D-614

Historic Structures Report
Fort Yellowstone Power House

Mammoth Hot Springs
Yellowstone National Park, Wyoming

Historic Structures Report
Fort Yellowstone Power House
Final Document

prepared by:
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and
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prepared for:
National Park Service
Rocky Mountain System Support Office
and
Yellowstone National Park

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1.0 EXECUTIVE SUMMARY

The Fort Yellowstone Power House, a hydroelectric generating plant, is located at Mammoth Hot Springs in Yellowstone National Park. This building has been determined eligible for listing in the National Register of Historic Places, as a contributing resource within the Fort Yellowstone - Mammoth Hot Springs Historic District. The district as a whole is eligible under National Register criteria A and C.

The U.S. Army constructed the power house in 1910-11, to provide electricity to the buildings and grounds of Fort Yellowstone. The building equipment including the penstock was modified in 1935. The building, designed to be compatible with the Colonial Revival style of the other Fort Yellowstone structures, also displays elements of the Mission style of architecture which was popular around the turn of the century. Elements of this style include a red tile roof, smooth walls light in color, and arched openings. Since the early 1970s, the building has been used only for storage. However, all of the machinery remains inside the building, and the structure itself is in good condition.

In order to preserve the Fort Yellowstone Power House the following need to be completed:

1. Protect the building by stabilizing and maintaining the exterior concrete surfaces, repair and maintenance of the windows and door, and provide positive drainage around the building.

2. Protect the historic and architectural integrity of the building and also, the part of the interior space with the electrical generating equipment, which is significant to the historic building.

3. Determine the feasibility of adapting the building for other uses in order to protect the historical significance of the building. In most cases this may require an addition to the building. The addition needs to be compatible with the existing structure in mass, scale and continuity.

The purpose of this Historic Structure Report (HSR) is to provide preservation recommendations for the power house, including suggestions for the adaptive reuse of the building. A separate report will determine the suitability of the power house for adaptive reuse as a curatorial facility for Yellowstone National Park.

2.0 HISTORICAL DEVELOPMENT

The Mammoth Hot Springs Hotel and the residential, maintenance, and administrative units associated with Fort Yellowstone were first supplied with electricity in 1902. This first hydro-electric system consisted of a concrete aqueduct carrying water from Glen Creek to a two-story, wood-frame power house. Obsolete only seven years later, the original powerhouse was replaced in 1910-11 with the current structure, constructed for $45,889. This new power house incorporated a basement boiler room [aka heater room] and a first-floor generator room (housing three turbine-driven generators), penstock room, "water closet," workshop, and closet. The walls, foundation, and flooring were concrete, and the roof was tiled. Not surprisingly, the building was lighted with electricity, provided with water connections, and heated with steam heat.[1]

In 1932, park day laborers constructed a new intake from Glen Creek and replaced the original flow line. This attempt to increase water pressure proved inadequate and in January of 1935, Yellowstone National Park engineer Philip Wohlbrandt received final approval for power system reconstruction, designed to meet the "urgent need" for revision of the Mammoth Hot Springs domestic water supply and to supply adequate electrical power to the additional housing and shop units being constructed at Fort Yellowstone.[2]

The Water and Power Development plan included revision of the intake on Glen Creek (completed by park forces); construction of a storage reservoir and connecting units (completed by park forces); construction of an additional flow line from Glen Creek to the reservoir (contracted out); construction of a steel penstock from the reservoir to the power house (contracted out); excavation of a trench for the penstock (completed by park forces);

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[1] "Building #63 [sic]," *Quartermaster's Records of Buildings*, Volume 167, Yellowstone National Park Library and Archives, Mammoth Hot Springs, Wyoming [YNP Archives].

[2] Ward P. Webber, Engineer, "Seasonal Report on Water and Power Development, Mammoth, Yellowstone National Park," March 30, 1936, p. 2, folder 6, box D-28, YNP Archives.

and replacement of the original power house hydroelectric equipment. The project was completed in 1937, at a total cost of $207,514.66 (Appendix A).[3]

NPS engineers located the new dam and reservoir at the head of a narrow draw 400' above Mammoth Terrace (and 2 miles to the southwest). The dam, designed by Ward P. Webber of the NPS Branch of Plans and Design (San Francisco), was constructed of earth fill, with a clay core. The 26.56 acre feet of water pooled behind the dam provided not only a power source, but met the domestic and fire-control water needs of the Mammoth concession and NPS administrative complexes.[4]

From the reservoir, domestic water was conveyed by the existing 18" pipe. The new penstock, leading from the reservoir to the power house, was constructed of 2180' of the "old" 26" steel pipe, "cleaned, painted and wrapped," and an additional 7,280' of new 28" to 30" steel pipe, constructed, welded, and installed by the Steel Tank & Pipe Company, of Berkeley California. "Pipe lines were laid and valved in such a manner that water can flow direct from the intake on Glen Creek into the penstock and also into the domestic supply line by-passing the storage reservoir" (Figure 1).

Park crews excavated nine thousand cubic yards of solid rock, loose rock, and earth from the penstock trench. Undefined "landscaping" along the trench and around the reservoir and power house was completed in the spring of 1937.[5]

As part of the general reconstruction of the power system, the three turbine-driven units in the power house were replaced. The new, more powerful equipment (installed by H. S. Tittle Company of San Francisco) included two 300 kilowatt generators driven by two 4500-horse power Pelton water wheels. A gas-driven, 175 kilowatt Leroi generating unit

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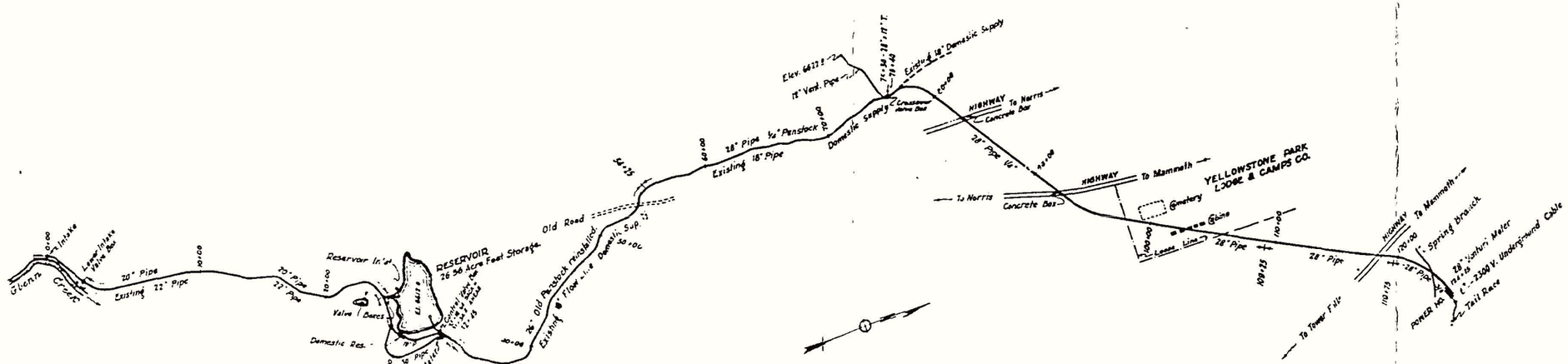
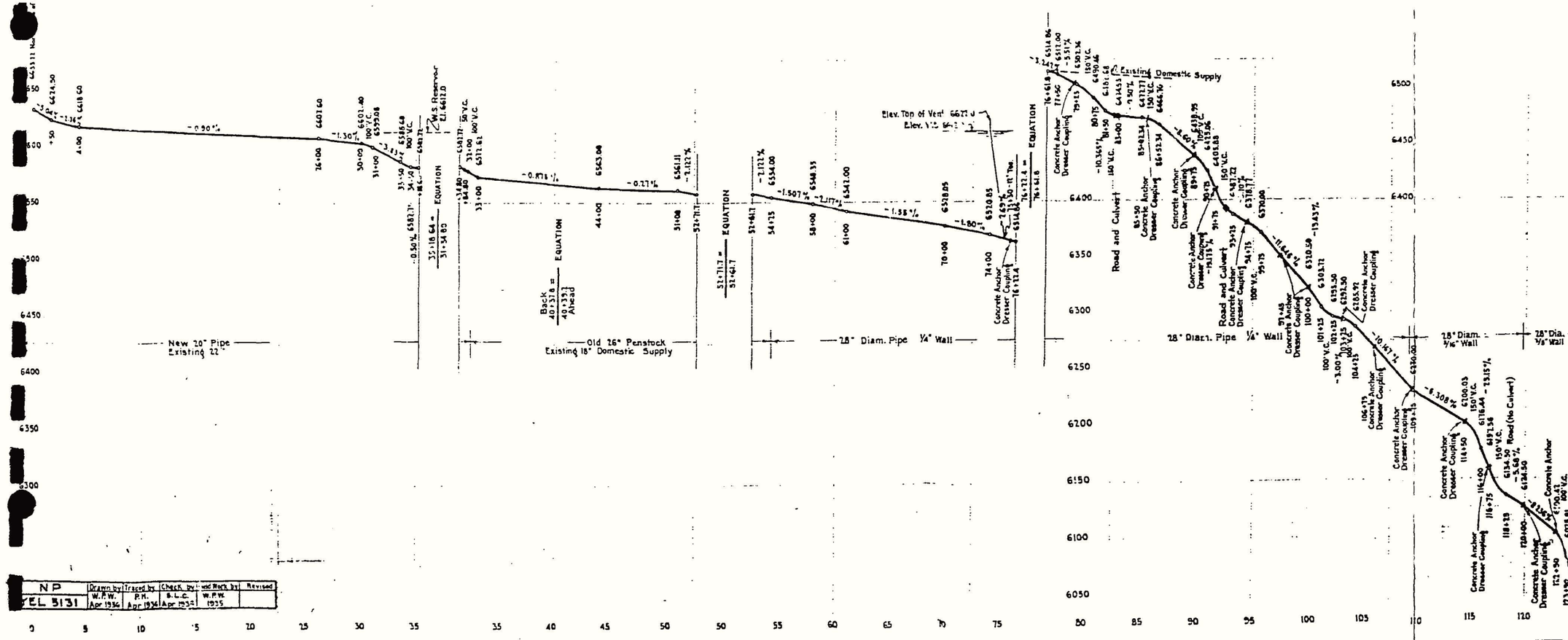
[3] Webber, "Seasonal Report on Water and Power Development, Mammoth, Yellowstone National Park," pp. 1-2; Philip H. Wohlbrandt, Park Engineer, "Final Report [on] Water and Power Development - Mammoth, F.P. 598," March 8, 1943, n.p, folder 9, box D-28, YNP Archives.

[4] Ibid.

[5] Webber, "Seasonal Report on Water and Power Development, Mammoth, Yellowstone National Park," p. 2; Wohlbrandt, "Final Report [on] Water and Power Development - Mammoth, F.P. 598," n.p.





NP	Drawn by	Traced by	Check by	and Work by	Revised
EL 5131	W.P.W. Apr 1936	P.H. Apr 1936	B.L.C. Apr 1936	W.P.W. 1935	

ON MICROFILM

HALF-SIZE REPRODUCTION

PUBLIC WORKS PROJECT – 1934 FY.
P.P 598 – ELECT. POWER PLANT
MAMMOTH HOT SPRINGS AREA

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

YELLOWSTONE NATIONAL PA

MAP AND PROFILE

MAMMOTH HYDRO-ELECTRIC PROJ
RESERVOIR ...D PENSTOCK
AS CONSTRUCTED

OFFICE OF THE CHIEF ENGINEER
SAN FRANCISCO CALIF.
APRIL 1936

SCALES MAP 1" = 500'
PROFILE: VERT. 1"= 100'
HOR. 1"= 500'

provided power during the construction process and was retained as a stand-by emergency power source. The Ideal Electrical Manufacturing Company, Mansfield, Ohio, furnished "most" of this electrical equipment. Modifications to the power house were limited to the reconstruction of the concrete bases on which the generators rested and to installation of a new exhaust stack. The power house roof and interior were repainted and the concrete floor resurfaced upon completion of the project (Figure 2).[6]

The power lines, running from the power house to concessioner, NPS residential, and NPS administrative units, were placed under ground and divided into two circuits in order to meet the projected power needs.

Upon completion of the reconstruction, Wohlbrandt described the hydroelectric system as:

> semi-automatic in operation ... [with] relays attached to all of the bearing, various parts of the governors and the generator, which will shut the entire plant down in case of anything going wrong with the various units. The generators are equipped with automatic valve regulators and synchronizing equipment, and provisions is made for tying in additional units.[7]

Although the equipment has been modernized and the larger hydro-electric system reconstructed in the 1930s, only "superficial" changes have been made to the building's exterior. Documented exterior changes, 1956-1968, are limited to exterior paint (1956), roof repair (1960), the construction of a roof platform on which a Civil Defense siren was mounted (1960), and "paint[ing of the] roof" (1967). Documented interior changes, 1956-1968, are limited to general maintenance (paint; repair of the Pelton wheels) and to the lowering of the ceiling in the "office" -- presumably the workshop. In 1959, the heating system was upgraded.[8]

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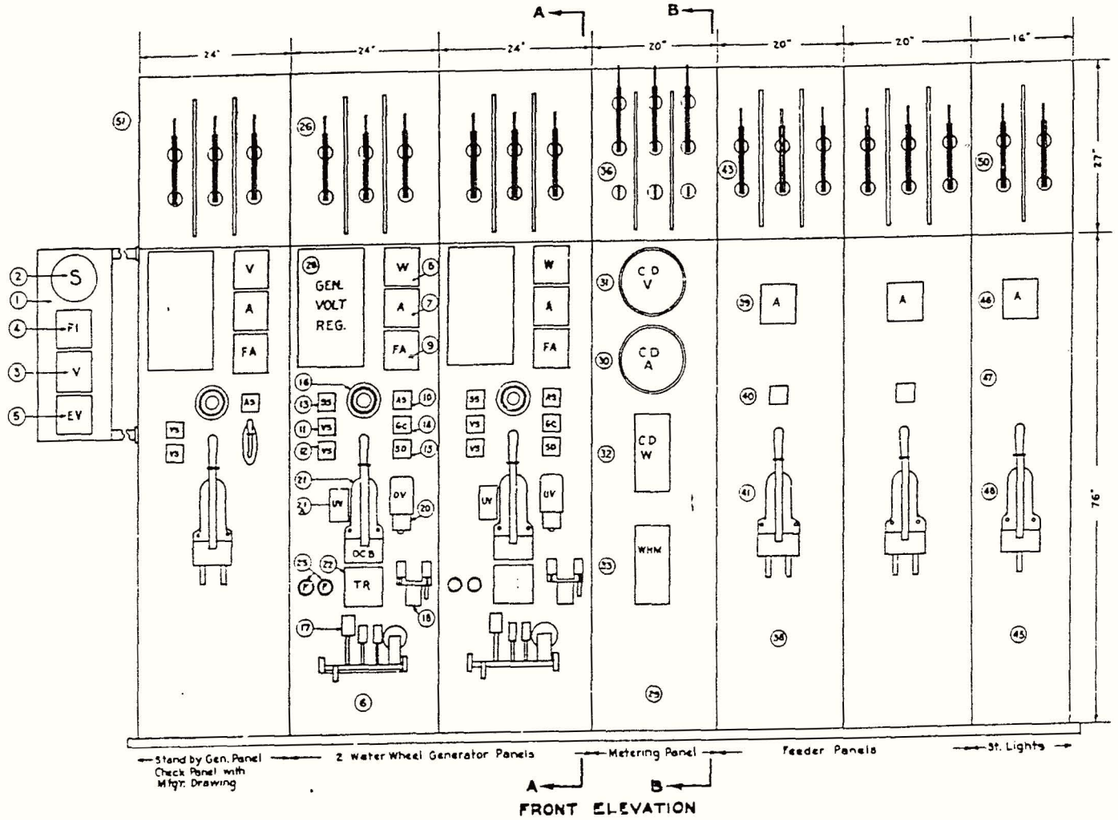
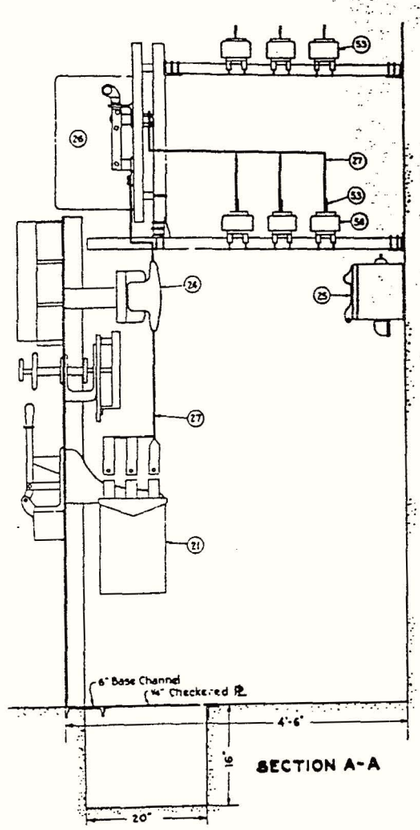
[6] Webber, "Seasonal Report on Water and Power Development, Mammoth, Yellowstone National Park," p. 3.

[7] Ibid.

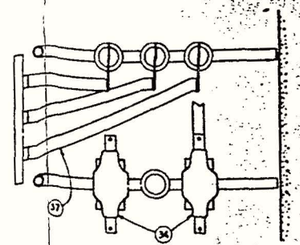
[8] David G. Battle and Erwin N. Thompson, *Fort Yellowstone Historic Structure Report* (report prepared for the USDI, NPS, Denver Service Center, May 1972), pp. 380-381; "Individual Building Data, Power House - Hydro Electric, #56," maintenance department building files, box D-28, YNP Archives.



