TROUT CREEK DAM
(Hemlock Lake Dam)
Gifford Pinchot National Forest
River Mile 1.8 on Trout Creek
Carson vicinity
Skamania County
Washington

HAER WA-182
WA-182
HAER
WA-182

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC WEST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
909 First Avenue
Seattle, WA 98104

HISTORIC AMERICAN ENGINEERING RECORD

TROUT CREEK DAM
(HEMLOCK DAM)

HAER No. WA-182

HAER
WA-182
(page 1)

Location: Trout Creek Dam is located at River Mile 1.8 on Trout Creek, a major tributary to the Wind River approximately 11 river miles upstream from the confluence with the Columbia River, within Gifford Pinchot National Forest. The dam site is reachable by paved road about 8 miles northwest of the town of Carson, Washington (Skamania County).

S.27, T. 4N, R 7E, W.M., USGS QUAD – Stabler (WA)
UTM: 10/583058E 5072426N (NAD 27) – North Abutment
Lat: 45.8924N Long: 121.9312W (NAD 27)

Present Owner: United States Department of Agriculture, Forest Service since 1929.

Present Use: Originally designed to impound the waters of Trout Creek for hydroelectric power generation for the Wind River Ranger District, Wind River Nursery, and a Civilian Conservation Corps camp. In the 1950's the dam was retrofitted for irrigation use for adjacent nursery fields. Recreation opportunities were developed in the 1930's along the reservoir created by the dam (Hemlock Lake), and adjacent shoreline. The north shore has a wooden deck/gravel walkway, picnic area and boat launch. Recreation is the primary current use of the dam, since power generation ceased in the 1950's, and the Wind River Nursery closed in 1997. The integrated fish ladder, even after significant modification in 1995, inhibits migration of fish from the creek below the dam to the reservoir.

Significance Statement: Trout Creek Dam and fish ladder were constructed by the Civilian Conservation Corps, Company No. 944, in 1935-36. The structure, a concrete arch dam, is believed to be one of the largest power generation plants constructed solely by a CCC company in the Northwest, and is among the first to incorporate a fish ladder.

Historians: Cheryl Mack, Gifford Pinchot National Forest (1997-2007).
Terrence L. Trembly, M.S., J.D., Lani Doely Photography, 2007.

Project Information: The Forest Service intends to remove Trout Creek Dam to improve fish passage, including threatened Lower Columbia River steelhead trout. Mitigation documentation is required by the Washington State Historic Preservation Office prior to removal of the dam and construction of a pilot channel through the stream bed.

Part I. Historical Information

A. Physical History:

1. Date of Construction: Trout Creek Dam, also known as Hemlock Dam, was built in 1935; the fish ladder was completed in early 1936 and is an integral component of the dam and its operation.

2. Architect/Engineer: The design of this concrete arch dam and integrated fish ladder is believed to be the work of the engineering staff of the U.S. Forest Service (Forest Service), Region 6, Portland, Oregon, based on title block information contained on historic drawings.

3. Builder/Contractor/Suppliers: Trout Creek Dam and fish ladder were built by the enrollees of Civilian Conservation Corps (CCC) Company 944, assigned to Camp Hemlock F-40, under the supervision of the Forest Service, Region 6, engineering staff. No information has been identified regarding suppliers, fabricators or contractors associated with the project.[1]

Construction materials such as cement, sand and gravel, wood for forms, prefabricated valve assemblies, tools and other supplies would have been purchased locally, where possible, from along the Columbia River corridor. These items would likely have then been transported to Carson via rail or truck, and from there by truck to the site. Local Experienced Men (LEM's), or local skilled tradesmen, from the area would have been involved in building forms, cement work, or use of heavy excavation equipment, since the Forest Service would not have had such skilled tradesmen on their regular staffing. The use of LEM's was consistent with CCC national program guidance for increasing employment opportunities for often unemployed local tradesmen following the Great Depression. LEM's also played an important role in training CCC enrollees.

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[1] After a diligent search for historic records on dam construction, none were located. It appears the records were lost or destroyed while in the custody of U.S.F.S., Region 6 or the Gifford Pinchot National Forest, after they were returned by the Federal Records Center, Northwest Region (RG-95) in the 1980's. Additional information obtained from National Archives and Record Administration (NARA), College Park, MD, (RG-79) contains mostly CCC camp inspection reports and diaries of certain U.S.F.S. employees who worked on dam construction.

4. Original Plans: Original plans were drawn up by the Region 6 Forest Service engineering staff, Portland, Oregon.

5. Alterations and Additions: Trout Creek Dam has been altered several times since construction in 1935, as needs changed at the Hemlock site. The dam was initially created to generate power for U.S. Forest Service Wind River Ranger District, Wind River Nursery, and the newly constructed CCC camp housing over 200 enrollees. Power generation stopped in the 1950's. The penstock to the power plant was later modified, and water was screened and pumped to irrigate nursery fields near the dam. Minor modifications to the fish ladder and its operation were made in the early 1990's. In 1995 a structural addition to the dam was made to divert flow from near the north abutment across the face of the dam to the base of south abutment to create an "attraction flow" for the fish ladder. These modifications are more fully described below.

