

EWEB'S STANDBY STEAM PLANT

HISTORIC DEVELOPMENT AND OPERATION



Standby Steam Plant Power Floor, Looking East
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INTRODUCTION

The following context documents the history and development of the Eugene Water & Electric Board (EWEB) Standby Steam Plant, located at 500 E. 4th Avenue, between the Willamette River and the main line of the former Southern Pacific Railroad. The property is near the intersection of 8th and Hilyard streets, east of the downtown core of Eugene, Oregon. The plant occupies a portion of tax lot 800, a 5.7 acre parcel, shown on Lane County Assessor's Plat 17033222, and is in the NW 1/4 NW 1/4 of Section 32, Township 17 South, Range 3 West, Willamette Meridian (see Figure 3). The site is a portion of the larger group of parcels that are collectively known as the EWEB Riverfront Property or the EWEB yard, and include EWEB's Administrative offices, shops, and warehouse structures in a sprawling complex.

The Standby Steam Plant itself is a multi-story masonry and steel-framed volume that was constructed in phases between 1931 and 1950 to house three steam boilers and turbines. As originally used, the facility produced 26.8mW of electricity, providing backup or standby generation to assure uninterrupted power supply to EWEB's service area. Unit No. 1, an oil-fired unit producing 6mW, went into operation upon the building's completion in 1931. Units Nos. 2 and 3, producing 9.3mW and 11.5mW respectively, went into operation in 1941 and 1950. Commercial steam distribution, as opposed to power generation, began in 1962. The Standby Steam Plant ceased regular generation in 1979 and then continued sporadically until formal cessation in 1995. Steam generation was largely shifted in 1975 to a newer, natural gas-fired unit located immediately to the southeast. The Standby Steam Plant now provides for water treatment and piping to support EWEB's on-going steam generation operations but the boilers and turbines are no longer in use. EWEB anticipates ending all operations at the facility in Summer 2012.

1.0 SETTING

The Standby Steam Plant is located upon land long associated with the Eugene Water & Electric Board, a multi-acre parcel lining the Willamette River, east of the downtown core. Eugene, the second largest city in Oregon and county seat for Lane County, was established in the 1850s and incorporated in 1862. Early industrial uses were established around the river and the Eugene Millrace, an excavated waterway that provided a stable power source for various mills and other uses. The millrace supported the development of timber, wood products, and agricultural uses in the area that would become the EWEB yards. Over time, particularly after the development of a stable electrical supply to replace water power, the millrace declined as a major economic force and the industrial uses gradually closed or relocated away from the river and the city core. EWEB's McClain Water Treatment Plant was located to the west of the steam plant, although that was removed many years ago. An EWEB electrical

substation and the Eugene Manufactured Gas Plant, in operation between 1907 and 1950, were located to the east.¹ EWEB's shops and maintenance yard--mostly vacant following construction of new facilities, an electrical substation, and a multi-story administrative building--occupy the remaining areas of the EWEB property.

2.0 STEAM PLANT OPERATION; AN OVERVIEW

In a generating plant, the potential energy of various types of fuels (fossil, nuclear, or renewable) is converted into another form of energy (usually mechanical or heat energy). This energy is used to turn fan-like blades inside a turbine. These blades are attached to a pole-like shaft. When the blades inside the turbine begin to turn, the shaft begins to turn. This causes wires located inside a magnetic field within the generator to turn. The resulting flow of electrons is electricity (www.energy.com, visited 3-Jan-2012).

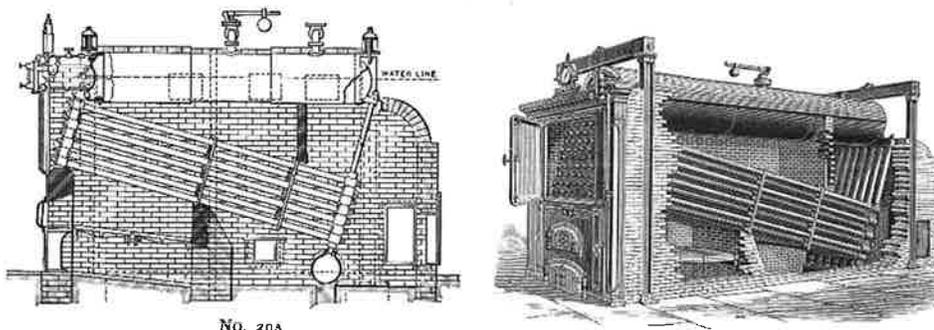
Along with hydroelectric generation, steam plants were among the earliest methods of electrical generation to achieve widespread, large-scale use. Primitive examples of steam power had been theorized as early as 150 B.C. The first true steam engine was reportedly designed by Sir Samuel Moreland in 1675, but it was not until the 19th century that steam as a motive force developed as a major element in industry. "Boilers," the chamber in which water is heated and converted to steam, evolved from a simple system in which water pipes passed through a wood-fired oven, to ever-more complex and efficient designs that reduced the amount of fuel required to obtain a stable steam supply. The development of the water tube boiler, the most common form of commercial boiler today, dates from a simple tube boiler developed by American inventor James Rumsey in 1788. In a water-tube boiler, the water travels through a dense series of metal tubes and the heated products of combustion circulate around the tubes, increasing the surface areas to create steam quickly and efficiently. "Boilers of this type are often called safety boilers" (ICS, 1905:24).

From there, incremental improvements and experimentation led to the 1856 development of the first *inclined* water tube boiler by Stephen Wilcox, where the tubes are set at an angle over the fire box, with a vent or flue at the lower portion to allow steam to rise. From this early design, the original Babcock & Wilcox boiler was patented in 1867. "The boiler consisted of a nest of horizontal tubes, serving as a steam and water reservoir, placed above and connected at each end by joints to a second nest

¹ The MGP plant produced lamp gas that was used for city lighting and heating and by the 1920s was owned and operated by the Mountain States Power Company. EWEB purchased the property in 1976, more than 25 years after the plant closed, as part of an HQ/riverfront site expansion (Spresser, 2012).

of inclined heating tubes filled with water (Babcock & Wilcox, 1930:19-20). Cast-iron doors frame the openings into the boiler, which in early versions was made of exposed coursed firebrick, later replaced with cast, riveted, or formed steel.

Originally used to power steam engines, and later to provide what was termed “district heating,” a system of underground high-pressure piping that provided steam heat from a central boiler, water-tube boilers became the major source of industrial power during the late 19th and early 20th centuries. With the rise of electric utilities, such boilers were used to fuel steam-powered turbines and generators that quickly became a significant source of electricity, especially in areas without, or at great distance from, waterways with sufficient year-round flows. “Steam turbines, powered first by coal, then later by oil, natural gas and eventually nuclear reactors, took a major leap forward in the first years of the 20th century...by the 1920s high-pressure steam generators were the state of the art” (Constable & Sommerville, 2003:4).



Cut-Away Views, Inclined Water Tube Boiler
(Babcock & Wilcox, 1930:25)

The operation of a steam-powered electrical generation facility begins with the combustion of a fuel, typically coal or oil, in a boiler through which water is passed to create steam. A fuel supply is necessary to fuel the boiler, requiring storage and, for oil, a pumping system, or for coal, a stoker that moves material into the fire box. Periodically ash and other waste needs to be removed from the chamber.

The steam, at high-pressure, is then piped toward a turbine, which in turn spins a generator to create electricity. Exiting the turbine, water as steam condenses and then must be recaptured and re-used (re-heated) or dispelled. A steady source of water, usually a river, enters the system via a water intake, and in modern plants is processed by varying methods to remove minerals and impurities, adjust pH, and otherwise treated to assure smooth operation and avoid clogging the system.

Steam generation plants, therefore, by definition incorporate three major systems that all must operate in parallel to create power: (1) a system to provide water and remove condensate, (2) a system to fuel the boiler and create steam, and finally (3) a system to convert that steam into power and distribute it to users. The basic components found in a typical unit of a steam-fired electrical generation plant include the following.²

- Water intake (providing a steady supply of water, typically from a river)
- Fuel storage (historically coal, oil, or hog fuel [wood], but now including natural gas, nuclear, bio-waste and other reliable, flammable, fuel sources)
- Fuel distribution (moving large amounts of fuel from storage to the boiler, whether oil pumps or automatic stokers for coal or wood products)
- Boiler, to create high pressure steam
 - Waste removal, to remove ash, where necessary
- Turbine/generator (although technically separate elements, these two functions were typically combined in later plant design into a single linear unit of common manufacture and design)
- Condenser (to recapture hot, high-pressure steam and return it to water)
- Electrical transmission elements (substation, transformers, etc.) to distribute generated electricity to users.

Although there are a limited number of boiler, turbine, and generator manufacturers, no steam plant is truly standardized, as each is based on the water source and the particular design of the plant, its fuel, capacity, and other factors. At its simplest level, however, all steam plants are essentially a boiler fired by a stable fuel source, that spins the turbine, which in turn spins the generator, before the heated water exits the system.

3.0 HISTORIC OVERVIEW

What is today the Eugene Water & Electric Board was established in 1911 to provide a clean and stable supply of drinking water to the residents of Eugene, Oregon. In April 1908 voters approved a charter amendment and authorized the sale of bonds in the amount of \$300,000 to purchase a private waterworks and create a public water utility for the city. A new water filtration plant, along with a hydroelectric unit to generate electricity to run it, was built at Walterville, on the McKenzie River, about 15 miles east of Eugene. "On March 11, 1911, the entire plant was turned over to a five-member commission appointed by the City Council, to serve without pay and direct the management and operation of the municipal facility" (Stone, 1986:ix). The new entity was called the Eugene Water Board.

² A "unit" in any electrical generation plant refers to one complete "line" in the system. Large plants have multiple units (typically numbered as Unit No. 1, No. 2, etc.) each of which will have the requisite components necessary to function on a nearly independent basis. Units, for example, might share a water or fuel supply, but each would have its own boiler, turbine, and generator.

Over the next few decades the Water Board expanded its operations to maintain service as Eugene's population and the demand for water and power grew. Growth was slow initially. In 1910 the city had 9,009 residents and in the following decade grew to just 10,593. In the next decade, between 1920 and 1930, Eugene nearly doubled to 18,901, according to the Federal census (OR Bluebook, 1933-44:142). With all these additional customers, the Water Board began development of new projects to both filter water and generate the additional power needed to pump it through the system. As early as May 1911 the Board requested a charter amendment from the Eugene City Council so that it might gain additional bond funding to develop a "Light Distributing System." By November 1911 new rules were adopted that allowed the Board to sell electricity in addition to water (Stone, 1986:22). In doing so, the Board entered into competition with the local power provider, Oregon Power Company (OPC), an investor-owned utility. After considerable negotiation, the Board purchased the OPC's distribution system in Eugene in 1914, and then contracted with the utility (which continued to provide electricity outside Eugene) to provide the standby power that assured supply when its own generation plants were insufficient to demand (Stone, 1986:26).

As Eugene's population grew, the rapid rise in commercial and residential use of electricity resulted in an ever-increasing need for new sources of generation. Beyond lighting, electric heat and cooking, and even refrigeration, became ever more common elements of the typical home at the same time that commercial and industrial use of electricity increased. As early as 1922 the Board considered the construction of a stream generation plant to augment their hydroelectric facility at Walterville, but this does not appear to have gone any further. That same year, 1922, the Water Board signed a new agreement for standby power with Mountain States Power Company, successor to OWP, so as to assure that it could provide stable power when its own hydro project was insufficient (Stone, 1986:32).³

Hydroelectric generation, among the most efficient methods of generating electricity and so yielding low-cost power for consumers, is also subject to the seasonal variations of water flows. In western Oregon, where most power is needed during the dark and cold winters, reservoirs are often at their lowest, awaiting the spring run-off as mountain snows melt that fill the region's rivers and streams. Consequently the

³ Mountain States, a successor to the North Idaho and Montana Power Company, had absorbed the interests of the Oregon Power Company, the original investor-owned utility that served the Eugene area. Mountain States was part of the Chicago, Illinois-based Byllesby-owned utilities that also included Pacific Power & Light in the northern portion of Oregon and the California-Oregon Power Company, COPCO, in the southern. Mountain States, among other plants, operated steam plants in Springfield and Marshfield (now Coos Bay), a Manufactured Gas Plant in Eugene and a small hydro facility in Stayton, east of Salem. Mountain States merged into what is now PacifiCorp in 1954 (Dierdorff, 1971:229).

generation of power on demand, usually created by burning coal or other fuels to power steam turbines, was a typical source for stable power that was independent of seasonal water flow. Where hydropower was available, steam power was a standard backup source. By the late 1920s, Mountain States Power, possibly as it too faced increasing demand from its own growing customer base, sought to significantly raise its contracted rates for standby power. Purchased standby power that had cost the Board \$4800 per year in 1916 rose to cost more than \$90,000 in 1929, an increase of more than 1800 percent!