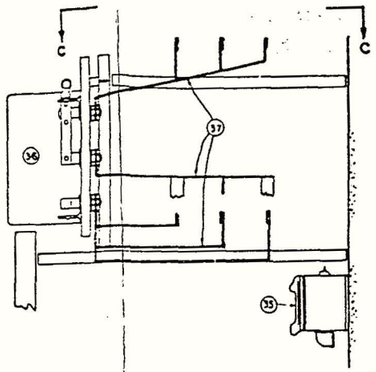
FRONT ELEVATION



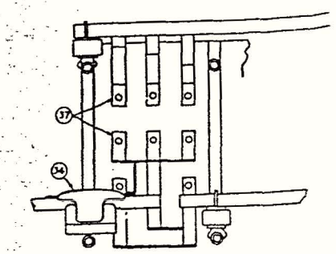
SECTION A-A



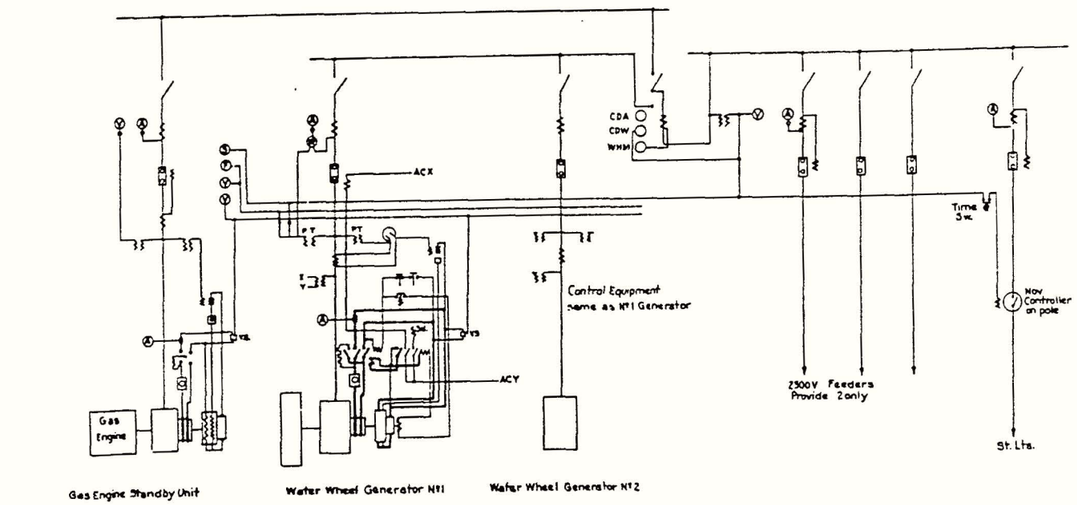
PLAN C-C



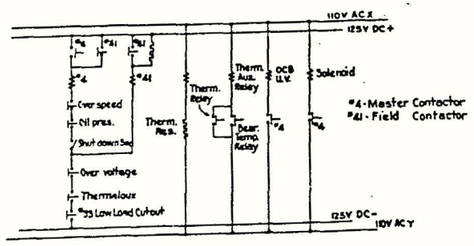
SECTION B-B



REAR ELEVATION OF METERING PANEL



STATION SINGLE LINE DIAGRAM
FOR POWER AND CONTROLS



SEMI-AUTOMATIC CONTROL DIAGRAM
FOR EACH MACHINE

NP YEL-5075	Designed	Drawn By	Traced By	Checked	Received
	L.J.S.	L.J.S.	A.D.G. May 1935	L.J.S. May 1935	

ON MICROFILM

RECOMMENDED BY: [signature] Chief Engineer DATE 5-17-35

CLEARED FOR LANDSCAPE FEATURES: [signature] Deputy Chief Architect DATE 5-17-35

CONCURRED IN BY: [signature] Superintendent DATE 5-18-35

APPROVED BY: [signature] Director DATE 5-21-35

HALF-SIZE REPRODUCTION

PUBLIC WORKS PROJECT - PHYSICAL IMPROVEMENTS
F.P.598 ELECTRIC POWER PLANT
MAMMOTH HOT SPRINGS AREA

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

YELLOWSTONE NATIONAL PARK

PROPOSED HYDRO-ELECTRIC POWER PLANT
AND EXTENSION TO WATER SYSTEM AT MAMMOTH
SWITCHING EQUIPMENT AND CONTROLS
FOR PROPOSED HYDRO-ELECTRIC
POWER PLANT

OFFICE OF THE CHIEF ENGINEER
SAN FRANCISCO, CALIF.
MAY, 1935
SCALE: 1"=1'-0"

3.0 ARCHITECTURAL ANALYSIS

3.1 Site Description

The Fort Yellowstone Power House is located at the base of a steep hill about one-quarter mile southeast of the main Fort Yellowstone building complex, in the area now referred to by the park as the Lower Mammoth housing area. This location takes advantage of the steep topography to create enough water head to run the turbines. Areas to the north, east and south of the power house contain park service housing units - some of which date to the historic period and some of which are modern. No development has occurred west of the power house because of the steep slope and the presence of wetlands.

A road from the Fort Yellowstone area winds down the hill on the north end of the power house site and turns south to parallel the east end of the building and continues into the Lower Mammoth housing area. This road is part of the original roadway from Gardiner, Montana to Mammoth. The steep slope on the west side of the power house is vegetated with a variety of evergreen trees. Runoff from the Mammoth Terraces cascades over this hill, and is diverted into a single channel on the south side of the power house. When the volume of water discharged from the Mammoth Terraces is high, there is potential for the hill to be wet especially at the point where the original water supply descended to the power house. The metal penstock remains in place directly behind the power house but the water intake is blocked and a section has been removed above the TW corrals.

North of the power house, a disturbed dirt lot slopes up slightly to the roadway (park service housing is located on the north of the road). The field contains sagebrush, grasses, and forbs, and is open except for some cottonwood trees along the roadway. The gradient of the field slopes toward the power house, causing drainage problems around the foundation on the north side of the building. Several satellite dishes are located in the field northwest of the building.

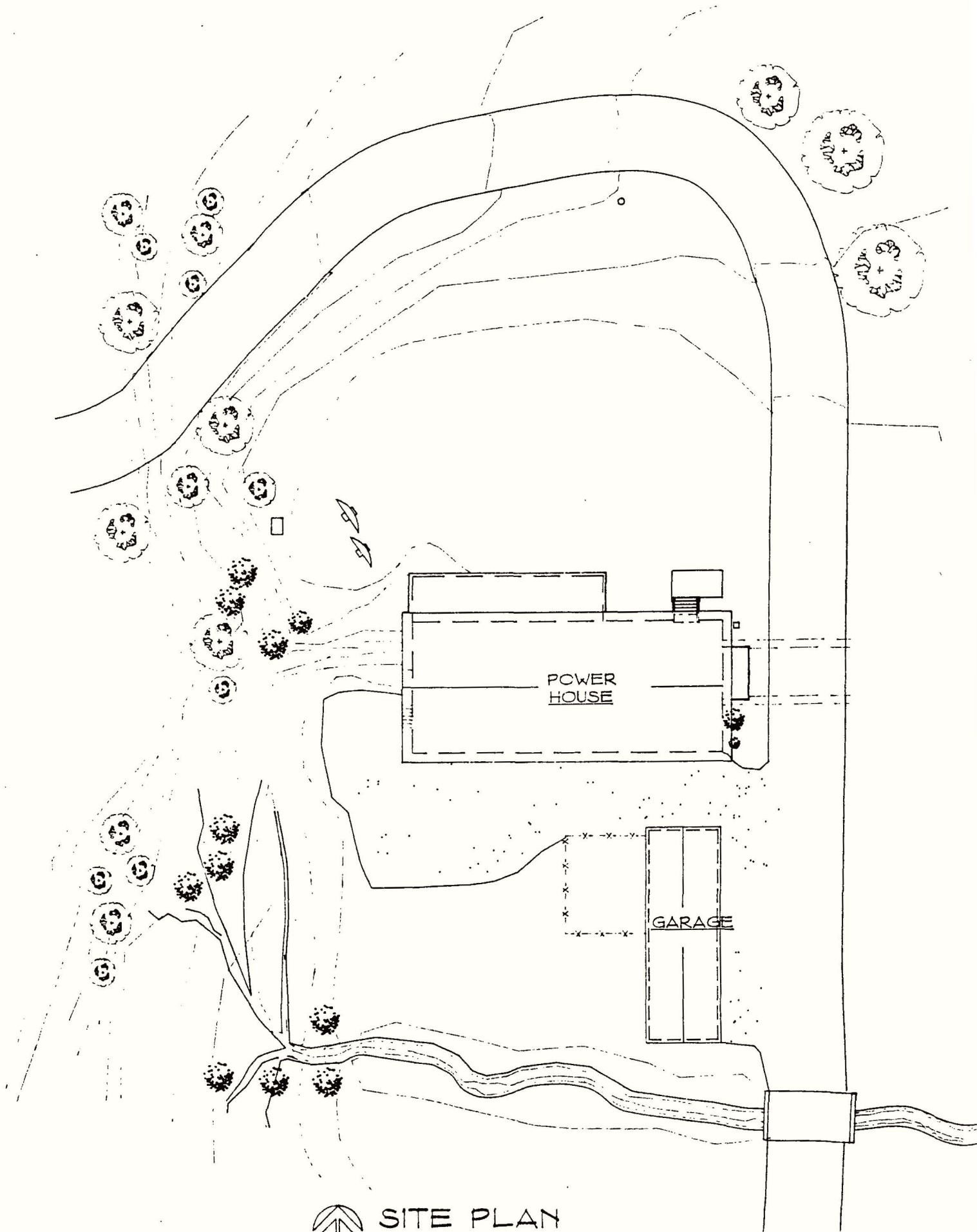
The area east of the power house contains a roadway as well as an open field of native grasses. This field formerly was used as the discharge area for the water from the power house. It still contains the discharge pipes within a wood and concrete superstructure, located just east of the roadway. At the time of the field review the area was dry, however

there is a streambed on the south side, indicating that water may flow through the area at some times of the year. More park service housing units are located to the east.

The area to the south contains a seven-bay, wood-frame garage oriented parallel to the road. Attached to and directly west of the garage, is a fenced area that contained the original power grid for the power house. This power grid has been abandoned but the fence and some of the power poles remain. Just west of the power grid is a graveled parking lot; beyond this to the south is the wet area, streambed, and additional park service housing. Figures 3 through 15 include plans and photographs of the area in the vicinity of the power house.

Site Condition

The power house site is in good condition; the only major problem being the lack of drainage on the north side of the building. Inadequate drainage of water flowing on the slope to the west may also be a problem in high water years. The site is maintained and the area around the building is kept in good condition.



SITE PLAN
EXISTING POWER HOUSE

SCALE NONE

FIGURE 3

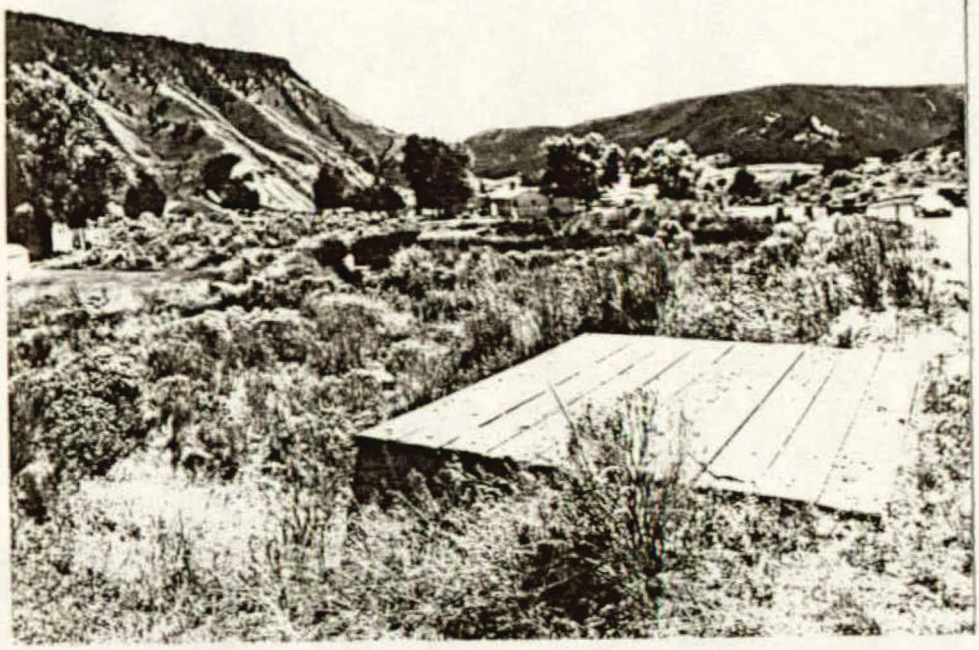


Figure 4. Looking south at the roadway between the power house and the upper and lower Mammoth housing areas.

Figure 5. Looking north along the top of the water discharge area from the powerhouse, to the streambed and wetlands area to the south.

Figure 6. Looking west toward the powerhouse, the water discharge area is underneath the roadway on the east side of the building.

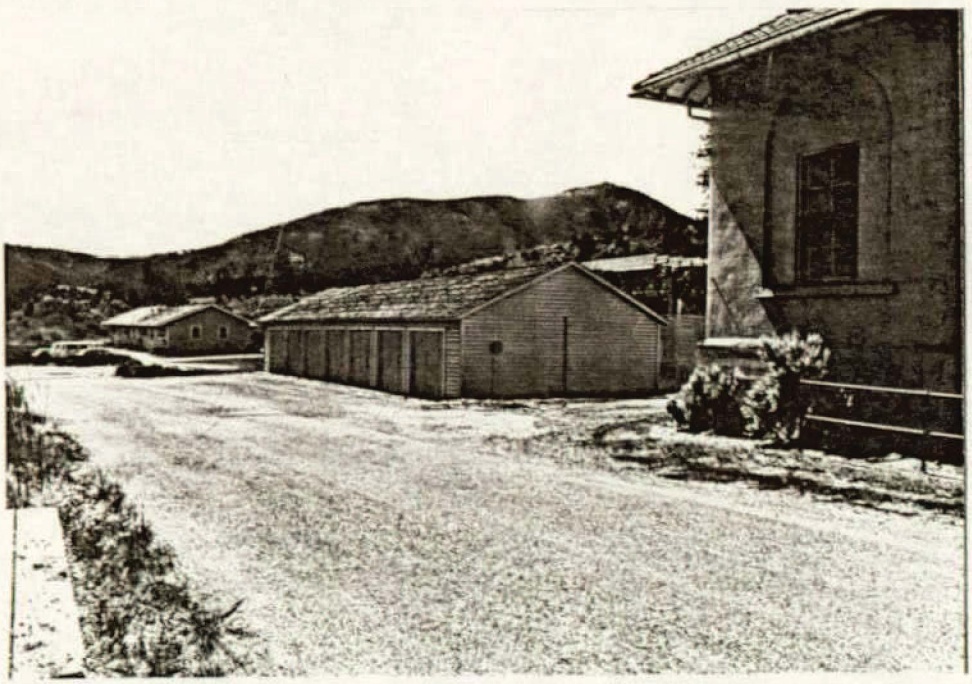


Figure 7. Looking south along the power house at a residential garage complex and residences beyond.

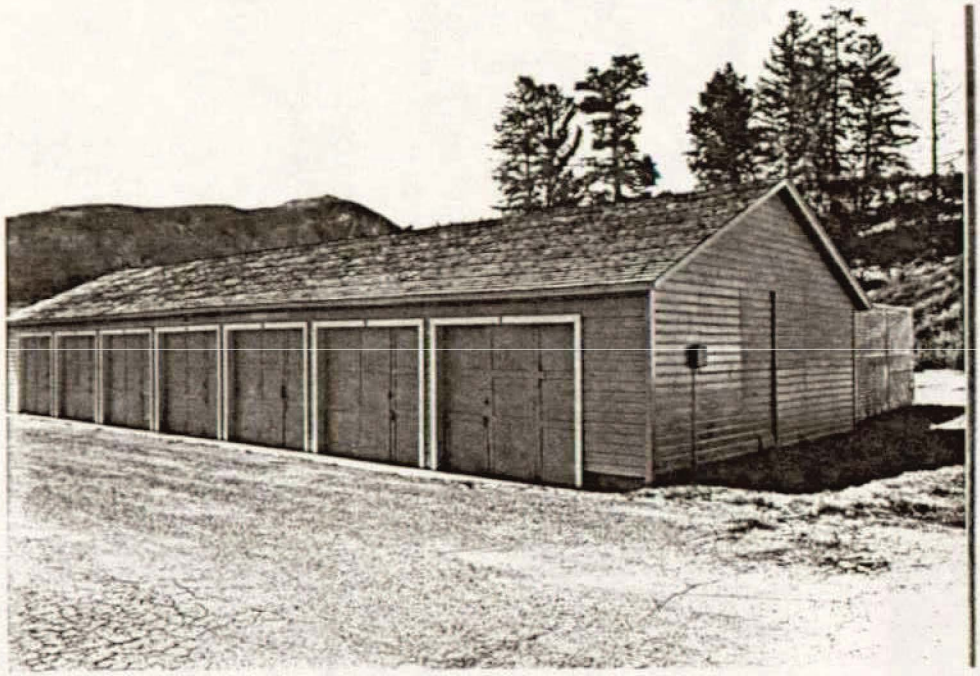


Figure 8. Looking southwest at the garage complex on the south side of the power house.

