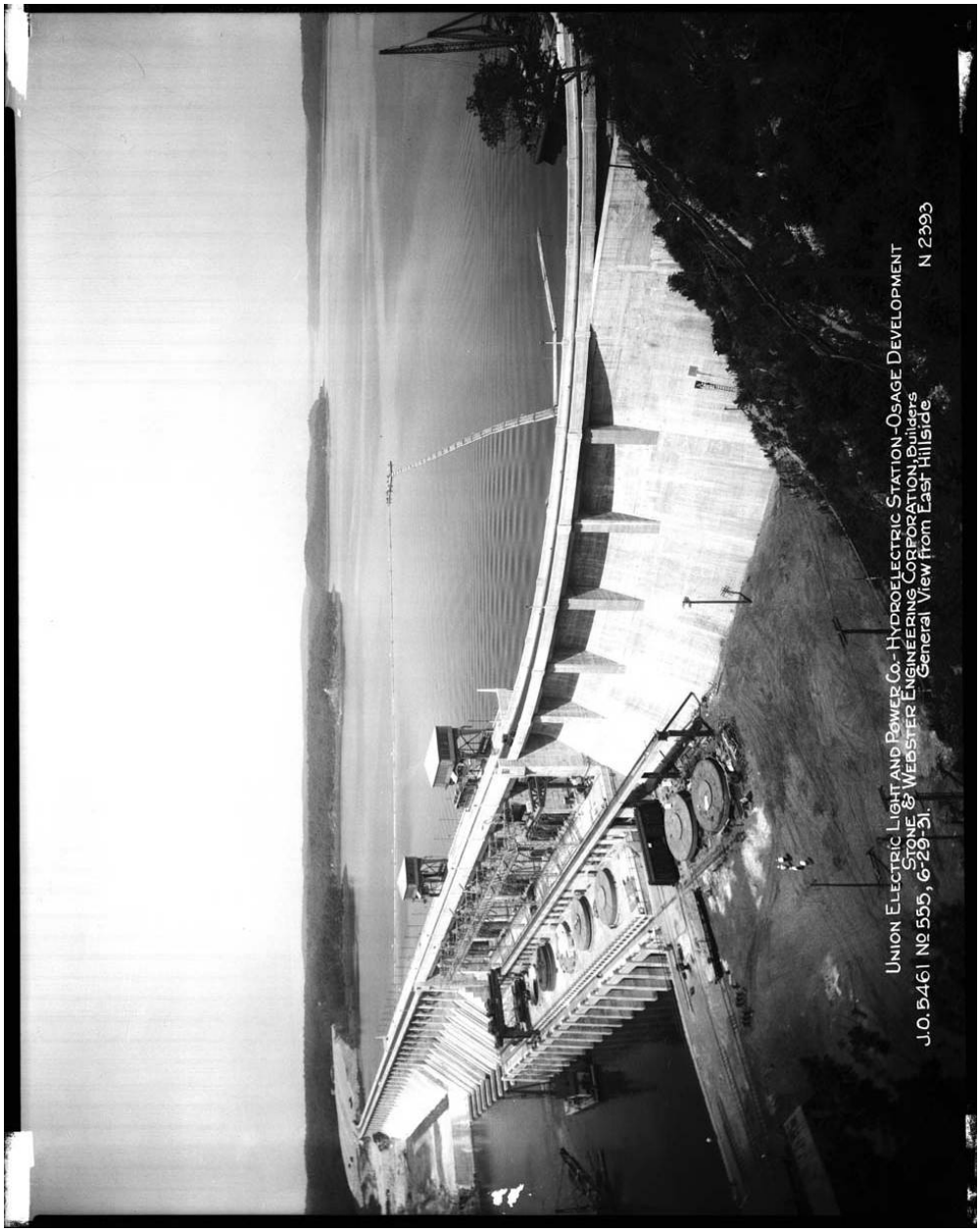
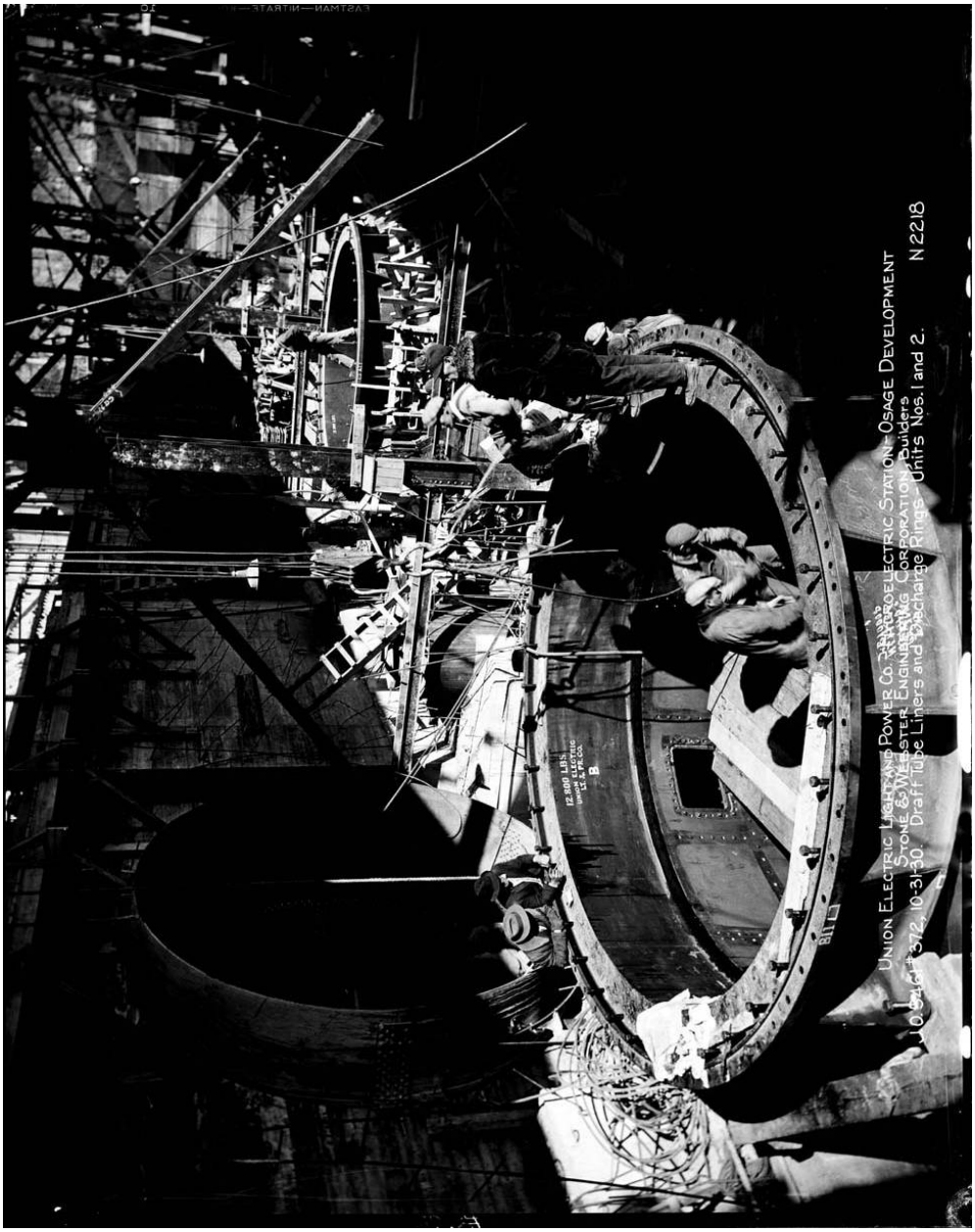
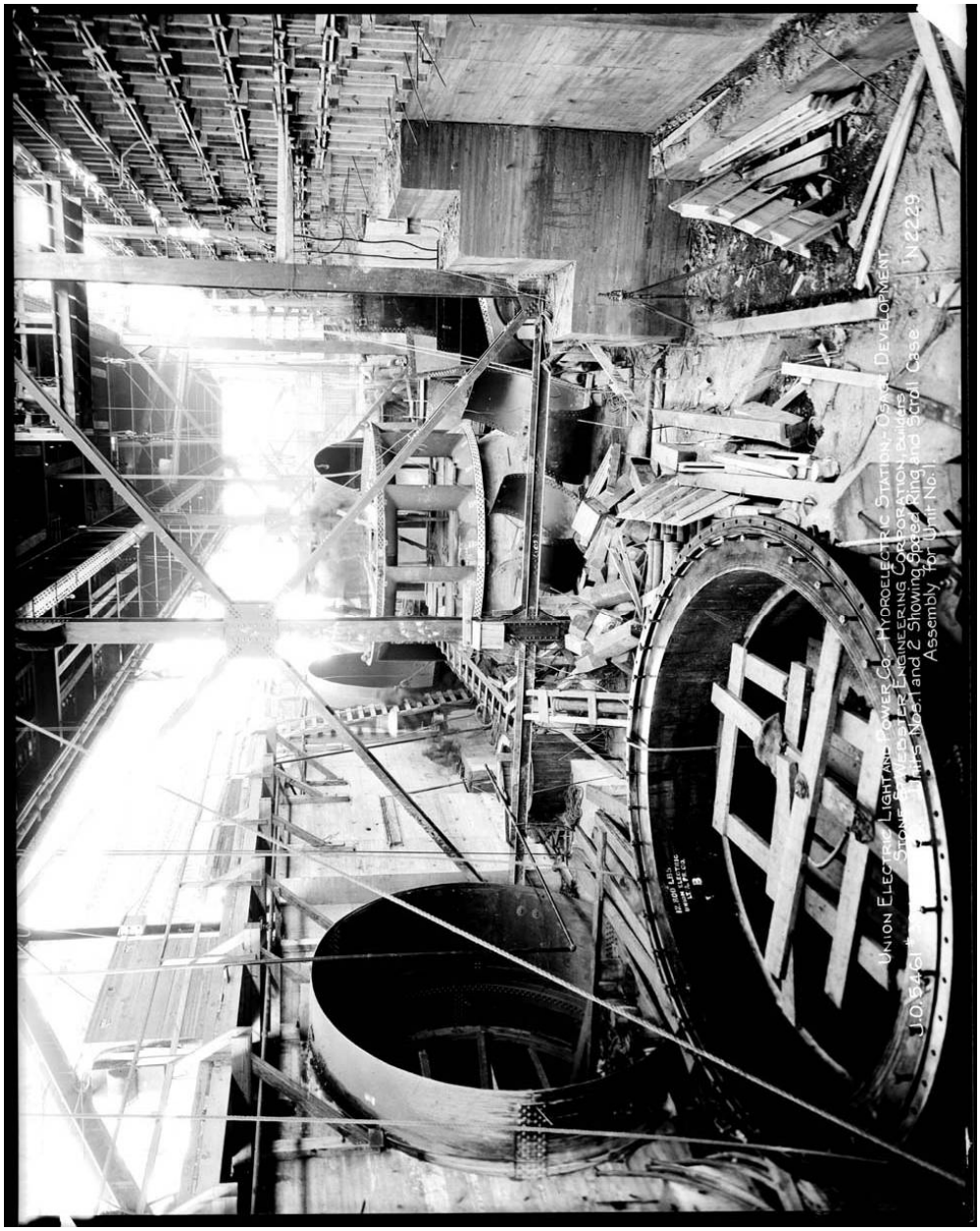
Union Electric Light and Power Co.- Hydroelectric Station-Osage Development
Stone & Webster Engineering Corporation, Builders
J.O. 5461 # 393, 11-14-30.
General View from East Hillside
N 2237