As a separate matter, the Water Board had added to its land along the Willamette River in downtown Eugene in 1924, largely to begin the planning process for the construction of an additional water filtration plant.⁴ To address its own power needs, the Water Board also initiated planning and completed a new hydroelectric facility farther up the McKenzie River. The Leaburg Hydroelectric Project, located about 22 miles east of Eugene, went into service in January 1930. Leaburg significantly increased generation capacity but even with this second hydro plant, the Water Board was still reliant upon expensive standby power from Mountain States. In April 1930 the Board decided that it would be more cost-effective to develop its own standby steam plant and the Willamette riverfront property was determined to be an excellent location for that project.⁵

The decision to build a standby plant in Eugene was communicated (to Mountain States) by letter April 19, 1930, and plans were then completed and the steam plant built (*Register-Guard*, 18-October-1936, (9:1-5).

3.1 STANDBY STEAM PLANT CONSTRUCTION, UNIT NO. 1 (1930-1931)

With the decision to move forward on the Standby Steam Plant, the Water Board hired Stevens & Koon, a Portland-based firm of consulting engineers, to design the project. J. C. (John Cyprian) Stevens (1876-1970), and R. C. (Ray Emerson) Koon (1882-1963) established their firm in 1920 and were nationally regarded engineers with wide experience that included mining, sewer/sanitation and hydroelectric facilities.⁶

⁴ This new facility would be completed on August 5, 1932, and named the Carl Arthur McClain Filtration Plant, in commemoration of the longtime Water Board manager who initiated the project and who had died that day of a stroke he suffered while on duty (Stoné, 1986:35).

⁵ The fate of the Mountain States steam plant on the property is unknown.

⁶ Stevens, an OSU graduate, worked for both the USGS and the Bureau of Reclamation before entering private practice in Portland in 1910. He patented several water measurement devices that were successfully marketed. With Koon, he would later play significant roles in the design of the Bonneville Dam, Umatilla Ordinance Depot, Reclamation's Willamette Valley project dams, Hells Canyon Dam, the Colorado River Basin Project and the City of Portland Sewerage System. Stevens was a key leader in the creation of what is today OMSI, the Oregon Museum of Science and Industry (American Society of Civil Engineers, <http://cedb.asce.org/cgi/WWWdisplay.cgi?17766>, visited 3-January-2012).

Survey and site work for the new facility began in late August 1930 and by September 10th work on filling the grade for a new railroad spur to provide materials to the site was underway. By mid-October the footings for the intake on the Willamette River as well as the walls of the lower floor level were completed by Stein Brothers, a Eugene-based construction firm. "On October 16 a power shovel was put to work in the river bed, digging a channel which would insure sufficient water supply at the intake. This work was carried on without interruption until it was finished on October 26" (EWEB [Moore], 1931:3-4). Forming work on the concrete portions of the plant to house the equipment--the floor, the boiler and turbine foundations--occurred during November, and by the middle of December the structural steel for the building arrived on site "...and was put in place as fast as it arrived." (EWEB [Moore], 1931:6). Concurrently the assembly of the massive boiler, with its firebrick walls and interior water tube system, was proceeding under the direction of Mr. Mauer, of the manufacturer, Erie City Boiler Company (See Figures 5-7).

Unit No. 1 was housed in a concrete and stucco building with interior steel framing that appears to have also been designed by Stevens & Koon as a part of their scope of work on the project. This first phase of the plant was 95'-9" long and 70'-6" wide, containing three levels or floors. A partially below grade bottom level (15 feet tall) held mechanical equipment and lines connecting to water and fuel sources. A second floor, 14 feet tall, held additional equipment and provided access to the boiler, while the main power floor level was 19 feet tall with an additional 10 feet above the near-full width gantry crane, creating an entire building height of approximately 58 feet above grade.

The stucco-clad exterior of the plant was divided by engaged columns into six equal bays on its north and south elevations, and four bays on the west. Large industrial style multi-paned steel sash windows provided substantial interior daylight. Ganged 12-light panels, set in two columns of three, light both ground level (middle) and upper floors. Above the windows, on stucco panels that occupy the top 10' of each bay (reflecting the uppermost, gantry crane, interior level), a diamond pattern decoration was incised in the wall surface, each created of four 5 1/2" by 11" ceramic tiles. The east-facing wall of the building was designed as a "temporary end" future expansion. This was built of steel frame and concrete block with a large (35' x 32'-2") door opening to provide access to the interior (Figure 8).

An intake structure was built on the south bank of the Willamette River, including a high-capacity pump that brought water into the plant. To the south of the main building a 100,000-gallon fuel storage tank was excavated into the grade. Excavation work here, also by Hargreaves and Lindsay, began on January 12, 1931, and by January

16 the placement of reinforcement steel had begun with the first pour, the bottom taking place two days later, on Sunday January 18, 1931. There were considerable problems with the forms for the walls of the oil storage tank, but by February 2 the tank was filled to check for leaks and backfilling with gravel began. Other smaller tanks, service tanks for the station's operation, were poured in March. Construction of the Fuel Transfer House, a small building located above the tank and holding pump equipment to move the Bunker Oil to the boiler, began on March 7th. The Fuel Transfer House was a small 12' x 12' structure with a slightly sunken concrete slab floor (2'-3" below grade) that held oil pumping equipment (Figures 9 and 12). Built of stucco-clad reinforced concrete, it had smaller scale steel sash industrial windows on three elevations with an entry door on the fourth, facing southerly. The building was of matched design to the main plant and was apparently designed to house equipment for an anticipated second fuel storage tank that was never constructed.

Unit No. 1 was fired by bunker oil, also termed Type C Fuel Oil or "bunker fuel," a low-grade heavy oil that is most typically associated with ship engines. Bunker oil has a fairly low flash point, the temperature at which combustion will occur, and is easier to transport and more readily available in the west than coal (the primary fuel source for steam generating plants in the eastern United States). Bunker oil arrived at the Eugene plant by railcar on the siding off the Southern Pacific main line and was stored in the 100,000-gallon tank built for that purpose on the site. Smaller, above-ground concrete tanks, called "service tanks," held smaller amounts of oil used in the operation of the plant itself.

Eugene-based Hargraves & Lindsay were awarded the contract for building the steel superstructure. Their crew was on site January 5th, with a projected completion date of March 14, 1931. Construction on the building, along with the continued installation of the boiler, the General Electric turbine/generator, and all of the related oil and water piping and control equipment occurred all through February. Plastering of the walls, glass for the windows, and the other details of the project were largely completed by early March. As shown in Figure 8, "the large door (for the east end of the building) arrived on May 28th and it was up and working on May 30th" (EWEB [Moore], 1931:16). The Standby Steam Plant was completed and put into operation in July 1931 at a total cost of \$388K (*Register-Guard*, 18-October-1936, 9:1-5).

The major individual elements of the 1931 Standby Steam Plant are:

- Water Intake
- Fuel Tank: 100,000 Gal. capacity, subterranean location (Concrete walls)
- Fuel Transfer House (containing oil pumping equipment)
- Steam Plant (Unit No. 1)

- Boiler: Erie City Iron Works, Water Tube/Refractory Walls, Oil-fired (Bunker, Type C oil), producing 1413 H.P.
- Turbine/Generator: General Electric ATB-HL-2, rated at 7500KVA, 6000kW
- Condensate Pump (to return spent steam)

Reflecting on the success of the Standby Steam Plant, which was referred to as a “Triple Threat,” Water Board Superintendent J. A. McArthur stated that the little used unit had still saved the utility over \$100,000, a more than a fourth of its cost, in just five years of operation.

The need of some auxiliary or standby source of electric energy with which to take up the load in case of breakdown or necessary repairs...is generally understood. Continuous electric service has become so necessary to public comfort that it must be had at whatever the cost. But the question has been asked in Eugene, why not build our own standby plant? (*Register-Guard*, 18-Oct-1936, 9:1-5).

3.2 STANDBY STEAM PLANT CONSTRUCTION, UNIT NO. 2 (1941)

The positive financial impact of the first unit of the Standby Steam Plant logically led the Water Board to consider additions to its capacity as demand on the system grew. As the original plans for the standby plant make clear, it was specifically intended to expand as needed, with the “temporary” door and wall at the east end so identified in the original plans. Although the late 1930s brought the promise of low-cost power from the Bonneville Power Administration, a federal agency with a mandated preference toward publicly owned utilities, the Board also determined to add to its own generation capacity by expanding the steam plant (Stone, 1986:56).⁷

In 1940-41 Standby Steam Unit No. 2 was designed and constructed, incorporated into the existing structure. “The new 7500 kilowatt plant will be housed in a reinforced concrete structure whose west side will butt against the east wall of the present plant, forming a building more than double the present size” (*Register-Guard*, 16-August-1940, 2-4). A matching stucco and concrete framework was built at the eastern end of the 1931 structure, extending the north elevation 49’-3” along the façade. The new Unit No. 2 structure was 98’-3” deep, and abutting the original building it created an ell-shaped footprint. The “temporary wall” and huge steel loading doors that were erected in

⁷ BPA’s Vancouver-Eugene 115kV Transmission Line, connecting the power generation from the Bonneville and Grand Coulee dams to Lane County, was put into service and was providing power to Eugene in November 1940 (Holstein & Lenz, 1987). BPA, as a part of its enabling legislation, was obligated to provide preferential supply to public power utilities like that in Eugene.

1931 were removed and moved to the east elevation of the new unit. The railroad spur that was constructed in 1931 and had been used to deliver fuel oil to Unit No. 1 was also slightly relocated at this time, as it stood in the way of the new construction.

Where Unit No. 1 ran on Bunker Oil, Unit No. 2 was designed to burn “Hog Fuel,” wood products that could include wood chips, shavings and residue from timber mills, sometimes including bark and other waste products from logging to milling operations. Hog fuel was a common source in much of Oregon and, given Lane County’s large timber industry, was a cost effective fuel source for the new boiler.⁸ Although not an issue at the time, hog fuel also burned far cleaner than fuel oil, reducing the smoke that was associated with the plant. The Board ordered a slightly larger boiler for Unit No. 2 that was needed for its own uses, so that they could use it to produce and sell surplus steam to the Central Heating Company, the Eugene Fruit Growers Association, and the University of Oregon, who all needed a reliable source of steam for heating or operations.

In adding to its steam generating capacity the Water Board in a limited way entered another public utility – sale of steam for heating and industrial purposes (Stone, 1986:56).

Because of its fuel source, entirely new elements were needed to keep the Unit No. 2 boiler in operation. “Looking toward future plant expansion, the new hog fuel bin, a 76-by-110 foot building 50 feet high and housing 1200 units of hog fuel, will be situated on the river bank far enough away from the east end of the new standby building to make room for another addition if that becomes necessary in years to come” (*Register-Guard*, 16-August-1940, 1:3-5). This large, open, gambrel-roofed structure (visible in Figure 12) was situated east of the Standby Steam Plant. As can be seen an aerial view taken in 1944 (Figure 13), fuel was moved via an overhead conveyor system into the southeast corner of the new Unit No. 2 building. Inside the plant, hog fuel was moved via self-feeding mechanized chain grate automatic stokers into the boiler for combustion (Figure 35).

The Unit No. 2 boiler, a Babcock & Wilcox “Integral-Furnace Boiler,” was a patented design with a 120,000 lb. capacity per hour, capable of producing 300 pounds of steam pressure at 750 degrees Fahrenheit. The large boiler is clad in fire brick, and rises from the lower floor level with the automatic stokers and chain grates located underneath a metal walkway, feeding from a series of vertical hoppers at the eastern side of the

⁸ Earlier plants in Oregon, including Mountain States’ steam plants in Springfield and Marshfield, burned hog fuel. Portland General Electric’s several plants built in the early years of the 20th century to provide additional power for the Lewis & Clark Exposition were also hog fueled. The most famous of these was “Station L,” which would later become the basis for OMSI, the Oregon Museum of Science and Industry.

building. This steam system crosses the centerline of the facility, as does Unit No. 1, to interface with the turbine/generators that are located on the north side of the building.

The water supply system for Unit No. 2 was simply tapped into the existing Unit No. 1 supply with additional piping and condensate systems to service the second boiler. The major individual elements of the 1941 Unit No. 2 include the following:

- Hog Fuel Storage
- Automatic Stokers, to move hog fuel into the boiler
- Boiler: Babcock & Wilcox, Water tube
- Turbine/Generator: Westinghouse, rated at 7500kW

Unit No. 2, including the building, the boiler and the turbine/generator, was completed in 1940 and placed into service. The cost of the entire project was estimated at about \$510,000 (*Register-Guard*, 16-August-1940, 1:3-5).

3.3 STANDBY STEAM PLANT CONSTRUCTION, UNIT NO. 3 (1950)

After WWII, as demand in the service area continued to grow, the Water Board (renamed the Eugene Water & Electric Board or EWEB in early 1949) considered construction of a hydroelectric plant at Hayden Bridge but ultimately determined to rebuild the existing hydroelectric plant at Walterville and add a second unit to the Leaburg Powerhouse. The decision was also made to build a third unit to the Standby Steam Plant (Stone, 1986:75). This was again a necessary response to the huge growth in electric customer demand, at least partially the result of an expansion of service beyond the city's limits. EWEB served 9,520 electric customers in 1940 and 18,577 a decade later, representing a 95% increase in its service area.