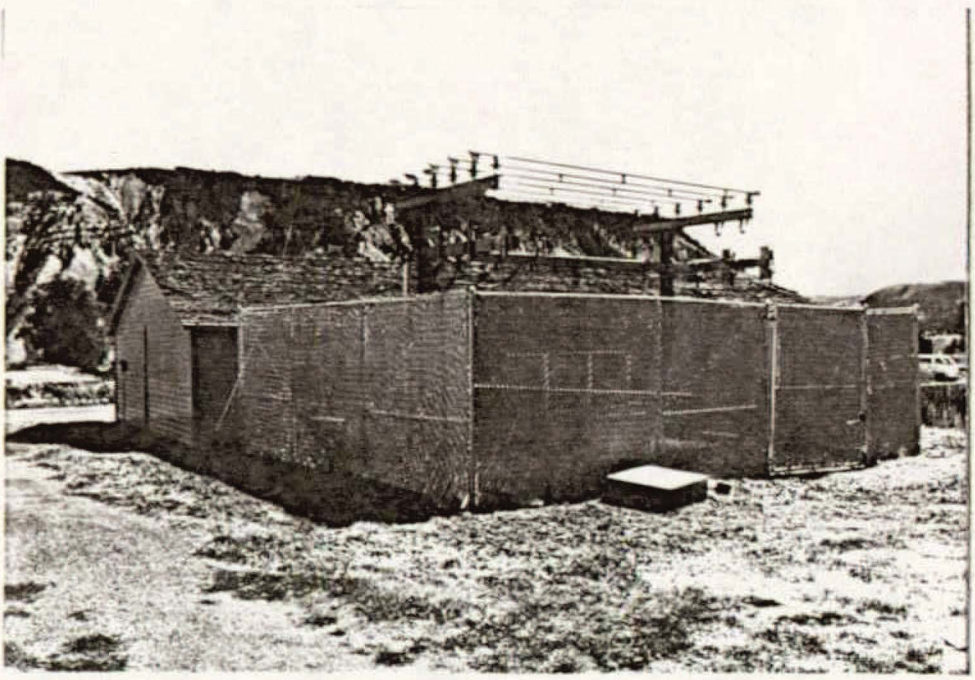


Figure 9. Looking southeast at the abandoned transformer grid on the south side of the power house and west side of the garage. This was abandoned at the same time as the power house.

Figure 10. Looking south from the power house toward the parking and residential areas beyond.

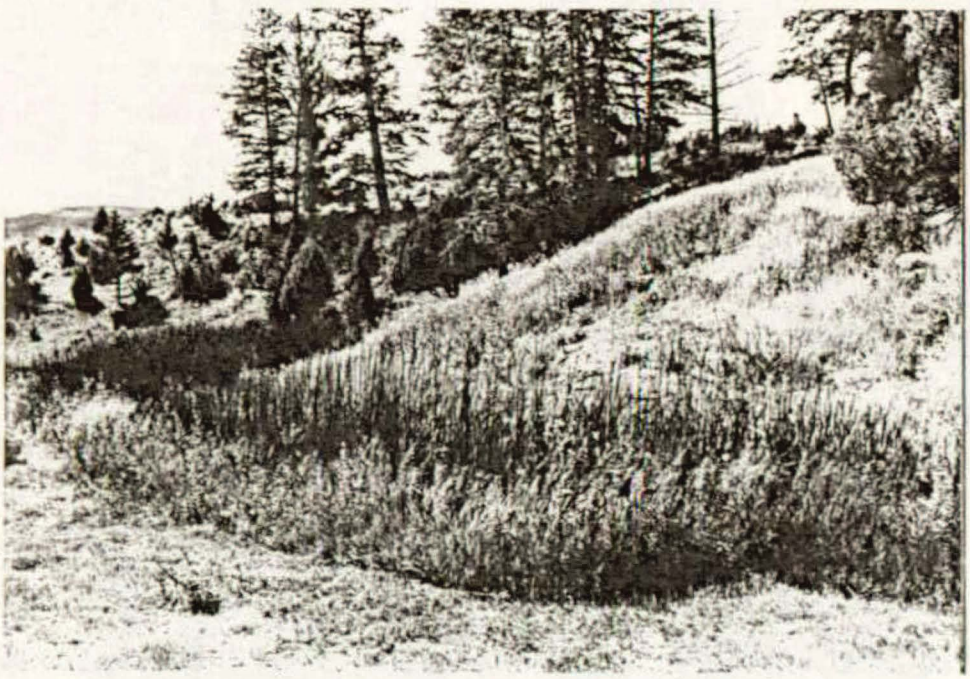


Figure 11. Looking southwest from the power house toward the wetlands area created from the runoff from the Mammoth Terrace.

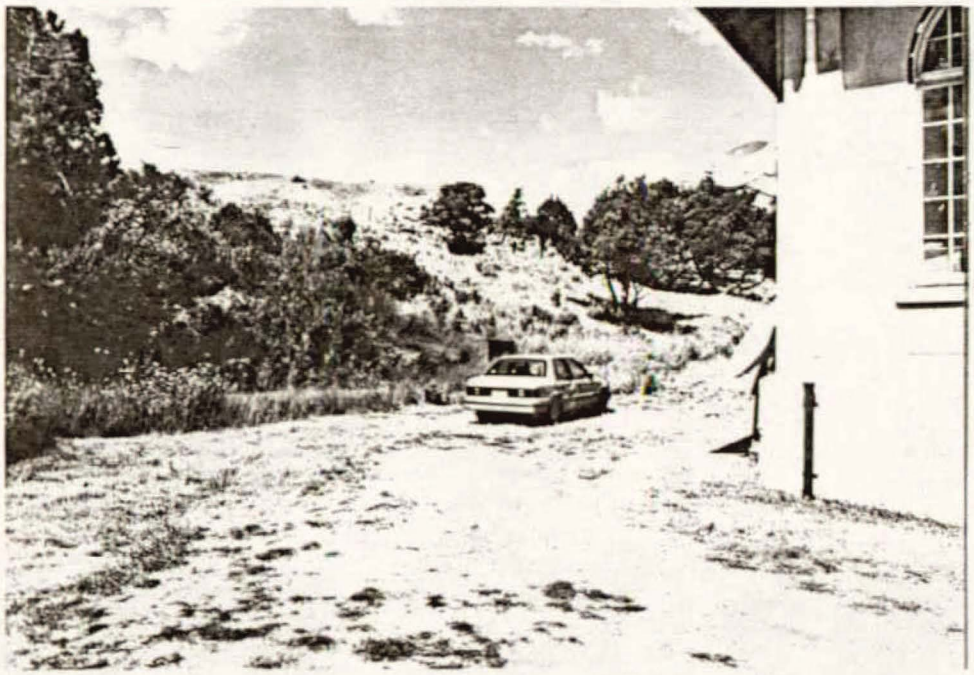


Figure 12. Looking northwest at the area directly behind the power house.

Figure 13. Looking west from the power house at the area where the original penstock is located. The concrete feature is part of the penstock.

Figure 14. Looking northwest from the power house at the hill rising to the west and the satellite dish area.

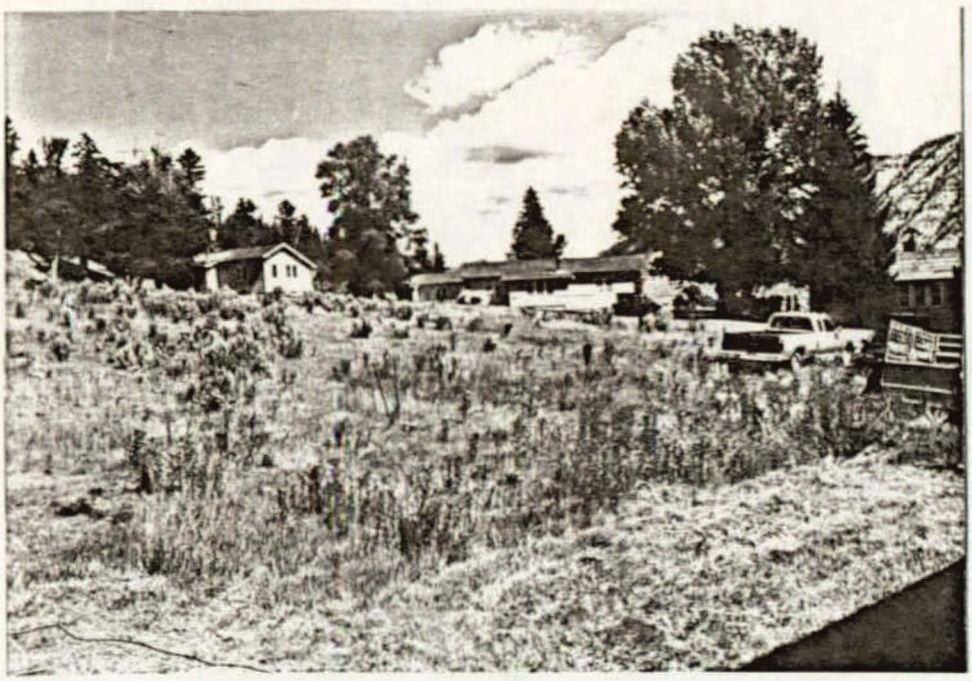


Figure 15. Looking north from the power house to open space and the Lower Mammoth residential area beyond.

3.2 Exterior Description

The Fort Yellowstone power house is a two story, painted concrete structure rectangular in plan with its long axis oriented east to west. A narrow, one-story, shed-roofed wing covers three-fifths of the length of the north side of the main block of the building. The main component has a symmetrical hipped roof finished with clay tile; the overhanging eaves are open exposing detailed wood rafters. Round metal gutters and downspout are attached to the eaves. A single hipped-roof dormer projects from the north side; a concrete chimney is centered in the roof on the east side. The roof of the lower wing is finished with built-up asphalt but has no overhang. The exterior walls are smooth formed concrete with unornamented pilasters equally spaced on the longer elevations above a concrete base at the height of the first floor level. The base projects beyond the face of the walls and is flush with the face of the pilasters; the top is bevelled for a drip cap except where interrupted by the pilasters.

The predominant architectural feature of this building is the sequence of arches that occurs on each side of the building. The north and south facades each have five arches, recessed and centered between the pilaster projections. On the south side, four of the arches are infilled with tall, triple-sash, wood-frame windows with divided lites, below an upper curved sash which also has divided lites. The lower center sash is an operable casement with an attached storm window. The window sills are cast concrete; a raised panel detail is cast into the walls below the sills. A 4/4 double-hung window, featuring a keystone above, is centered horizontally and aligned with the sill within the eastern-most archway; the remainder of this arch is infilled with concrete. A basement window is below the second arch from the right.

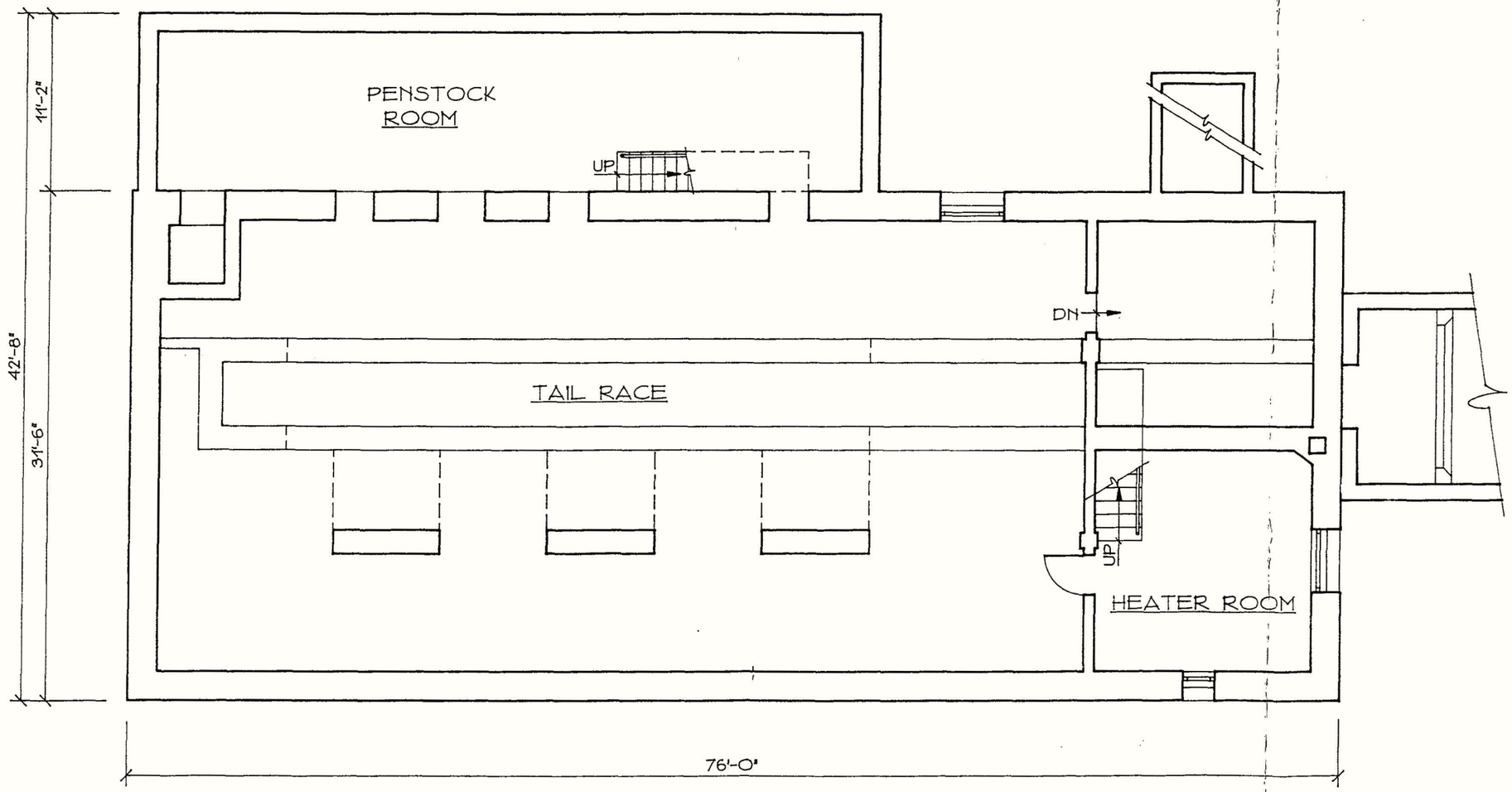
On the north side, the facade is interrupted by the extension of the one-story wing, however the upper arched sashes and column projections continue above the line where the shed roof engages the vertical wall of the taller component. The wing contains 4/4-lite double-hung windows grouped in pairs and aligned vertically with the arched windows above; the sills of these windows are at the base projection. The exterior walls of the wing are

smooth concrete above the projecting base. An single entry door is centered within the eastern-most arch. This entry is accessed via a series of concrete steps with a painted pipe railing. A single light fixture mounted above the door illuminates the last step; there is no landing. The painted wood door is stile and rail with two recessed panels. The adjacent archway to the west features a full arched window. The roof dormer is centered over this window, and a basement transom window is centered below it.

The east facade features smooth concrete walls with two recessed arches. Single 4/4 double-hung windows are horizontally centered within the arches and align with the sills of the other windows. A metal pipe railing is mounted on top of the intake wall; the basement window on this facade is screened by vegetation.

A double wooden door below an arched transom with divided lites is centered in the west elevation; it is flanked by 4/4 double-hung windows in the smooth walls. The painted wooden double doors are stile and rail with recessed diagonal board infill and decorative crossbraces on the lower portion. A wooden stair with a landing leads to this set of doors.

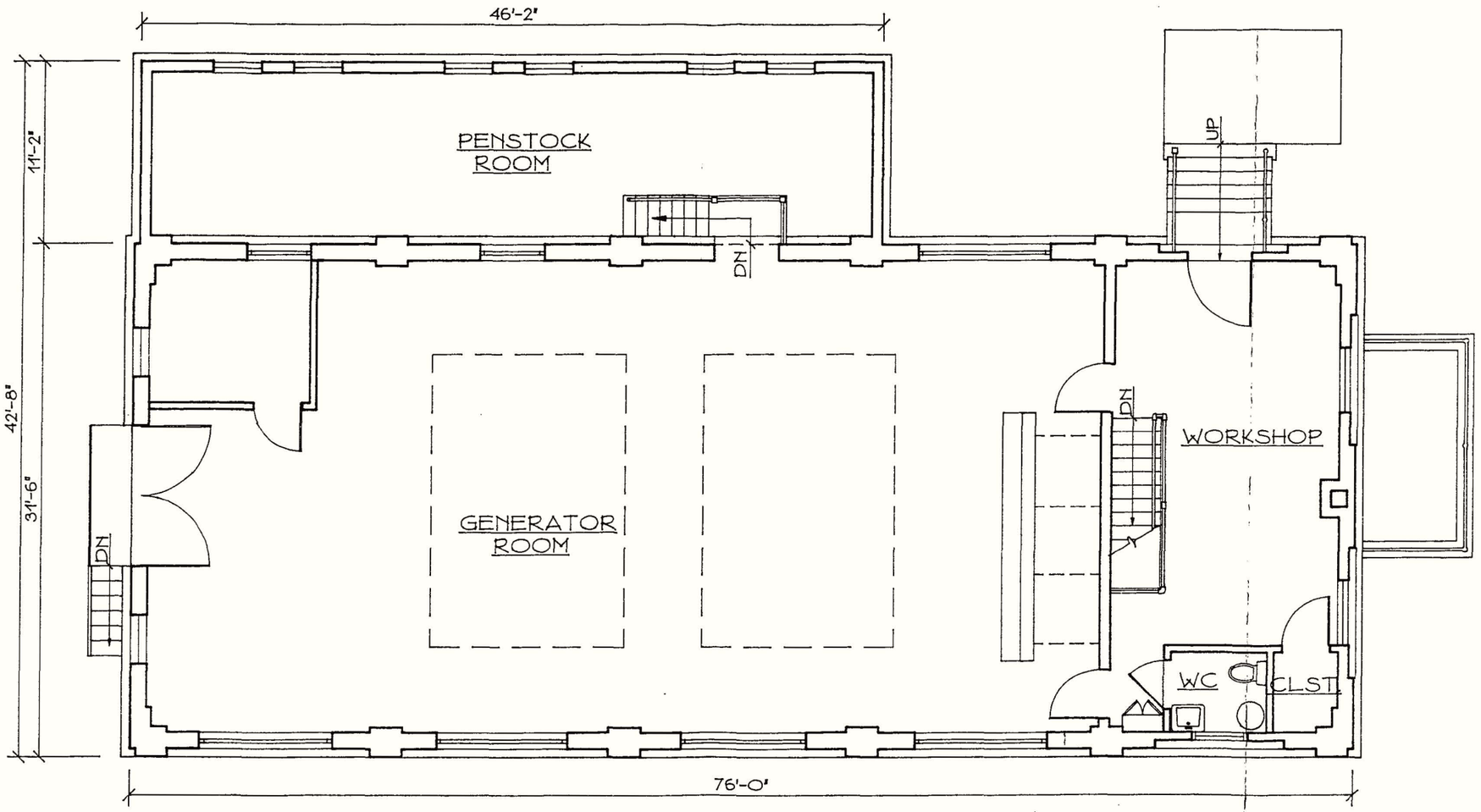
Figures 16 through 29 include floor plans, elevations, and photographs of existing conditions.