B. Historical Context:

The construction of the dam and fish ladder along Trout Creek are outgrowths of the original settlement of the Wind River valley, logging of its valuable timber, and most importantly, the decision of the Forest Service to locate a ranger station and research station in the Wind River drainage beginning in the early 1900s.[2]

The earliest non-native settlement of the lower Wind River valley began following the passage of the 1850 Donation Land Act. These early settlers engaged in stock raising over the bottom land near the Columbia River, as well as harvesting timber.[3]

One of the earliest sawmills in the area was completed in 1881 where the town of Carson, Washington, now stands, near the confluence of the Wind River and the Columbia River. Henry Metzger, an early settler in the area, reported that the mill processed timber harvested from more than a thousand acres in the surrounding area. According to Metzger, the company procured its timber by placing temporary settlers on the land until the timber was cut, a practice that was illegal under the Donation Land Act. By 1886, over 1200 acres had

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[2] Cheryl Mack and Rick McClure. *Wind River Administrative Site Historic District.* Heritage Program, Gifford Pinchot National Forest. 1999.

[3] Elsie Bloomquist. A History of Carson. *Skamania County Heritage* 14(1). 1985.

been logged using this strategy, and the mill operation left the valley. Families then settled on the logged over land in the valley flats.

The middle and upper valley was made more accessible in 1890 with the completion of a bridge across the Wind River, located one-half mile upstream of the current highway bridge. This original bridge washed out, however, and for a time the only access to the "middle flats" and upper valley was by way of a cable crossing. Several pioneers were present in the "middle flats" across the river from Carson by the early 1890s, with settlers' cabins reaching as far up the valley as Soda Springs.

1. Early Settlement

In 1898 Bernard Erikson filed a homestead claim for 160 acres on the north bank of Trout Creek, a parcel which included the present site of the Forest Service's Wind River Work Center. It is likely that Mr. Erikson filed the claim with timber speculation in mind, since by 1901, prior to issuance of a patent, he sold the entire 160 acres to the Storey and Keeler Lumber Company. This company, which had incorporated in LaCrosse, Wisconsin in 1899, had been buying out settler's claims in the Wind River valley since May of 1900. Since Mr. Erikson himself was from LaCrosse, it is likely he served as one of several "dummy" entryman sent from Wisconsin by the Storey and Keeler Lumber Company to claim timber land under the homestead laws.

In January of 1902 the Storey and Keeler Lumber Company changed its name to the Wind River Lumber Company. Through the purchase of homestead claims, the Company owned most non-federal land in the upper Wind River Valley. Their subsidiary corporation, the Skamania Boom Company, acquired a state charter in 1901 permitting the artificial flooding of the Wind River and its tributaries for the purpose of transporting logs.[4] The Wind River Lumber Company controlled the means of transporting timber, giving it a virtual monopoly on the logging of lands in the Wind River drainage.

2. Splash Dams on the Wind River and Trout Creek

The only feasible way to transport logs from the upper Wind River valley in the early 1900s was to float them down the river. This was accomplished through the use of large "splash dams." Splash dams were constructed on the Wind River, Trout Creek and Panther Creek between 1901 and 1903. The splash dam on Trout Creek was built immediately upstream of the location of

[4] Jamie Tolfree. History of the Wind River Lumber Company in the upper Wind River Valley, Part 1. *Skamania County Heritage* 13(4). 1984.

the present concrete dam and bridge. These splash dams were substantial hewn log structures, featuring flood gates operated by a windlass. The logs were contained in ponds behind the dams and released as water rushed through the open floodgates. Releases were made only when an adequate volume of water behind the dams was available to flush logs down the length of Trout Creek to its confluence with the Wind River, and then downstream to the Columbia River, where they were rafted to the Company's mill at Cascade Locks.

In 1903 the Wind River Lumber Company built logging Camp 3 at the site of the splash dam on Trout Creek. Company land in the vicinity of Camp 3 (the site of the present Wind River Work Center) was logged between 1903 and 1905. At least a portion of this area had burned in the Yacolt Fire of 1902, and early photographs show extensive standing dead timber.

From 1903 to 1912 Camp 3 contained at least eleven buildings, including an office, three bunkhouses, a barn, blacksmith shop, filing shed and a cookhouse/dining hall. Early photographs provide information on the layout of the camp and the architecture of the buildings. The company office, barn, and two buildings identified from photographs as bunkhouses were of log construction with shake covered gable roofs. The cookhouse/dining hall was of frame construction with exterior walls of vertical boards and a gable roof covered with shakes. A third large bunkhouse was also of frame construction. The cookhouse and at least one of the bunkhouses were situated in the immediate vicinity of the present dam and bridge. Camp 3 served as the base for both the "May" and "November" Forest Service timber sales (more fully described below), and between the years of 1903 and 1910 served as home for crews of up to 50 men between the months of April through November. Due to their isolation, these logging camps were self-sufficient, and resembled small settlements.

3. Early Forest Service History

At the time Camp 3 was built the land on the south side of Trout Creek in the vicinity of the project area was under the jurisdiction of the Mount Rainier Forest Reserve. The Reserve was established in 1897, and was administered by the General Land Office within the Department of the Interior. In June of 1902 Horace Wetherell, one of the early settlers in the "middle flats", was appointed as Assistant Forest Ranger in the Wind River Valley. These early rangers were essentially custodians, and their duties included suppression of forest fires and prevention of timber theft on public lands. Wetherell worked out of his home, as there were no ranger station offices at that time.

Horace Wetherall resigned in 1904, and was replaced by Elias J. Wigal. Like Wetherall, Mr. Wigal homesteaded in the Wind River valley in 1891, joining the Forest Service at the age of 50. Wigal initially worked out of his home, which was located between Hemlock and Carson. In 1905 Congress transferred the Forest Reserves from the Department of the Interior to the Department of Agriculture, and the Bureau of Forestry was renamed the Forest Service. In 1907 the name "Forest Reserve" was changed to National Forest, and the Columbia National Forest was officially established in 1908.