Unit No. 3 would be the largest of the three steam units at the Standby Steam Plant. The Riley Stoker Corporation built the water tube boiler, with water walls and traveling grates. The boiler was designed to be capable of burning multiple fuel sources--hog fuel, oil or coal and the fuel hoppers were divided into a "coal side" and a "wood side" with oil as a second or standby fuel (Bondioli, 2012). The Unit No. 3 turbine/generator, built by Westinghouse, boosted plant capacity by 11,500kW, bringing total output of the Standby Steam Plant to 25,000kW, or 25mW.⁹

Unit No. 3 is housed in another extension to the volume, this time built of steel frame and a corrugated Transite exterior cladding system. Originally designed as a simplified version of the earlier buildings housing Units 1 and 2, with "gunite" or sprayed stucco

⁹ Later reports place Standby Steam Plant output at 26.8mW, probably an indication of increased efficiencies or re-winding during the plants last decades of operation.

cladding, EWEB changed the construction to “corrugated asbestos” prior to construction (EWEB Drg No. 1185).¹⁰ Matched in height to the earlier structure, the three 18’-5” wide bays on the north elevation are unrelieved, without the engaged columns, but retain matched multi-pane steel sash industrial windows below a simple top element. This far more functional exterior design lacks any of the surface detailing associated with the original 1931 structure or the 1941 addition.

The east-facing elevation of Unit No. 3 consists of two portions, one the third iteration of the large movable doors set within a steel and CMU or concrete block wall frame. These are assumed to be the original 1931 doors now simply migrated to their third and final location. To the rear of this portion of the building, a Transite-clad volume houses the large boiler, encompassing a total depth of approximately 111 feet, and creating another stepped volume that projects to the south beyond Unit No. 2. At the uppermost level of this portion of the Unit No. 3 structure, the Transite cladding is rotated 90 degrees with horizontal ribbing, to create something akin to a window band on both elevations, essentially the only “decorative” element of the Unit No. 3 structure.

As the result of the Board’s wise planning in 1940, the construction of Unit No. 3 was indeed possible within the open space east of Unit No. 2, retaining the large hog fuel storage bin that had been built as part of that earlier project. The first overhead conveyor system, which had entered Unit No. 2 at its SE corner, however, was removed, and a new and much longer fuel conveyor was constructed to the west, entering Unit No. 3 at its SW corner, as shown in Figure 15 (see also Figure 19).

Unit No. 3 was apparently designed internally by EWEB during 1948 and was built and put into service in 1950. Although EWEB reportedly did burn some coal in Unit No. 3 at times, hog fuel was plentiful, efficient, and cost effective, and remained the primary fuel source throughout the unit’s operation. The elements of Unit No. 3 include:

- Steam Plant (Unit No. 3)
 - Automatic stoker system, conveyor, etc.
 - Boiler: Riley Stoker Corp. Water tube, Hogged wood waste and bark with auto combustion control.
 - Turbine/Generator: Westinghouse, rated at 11500kW

¹⁰ “Transite” is actually a trade name of the Johns-Manville Corporation that manufactured siding, piping and other products although the term is generically applied to asbestos-cement products from a number of manufacturers. The rebuilt powerhouse at Walterville was also clad in Transite, a popular exterior cladding system for industrial projects during the 1950s. Transite comes in large sheets, 24” x ten feet or longer, and can be directly applied over a steel framework, providing quick construction and a durable fireproof surface. In that era, Transite’s asbestos-cement construction was not as problematic as it would later become. Today Transite is still available, without any asbestos, and is something of a precursor to “Hardi-Plank” and similar cement-based siding products..

3.4 LATER OPERATIONS, (1951-1995)

Operating with three units, producing a total of 25mW, the Standby Steam Plant remained a source of electrical generation for EWEB for the next four-plus decades, augmented by the board's continuing reliance upon its own hydroelectric generation and purchased power from the Bonneville Power Administration. The availability of its own source of standby or firm power reduced the utility's reliance upon purchased power from the Bonneville Power Administration and helped meet system demand. In some situations EWEB's steam plant was able to supplement BPA's own power needs, as EWEB sold that Federal agency extra power when it could (*Oregonian*, 6-Dec-1956, 24:1).¹¹

Although there is some indication that EWEB sold excess steam from Unit No. 2, ordered in a larger size specifically to meet that need as early as 1940, the utility did not directly provide steam to customers. Steam heat in the downtown area of Eugene was under the control of a private, investor-owned utility, the Central Heating Company that had been established in 1925. Central Heating developed a complex system of underground piping to provide steam heat to Eugene office buildings and industrial users, paralleled by a system to collect and remove the condensate (*Oregonian*, 11-May-1962, 24:2).

By the early 1960s Central Heating's plant was aging and their boiler, which apparently burned oil or coal, was a source of considerable air pollution when compared to the hog fuel boilers at the EWEB plant. Faced with increased public concerns about air quality and the costs of upgrading its plant, Central Heating's continued operation was uncertain. In May 1962 EWEB purchased the company's assets and assumed service to several hundred customers, all fed by the system of underground high-pressure pipes. "EWEB will use steam from its electric generating plant to serve central heating customers" (*Oregonian*, 2-May-1962, 19:1). EWEB paid Central Heating \$235, 000 for the operation and the purchase was seen as a boon to air quality in the region.

As the regional electrical grid grew during the 1960s and 1970s, amplified by the completion of EWEB's own Carmen-Smith Hydroelectric Project and numerous additions to the Federal Columbia River Power System (supplying BPA power), the comparatively small electrical generation of the steam plant reduced in importance to EWEB.¹² In 1974 EWEB experimented with burning garbage at the steam plant.

¹¹ BPA, with its own growing customer demand, was unable to augment the power available from Grand Coulee and Bonneville until the completion of the first unit at McNary Dam in 1954.

¹² The three units of the Steam Standby Plant produced 28mW. EWEB's Carmen Smith Project, completed in 1963, generates 92mW. For comparison purposes, the Ice Harbor Dam, operated by the US Army

EWEB Standby Steam Plant
Historic Development & Operation
February 2012

The garbage, from Los Gatos, Calif., was burned as another in a series of tests to determine what modifications will be needed if EWEB starts using Lane County's processed garbage as fuel to produce steam and electricity (*Oregonian*, 4-October-1974, 21:7).

While EWEB was reportedly "pleased" with the garbage testing, and continued to test processed garage pellets, no modifications to the plant were made and the idea was not further pursued for unknown reasons. As late as the 1970s, the Standby Steam Plant continued to burn some 1000 tons of wood waste daily to fuel Units No. 2 and 3. Unit No. 1, which burned fuel oil, more expensive than hog fuel, appears to have been little used after 1962. Although not entirely clear, EWEB appears to have ceased electrical generation at the Standby Steam Plant in October 1979 and then re-started the generators in 1987 until finally permanently ending all electrical generation at the Standby Steam Plant in 1995 (*Oregonian*, 15-Oct-1987, C10:5-6; Bondioli, 2012).

In 1995 EWEB had built a new facility to efficiently develop high-pressure steam to feed its downtown heating customers. This natural gas-fired system, consisting of 3 boilers, is located to the south of Unit No. 3 and relies upon the water supply and water treatment systems inside the Standby Steam Plant. This natural gas-fired plant remains in operation although EWEB plans to end its steam production in Summer 2012. The central steam heating system in Eugene, while long a fixture of that city's downtown, has seen a steep decline in its customer base over the past decade.

[In 1962] there were 275 customers, including downtown businesses and apartment complexes, churches and government office buildings....by 2003 EWEB had just 100 steam customers....[The steam heating plant] still serves about two dozen buildings in and near downtown Eugene (*Register-Guard*, 18-Jan-2011, A1).

Corps of Engineers and providing power to Eugene through BPA, went online in 1962 and has a capacity of 693mW.

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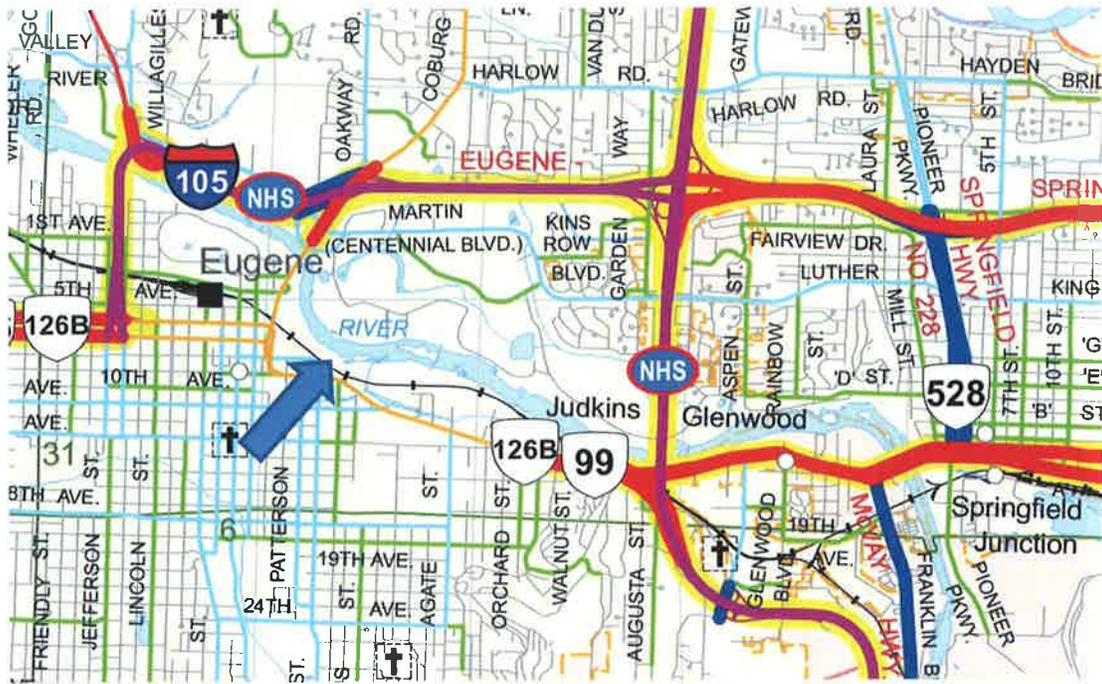


Figure 1. General Location, EWEB Standby Steam Plant (ODOT Lane County Map)



Figure 2. Aerial View, EWEB Standby Steam Plant, 2011 (GoogleEarth)