POWER HOUSE
EXISTNG BASEMENT PLAN

SCALE 1/8" = 1'-0"

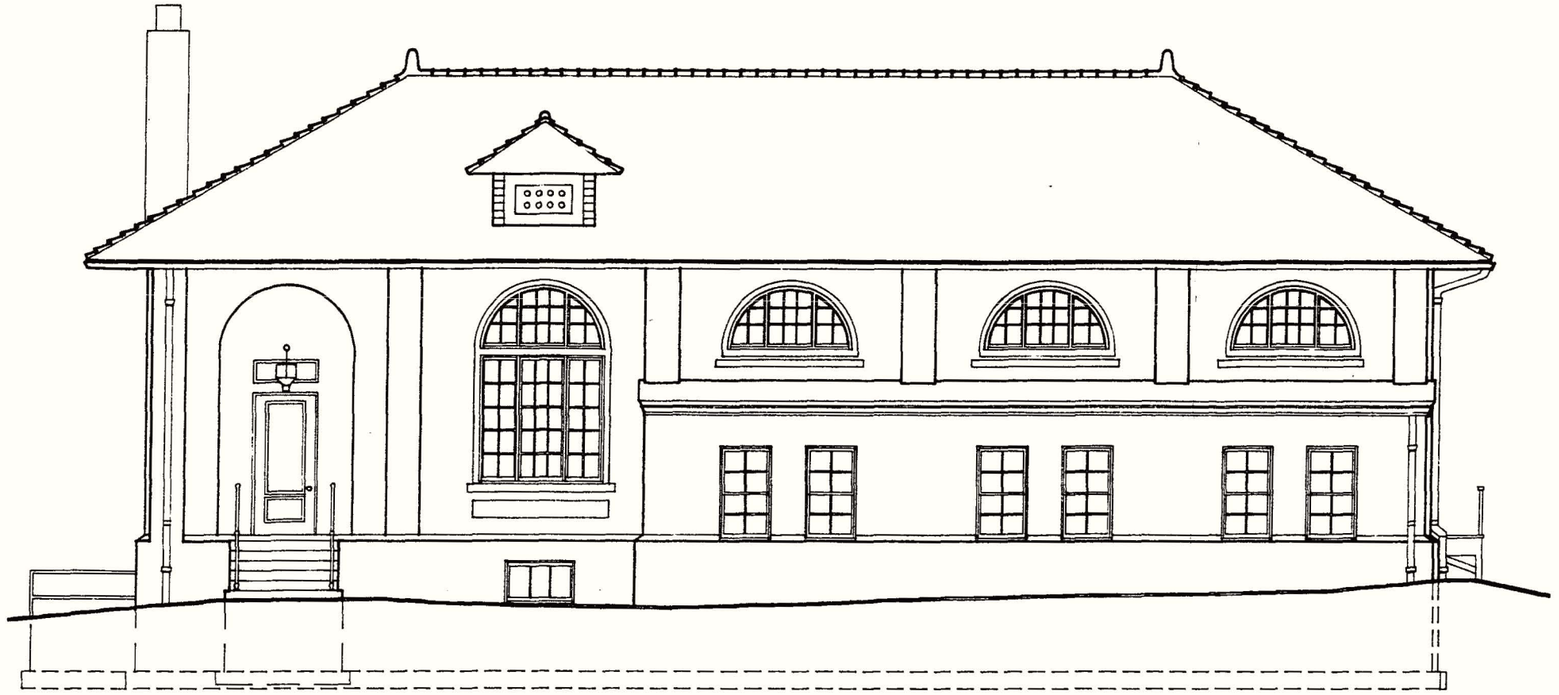
FIGURE 16



POWER HOUSE
EXISTING MAIN FLOOR PLAN

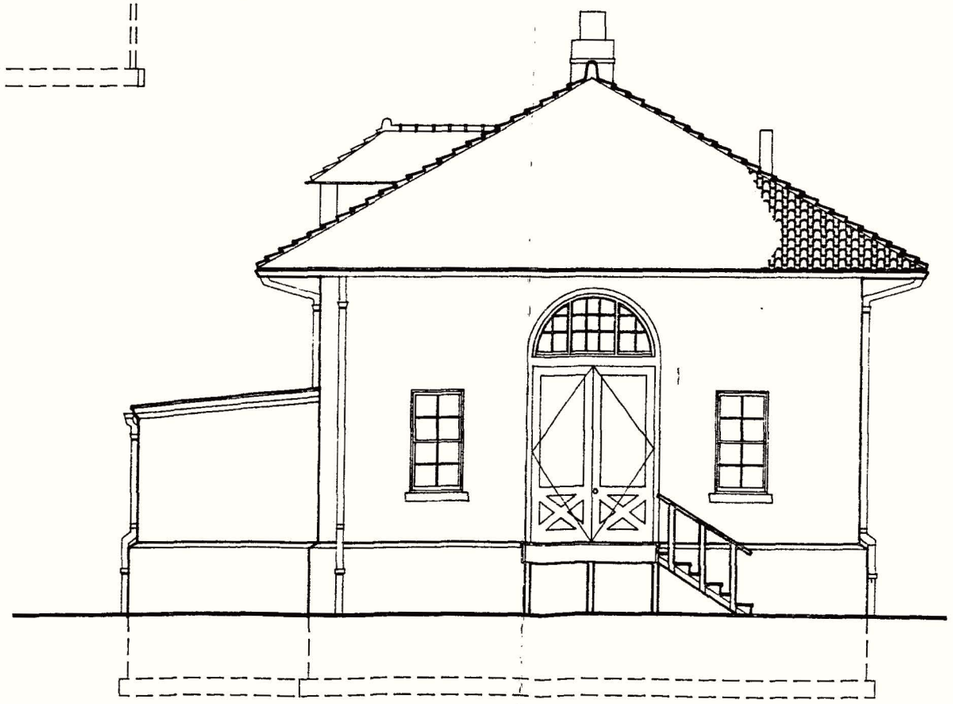
SCALE 1/8" = 1'-0"

FIGURE 17



POWER HOUSE
EXISTING NORTH ELEVATION

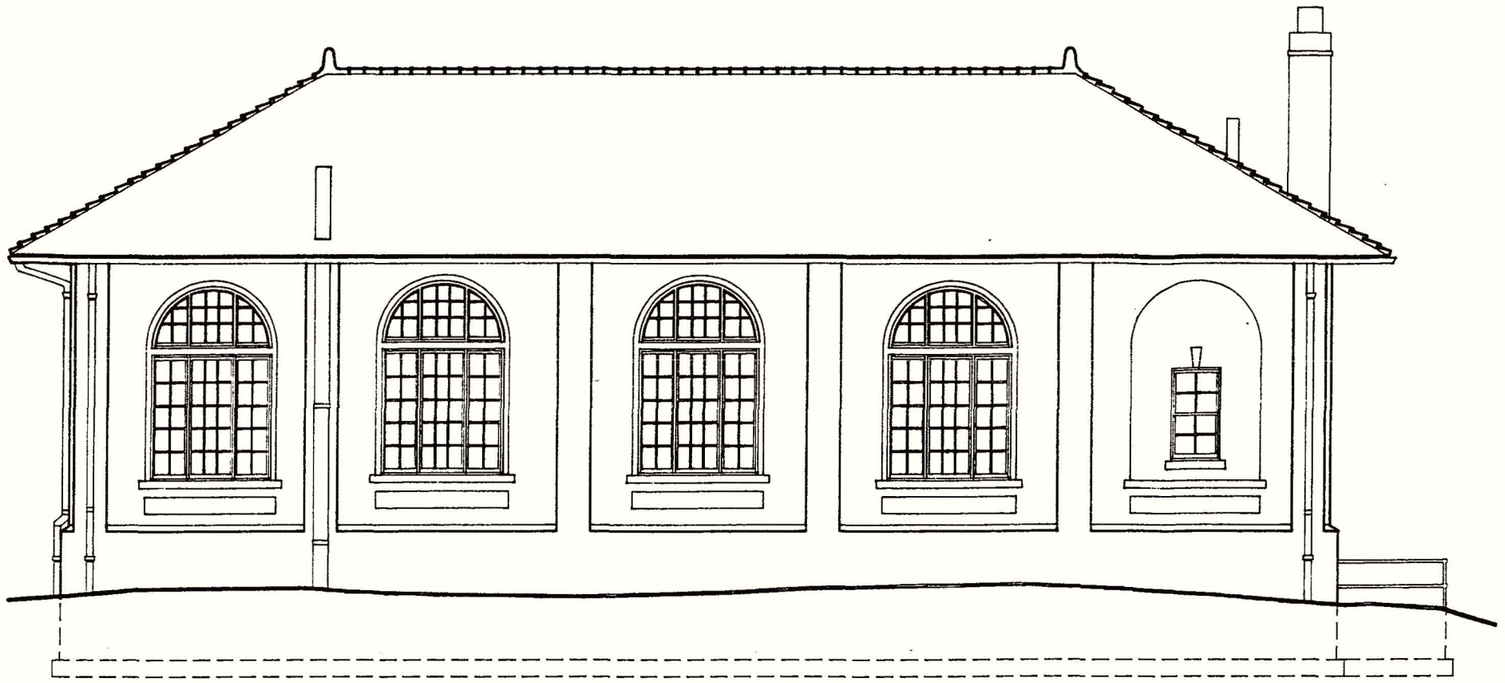
SCALE NONE



POWER HOUSE
EXISTING WEST ELEVATION

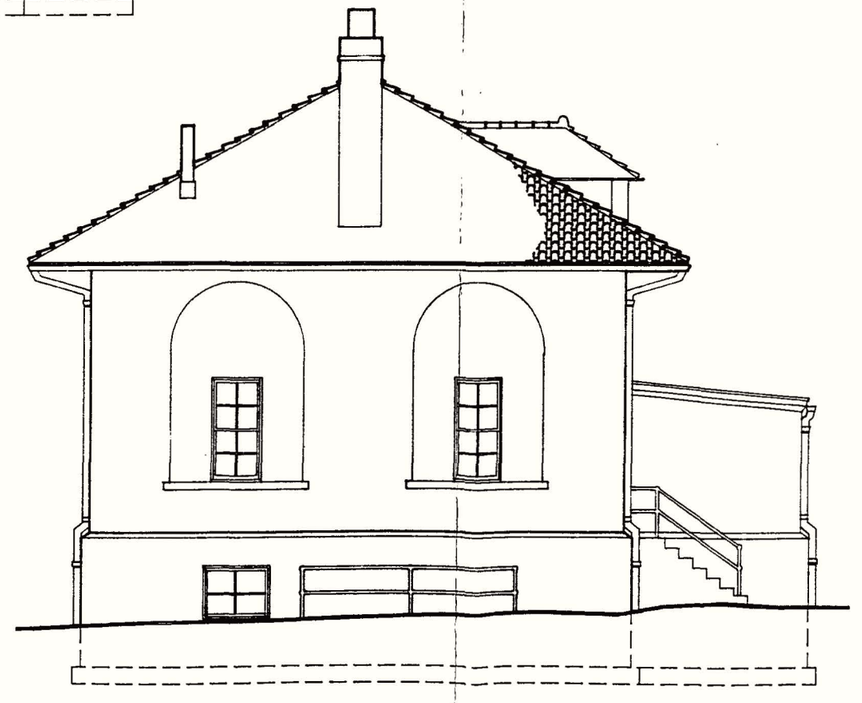
SCALE NONE

FIGURE 18



POWER HOUSE
EXISTING SOUTH ELEVATION

SCALE NONE



POWER HOUSE
EXISTING EAST ELEVATION

SCALE NONE

FIGURE 19

Figure 20. Looking southwest at the power house.

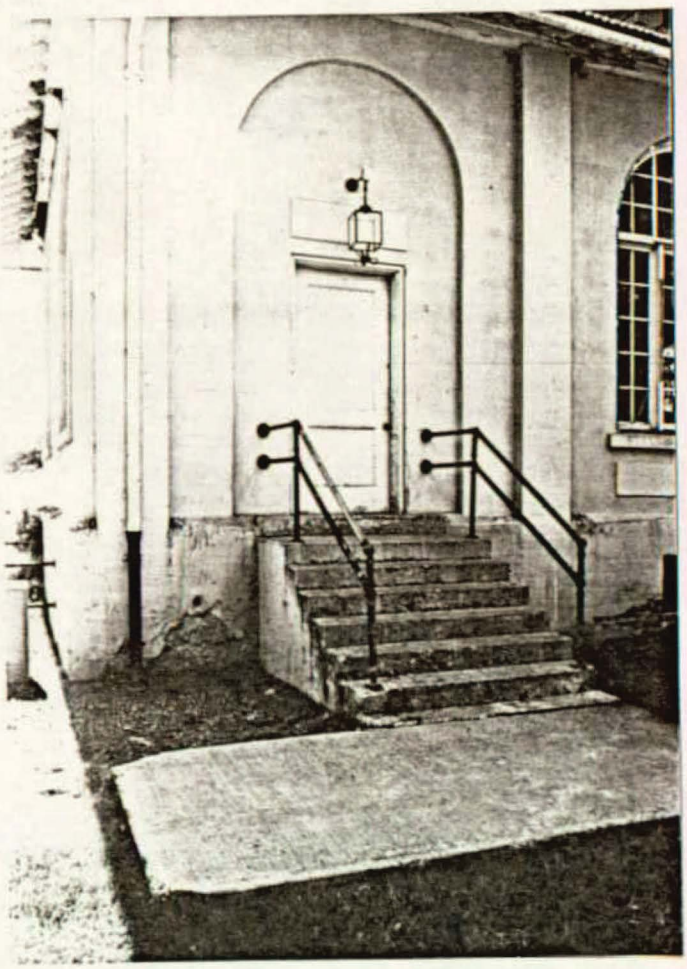


Figure 21. Looking south at the main entrance. The concrete steps have some deterioration and there is some surface spalling along the concrete base due to poor drainage.

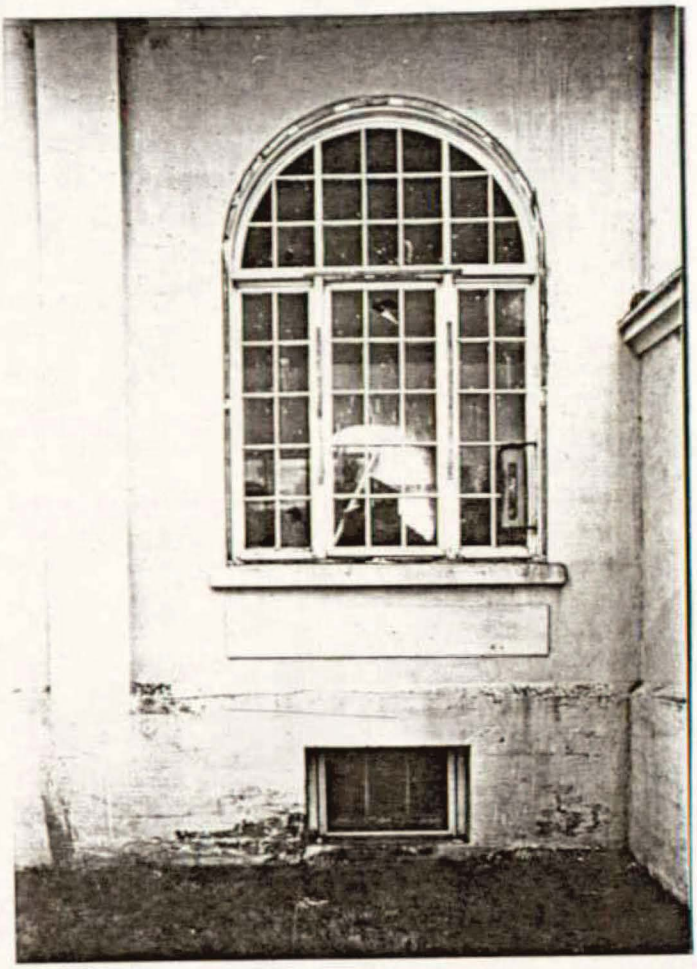


Figure 22. Looking south at one of the typical wood windows on the building. Note the peeling paint and weathering of the wood sill and bottom sash.