In 1907 Mr. Wigal constructed a ranger station cabin on the south side of Trout Creek, near the Wind River Lumber Company's splash dam, directly across the creek from Camp 3. This would place it near the southern approach to the present concrete bridge. The one-room cabin, sided with cedar shakes, was the first ranger station constructed within the Mount Rainier Forest Reserve. The facility was designated the Hemlock Ranger Station, due to the large number of hemlock trees in the vicinity. The site was chosen to enable Wigal to effectively administer the first federal timber sale awarded to the Wind River Lumber Company in 1906.

The Wind River timber sale of May 10, 1906 (referred to as the May Timber Sale) was one of the first large commercial timber sales on Forest Reserve lands in the Pacific Northwest. It was an area of 280 acres, from which 14.6 MMBF of timber was cut. This sale included land on the south side of Trout Creek. The total value of the timber sale was $12,921. This low value was attributed to the fact that the sale included a portion of the Yacolt burn of 1902, and the fire-killed timber had deteriorated to a marked degree. A second sale was awarded to the company on November 21, 1906 (referred to as the November Timber Sale), estimated at 23 MMBF. This included a parcel at the far upstream end of the log pond on Trout Creek.

Ranger Wigal constructed a second Ranger Station cabin at Hemlock between 1908 and 1909, next to the first one. It was two stories high and built entirely of hewn cedar logs. The sides were covered with split and shaved shingles. This building was situated along the edge of Trout Creek, at what is now the southern approach to the concrete bridge. The cabin built in 1907 was then being used as a tool house, and also as an extra bunkhouse for loggers working for the Wind River Lumber Company. Since the only access to Hemlock Ranger Station was across the Wind River Lumber Company's splash dam, Ranger Wigal constructed a log bridge across the top of the dam in 1910. These two cabins were the only Forest Service structures on the south side of the creek until 1911, and it is apparent from examination of ranger diaries and internal memos that the Wind River Lumber Company's barn, cookhouse, blacksmith shop, filing shed and root cellar at Camp 3 were being used jointly by the lumber company and the Forest Service.

Further administrative developments at the Hemlock Ranger Station included establishment of the Wind River Nursery in 1909. The nursery was established in order to grow trees to reforest areas burned over by the Bull Run Fire on the Oregon (now Mt. Hood) National Forest in Oregon, as well as areas deforested by the Yacolt Burn. Nursery fields were prepared in areas which had already been logged by the Wind River Lumber Company. Preparation of these early fields involved clearing, stump removal and fencing. An irrigation system constructed of wooden pipes was also installed, and was served by water diverted from Martha Creek and one of its tributaries.

The Wind River Lumber Company shifted its operation further north by June of 1910, and abandoned Camp 3. However, they continued use of the splash dam on Trout Creek to provide additional water to flush logs down the Wind River. From 1910 to 1912, the Forest Service used buildings at Camp 3, in particular the cookhouse and barn. By 1913 the Forest Service constructed its own barn and mess house on the south side of Trout Creek, and it is likely that Camp 3 was truly abandoned.

The years between 1909 and 1914 saw a great deal of expansion at what is now the Wind River Administrative Site. The Wind River Experiment Station was established in 1913, later to become part of the Pacific Northwest Forest and Range Experiment Station. The nursery and the Experiment Station worked hand in hand to develop the basic body of knowledge on which modern reforestation and tree growing practices are based. The Wind River Arboretum was also established at the site in 1912, and remains one of the oldest in the Northwest. It ranks among the earliest forestry projects of an experimental nature still in existence in the region. The Arboretum, in conjunction with the duties of the companion Experiment Station, was the site of many plantings of tree species from throughout the world to determine their suitability for forest planting in the western portion of the Cascade Range in Washington and Oregon, and later for more comprehensive dendrological study and exhibition purposes.[5]

In 1923 the Forest Service converted the Wind River Lumber Company's splash dam to hydroelectric use, and built a power house on the north side of Trout Creek, downstream from the splash dam. The power plant was built on what was then Wind River Lumber Company land. The Forest Service operated the hydroelectric plant and the dam under a long-term lease with the

[5] Roy R. Silen and Leonard R. Woike. *The Wind River Arboretum, 1912-1956*. Portland, Or: Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Dept. of Agriculture. 1959.

Company. In 1924, all Ranger District buildings were wired for light from the Trout Creek hydroelectric plant. The task of operating the hydroelectric plant was divided between the Ranger Station, the Nursery and the Wind River Experiment Station, each of whom was responsible for operations for a four month time period.

The Wind River Lumber Company struggled financially in the 1920's. A forest fire south of Falls Creek in 1925, probably started by sparks from one of the company's donkey engines, ultimately led to the company's bankruptcy. Mortgage foreclosure led to the sale of all company lands beginning in 1926, and in 1929 the Forest Service purchased the parcel containing the former site of Camp 3 (the current Wind River Work Center) and the splash dam. The desire to acquire the dam/bridge and the hydroelectric plant were the primary catalysts for the purchase.

4. CCC Program

The year 1933 brought a great deal of change to the Forest Service with the establishment of the Civilian Conservation Corps (CCC). The CCC was only one of President Roosevelt's New Deal programs intended to relieve unemployment problems, but was specifically focused to aid in conservation efforts across the nation.