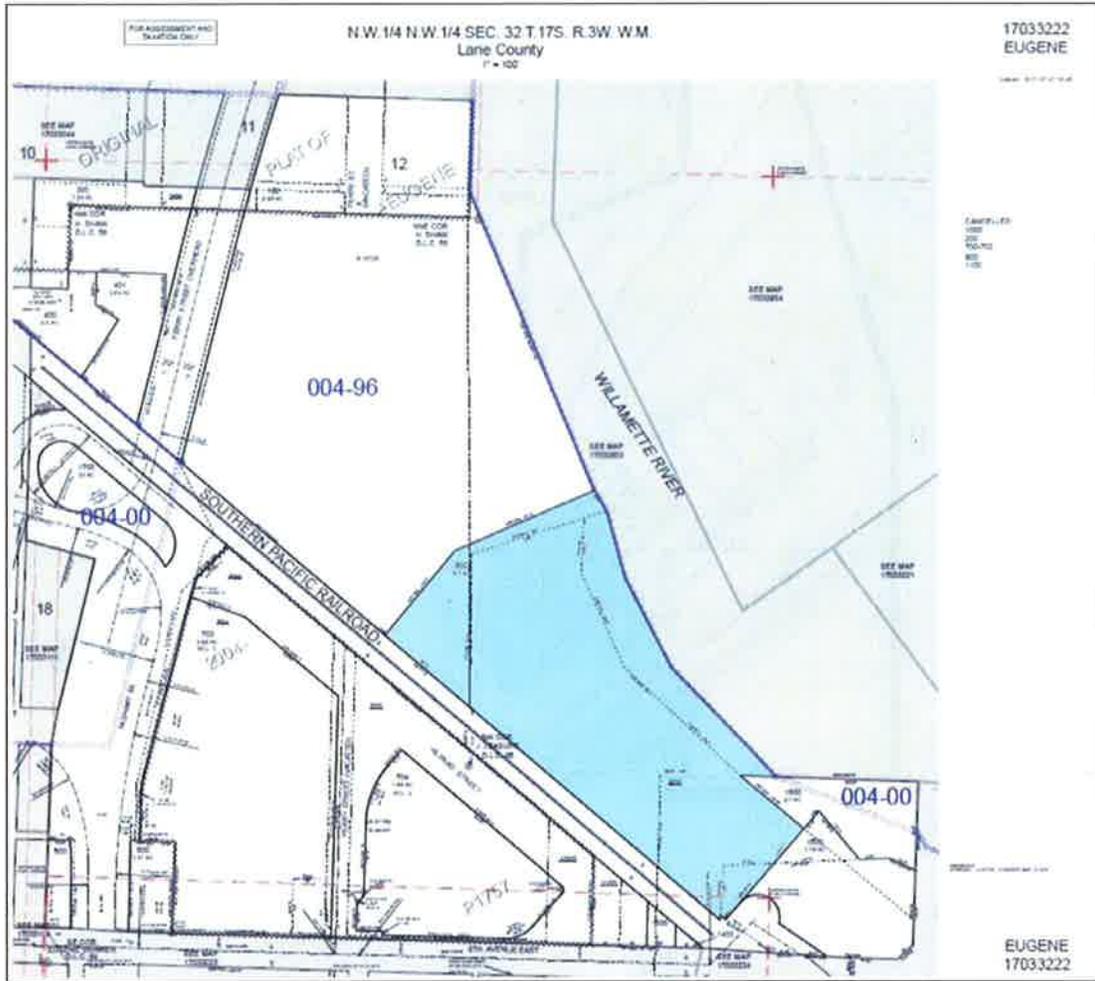


Figure 3. Lane County Assessor's Plat, 17033222, Tax Lot 800

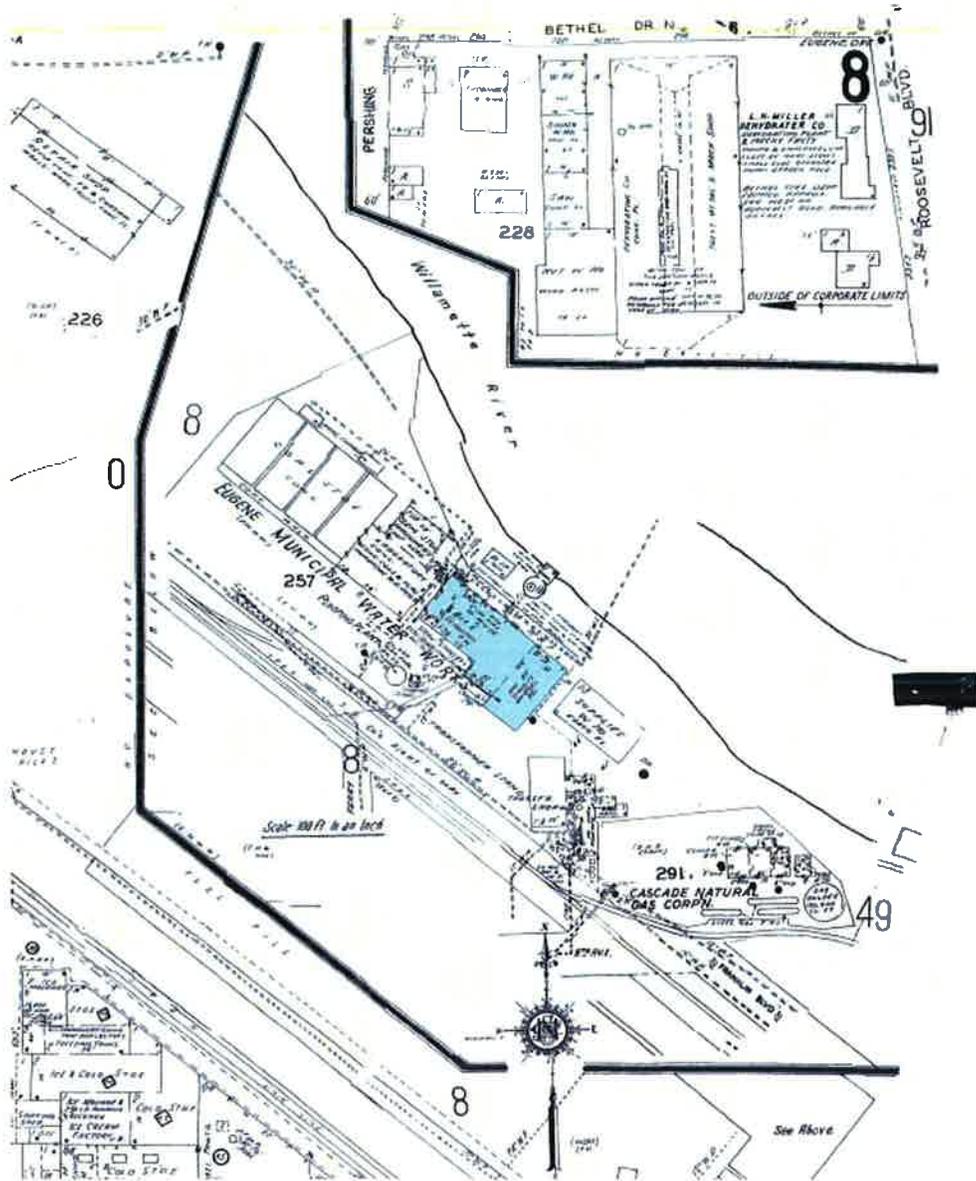


Figure 4. Sanborn Fire Insurance Map, 1925, updated to 1962, showing Standby Steam Plant, as expanded



Figure 5. Historic View, Standby Steam Plant Construction, "taken from top of settling tank," shows some boiler construction and beginning pour for turbine foundation, looking West, 23-Dec-1930 (EWEB Archive)

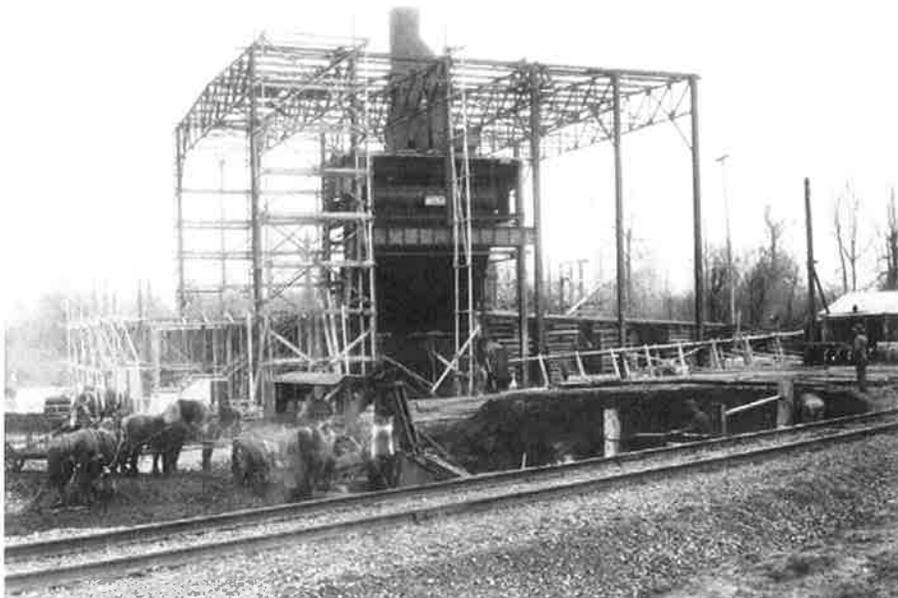


Figure 6. Historic View, Standby Steam Plant Construction, Looking NE across RR Spur, showing boiler, frame and oil tank excavation, 13-January-1931, (EWEB Archive)

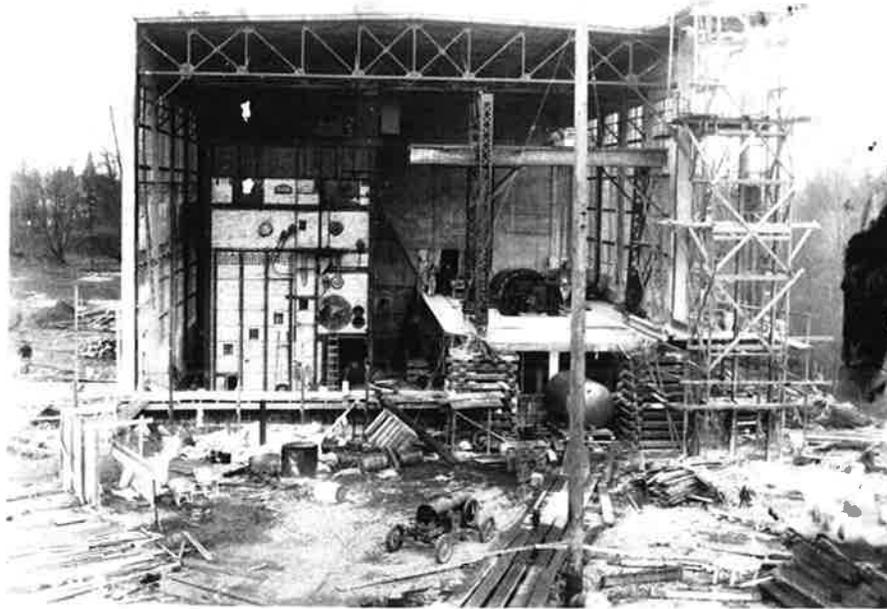


Figure 7. Historic View, Standby Steam Plant Construction, looking West, showing boiler (left), turbine (right) and exterior building frame, March 1931, (EWEB Archive)



Figure 8. Historic View, Standby Steam Plant, "Showing Erection of Large Doors on East End," looking NW, June 1931 (EWEB Archive)



Figure 9. Historic View, Standby Steam Plant Construction, Looking SE, circa June 1931, (EWEB Archive)

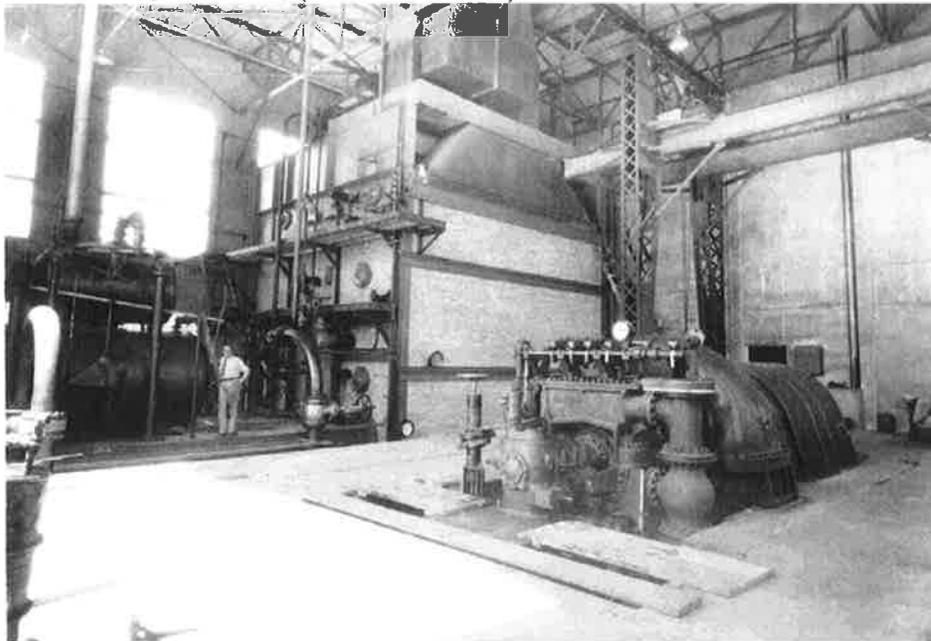


Figure 10. Historic View, Standby Steam Plant Interior, Unit No. 1, Looking SW, toward boiler. Unit 1 Turbine/Generator at Right (EWEB Archive)

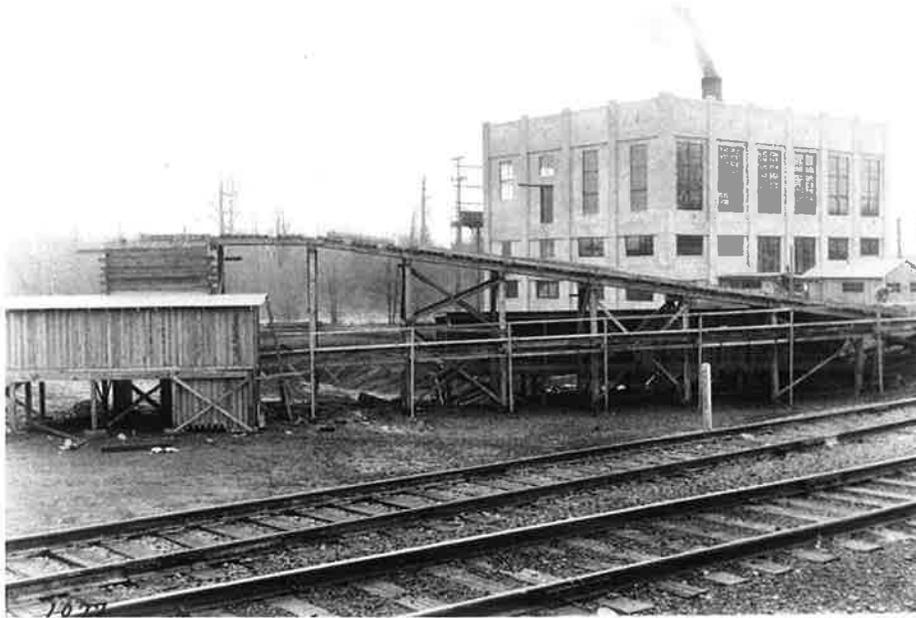


Figure 11. Historic View, Standby Steam Plant, from Fruit Growers Docks, Looking NE, December 12, 1931 (EWEB Archive)