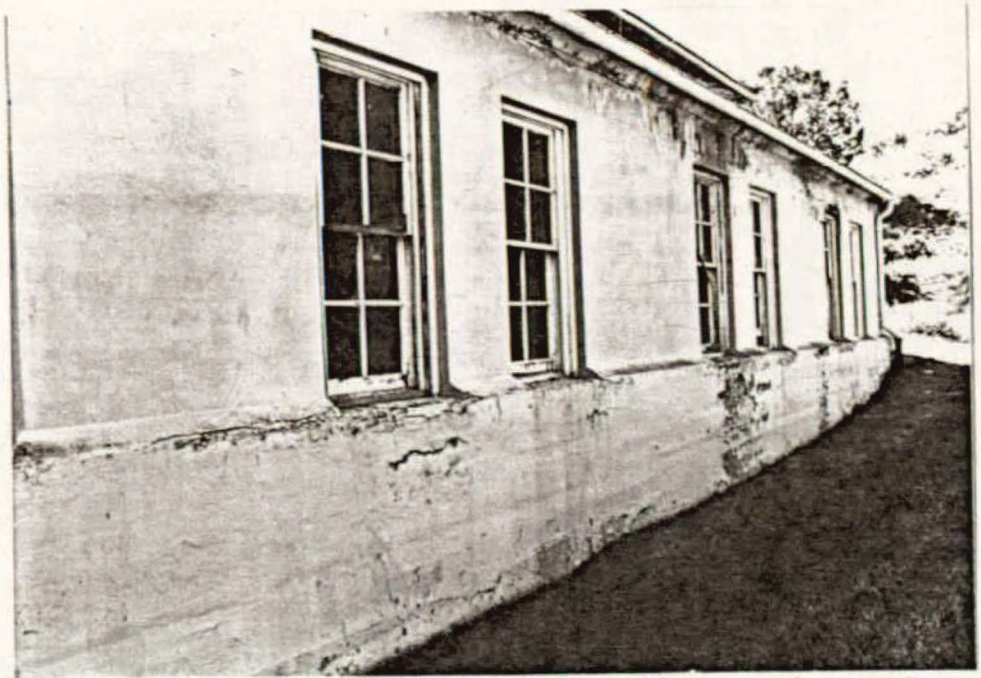


Figure 23. Looking southwest along the shed roof wing of the power house. Some of the paint has come off the concrete surface and there is some concrete surface deterioration.

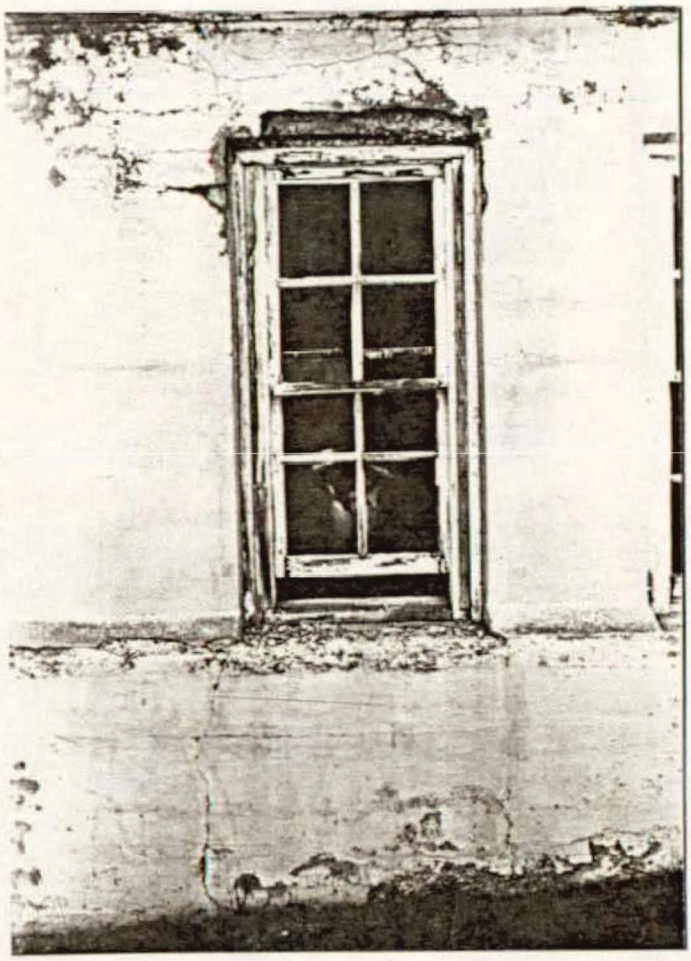


Figure 24. Looking south at a window in the middle of the shed roof wing. This window is in very poor condition due to water coming off the roof above. The window is weathered and rotted in some areas and the concrete around the window is spalling due to the moisture.

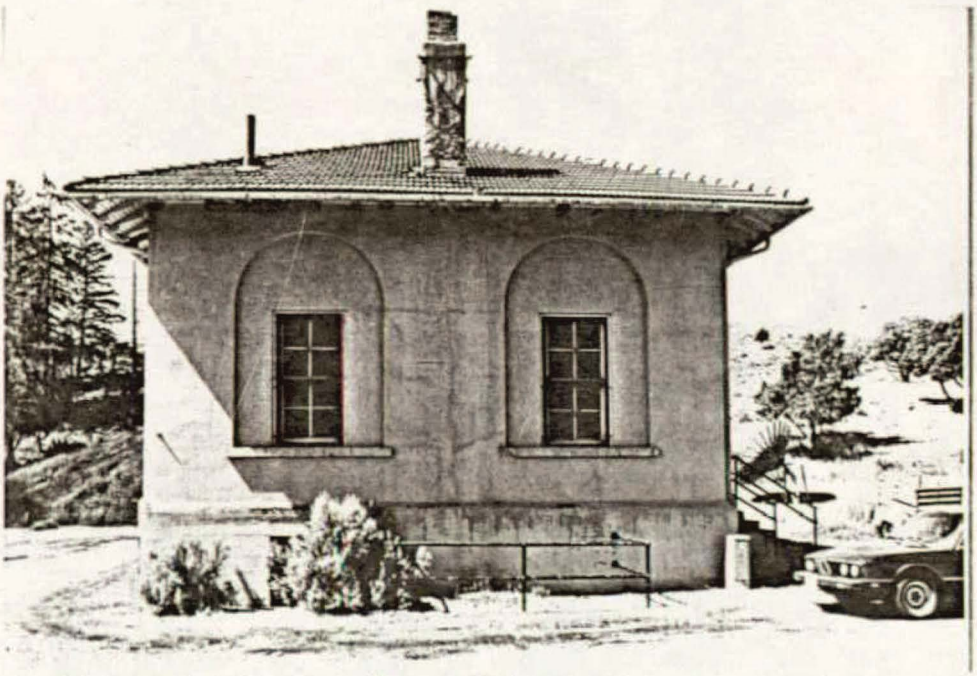


Figure 25. Looking west at the power house. This elevation appears to be in good condition. Note some deterioration of the chimney that is cracked and spalling.

Figure 26. Looking northwest at the power house. Note the shrubbery up against the building. Most of the walls are in good condition.

Figure 27. Looking northeast at the power house. Note the low area along the building where some of the site water drains into the foundation. There is minor concrete base deterioration at this point.

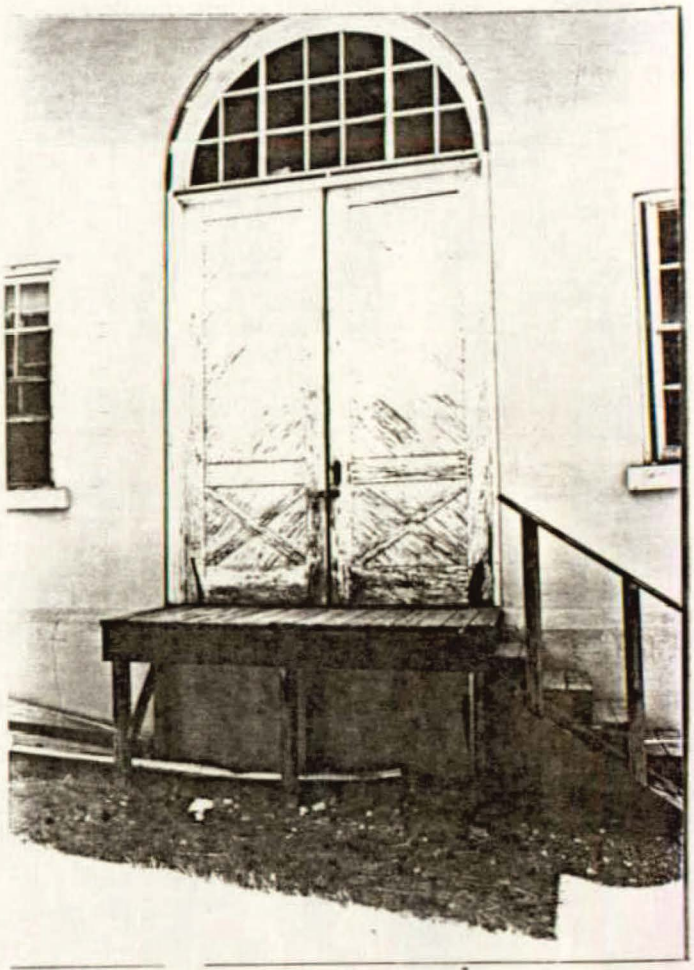


Figure 28. Looking east at the loading dock and doors on the west side of the power house. The doors are slightly weathered.

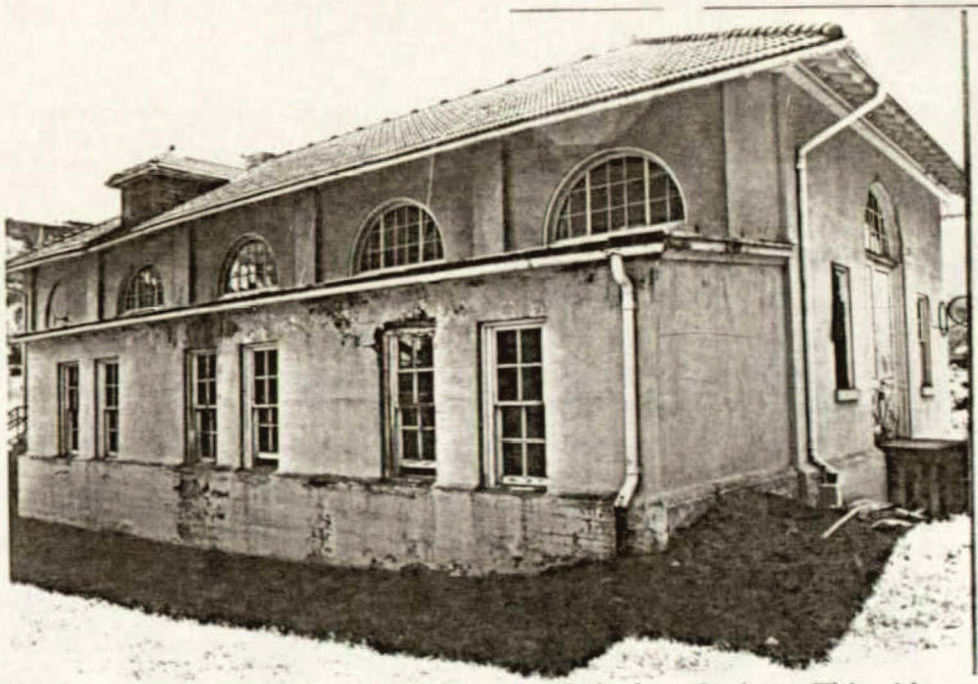


Figure 29. Looking southeast at the power house and shed roof wing. This side appears to have the most deterioration including poor grade for drainage around the building, concrete spalling, weathered and rotted windows, broken glass, gutter leaks and downspout leaks and a poor roof on the wing.

3.3 Interior Description

The main floor of the power house is divided into rooms of unequal size; a large room on the west side of the building houses the generators, while a smaller room on the east end houses a workshop. The stair to the basement level is adjacent to the dividing wall between these two rooms. The workout room also contains a small restroom and closet on the south side. The workshop is presently filled with portable exercise equipment, and a carpet covers the floor.

The floor and walls of the main floor are concrete; the walls are painted. The ceiling is smooth painted plaster. Interior doors are painted wood stile and rail five-panel with flat wood trim. A painted metal pipe rail surrounds the stair opening and continues down as a handrail within the workshop and down the stairs to the heater (boiler) room in the basement. The one-story wing on the north side of the building is accessed by a stair from the generator room. The generator room is filled with large transformer and generator equipment embedded in, and secured to, the floor. Two exposed I-beams running at the ceiling run the full length of the building and function as tracks for pulleys and wenches for moving equipment. Light fixtures are the original pendant type with glass globes hung on rods.

The basement level contains the lower end of the penstocks, and the structural elements that support the generators on the main floor. The basement level was used primarily for the servicing the penstock and related equipment, therefore, ceilings vary in height and in most cases are too low to allow a person to walk comfortably through the area. The heater room, located in the southeast corner of the basement, has a full height ceiling; an area just to the west accessed through a new doorway from the heater room was excavated to allow for a higher ceiling. The piping for the turbines extends from the penstock room across to the center of the floor below the generator room and then upward to the generators. The water drops down into the tail race and moves east through the building to the outside. Three concrete arches meant to support the generating equipment on the main floor, are located just south of the trail race. The floors on the north side are concrete but the floors on the south side are earth.

Figures 30 - 38 provide photographs of existing interior conditions. Also, a copy of the original floor plans is provided in Appendix A.

3.4 Electrical and Mechanical Systems

The only functioning electrical system within the building consists of a small panel with power for some general lighting and a few outlets in the workshop area. All of the wiring associated with the power plant for producing electricity has been disconnected and removed. The wiring that remains is in metal conduit and is in good condition.

Most of the original equipment remains in the building. The boiler and plumbing system for the bathroom are intact, but have been disconnected. The only area that appeared to be heated was the workshop area. There are no other radiator units within the generator or basement spaces.

3.5 Handicap Accessibility

The building is not accessible because of the steps up to the first floor and down into the lower areas. There are no accessible bathrooms within the building.

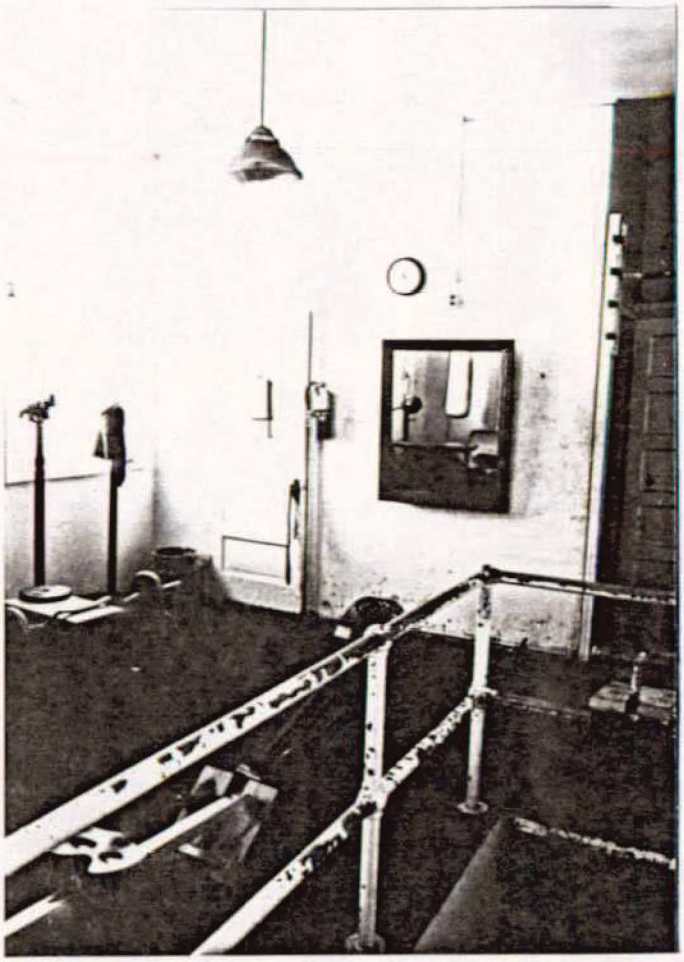


Figure 30. Looking southeast at the interior of the front entrance room, which was originally used as a workshop. Note the original wall surfaces, doors, trim and lighting.

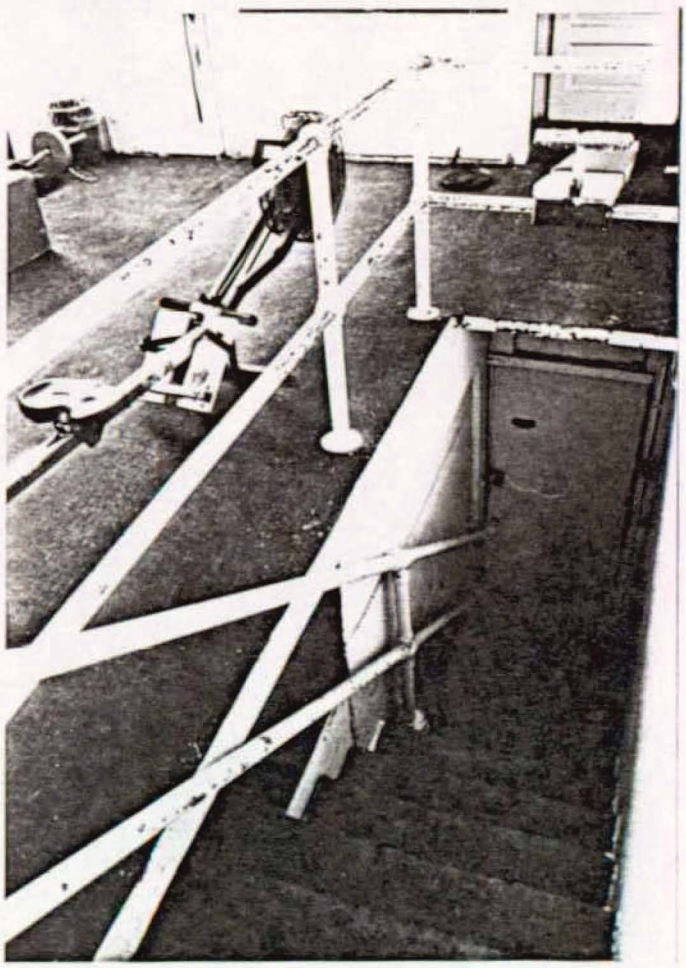


Figure 31. Looking south at the stair to the basement.