By 1932, three years after the stock market crash of 1929, nearly 1/3 of the available workforce in the United States was out of work- over 13 million people. A group especially hard hit was young people, who were untrained, unskilled, in some cases uneducated, and without hope of gaining work experience. In response to the Great Depression, newly elected Franklin Delano Roosevelt, working closely with Congress, advanced many of his "New Deal" programs designed to pull America out of the economic doldrums. None were more popular than the Civilian Conservation Corps (CCC).[6]

Roosevelt, in his proposal to the Seventy-third Congress that was in Special Session (an emergency session to address the nation's dire economic condition), in early March of 1933, stated, "I propose to create a civilian conservation corps to be used in simple work, not interfering with normal employment, and confining itself to forestry, the prevention of soil erosion, flood control, and similar projects."

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[6] John A. Salmond. *The Civilian Conservation Corps, 1933-1942; A New Deal Case Study*. Duke historical publications. Durham, N.C.: Duke University Press, 1967.

Roosevelt had said "I call your attention to the fact that this type of work is of definite, practical value, not only through the prevention of great present financial loss, but also as a means of creating future national wealth." FDR had the foresight to see that the CCC, while preserving and upgrading the nation's natural and cultural resources, would also serve to enrich another of the nation's valuable resources – its youth.

Congress moved swiftly on the proposal, and by the end of March the Emergency Conservation Work Act was on FDR's desk to be signed. President Roosevelt issued an executive order on April 5, 1933 officially establishing the Emergency Conservation Work (ECW) program. The name of the program, ECW, was later officially changed to the Civilian Conservation Corps (CCC) by an act of Congress June 28, 1937.[7]

Documents prepared by affected federal agencies involved in implementing the program, including widely distributed government forms, continued to reference the work as ECW or CCC interchangeably during the nine year run of the conservation program. This ambiguity is a source of confusion for some readers.

The comprehensive program called for cooperation of existing federal government departments to take on new responsibilities to get the CCC going in quick order, by recruiting, transporting, educating and housing young men in the areas where project work was to occur.

The Department of Labor would coordinate the selection of enrollees from needy families with unemployed but employable young men. Enrollment quotas were issued for each state, with requirements that the enrollees be male, between the ages of eighteen and twenty-five, single, unemployed, from families on "relief", and in good physical condition. Physical fitness was required, as the labor was strenuous.

There were no shortages of unemployed young men between the ages of 18 and 25 to serve as enrollees in the CCC. Speed in implementation was key, and with a certain amount of precision the CCC program got off to a rapid start throughout the nation. Simply put, the Army would assemble the companies of up to 200 men, and provide initial physical training. The Army would then transport enrollees, usually by train, to camps where conservation work would be done. The Army would run the camps, including housing, feeding, clothing, supervising and disciplining enrollees. They would also provide medical and dental attention. No military training, however, was allowed. The federal government agencies involved in "conservation work"

[7] Salmond, Ibid.

such as the Departments of Agriculture (Forest Service and Soil Conservation Service) and Interior (National Park Service, Bureau of Reclamation, and Bureau of Indian Affairs in Indian Country) would identify and be responsible for work projects and provide personnel to manage the projects. When on work detail the enrollees would be under the supervision of the project management leadership of the sponsoring conservation agency, instead of the Army. [8] Enrollees also were given educational opportunities as the program developed over time.

The CCC was very active throughout the Northwest, and on the Columbia National Forest (renamed the Gifford Pinchot National Forest in 1949), from the early beginnings of the program until it ended with America's march to war in 1942. Unemployment was high in rural Western Washington, and elsewhere throughout the state. Temporary and permanent camps, and the companies which occupied them, came and went over the years, beginning shortly after the program was authorized in 1933.[9]

Companies would sometimes be formed locally or from other areas within a state, and assigned to an area camp, or be transported to locations far from their origins. One reason for transport such a distance to an assigned camp was to decrease opportunities for desertion prior to the end of an initial six month enrollment period. Enrollees could extend their stay in six month increments following their initial work assignment.

To be sure, the CCC was a highly structured program, conforming to Army organizational requirements to look after enrollees. For the Forest Service throughout the nation and on the Columbia National Forest this low cost labor consisting of energetic young men – untrained but trainable - was greeted with great enthusiasm. It put young men to work, learning new skills in a highly disciplined environment, and performing long needed conservation work on often neglected or abused forest lands.

5. Company 944 at Camp Hemlock (F-40)

Civilian Conservation Corps Company 944 was organized on May 15, 1933, less than two months after the legislation creating the CCC was passed, at Fort Lewis, Washington. The company was assigned to work on projects in the Columbia National Forest, and was assigned to Camp Hemlock, F-40. This 200-person camp was to be located near the former site of Wind River Lumber Company's Camp 3. The company set to work after arriving at Camp Hemlock constructing permanent buildings, which were ready for occupation

[8] Salmond, Ibid., 31-36.
[9] Gerald W. Williams. *The Civilian Conservation Corps' (CCC) Contribution to the Forests in the Pacific Northwest Region.* Umpqua National Forest. Undated and unpublished manuscript.

on June 12, 1933. The camp, located on the north side of Trout Creek, consisted of four barracks, a mess hall, two wood sheds, a washroom, latrine, infirmary, education hall, recreation hall, office, officers' quarters and garage, workshop, paint shed, machine storage shed, machine shop, grease rack, oil house, and a water tank. A fifth barracks, storage shed, and wash rack were added to the camp later. After the initial construction at the camp, the enrollees were assigned to the Forest Service for conservation work on various projects in the Columbia National Forest and within the Nursery itself. Enrollees engaged in a wide range of conservation related projects including falling snags, planting trees, constructing and repairing roads, trails, and telephone lines, maintaining trucks and equipment, performing lookout and fire guard duty, and fighting forest fires when the need arose.