Figure 12. Historic View, Standby Steam Plant, Unit No. 2 Expansion, looking NE, circa 1941, (EWEB Archive)

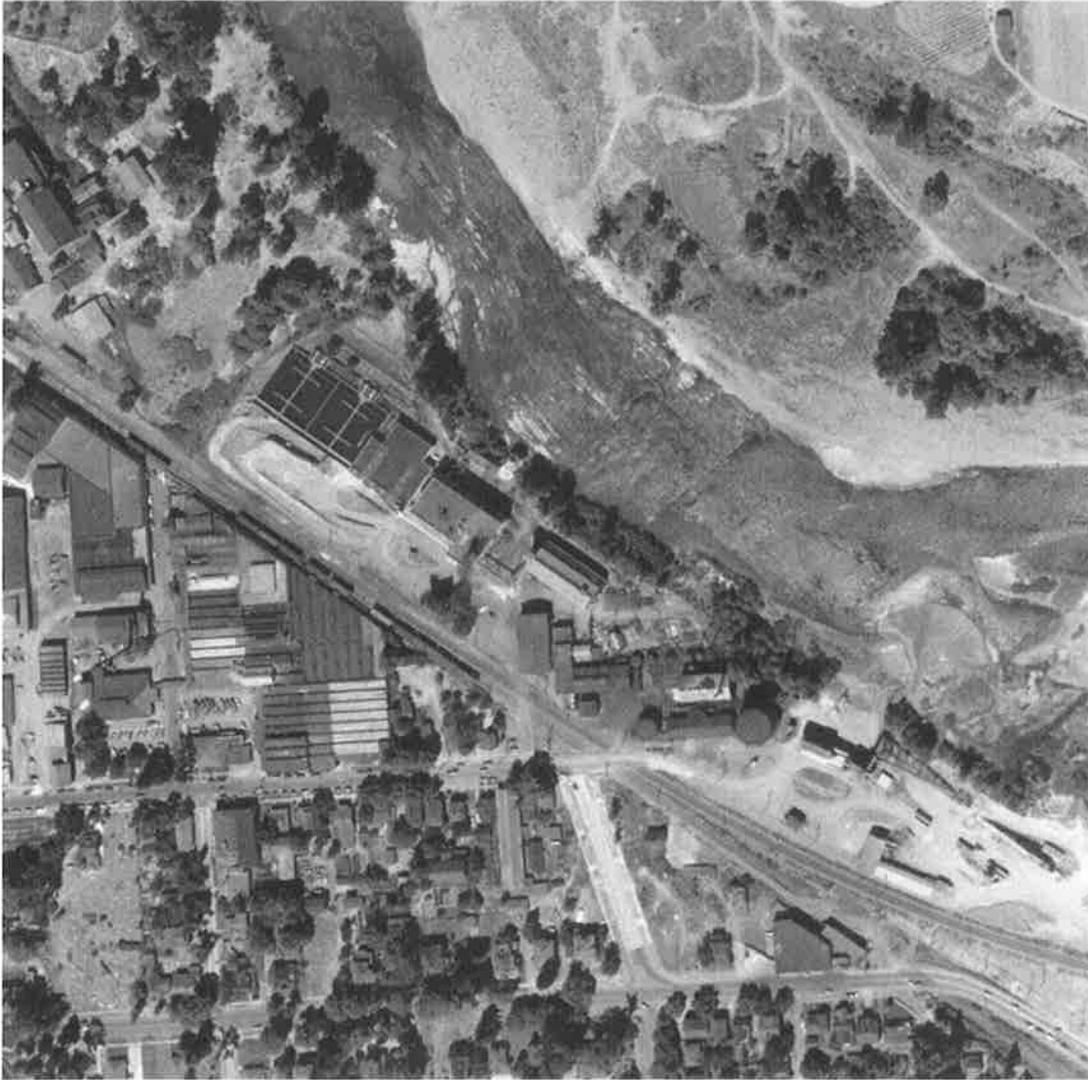


Figure 13. Historic Aerial View, 1944 (US Army Corps of Engineers)



Figure 14. Historic View, Standby Steam Plant, with all three units, looking SE (showing North Elevation), c1962 (EWEB Archive)



Figure 15. Historic View, Standby Steam Plant, looking NW (showing South and east elevations. Note Wood Chip Conveyor, c1962 (EWEB Archive)

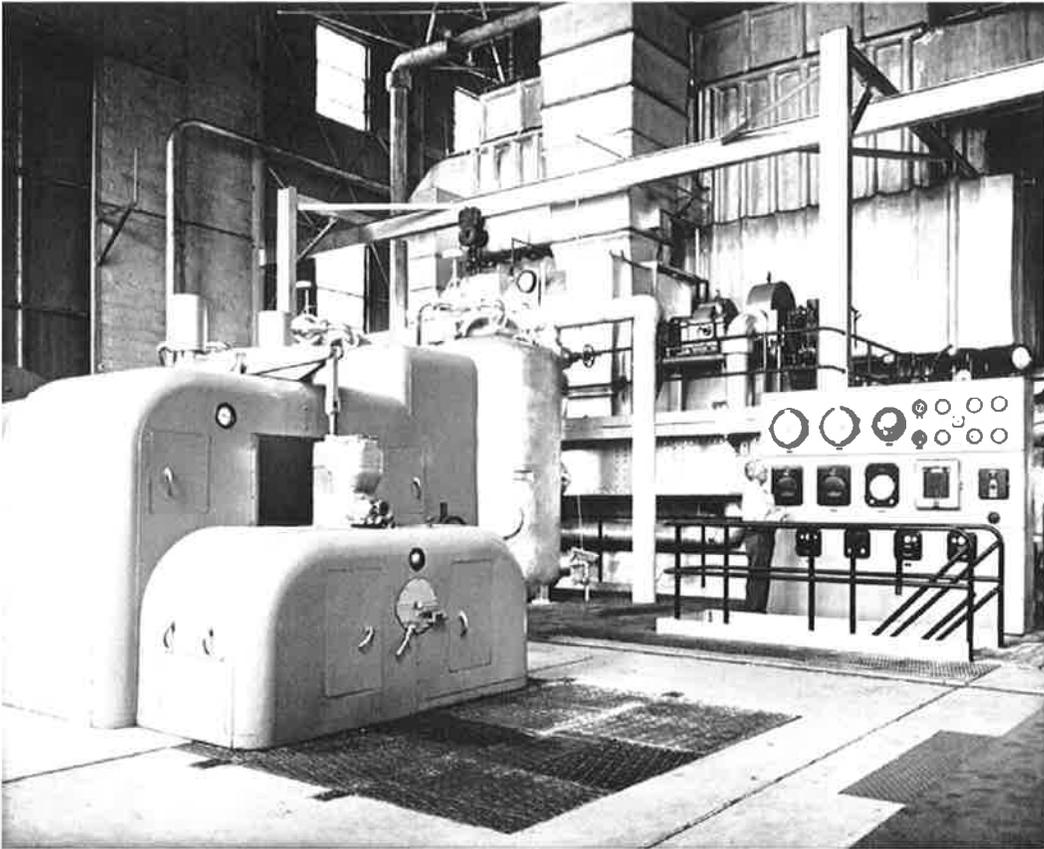


Figure 16. Historic View, Standby Steam Plant Interior, Unit No. 3, showing turbine/generator in foreground, looking South, toward boiler, c1962 (EWEB Archive)



Figure 17. Historic Aerial View, 1952 (Cascade Aerial Photography)



Figure 18. Current Image, West and north-facing elevations, looking SE, toward Natural Gas-Fired plant, November 2011



Figure 19. Current Image, West and south-facing elevations, looking NE, November 2011



Figure 20. Current Image, South and east-facing elevations, Looking North, November 2011



Figure 21. Current Image, East and north-facing elevations, Looking SW, November 2011



Figure 22. Current Image, North-facing elevation, looking SE, November 2011



Figure 23. Current Image, Cornice & Pilaster Details, Typical, November 2011
(rotated image)



Figure 24. Current Image, Fuel Transfer House and Oil Tank island, Looking East, November 2011



Figure 25. Current Image, Fuel Transfer House, Looking South, November 2011



Figure 26. Current Image, Fuel Transfer House, Interior View, November 2011



Figure 27. Current Image, Interior, Power Floor, Looking East (Unit 1 in foreground), November 2011



Figure 28. Current Image, Boiler, Unit No. 1, Looking South from Power Floor, November 2011



Figure 29. Current Image, Boiler, Unit No. 1, west side, looking north, toward Power Floor, November 2011



Figure 30. Current Image, Turbine Generator, Unit No. 1, Looking NW,
November 2011



Figure 31. Current Image, Turbine Generator, Unit No. 1, Looking SW,
November 2011

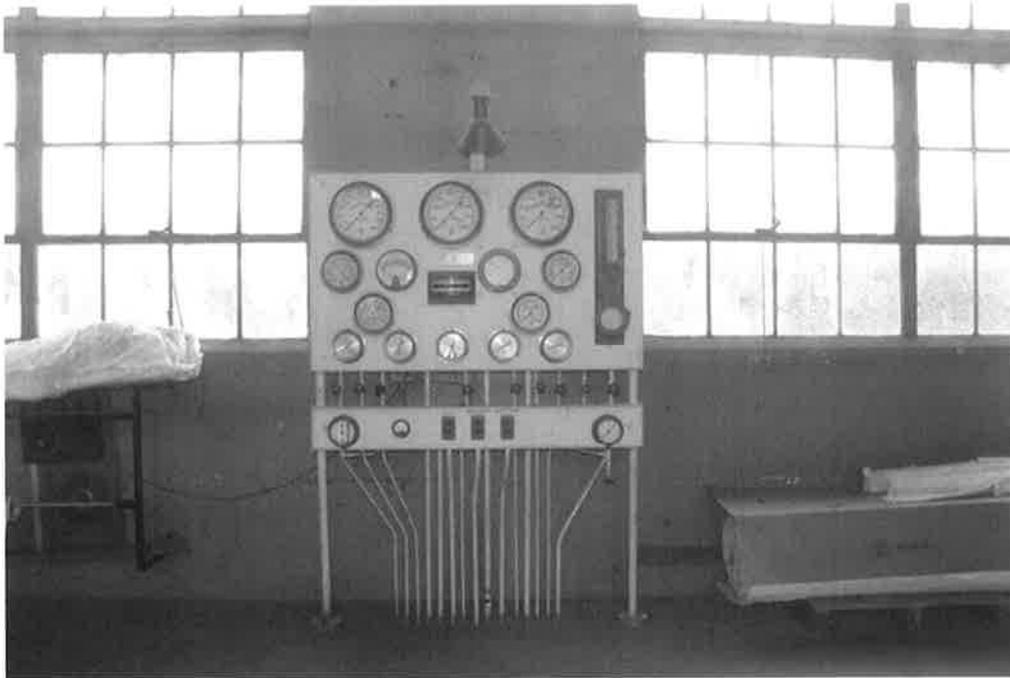


Figure 32. Current Image, Unit No. 1 Controls, November 2011

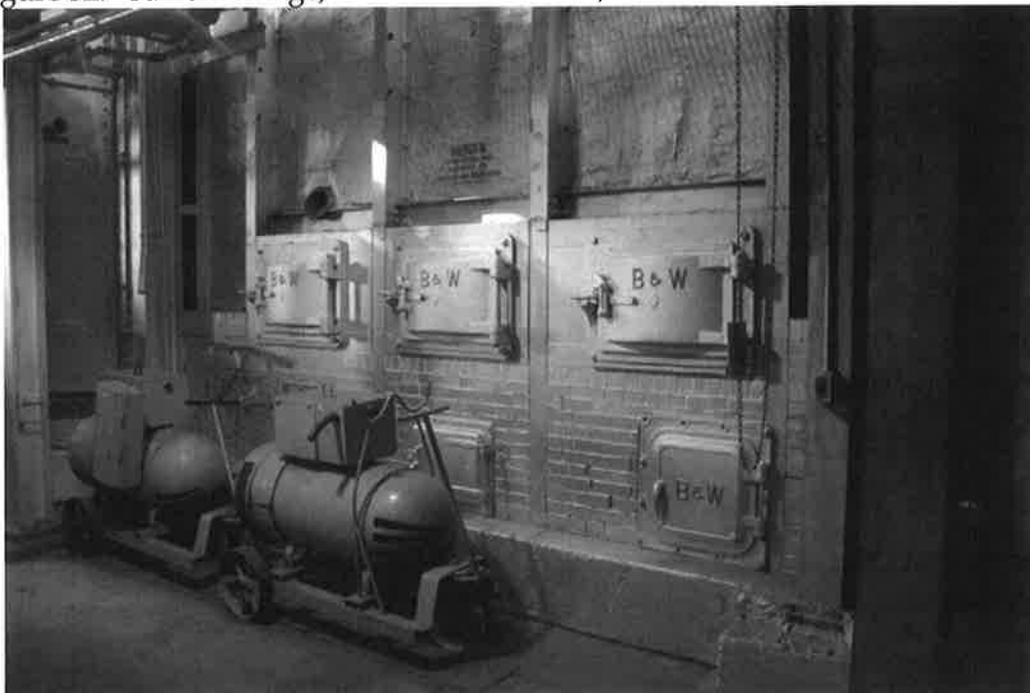


Figure 33. Current Image, Boiler, Unit No. 2, November 2011



Figure 34. Current Image, Boiler, Unit No. 2, January 2012



Figure 35. Current Image, Automatic Stokers, Unit No. 2, January 2012



Figure 36. Current Image, Lower Level, Looking West toward Tool Room, at Boiler No. 2 (L) and Condenser (R), November 2011