Union Electric Light and Power Co. Hydroelectric Station, Osage Development
Stone & Webster Engineering Corporation, Builders
J.O. 5461 #447, 1-2-31.
General View from East Hillside
N 2285

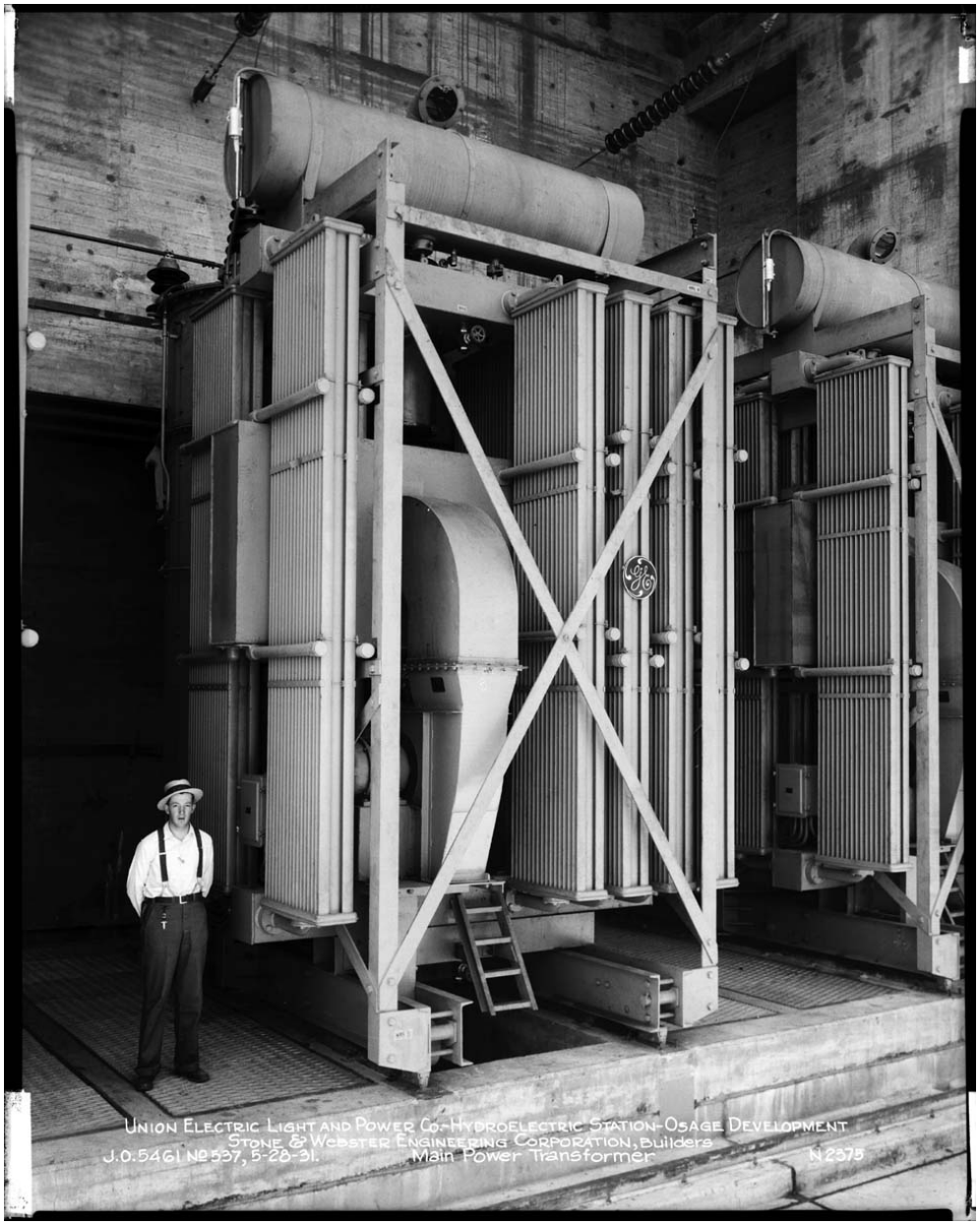

Union Electric Light and Power Co.- Hydroelectric Station-Osage Development
J.O. 5461 No. 555, 6-29-31.
Stone & Webster Engineering Corporation, Builders
General View from East Hillside
N 2393

UNION ELECTRIC LIGHT AND POWER CO.-HYDROELECTRIC STATION-OSAGE DEVELOPMENT
SANBORN & WEBSTER ENGINEERING CORPORATION, BUILDERS
J.O. 5461 No. 568 7-27-31 View of Dam and Power Station from Osage-Page Tower No. 1 N 4206


UNION ELECTRIC LIGHT AND POWER CO. HYDROELECTRIC STATION - OSAGE DEVELOPMENT
STONE & WEBSTER ENGINEERING CORPORATION - Builders
J.O. 5416 - 572, 10-31-30. Draft Tube Liners and Discharge Rings - Units Nos. 1 and 2.
N 2218


Union Electric Light and Power Co. Hydroelectric Station No. 2 Development
Stone & Webster Engineering Corporation Builders
Tube Nos. 1 and 2 Showing Speed Ring and Scroll Case
Assembly for Unit No. 1
U.D. 2229