During 1933, the first year of the CCC at Camp Hemlock, enrollees were used within the Nursery for weeding the planting beds. The enrollees were also put to work developing more land for the Nursery operation, clearing approximately 7 acres on the north side of the Nursery, bringing the field acreage to over 20. The water system was also expanded by the CCC in the early years of Camp Hemlock. The original Martha Creek system was supplemented by a new system taking water from Trout Creek, constructed by the CCC in 1933. This new gravity system delivered water through over 13,000 feet of wood pipe through the center and north end of the fields.

In addition to the conservation projects conducted by the CCC, a major building campaign was also initiated. The Emergency Relief Act made it possible to hire local unemployed skilled workmen to work with the CCC crews on larger construction projects. Local Experienced Men (LEM's), as they were called, were hired to help supervise the enrollees and teach them the skills necessary to carry out their work. Each camp also had an educational advisor, provided by the federal Office of Education. Supplies for constructing and operating the camps, and materials required for the construction projects also helped the local economy, keeping businesses afloat during this difficult time.

The CCC construction projects and forest improvements are the most recognizable evidence of this valuable program. Individually and collectively these sites that include both administrative and recreational facilities and structures reflect a high level of comprehensive site planning and represent a distinctive architectural style. Gail Throop, an authority on CCC construction in the Pacific Northwest, notes that,

> Durability of construction, attention to detail and quality of workmanship are exemplified in the improvements of the Civilian Conservation Corps. But beyond this, an ethic of non-

> intrusiveness is embodied in the sites and structures. Whether rugged as typified by recreational facilities, or refined as found in the administrative structures and their support buildings, the improvements harmonize with their environment, becoming almost a part of it.[10]

Developing work projects and construction schedules for the CCC enrollees involved a deliberate effort to include anticipated needs as well as immediate requirements when facilities were constructed. Administrative sites, ranger stations, and service compounds reflect the new attention to comprehensive planning within the Forest Service, with a continued attention to the potential for expansion. Planning was done on the local level, but often with guidance from the Washington, D.C. office. These significant and coordinated planning efforts allowed the Forest Service to realize its goal of creating harmonious structures, blending not only with the environment but also with nearby buildings.

6. Trout Creek (Hemlock) Dam is Planned and Constructed

In addition to building barracks, residential structures, and utility buildings, the CCC enrollees at Camp Hemlock made other major improvements at the Wind River Administrative Site. The former Wind River Lumber Company's splash dam still served as a source of hydroelectric power for the Nursery, Ranger Station and Research Station. In 1934 it was reported that the power plant could not handle the additional demand for electricity from Camp Hemlock, with its population of over 200 people, along with new structures within the Nursery complex. The generating machinery was in poor condition and very noisy. The old dam itself was also in poor condition, and in need of extensive repair.

With the need for a new power plant easily justified, it was determined that a concrete dam capable of regulating water flow and passing fish above the dam would be constructed. No doubt, the presence of the CCC as an available low cost work force also factored heavily into the decision to build a new, larger and more technologically advanced structure for the expanding needs for power and recreation at the Wind River site. The dam was to be of concrete and have a "fishway,"[11] a relatively new fish conservation measure for the time.

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[10] Gail E. Throop. "Utterly Visionary and Chimerical: a Federal Response to the Great Depression: an Examination of Civilian Conservation Corps Construction on National Forest System Lands in the Pacific Northwest." M.A. Thesis, Portland State University. 1979: 28.

[11] The term "fishway" is used on historic drawings in this report, and is synonymous with the term "fish ladder." A fish ladder is basically an inclined trough in which water flows from the upper to the lower pool

In this effort, Forest Supervisor Kirk P. Cecil was the driving force, although Region 6 engineers (with initials R.W.L. and H.E.H.) served as designers. Planning for the dam began in September of 1934, and initial construction work began in February of 1935. After the acquisition of a three yard cement mixer ("A new concrete mixer has been awarded the Columbia – a two sacker they say. Goes to Hemlock dam first run" *Columbia Bar* 1935), work started on the dam, which was located immediately below the splash dam, early in 1935.

An internal Forest Service newsletter called the *Columbia Bar* described the project in February of 1935:

> The old Trout Creek Dam and Bridge at Hemlock have about served their usefulness and are about to be replaced with new structures. A concrete arch dam will be built below the present dam. A crew of CCC's have been excavating for solid footing for the dam and expect to be down to solid rock in a few days. Bids have been issued by the Regional Office for concrete, sand, and gravel. As soon as this material arrives we will be ready to start on the concrete work.
>
> By careful planning we will be able to keep the hydroelectric plant in operation while the new dam is under construction. The generator will have to be operated by an engine for two or three weeks while changing the pipe line. A concrete fish ladder will be constructed at the dam.