Figure 37. Current Image, Tool Room (Lower Level), Looking North, November 2011



Figure 38. Current Image, Lower Level, Looking East from Tool Room. Unit No. 1 Condensor at Left, Boiler No. 1 at Right, November 2011

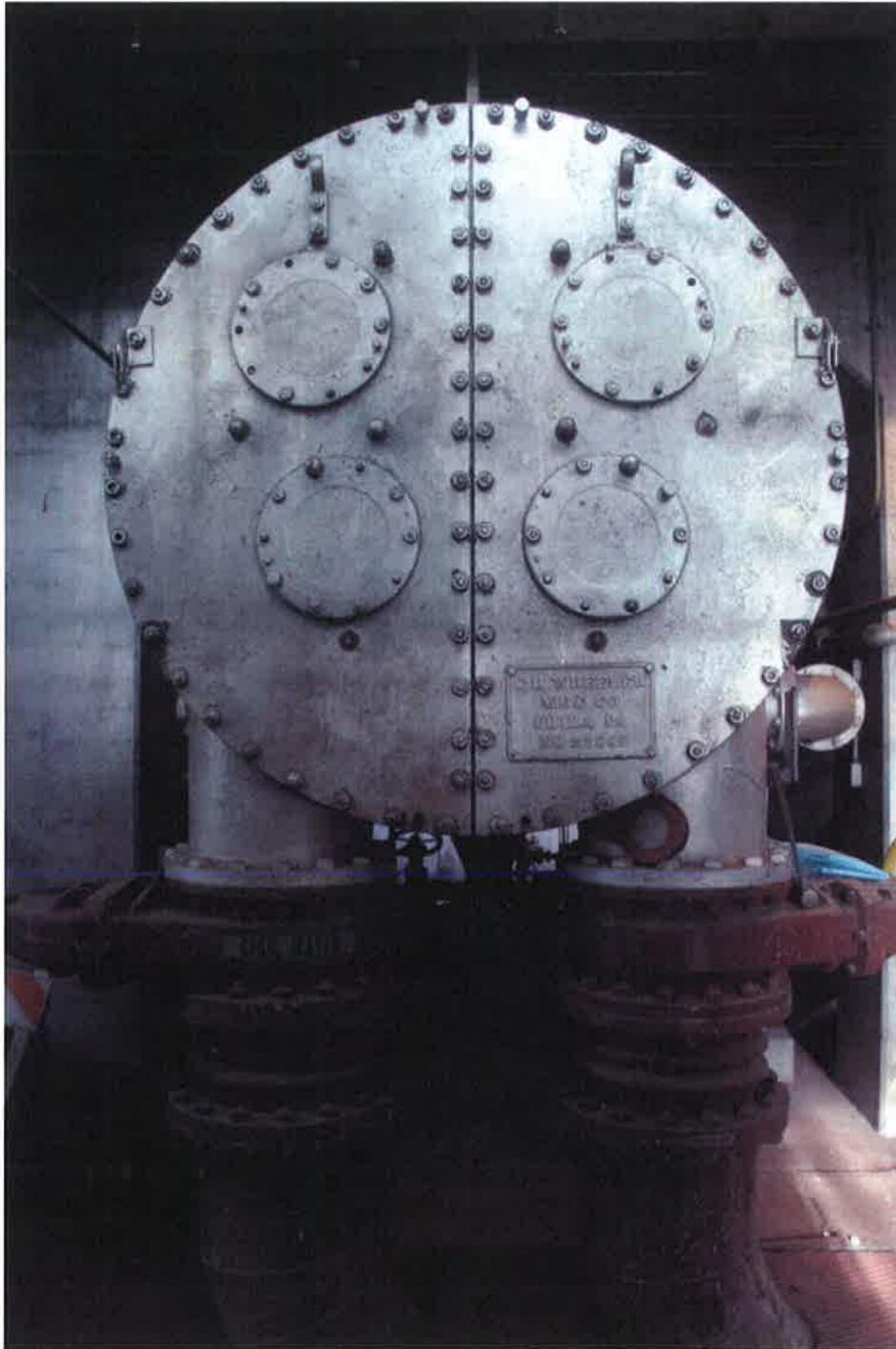


Figure 39. Current Image, Condenser, Unit No. 1, November 2011

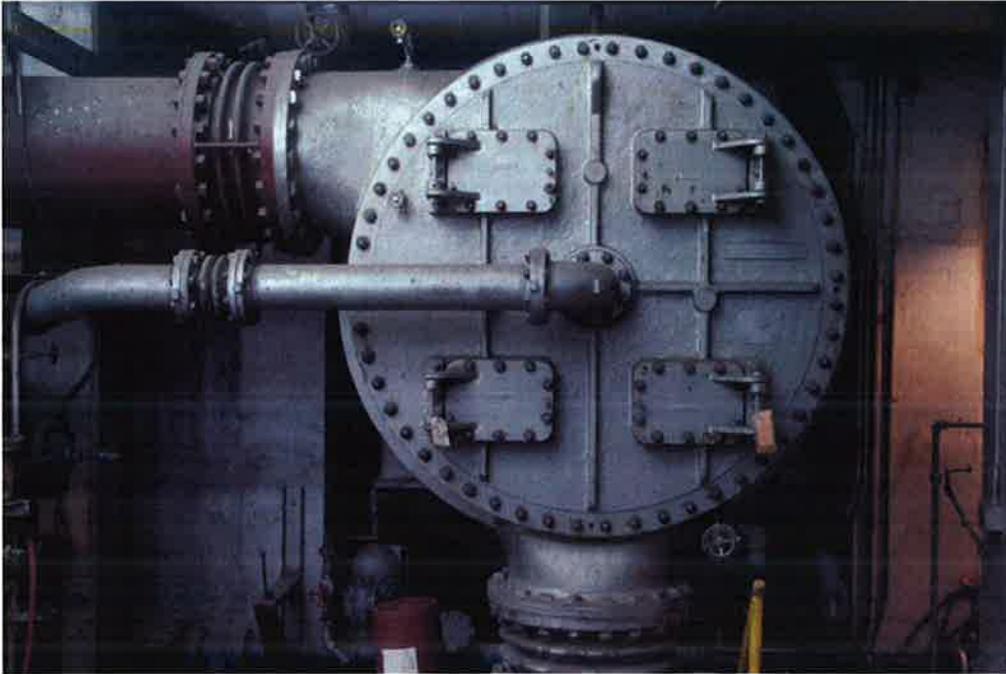


Figure 40. Current Image, Condenser, Unit No. 2, November 2011



Figure 41. Current Image, Turbine/Generator Unit No. 2, Looking SW, November 2011



Figure 42. Current Image, Turbine/Generator Unit No. 3, Looking SE, November 2011



Figure 43. Current Image, General View from Catwalk at Boiler Unit No 1. Looking NE, toward Power Floor, November 2011



Figure 44. Current Image, Automatic Stoker, Unit No. 3, looking West, January 2012



Figure 45. Current Image, Automatic Stoker, Unit No. 3, looking East, January 2012



Figure 46. Current Image, General View, Toward Boiler Unit No. 3, Looking SE from Power Floor (Unit No. 2 Turbine/Generator in foreground), November 2011



Figure 47. Current Image, Unit No. 1 Dedication Plaque, North Elevation, January 2012.

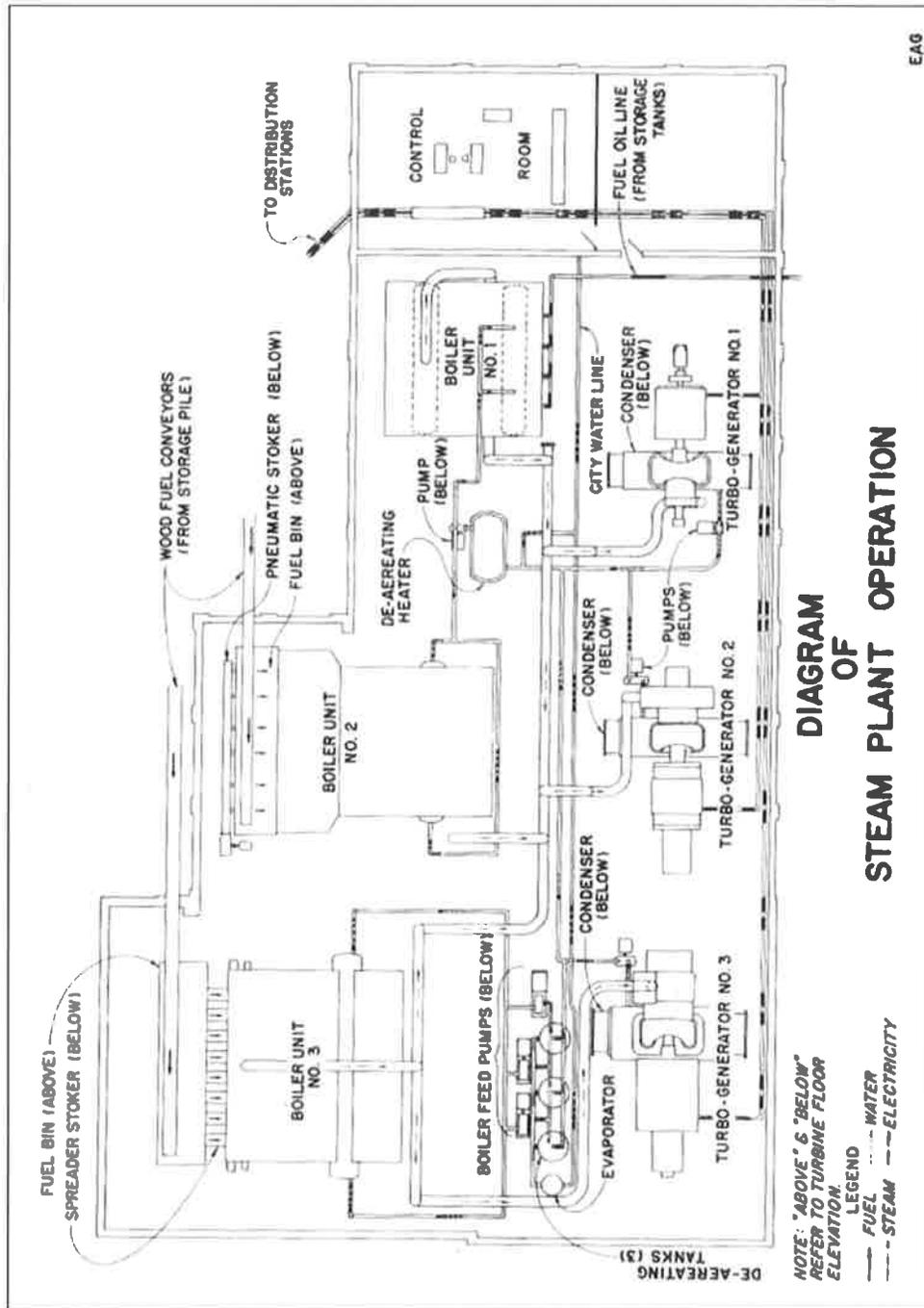


Figure 48. Schematic of Standby Steam Plant, c1950 (EWEB Archive)