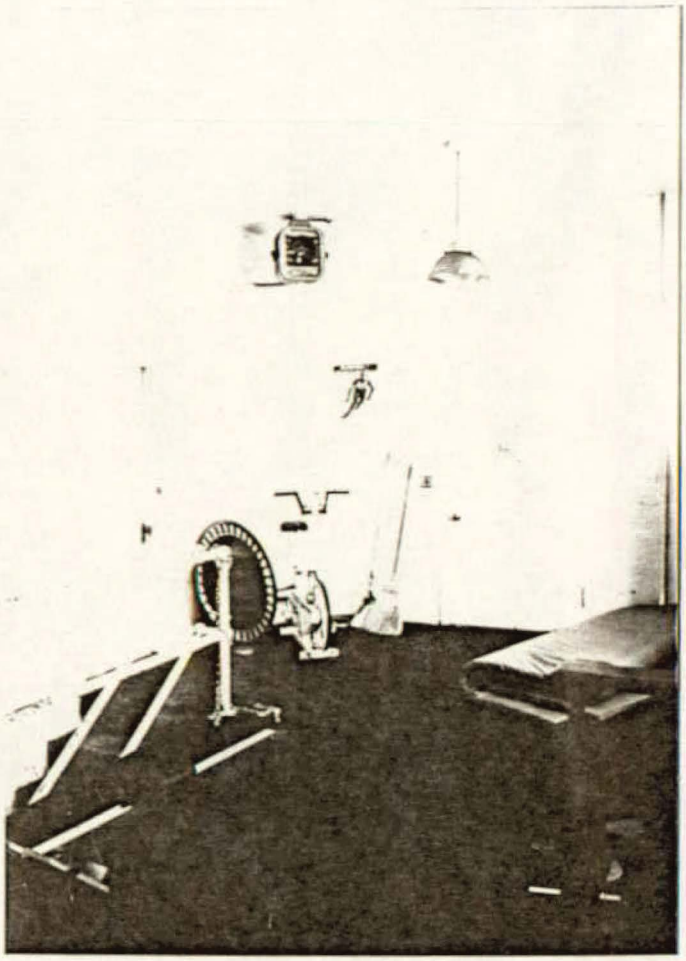


Figure 32. Looking north at the interior of the front workshop area. The door to left accesses the generator room, and the door to the right exits the building.

Figure 33. Looking east at the meters and gauges of the transformer bank where the flow of electricity was controlled.

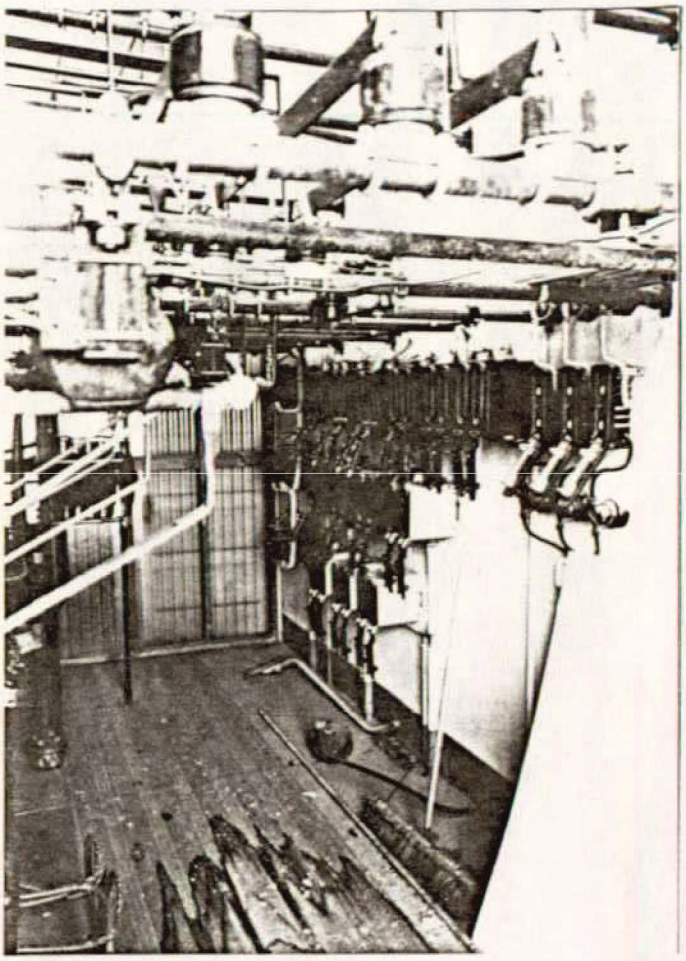


Figure 34. Looking northeast at the main switches for the transformers on the east side of the generator room.

Figure 35. Looking east at the generator room. The turbines and generators are directly in the center and to the right of the photo amongst the storage boxes.

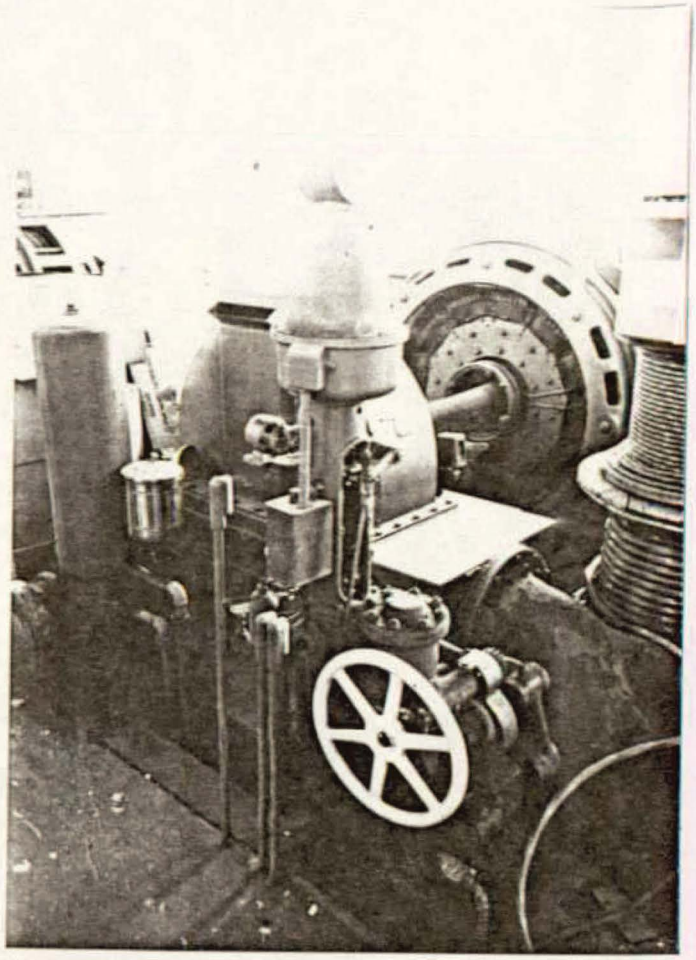


Figure 36. Looking southwest at the generator equipment in the center of the generator room. All of this equipment contributes to the significance of the building.

Figure 37. Looking east at the generator room, and original equipment. The room is currently used for storage.

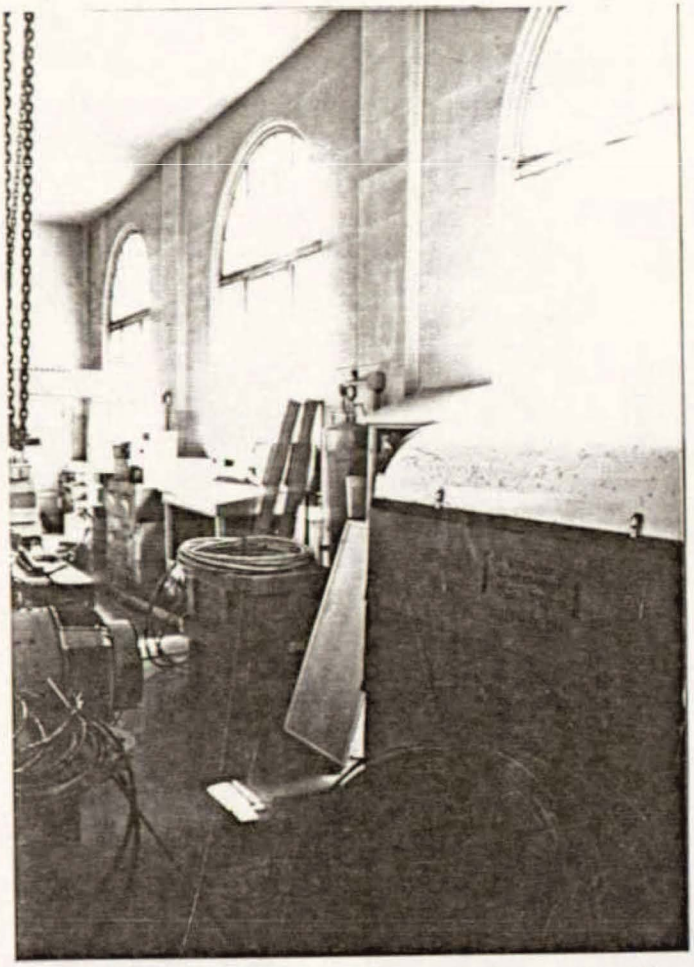


Figure 38. Looking southeast at the large windows on the south side of the building. The interior space and materials are in good condition.

3.6 Building Condition

Both the exterior and interior of the Fort Yellowstone Power House are in good condition. The exterior walls of the building show minor settlement cracks and peeling paint; swallows' nests are found on the exterior walls. This is most prevalent in the wing, where the lack of an overhang and gutters has allowed water to penetrate into the concrete walls and windows on the north side. Also, some concrete deterioration is evident along the base of the structure due to poor drainage of surface water. The clay tile roof is in good condition with only minor maintenance work required. The roof of the wing is leaking and in poor condition. The wood window frames are somewhat weathered, with loose and missing paint, and some of the glazing is missing or broken. The wood doors are weathered but functioning.

4.0 PRESERVATION RECOMMENDATIONS

The Fort Yellowstone power house is included in the Fort Yellowstone Historic District listed on the National Register of Historic Places. Any plans for the renovation of this building will have to be reviewed and approved by the National Park Service and the Wyoming State Historic Preservation Office (SHPO). Preservation maintenance, where all work is done in-kind and does not adversely affect the historic integrity, falls under the memorandum of agreement between the advisory council, the National Park Service and SHPO. The building is in need of preservation maintenance and some renovation in order to preserve its historical and architectural integrity. It will be essential to maintain the historical integrity of this important historical site.

Several levels of preservation treatment are defined in the Secretary of Interior's Standards and Guidelines. Decisions regarding the level of preservation treatment appropriate for a given building are based upon consideration of all available information regarding the building, including its history, its original and present condition, and the potential for future reuse. The various levels of preservation treatment are defined by the Secretary of the Interior as follows:

1. Stabilization is defined as the act or process of applying measures designed to re-establish a weather-resistant enclosure and the structural stability of an unsafe or deteriorated property, while maintaining the essential form as it exists at present.

   Stabilization shall re-establish the structural stability of a property through the reinforcement of load-bearing members or by arresting material deterioration leading to structural failure. Stabilization shall also reestablish weather-resistant conditions for the property. Stabilization shall be accomplished in such a manner that it detracts as little as possible from the property's appearance. When reinforcement is required to re-establish structural stability, such work shall be concealed wherever possible so as not to intrude upon or detract from the aesthetic and historical quality of the property, except where concealment would result in the alteration or destruction of historically significant material or spaces.

2. Preservation is defined as the act or process of applying measures to sustain the existing form, integrity, and material of a building or structure, and the existing form and vegetative cover of a site. It may include initial stabilization work, where necessary, as well as on-going maintenance of the historic building materials.

   Preservation shall maintain the existing form, integrity, and materials of a building, structure or site. Substantial reconstruction or restoration of lost features generally is not included in a preservation undertaking.

   Preservation shall include techniques of arresting or retarding the deterioration of a property through a program of on-going maintenance.

3. Rehabilitation is defined as the act or process of returning a property to a state of utility through repair or alteration which makes possible an efficient contemporary use while preserving those portions or features of the property which are significant to its historical, architectural, and cultural values. Another name for rehabilitation is adaptive reuse.

   Contemporary design for alterations and additions to existing properties shall not be discouraged when such alterations and additions do not destroy significant historic, architectural, or cultural materials and such design is compatible with the size, scale, color, material, and character of the property, neighborhood, or environment.

   Whenever possible, new additions or alterations to structures shall be done in such a manner that if such additions or alterations were to be removed in the future, the essential form and integrity of the structure would be unimpaired.

4. Restoration is defined as the act or process of accurately recovering the form and details of a property and its setting as it appeared at a particular time by removing later work or by replacing missing, earlier work.

Every reasonable effort shall be made to use a property for its originally intended purpose or to provide a compatible use that will require minimum alteration to the property and its environment.

Reinforcement required for structural stability or the installation of protective or code required mechanical system shall be concealed whenever possible so as not to intrude or detract from the property's aesthetic and historical qualities, except where concealment would result in the alteration or destruction of historically significant materials or spaces.

5. Reconstruction is defined as the act or process of reproducing by new construction the exact form and detail of a structure or object, or a part thereof, as it appeared at a specific period of time. Reconstruction is a very difficult level of treatment that requires a great deal of documentation about the integrity of each aspect of the structure. The National Park Service does not generally encourage the reconstruction of historic structures. Reconstruction would be needed if it adds to the integrity of the structure or each of its elements.

   Reconstruction of all or a part of a historic property shall be appropriate when the reconstruction is essential for understanding and interpreting the value of a historic district, or when no other building, structure, object, or landscape feature with the same associative value has survived and sufficient historical documentation exists to insure an accurate reproduction of the original.

   The reproduction of missing elements accomplished with new materials shall duplicate the composition, design, color, texture, and other visual qualities of the missing element. Reconstruction of missing architectural features shall be based upon accurate duplication of original features substantiated by historical, physical, or pictorial evidence rather than upon conjectural designs or the availability of different architectural features from other building.

   Reconstruction shall include measures to preserve any remaining original fabric, including foundations, subsurface, and ancillary elements. The reconstruction of missing elements and features shall be done in such a manner that the essential form and integrity of the original surviving features are unimpaired.

Some of these items come under separate categories in the budgeting and improvement work to be done on a historic structure. There are three areas to consider:

1. **Preservation:** This includes the major work to be done to maintain the existing form, integrity, and materials of a structure within the context of a change in usage. The new use change must be consistent with the original historic character of the structure.

2. **Preservation Maintenance:** This includes the maintenance of items that are failing in their performance and making necessary alterations, like in-kind replacement, before major problems occur (e.g. roof repair).

3. **Cyclical Maintenance:** This includes the annual maintenance of items to keep them in good condition (e.g., winterizing, painting windows, adjusting locks, etc.) This should be done before there is a problem.

The Fort Yellowstone power house is in need of preservation maintenance to bring back the integrity of the historic fabric. These materials (historic fabric) and the architectural features contribute to the significance, and thus the eligibility of the building. Generally, the building is in good condition and has been little-modified from its original appearance; minor restoration will bring back the integrity of those materials.

The recommendations for the preservation of Fort Yellowstone power house are as follows:

Site

1. Regrade the area around all sides of the building (especially on the north side) to provide positive drainage around the building thus eliminating the deterioration of the concrete base.

2. Define organized parking areas around the building; design a parking plan for the north side of the building that maintains the view of the historic building as much as possible.

3. Inspect the water entrance to the penstocks to make sure that the water source is closed off from the building.

4. Monitor and maintain the wet areas and streambed to make sure that the water continues to flow away from the building.

5. Maintain the wood structure that extends from the tail race over the discharge area to make sure that it is stable and does not become a potential hazard.

Power House Exterior

1. Prepare a plan for repair and patching of the exterior stucco especially on the north side of the building. Paint all walls where patching is applied to match existing.

2. Replace the roof on the wing with a single-ply roof membrane, and provide gutters to keep the water away from the surface of the concrete. Repair or replace gutters and flashing in-kind to existng, to prevent water damage to eaves and soffits.

3. All windows and doors need some degree of preservation maintenance including reglazing and painting of the frames, doors and sashes. All of the trim around the windows and doors needs to be sanded and repainted. All exterior doors need to be reworked with repair of weathered or worn wood, adjustment of hardware, and the refinishing of the wood.

4. The exterior concrete stairway is starting to deteriorate and will need to be repaired.

5. Provide ongoing general preservation maintenance.

6. Develop and implement an Integrated Pest Management Plan for the building to deal with the swallows' nests and other problems.

7. Preserve the architectural and historical integrity of the exterior of the building if adapted for another use.

Power House Interior

1. Preserve the interior of the building as is until a new use can be found for the building.

2. Protect and preserve the existing equipment which is significant to the building. This includes the penstocks and piping, the switches and gauges and related equipment of the transformer control space, and the turbines and generators of the power plant. All effort should be made to preserve and interpret various aspects of the original equipment no matter what is proposed for the new use.

3. Potential uses for the power house include a research facility, museum collection storage and research, general storage, office space, and housing units such as apartments. All of these uses have positive and negative aspects because of the need to protect the architectural and historical integrity of the building.