In 1936 the CCC began development of a picnic area along the north shore, which included a boat launch, boat dock and swimming float, and beach facilities. The magnitude of the project was noted by the *Vancouver Evening Columbian* in the May 6, 1936 edition,

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in a series of compartments or chambers. The trough, which may be made of wood or concrete, contains tiered chambers, with successive elevation changes which permit the fish to move from one chamber to the next through the opening which allows water to pass. If the elevation change from upper to lower pool is great the structure may contain one or more "swithbacks" in which the orientation of the structure will change direction. Chambers are designed to be large enough to permit the fish a resting place before attempting (swimming or jumping depending on elevation change and chamber design) to the next higher level, until the journey to the top pool is achieved. A fish heading downstream would reverse its path. The design of a fishway takes into account the strength and jumping ability of the individual species of fish it must accommodate. The elevation change between successive chambers will be smaller for weaker fish species. Examples of designs include a "rapids" type" in which the elevation change is small and the water flows from alternating chambers in which the baffle walls are shorter than the chamber, creating kind of a zig zag rapids for the fish to swim following the flow of swift water. The second is a "sluice type" in which each chamber contains a weir within the full length wall, but the weir is placed in alternating locations across the wall, and also produces a zig zag path. A weir and stall design was selected for the fishway at Trout Creek Dam, which could be easily traversed by the muscular and strong swimming trout species of the drainage, including the steelhead trout, an anadromous fish native to Trout Creek.

> In the immediate vicinity of the nursery is located the largest CCC construction project undertaken in the United States. It resulted in the erection of a concrete dam to provide water storage and water power for the Forest Service. The lake behind the dam is to be stocked with fish and will be of service for public recreation.

7. Wooden Arch Bridge above Dam

After the dam and fish ladder were completed, the CCC began construction of a three-hinged wooden arch bridge across the creek in January of 1936, to replace the Wind River Lumber Company's log bridge. Completed in June of the same year, this bridge was designed by Forest Service engineers and built by CCC labor under Forest Service direction.

> The new bridge will be an arch rib type bridge, which will cross the pond above the dam. This is a new type of wood structure and will fit in well with the dam and surroundings. *Columbia Bar*, Feb 1935.

This 1936 bridge was replaced in 1975 by a concrete bridge built in approximately the same location. The concrete bridge remains in place as of 2007.

8. Post-CCC Development at Trout Creek Site

In 1940 the direct current (DC) generator at the power plant was replaced by an alternating current (AC) generator, capable of supplying electricity to the entire compound at Wind River. By the 1950s, however, Bonneville Power Administration[12] began supplying electricity to the administrative site, and the power plant was shut down and eventually removed. A new intake and screening system for irrigation was completed on the dam in 1954, utilizing the outlet that formerly supplied the powerhouse with water. A pumphouse was installed immediately below the dam in 1958, providing water to irrigate newly-developed Nursery fields. Water for the Nursery was regulated by a valve structure located in the left abutment non-overflow section of the dam.

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[12] Bonneville Power Administration (BPA), also a New Deal era project, is a self-financing federal agency created in 1937 which transmits and markets hydroelectric power from generation facilities initially constructed on the Columbia River. Its first power generation projects, started in 1933 and completed in the following years, included Bonneville Dam (1938) and Grand Coulee Dam (1941). Its service area included parts of Washington, Oregon, Idaho and Montana (http://www.bpa.gov/).

Timeline Summary:

1881 - First sawmill completed at Carson near mouth of Wind River at confluence with Columbia River

1890 - Bridge across Wind River allows access to middle and upper valley

1898 - Erikson Homestead in upper valley near site of Wind River Work Center

1901 - Story & Keeler begins systematic purchase of homesteads in upper Wind River valley

1902 - Splash dams built for log transport down Panther Creek and Wind River

1903 - Camp 3 logging camp and splash dam constructed on north side of Trout Creek

1907 - Forest Service Ranger station is constructed on south side of Trout Creek across from Camp 3

1909 - Wind River Nursery established

1912 - Wind River Arboretum Established

1913 - Forest Service expands administrative site;
Wind River Experiment station established

1923 - Forest Service converts Wind River Lumber Co. splash dam to hydroelectric use and builds powerhouse on north side of Trout Creek under long term lease

1924 - Ranger district building are wired for electricity

1926 - Wind River Lumber Co. sells company lands following foreclosure

1929 - Forest Service purchases former site of Camp 3 and splash dam

1933 - CCC "Camp Hemlock" is established; occupied by Company No. 944

1934 - New power house constructed

1935 - Trout Creek Dam is designed; construction of dam (Feb.– Sept.); construction of fish ladder begins

1936 - Fish ladder completed, and Three-hinged wooden arch bridge built (Jan. – June)

1940 - Direct current (DC) generator replaced with alternating current (AC) generator

1950s Bonneville Power Administration begins supplying power for Wind River site; power generation function of dam ceased

1954 - New intake structure and screening system installed for irrigation purposes

1958 - Pump house installed for irrigation of nursery fields

1995 - Fish attraction flow pipe assembly installed across dam, concrete wall added and lower weir of fish ladder modified. Expanded metal grating added in same area

Part II. Structural/Design Information

A. General Description:

During the first two years of the CCC program the Forest Service developed and distributed national policy and technical guidance material to assist Forest Service engineering staffs and decision-makers at the Region and individual Forest levels in making technically and economically sound decisions regarding the projects for which they were responsible. Among these was a guidance document dedicated to the design and construction of Forest Service dams.[13] It is likely these sources were consulted by Region 6 and the Columbia National Forest in securing preliminary approval for the proposed dam project at Trout Creek, and would also have aided engineers and draftsmen in preparing the final design documentation. The Trout Creek (Hemlock) Dam is a concrete arch dam, with integrated "fishway," or fish ladder, allowing fish, primarily powerful steelhead trout to migrate from the stream below the dam to the reservoir above (Hemlock Lake) to their upstream spawning areas.