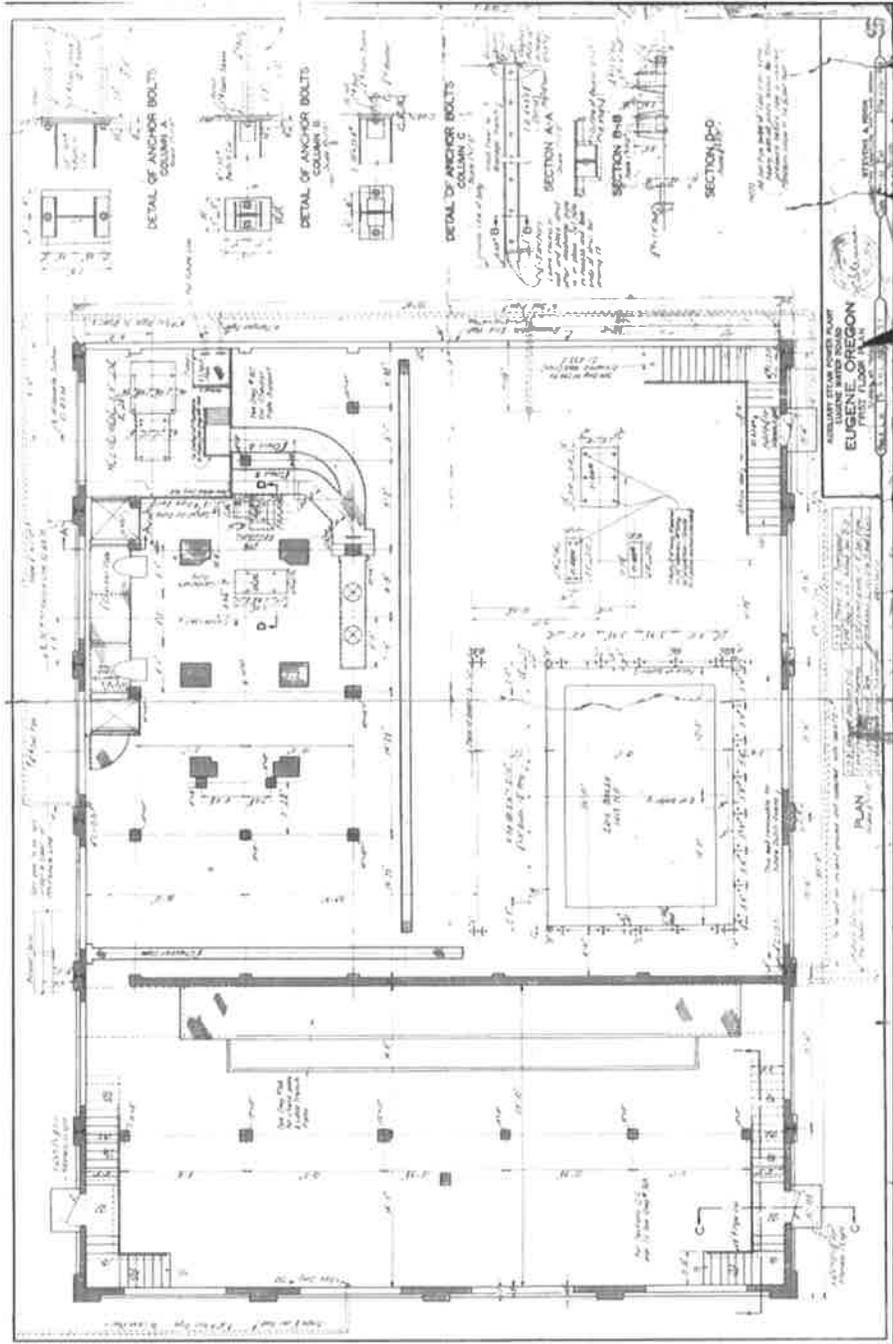


Figure 50. Floorplan, Standby Steam Plant Unit No. 1, 1930 (EWEB Archive 1531)

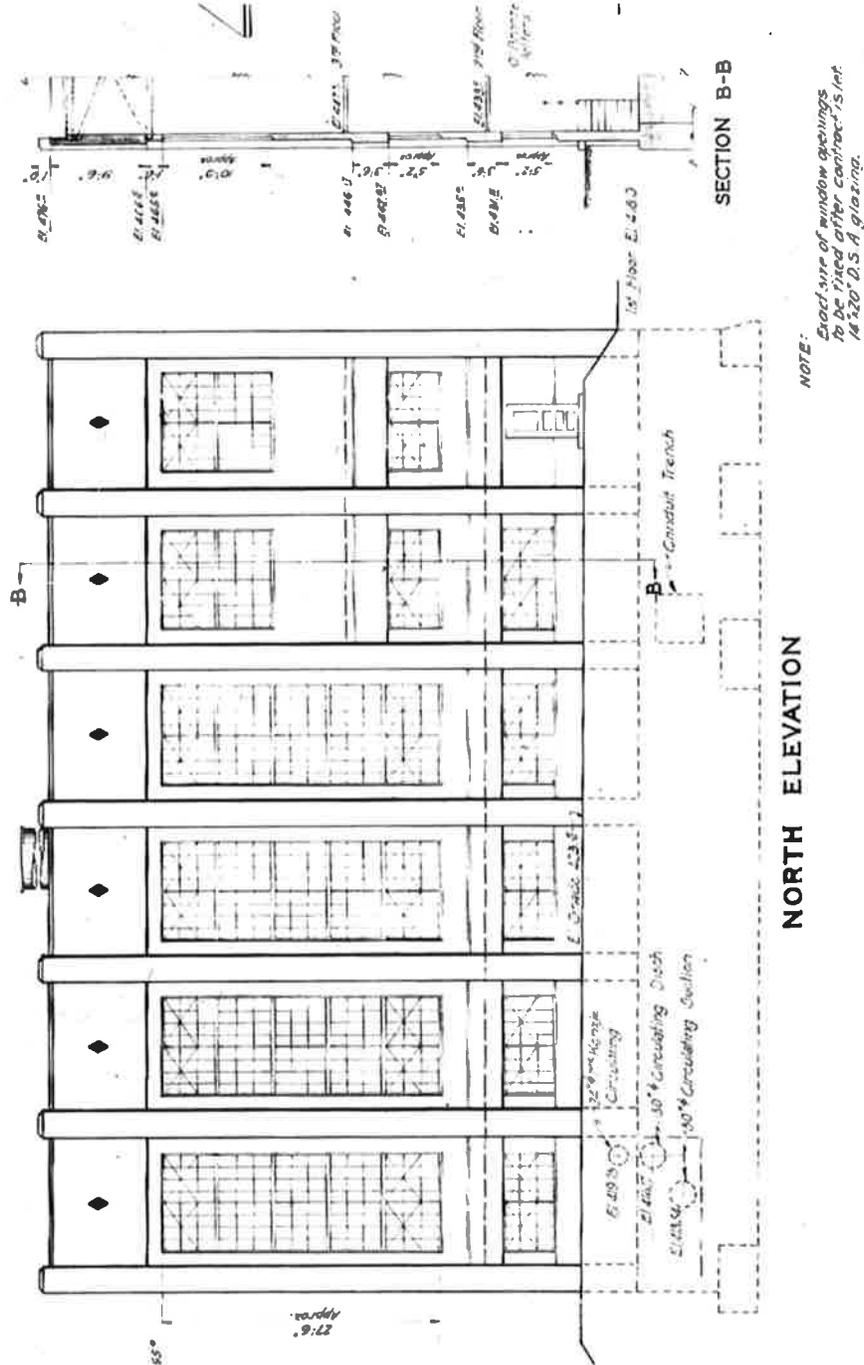


Figure 51. Standby Steam Plant, North Elevation 1930 (EWEB Archive, #1531-3)

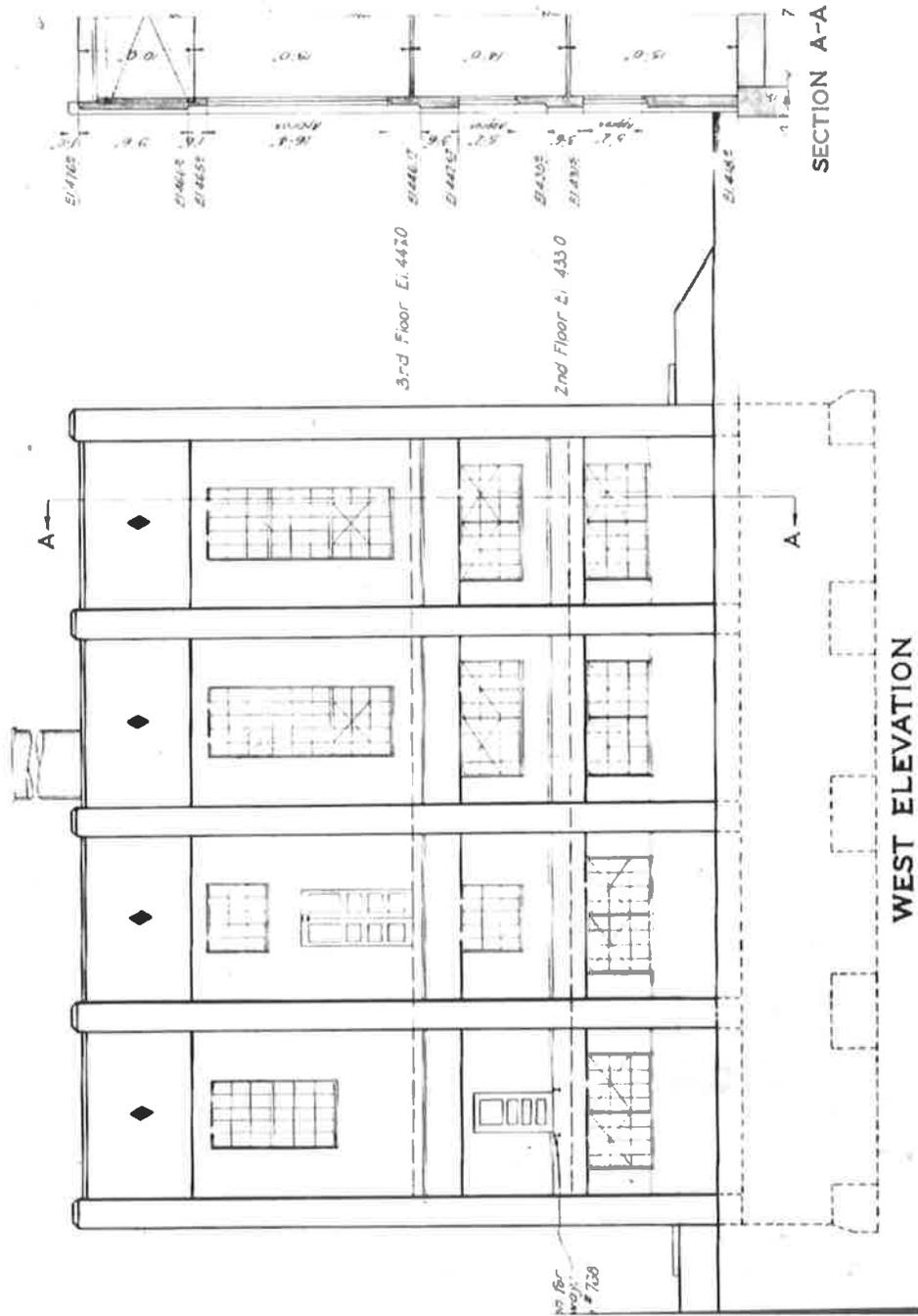


Figure 52. Standby Steam Plant, West Elevation, 1930 (EWEB Archive, #1531-3)