Union Electric Light and Power Co. Hydroelectric Station-Osage Development
Stone & Webster Engineering Corporation, Builders
Power Station Unwatering Tunnel
J.O. 5461 No. 4835, 2-5-31
N 2323


UNION ELECTRIC LIGHT AND POWER CO.-HYDROELECTRIC STATION-OSAGE DEVELOPMENT
STONE & WEBSTER ENGINEERING CORPORATION, Builders
J.O.5461 Nº 537, 5-28-31.
Main Power Transformer
N 2375

WHITING
150 TON
AUX. HOOK 20 TON
UNION ELECTRIC LIGHT AND POWER CO. HYDROELECTRIC STATION - OSAGE DEVELOPMENT
STONE & WEBSTER ENGINEERING CORPORATION, BUILDERS
J.O. 5461 № 558, 5-29-51. 150 Ton Crane Handling Rotor for Generator № 4
N 2576

UNION ELECTRIC LIGHT AND POWER CO. - HYDROELECTRIC STATION - OSAGE DEVELOPMENT
STONE & WEBSTER ENGINEERING CORPORATION, Builders
J.O.5461 № 539, 5-28-31.
Headgates for Unit № 3 from Penstock
N 2377

UNION ELECTRIC LIGHT AND POWER CO.-HYDROELECTRIC STATION-OSAGE DEVELOPMENT
STONE & WEBSTER ENGINEERING CORPORATION, BUILDERS
J.O. 5461 N.S. 5-29-31.
GOVERNORS-UNITS NOS. 1 AND 2.
N.2561

Union Electric Light and Power Co. Hydroelectric Station-Osage Development
Stone & Webster Engineering Corporation, Builders
Main Control Room
J.O. 5461 No 544, 5-29-31.
N 2382

Union Electric Light and Power Co-Hydroelectric Station-Osage Development
Stone & Webster Engineering Corporation, Builders
Station Service Control Room
J.O. 5461 No. 545, 5-29-31.
N2383

UNION ELECTRIC LIGHT AND POWER CO.-HYDROELECTRIC STATION-OSAGE DEVELOPMENT
STONE & WEBSTER ENGINEERING CORPORATION, Builders
J.O. 54161 No 559, 6-29-51. View of Main Generator No 1 with Drip Pans and Pipe Covering Completed. N 2397

Union Electric Light and Power Co.-Hydroelectric Station-Osage Development
Stone & Webster Engineering Corporation, Builders
J.O. 5461 No 561, 6-29-31.
View of Spare Water Wheel Runner
N 2399

Bibliography:

AmerenUE. Original construction photos of Osage Plant/Bagnell Dam. Photos on file at AmerenUE, St. Louis, Missouri.

AmerenUE. Original construction plans of Osage Plant/Bagnell Dam, modified by AmerenUE for HAER documentation on January 6, 2010. Plans on file at AmerenUE, St. Louis, Missouri.

AmerenUE and Duke Engineering and Services, Inc. Osage Project (FERC No. 459). Initial Consultation Document. January 2001.

American Society of Civil Engineers. "Inspection of Osage Hydro-Electric Development of Union Electric Light and Power Company by Stone and Webster Engineering Corporation Engineers and Builders." Fall Meeting, St. Louis, Missouri. October 4, 1930.

Burke, Lorraine. *50th Anniversary Bagnell Dam 1931-1981*. Lake of the Ozarks Area Council of the Arts, 1981.

Clark, A.W. "Construction Features of Osage Hydro-Electric Development," *Engineering News-Record*, March 26, 1931.

"Hydro Turbine Operator Laboratory Lessons for Osage Plant." On file at Bagnell Dam, Lake Ozark, Missouri. Undated manuscript.

Lence, Cally, and Gail White. "Bagnell Dam and Osage Power Plant." National Register of Historic Places Nomination. U.S. Department of the Interior, National Park Service, Washington, D.C. Listed August 27, 2008.

Pilkington, Carole Tellman. *The Story of Bagnell Dam*. Lake Area Chamber of Commerce, 1989.

Strandburg, G.R. "The Osage Hydro-Electric Project." *Civil Engineering* Vol. 1, No. 4, 1931.