General Recommendations

1. Prepare an Historic Preservation Maintenance Plan for the Mammoth Hot Springs power house.

2. Prepare an interpretive plan for the power house and related equipment.

3. Camouflage existing satellite dishes with net or paint to blend with landscape.

5.0 BIBLIOGRAPHY

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Webber, Ward P. Engineer. "Seasonal Report on Water and Power Development, Mammoth, Yellowstone National Park," March 30, 1936, folder 6, box D-28, Yellowstone National Park Library and Archives, Mammoth Hot Springs, Wyoming.

Wohlbrandt, Philip H. Park Engineer. "Final Report [on] Water and Power Development - Mammoth, F.P. 598," March 8, 1943, folder 9, box D-28, Yellowstone National Park Library and Archives, Mammoth Hot Springs, Wyoming.

APPENDIX A

CONSTRUCTION COST REPORT, WATER AND POWER DEVELOPMENT MAMMOTH, 1937

10-174
(May 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
CONSTRUCTION UNIT COST REPORT

YELLOWSTONE NATIONAL PARK

Sheet 1 of 3 sheets

PERIOD ENDED [illegible]

PROJECT Water and Power Development, Mammoth ACCOUNT NO. P598 DAY LABOR — CONTRACT

CONTRACT NO. _____ DATE OF APPROVAL _____ CONTRACT COMPLETION DATE _____

SYMBOL	CONSTRUCTION COST UNITS Name	Type	WORK DONE THIS PERIOD Sta. to Sta.		PERCENT COMPLETE	ANALYSIS OF COSTS Labor	Mat&Sup.	Indirect Charges	Contract* Payments	Prorated Overhead (2)	Totals this Period	Totals Prev. Report	Total Costs To Date	QUANTITIES Units	This Month	Totals to Date	UNIT COSTS	TOTAL ESTIMATED Quantity	Cost
	POWER HOUSE																		
	Electrical Equipment												16,800.30						
	Pelton Water Wheel												15,651.41						
	Remodel P.H. Force Acct.												2,416.50						
	" " Tittle												4,942.94						
	W.O. #1												1,514.01						
	W.O. #2												1,153.90						
	W.O. #3												1,548.95						
	W.O. #4												639.04						
	Power House Landscape												462.70						
	Salvage Material												600.00						
	Standby Gasoline Locomotive												6,952.55						
	Standby Install												3,186.43						
	Standby Operation												6,052.99						
	Project General												169.85						
	Water Distribution System												5,067.14						
	Tent Quarters												132.58						
	Overhead												3,244.14						
	Engineering												5,669.51						
	PIPE LINE																		
	Pipe contract												52,291.53						
	W.O. #1												135.20						
	W.O. #2												85.30						
	W.O. #3												100.05						
	W.O. #4												313.72						
	General												1,403.06						
	Construction Cost Total											Bal. Fwd.	138,533.82						
	Construction Engineering (Field Headquarters)																		
	Survey (Field Headquarters)																		
	Total Cost of Project to Date																		
	Less Retained Percentage (Contract)																		
	Expenditures to Date																		

Estimated Cost
Engineering (Estimate)
Estimated Total Cost

REMARKS: The breakdown of unit costs have not been drawn for the reason we are not acquainted with the records as kept and not sure of the quantities.

RESIDENT ENGINEER

Edmund B. Rogers
SUPERINTENDENT

*Contract payments will include the "RETAINED PERCENTAGE"

SUMMARY OF EXPENDITURES TO DATE			
ELEMENTS OF COST	This Month	Previous	Totals to Date
Labor			
Materials & Supplies			
Indirect Charges			
Contract Payments			
Prorated Overhead			
Total Construct'n Costs			
Construction Engineering			
Surveys			
Cost of Project to Date			
Less Retent			
Expenditures to Date			
Total Allotment			
Balance			

10-174
(May 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
CONSTRUCTION UNIT COST REPORT

~~YELLOWSTONE NATIONAL~~ PARK

PERIOD ENDED FINAL

PROJECT ~~Water and Power Development, Mammoth~~

ACCOUNT NO. ~~F.P. 509~~

DAY LABOR ~~or~~ CONTRACT

CONTRACT NO. _____ DATE OF APPROVAL _____ CONTRACT COMPLETION DATE _____

SYMBOL	CONSTRUCTION COST UNITS		WORK DONE THIS PERIOD	PERCENT COMPLETE	ANALYSIS OF COSTS								QUANTITIES			UNIT COSTS	TOTAL ESTIMATED	
	Name	Type	Sta. to Sta.		Labor	Mat.&Sup.	Indirect Charges	Contract* Payments	Prorated Overhead (2)	Totals this Period	Totals Prev. Report	Total Costs To Date	Units	This Month	Totals to Date		Quantity	Cost
	PIPE LINE (Continued)										~~Bal.Fwd.~~	~~138,533.62~~						
	~~Excavation, uncl.~~											13,576.90						
	" rock											3,092.85						
	~~Laying pipe~~											21,562.66						
	~~Backfill~~											314.44						
	~~Cleanup~~											2,051.77						
	~~Culvert Intake~~											1,510.69						
	~~Engineering~~											801.60						
	~~Venturi Meters--Water Wks. Supply Co.~~											1,992.30						
	~~RESERVOIR~~																	
	~~General~~											2,292.60						
	~~Clearing and Grubbing~~											491.91						
	~~Burning~~											36.22						
	~~Stripping~~											3,352.30						
	~~Road~~											760.69						
	~~Unclassified excavation~~											3,741.76						
	~~Rock excavation~~											45.46						
	~~Puddling~~											337.73						
	~~Reinforced concrete~~											8,049.69						
	~~Embankments~~											2,309.83						
	Inlet race											257.47						
	Landscaping											1,211.36						
	Reservoir top											380.49						
	~~High pressure check~~											591.84						
	~~Engineering~~											44.83						
	Recording Int.											582.50						
											~~Bal.Fwd.~~	~~199,025.70~~						

Construction Cost Total

Construction Engineering (Field Headquarters)

Survey (Field Headquarters)

Total Cost of Project to Date

Less Retained Percentage (Contract)

Expenditures to Date

Estimated Cost

Engineering (Estimate)

Estimated Total Cost

REMARKS: _____

*Contract payments will include the "RETAINED PERCENTAGE"

Acting RESIDENT ENGINEER

SUPERINTENDENT

SUMMARY OF EXPENDITURES TO DATE

ELEMENTS OF COST	This Month	Previous	Totals to Date
Labor			
Materials & Supplies			
Indirect Charges			
Contract Payments			
Prorated Overhead			
Total Construct'n Costs			
Construction Engineering			
Surveys			
Cost of Project to Date			
Less Retent			
Expenditures to Date			
Total Allotment			
Balance			

YELLOWSTONE NATIONAL PARK

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
CONSTRUCTION UNIT COST REPORT

PERIOD ENDED FINAL June, 1937

PROJECT Water and Power Development, Mammoth ACCOUNT NO. P598

DAY LABOR & CONTRACT

CONTRACT NO. I-1p-3564 DATE OF APPROVAL May 27, 1935 CONTRACT COMPLETION DATE

SYMBOL	CONSTRUCTION COST UNITS Name	Type	WORK DONE THIS PERIOD Sta. to Sta.		PERCENT COMPLETE	ANALYSIS OF COSTS Labor	Mat&Sup.	Indirect Charges	Contract* Payments	Prorated Overhead (2)	Totals this Period	Totals Prev. Report	Total Costs To Date	QUANTITIES Units	This Month	Totals to Date	UNIT COSTS	TOTAL ESTIMATED Quantity	Cost
	RESERVOIR (Continued)											Bal. Fwd.	199,023.70						
	Crates												108.00						
	Chlorine Plant Install												2,405.59						
	Power Line												3,343.88						
	Chlorine House												2,633.49						
	Construction Cost Total					55,070.03	31,798.95	20229.85	100,415.03				207,514.66					Estimated Cost	
	Construction Engineering (Field Headquarters)																	Engineering (Estimate)	
	Survey (Field Headquarters)																	Estimated Total Cost	
	Total Cost of Project to Date																		
	Less Retained Percentage (Contract)																		
	Expenditures to Date																		

REMARKS: Plans YEL- 3105, 3221, 5059, 5065, 5067, 5069, 5070, 5071, 5074, 6076, 6077, 6080, 6083, 6085, 6086, 6093, 6099, 6103, 6113 and 5114.

Acting RESIDENT ENGINEER

SUPERINTENDENT

*Contract payments will include the "RETAINED PERCENTAGE"

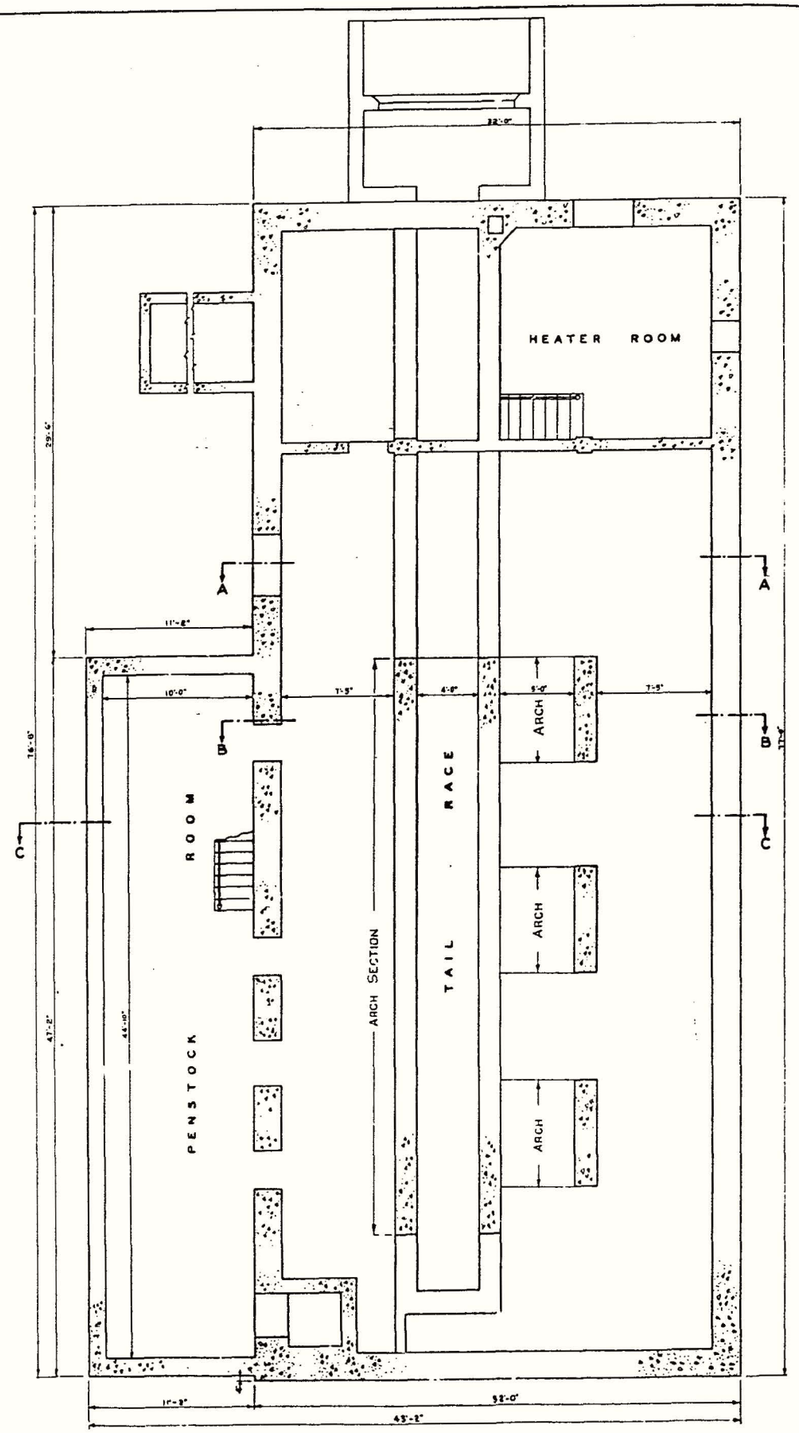
SUMMARY OF EXPENDITURES TO DATE

ELEMENTS OF COST	This Month	Previous	Totals to Date
Labor			51,117.86
Materials & Supplies			31,665.45
Indirect Charges			19,799.60
Contract Payments			100,415.93
Prorated Overhead			
Total Construct'n Costs			202,998.84
Construction Engineering			4,515.82
Surveys			
Cost of Project to Date			207,514.66
Less Retent			
Expenditures to Date			207,514.66
Total Allotment			207,514.66
Balance			

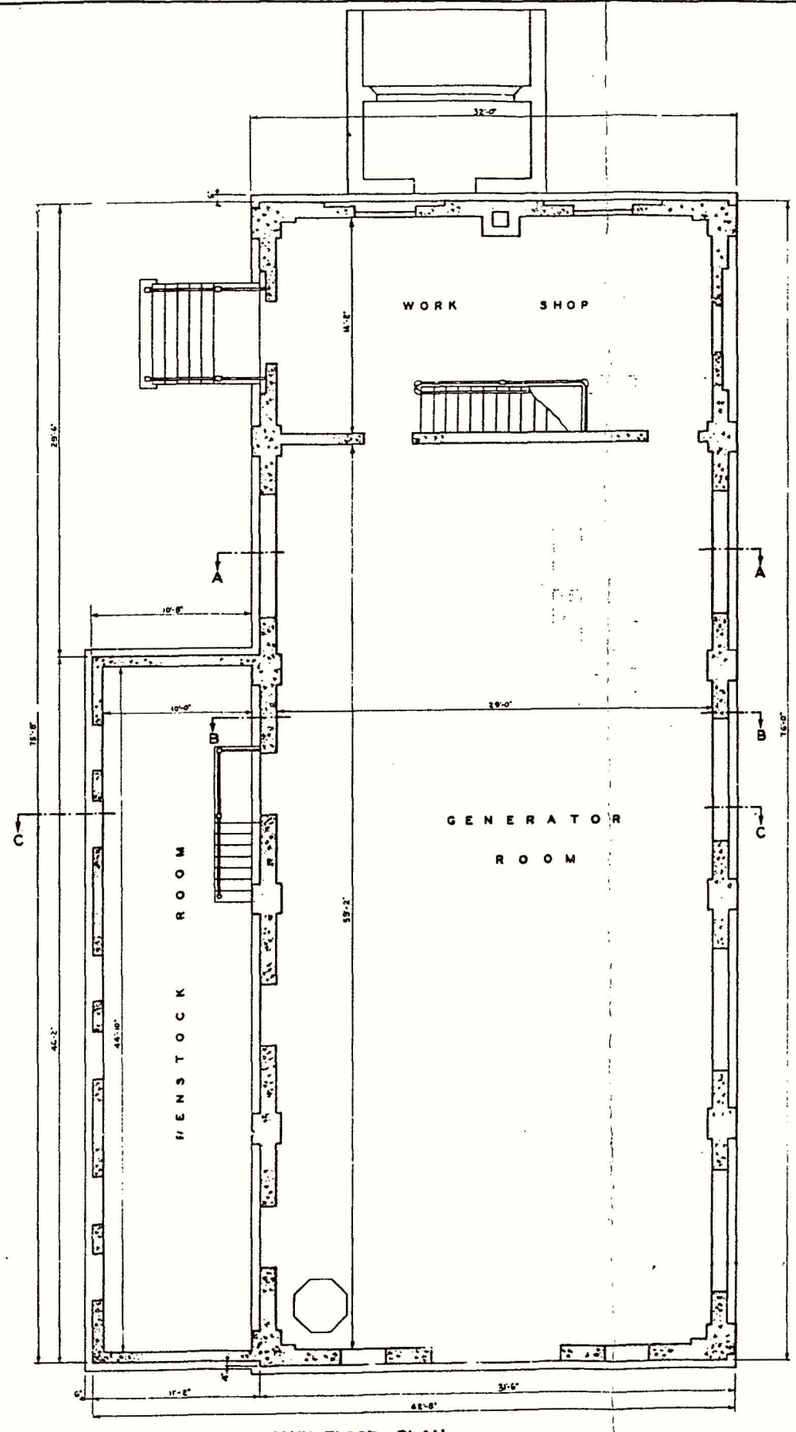
6-7831

APPENDIX B

ORIGINAL CONSTRUCTION PLANS



BASEMENT PLAN
EXISTING POWER HOUSE



MAIN FLOOR PLAN
EXISTING POWER HOUSE

NP
YEL-5069
Sheet 1 of 2 Sheets
H.O.R.

HALF-SIZE REPRODUCTION

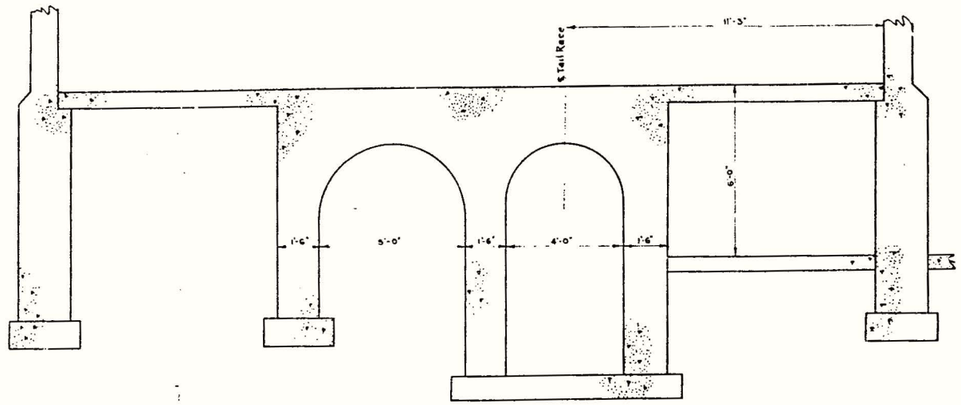
Note - This sheet traced from old print received from Yellowstone Nat'l Park Sheet No.1 Dwg. 2-903 dated Jan. 1909.