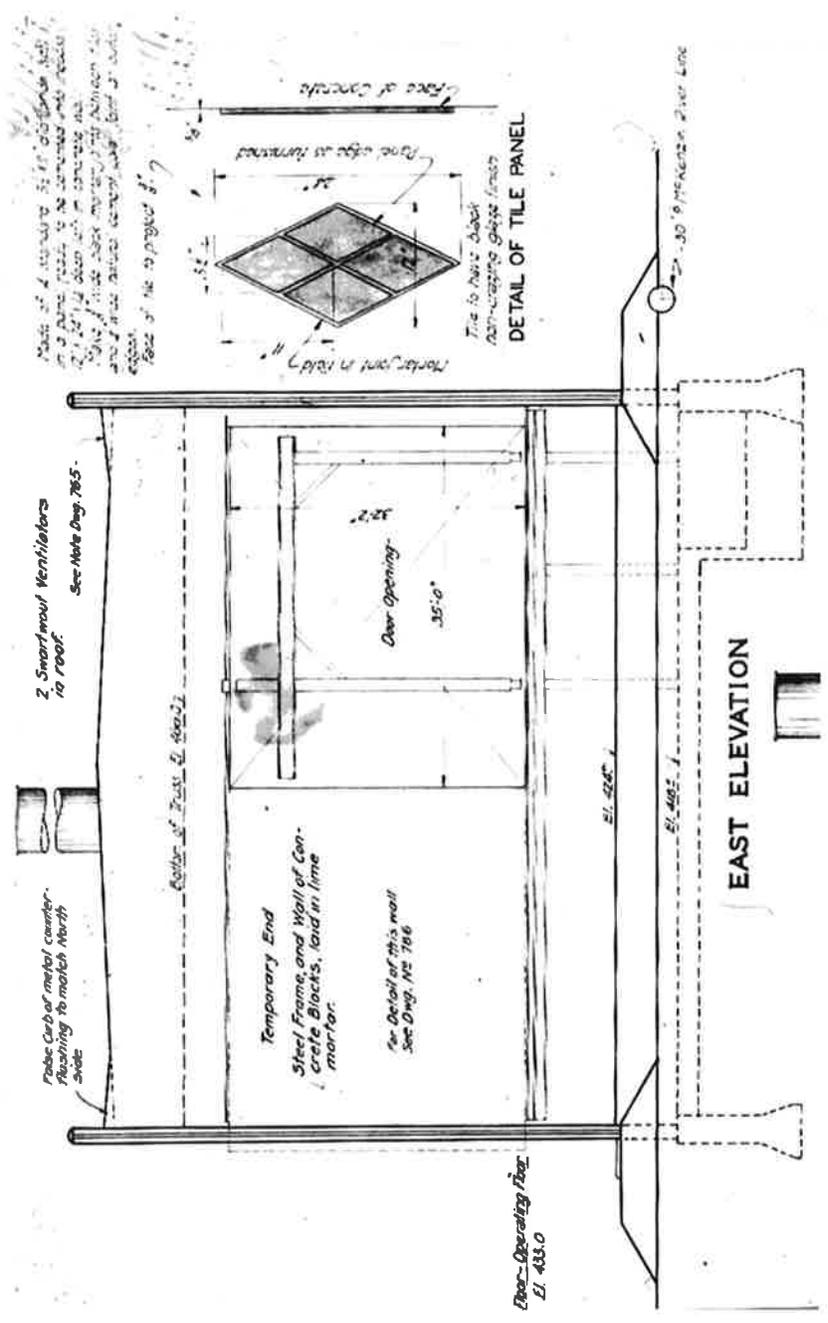


Figure 53. Standby Steam Plant, East Elev. & Tile Details, 1930 (EWEB Archive,#1531-3)

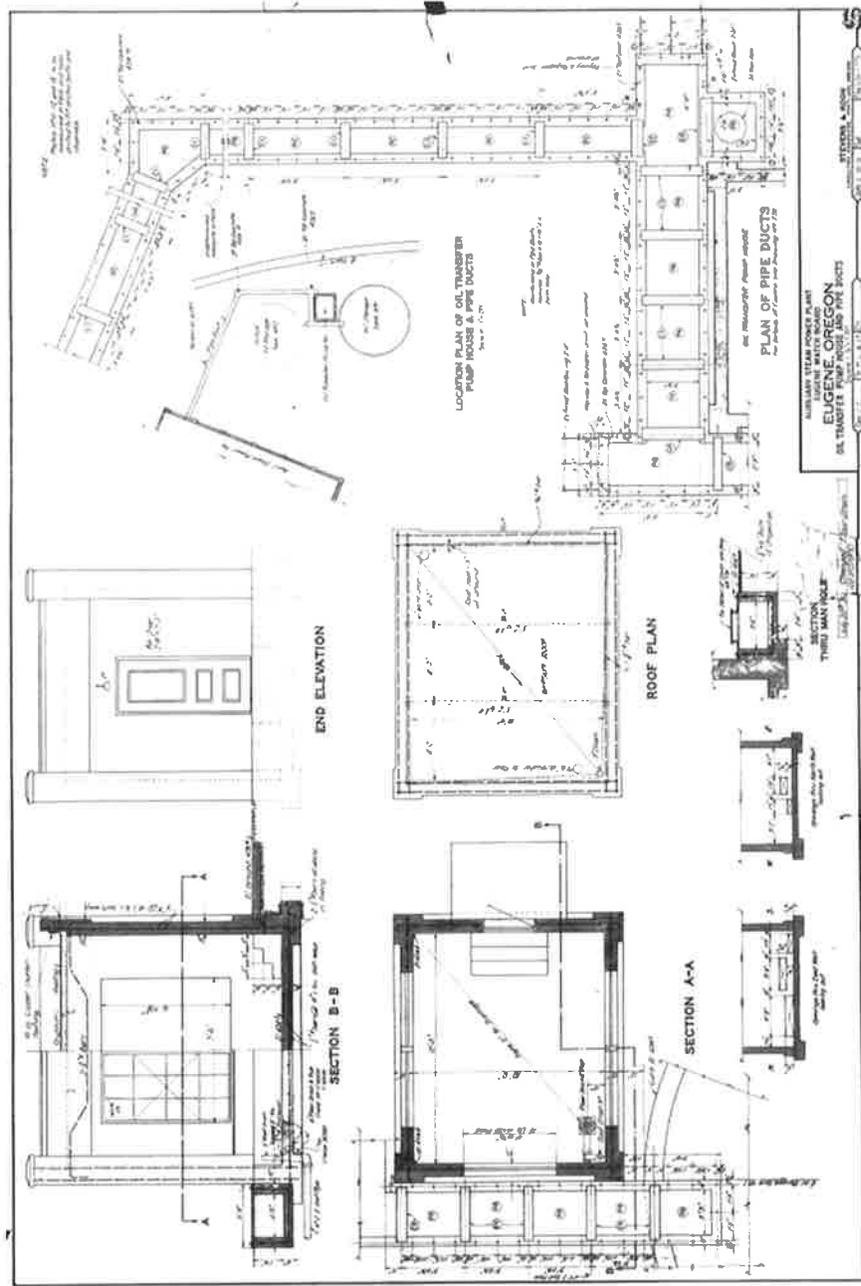


Figure 54. Standby Steam Plant, Fuel Transfer House, 1930 (EWEB Archive, #1531-32)

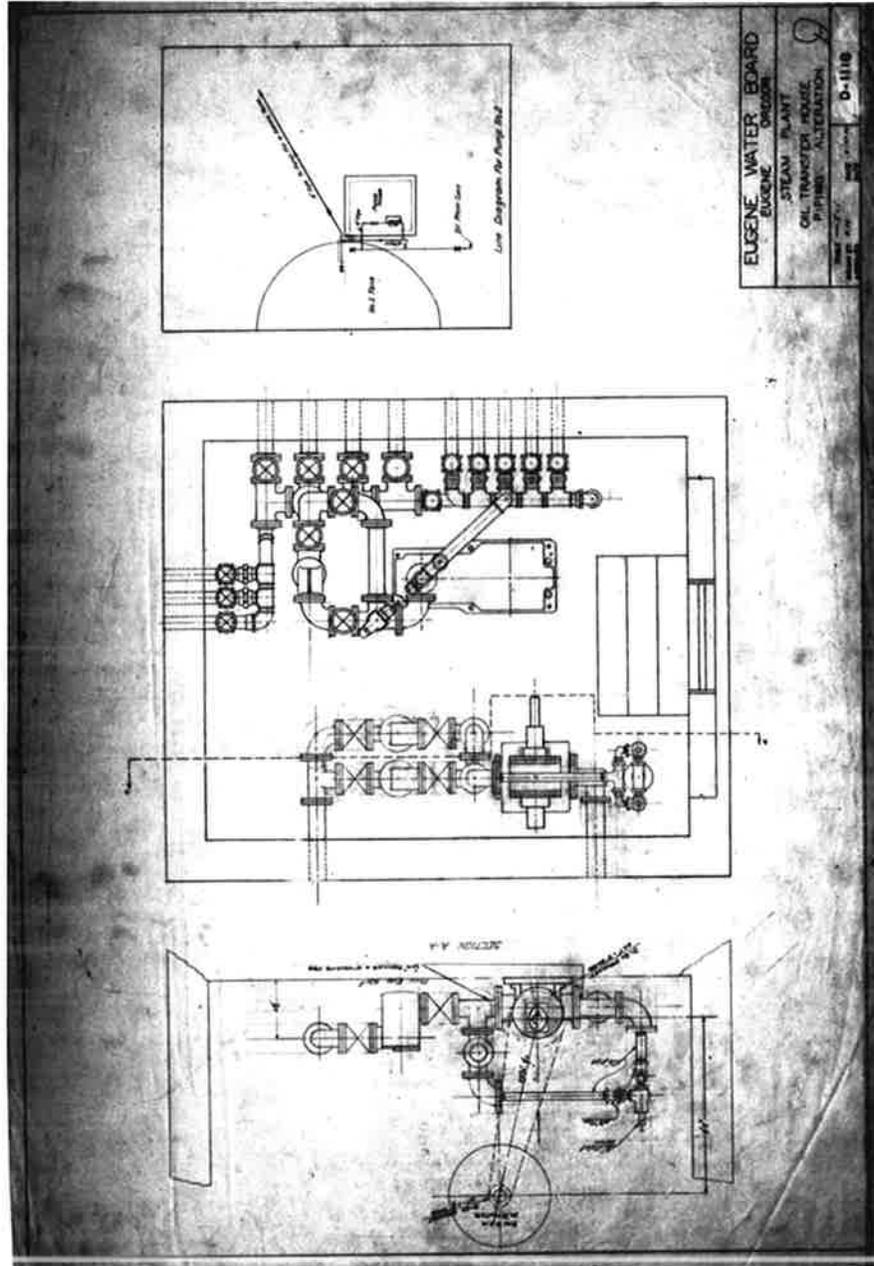


Figure 55. Standby Steam Plant, Fuel Transfer House, Piping Diagram, 1939
(EWEB Archive, #D-1118)

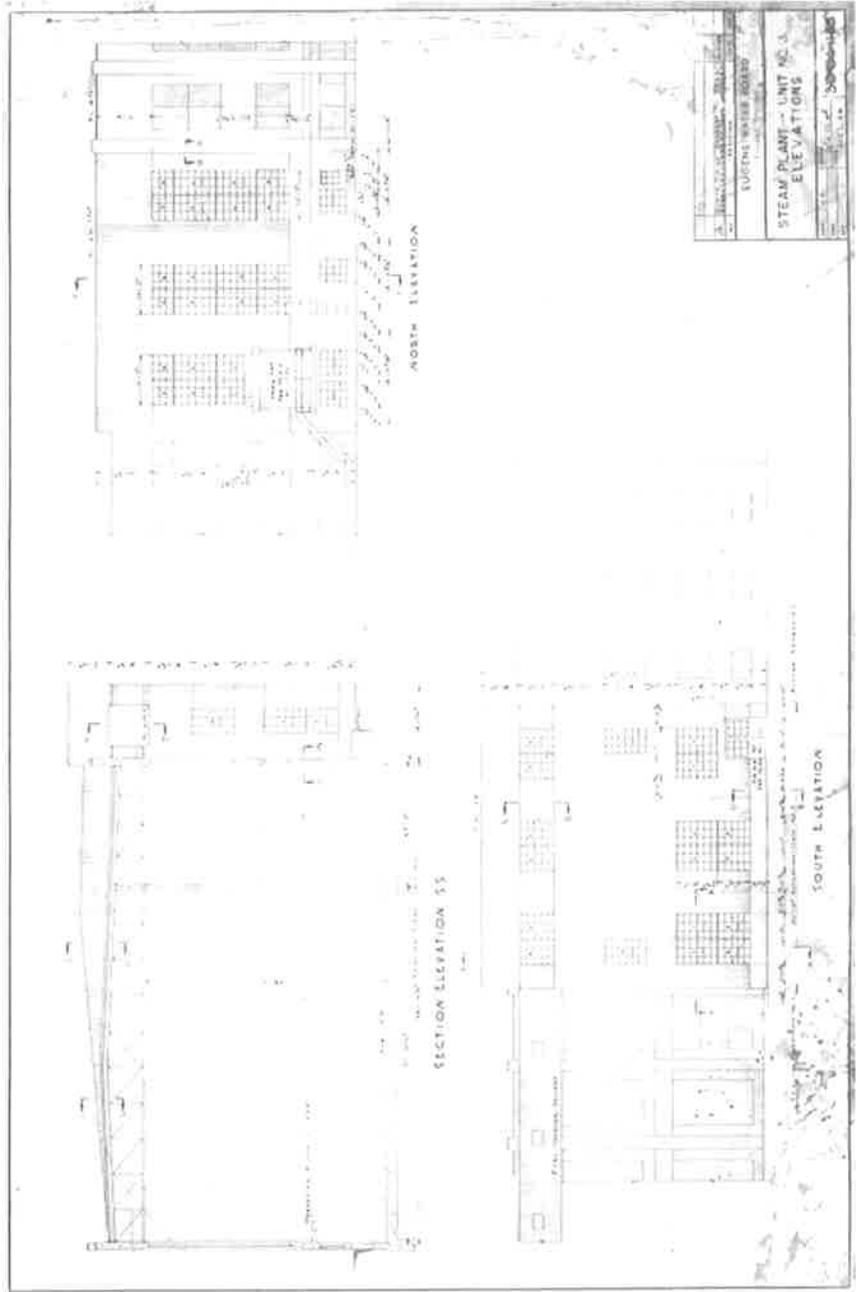


Figure 56. Standby Steam Plant Unit No. 3, Jun 1948, (EWEB Archive, #30-04-1185)