1. Dam: The concrete arch dam design is ideal for this location on Trout Creek. The span is short and the dam height is low. Competent basalt

[13] United States. Department of Agriculture, Forest Service, *Design and Construction of Forest Service Dams for use of Civilian conservation Corps*, 1935.

rock is present at the north and south abutment locations to resist the arch thrust from the weight of stored water. The arch type dam also uses less concrete per linear foot than similarly sized solid gravity or hollow gravity dams. An arch dam is preferred to either stated alternative because it is less costly to construct, in part due to less concrete.

The concrete arch dam measures 183'-0" across, with a 112'-0" wide spillway. The height of the dam is 26'-0" to the crest of the spillway; the north and south abutments extend upward another 6'-0", making it 32'-0" to the tops of the abutments. The outer radius across the face of the dam is 100'-0". Dam thickness at the base 4'-8". Crest width is 4'-0". The principal spillway is an overflow dam crest, located at the center of the dam. Controls include flashboards capable of raising the reservoir level up to approximately 3 feet above the crest spillway, although stand pipes appear to be only about 2 feet high along the north portion of the spillway crest in 2007. The dam has a discharge capacity of 5,100 cubic feet per second over the crest. A total of 440 cubic yards of concrete was used in its construction.

The Trout Creek drainage area to the dam is 29.2 square miles, and active storage was 173 acre-feet, with surface area at the dam crest of 20.5 acres (at dam crest elevation of 111.0'). Surface area at spillway crest is 11 acres (at elevation 104'), as measured from datum points on historic diagrams.

The dam was completed in September of 1935, and work began immediately on the fish ladder. Work on the fish ladder continued through the winter of 1935-36.

2. Fish Ladder: The fish ladder or "fishway" assembly is an overflow weir and stall-type concrete design. It was constructed of cast in place concrete, except that native basalt rock is incorporated as a south wall in all but five of the individual stalls along the slope. It is approximately 155 feet long, with one "switchback" near the middle of its length. It was completed in December 1935. It runs along the south bank of the creek, through the south abutment.

The following description of the fish ladder progresses from the crest of the dam at the south abutment, to the stream channel at the base. The upper entrance of the fish ladder through the dam has a submerged 2'-0" x 2'- 0" opening, located immediately behind the upstream metal trash rack. The trash rack extends from the south bank diagonally to a point where it joins the arch near the south abutment. The projection of the fishway, at its

top, is away from the south abutment of the dam at an angle of 59 degrees, as it loses elevation from just below the level of the crest. Four chambers or control pools with slots are located at the head of the fishway. These chambers are 5'-0" in length, and the first three are 5'-0" wide. The fourth chamber is 5'-6'' wide.[14] Below these chambers there are eight weirs in the upper part of the fishway. Below the eighth weir the fish ladder makes a turn of almost 150 degrees, back toward the base of the dam. The lower part of the fishway contains ten weirs. Each weir has a rectangular notch, measuring 1'-6" in width, and varies in depth from just over 10.5" to just under 1'-1".

The pools which are formed between the weirs average 5'-6" in length. The width of the pools ranges from 5'-0" to 11'-2". The variation is due to the fact that the natural rock was utilized for one side of the ladder whenever possible, resulting in extremely varied widths, while the formed longitudinal wall maintained its straight parallel course as the outer wall, opposite the native rock. The bottom of each pool appears to be comprised of the native rock, which has either been blasted or chipped to relative uniform depth, based on historic drawings. The depth of the pools from the lowest point on the weir wall to the bottom of the pools average 3' to 4' or more, depending on how much water is flowing through the assembly through the weir opening. The concrete walls of the ladder are 8" thick. The bottoms of most of the pools appear to be carved from the native basalt rock based on historic drawings.

Portions of the fish ladder at the top, and at the base of the dam were modified in 1995. These modifications are more fully described below.

B. Construction:

No construction logs or engineering diaries for Trout Creek Dam, fish ladder or power plant have been found, however select historic photos give some insight to the construction methods used by the Forest Service engineering staff for this project. In addition, guidance material such as the Design and Construction of Forest Service Dams,[15] and the Civilian Conservation Corps Handbook[16] would likely have been consulted, especially for technology and technique for cement mixing and concrete ("Concrete" is cement with appropriate portions of sand,

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[14] At some point, expanded metal grate work has been affixed over the top of the first four chambers. It is believed this was part of the 1995 modifications discussed in Section 2.D.
[15] USDA, Ibid. 43-60.
[16] USDA, Forest Service. Civilian Conservation Corps Handbook. 1935 [Washington State Library, Olympia].

gravel or small rocks mixed together, in which the cement serves as the matrix bonding agent. The term "cement" is often used generically to include concrete).

1. Dam: Photos taken during dam construction show concrete being hauled in wheelbarrows by CCC enrollees, as well as a three-yard cement mixer, set in various locations on platforms with the cement being transported to forms or wheelbarrows by means of a chute. Concrete form construction of the arch was first undertaken beginning at either abutment. The last section to be constructed was the center segment of the arch, allowing the creek to flow until the last of the construction. The creek was then diverted through other bypass structures or was transported in an 18" diameter wooden pipe, built on a trestle-like support, to the new power house situated on the creek about 200 yards downstream.

Wind River District Ranger Ross Shepeard helped work on the dam, as indicated in his daily diary entry for Aug. 23, 1935:

> (23) Trout Cr Dam 14
> Began work at 8 A.M. spent the day helping Mr. Howard on the Trout Cr dam, Built the coffer dam and poured concrete, finished the base at 11 P.M.