NOTE: THIS PLAN HAS BEEN PREPARED FOR THE INFORMATION OF BIDDERS AND SHOWS FLOOR PLANS AND SECTIONS APPROXIMATELY AS EXISTING.

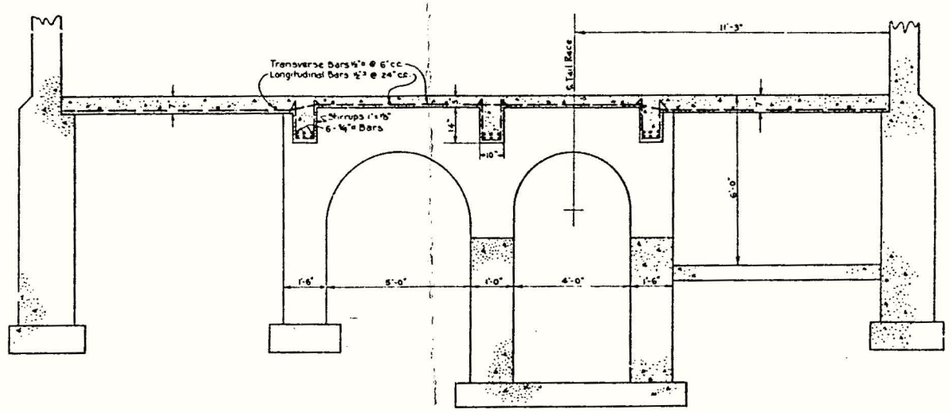
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
YELLOWSTONE NATIONAL PARK
HYDRO-ELECTRIC POWER PLANT
BASEMENT, FLOOR PLANS & SECTIONS
OFFICE OF THE CH. F ENGINEER
SAN FRANCISCO, CALIF.
MAY, 1938
SCALE 1/8" = 1'-0"

Sheet 1 of 2 Sheets

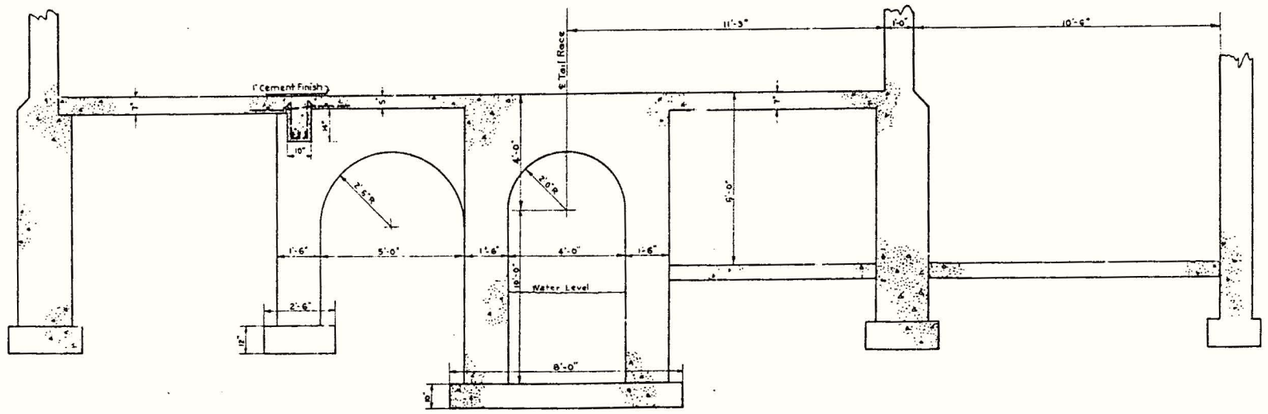
NP
YEL-5068



SECTION B-B



SECTION A-A



SECTION C-C

NOTE: THIS PLAN HAS BEEN PREPARED FOR THE INFORMATION OF BIDDERS AND SHOWS FLOOR PLANS AND SECTIONS APPROXIMATELY AS EXISTING.

Note:- This sheet traced from old prints of D'olier Engineering Co. Dated 3-11-09 & 6-21-09 Sheets 8553 & 8719

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

YELLOWSTONE NATIONAL PARK

HYDRO-ELECTRIC POWER PLANT
BASEMENT, FLOOR PLANS & SECTIONS

OFFICE OF THE CHIEF ENGINEER
SAN FRANCISCO, CALIF.
MAY, 1933
SCALE: ⅛"=1'-0"

NP
YEL-5069 Sheet 2 of 2 Sheets

Sheet 2 of 2 Sheets NP YEL-5069

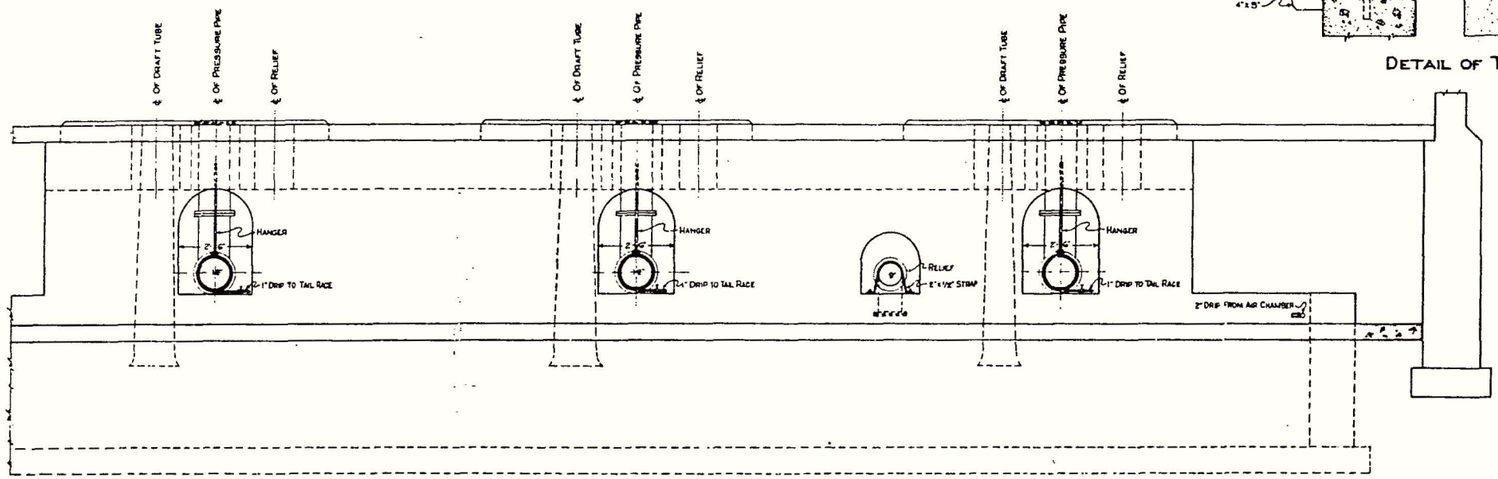
Traced from Park Dwg. No. 8213-1

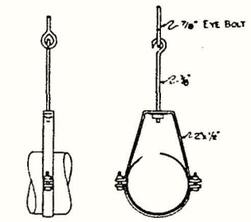
HALF-SIZE REPRODUCTION

FORT YELLOWSTONE, WYOMING.
ARRANGEMENT OF HYDRO-ELECTRIC POWER PLANT

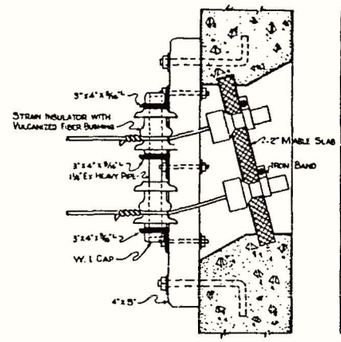
Copied from Old Print of Dolier Engr Co. Sent in from Park Sept. 1934.

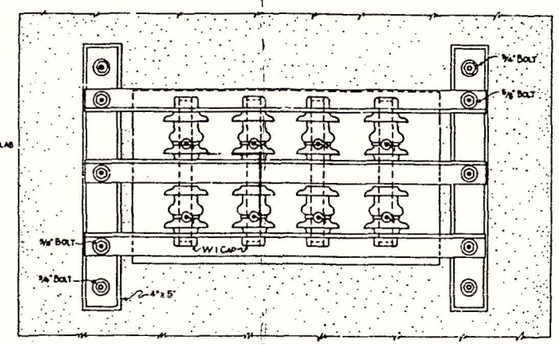
NPS YEL-5043 Sheet 1 of Sheets



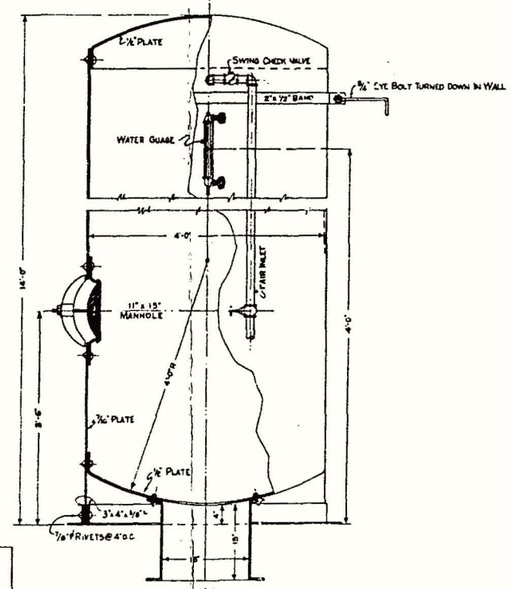


HANGERS FOR PRESSURE PIPES

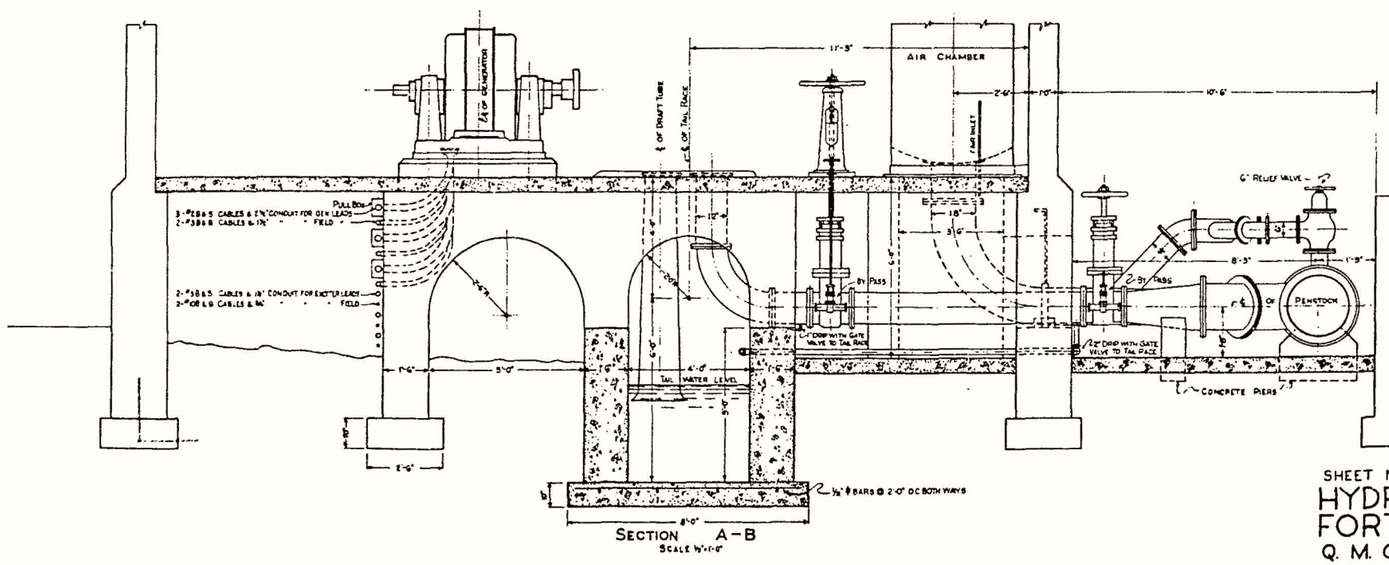




DETAIL OF TRANSMISSION LINE ENTRANCE
SCALE 1 1/2" = 1'-0"



DETAIL OF AIR CHAMBER
SCALE 1" = 1'-0"



SECTION A-B
SCALE 1" = 1'-0"

SECTION C-D
SCALE 1" = 1'-0"

SHEET NO. 5 2-903 CONSTRUCTION SHEETS 9

HYDRO-ELECTRIC POWER PLANT FORT YELLOWSTONE WYOMING

Q. M. G. O. JAN. 1909

COPIED FROM OLD PRINT OF DOLIER ENGR. CO.
SENT IN FROM PARK SEPT. 1934

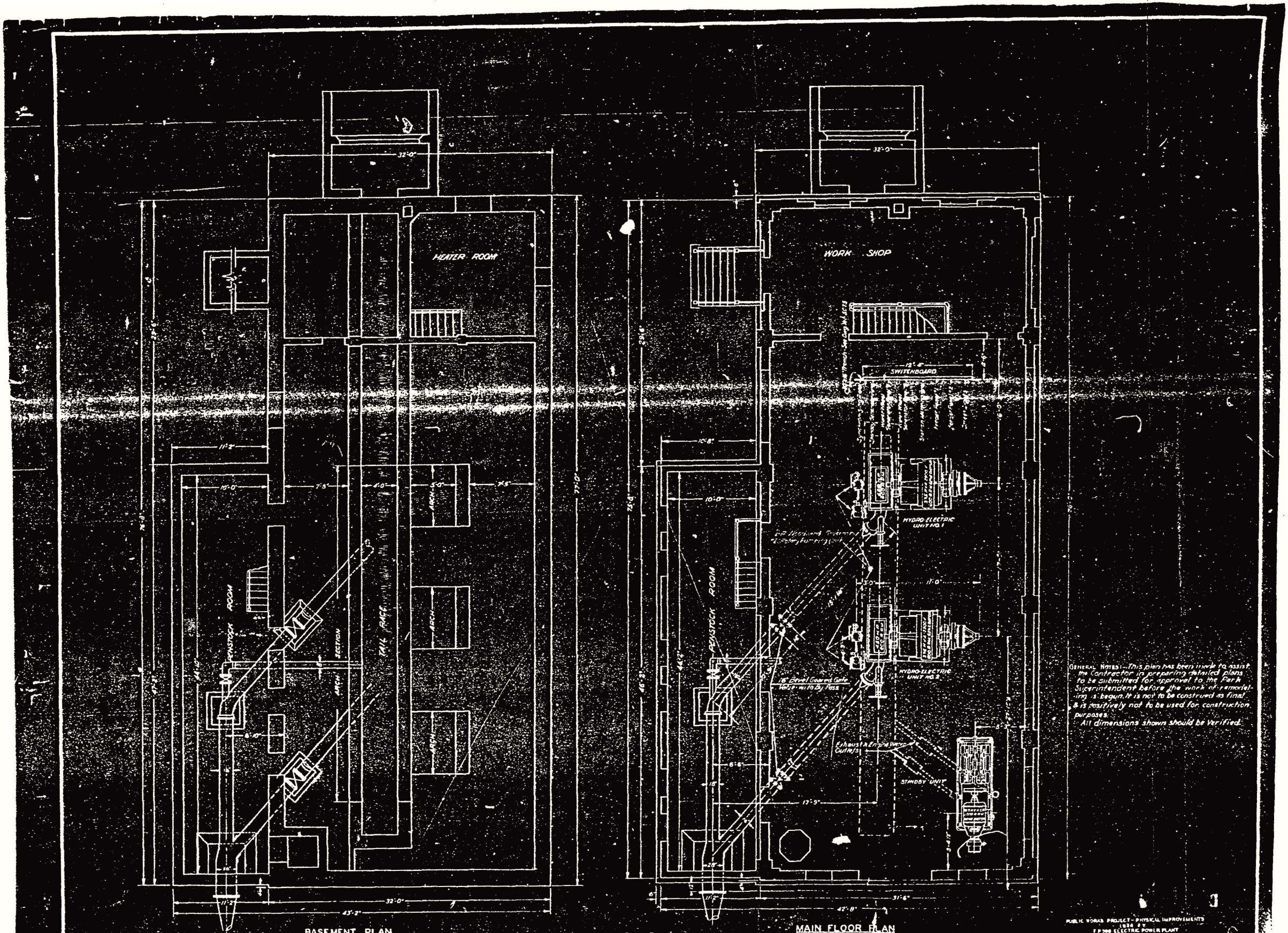
NP
YEL-5043 Sheet 2 of Sheets

MDK

YEL-5043

APPENDIX C

1935 MODIFICATION DRAWINGS



BASEMENT PLAN
EXISTING POWER HOUSE

MAIN FLOOR PLAN
EXISTING POWER HOUSE

GENERAL NOTES:- This plan has been made to assist the Contractor in preparing detailed plans to be submitted for approval to the Park Superintendent before the work of remodeling is begun. It is not to be construed as final & is positively not to be used for construction purposes.
All dimensions shown should be Verified.

PUBLIC WORKS PROJECT - PHYSICAL IMPROVEMENTS
1934 FY
P.P.300 ELECTRIC POWER PLANT
MAMMOTH HOT SPRINGS AREA

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

YELLOWSTONE, NATIONAL PARK

PROPOSED HYDRO-ELECTRIC POWER PLANT
AND EXTENSION TO WATER SYSTEM AT MAMMOTH

GENERAL LAYOUT
FOR POWER PLANT

OFFICE OF THE CHIEF ENGINEER
SAN FRANCISCO, CALIF.
APR 1933
SCALE 1/4"=1'-0"

NP
YEL-5104

NP
YEL-5104