2. Fish Ladder: The fish ladder is incorporated into the native basalt flow rock of the slope. Thus, nearly all south walls of each chamber, except the turn area, consist of native rock, while the other longitudinal walls or weir walls running at 90 degree angles to the longitudinal walls are of form cast concrete, using shiplap board forms. Significant detail work, including careful cleaning of mud from rock fissures, would have been required to ensure competent bonding of fine grouting or cement work to the native rock. Specifically, longitudinal concrete walls were secured to the native rock by placement of 7/8"diameter steel dowels, up to 14" in length, and grouted into drilled holes in the basalt on the one end, and the other end imbedded into the poured concrete created from the forms. Likewise, weir walls were secured to the native basalt walls with 7/8" doweling up to 24" long and grouted into the basalt on one end, and the concrete formed longitudinal wall on the other. Weir walls were secured to longitudinal walls by carefully cleaned, hooked steel bars of 7/8" diameter, running the width of the wall and secured in the longitudinal wall or native basalt, as the case may be.

As was noted in the fish ladder description in the previous section of this report, the bottoms of some, if not all, of the pools appear, based on historic drawings, to be sculpted from the natural basalt rock, which would

have been blasted or chipped out before the concrete wall work was constructed.

C. Operation: The design of Trout Creek Dam allowed for a variety of ways to pass water.

The dam, at the time of construction, could bypass water four ways:

1. Across the full width of the dam crest spillway for a full distance of 112', or any segment thereof, through strategic placement of "flashboards," historically to a height of up to 3.'

   The water level of Hemlock Lake could be increased for recreation or to direct more water to the fish ladder through the placement of flashboards (also called "stoplogs") into "H" shaped metal stanchions attached to 2" diameter stand pipes connected to metal fittings imbedded in the concrete, across the crest. The "H" shaped brackets are of the same height as the standpipe, and are spaced a distance of 5'-1" on center. Finished cedar or fir boards (finished size 1 5/8" x 4" (or 6" to 8") x 58") were manually placed on edge into the stanchion brackets.

   When assembled across the dam at uniform, or different, heights for particular segments, the level of the reservoir could be increased up to 3' or any lesser depth from the crest top. By strategic placement of the flashboards, water flow could be easily directed to any location across the crest spillway, for example the area just above the fish ladder entrance to attract fish to the structure. The standpipes with flashboards in place were designed to fail under severe flood conditions. Based on the fact that only a portion of the spillway crest presently contains standpipes of 3' in height, while other sections now contain standpipes of 2' or less, it is presumed that such a failure occurred. Alternatively, pipes may have been modified, or shorter new pipes installed at those locations.

   Seasonally, the flashboard assembly was managed to direct flow to the deepest parts of the stream channel below to avoid rocks, when bypassing downstream migrating fish, including smolt (juvenile fish). In more recent years, the flashboards have been lined with black poly plastic sheeting on the upstream side, to stop water leaks and reduce smolt mortality from

injury or death caused by being trapped against the flowing water and held against or between the sometimes leaking flashboards.[17]

2. Through the power generation (and later the Nursery pump house) diversion pipe, or penstock.

3. Through the waste flow, or sluice gate opening, with slide head gate near north abutment at base of dam. The dimensions of the downstream opening are 3'-0"x 4'-0". This feature was used to flush sediment from the base of the dam until approximately 1977, when it was determined this had adverse effects on downstream aquatic habitat.

4. Through the submerged 2'-0 x 2'-0 fish ladder opening, along the south abutment and down the fish ladder assembly.

A fifth means of by-passing water was created in 1995 with the addition of a 24" diameter high density polypropylene pipe near the power plant intake near the north abutment.

D. Detail of 1995 Modifications to Dam and Fish Ladder

The fish ladder has undergone minor changes over time to meet fisheries management objectives, including changes directed at the depleting native steelhead trout population in recent years. In 1992 an adult fish trap was installed at the top of the fish ladder. Its purpose was to trap returning adult steelhead for study of migration characteristics in the Trout Creek watershed. The trap was removed in January 1993 because of concern that its presence may have contributed to the low return of adult fish since it was installed.[18] The extent of the physical modification of the 1935 structure by the 1992 modification is not known.

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[17] Charlie Cochran, Washington Department of Fisheries, October 28, 2007, interview with Terrence Trembly.

[18] Dwight Edward Perkins. *"Evaluating Small Dams to Improve Stream Conditions for Anadromous Fish."* Master's thesis, Washington State University. 2000. The paper includes a literature review and summary of scientific and technical concerns regarding the fish passage "attraction flow" issue. The paper also develops engineering alternatives to address the problem, including dam and sediment removal, and construction of a pilot channel for this reach of Trout Creek. The alternatives considered are directed to returning Trout Creek to its pre development state.

The dam and fish ladder were rather significantly modified in 1995 to increase the "attraction flow" for fish migrating upstream.

It was believed by fisheries managers that upstream migrating fish were confused when confronted by water falling over the crest spillway, especially during periods of high flows. The natural instinct of the fish is to seek out the area of highest flow, and try to jump up over the spillway. This, of course, is impossible, as the crest is some 26' above the stream below the dam. This condition is amplified when the streamflow over the spillway crest is great, since it can be significantly larger than the flow through the fish ladder. Alternatively, the fish did not seem to be sufficiently attracted to the opening of the fish ladder. So, a means to attract fish to the area of the fish ladder was believed, at the time, to solve the problem. Photograph No. 15 shows the design for the 1995 attraction flow assembly. A large volume waterline was installed to increase attraction flow for fish at the fish ladder entrance below the dam, theoretically directing them to the fish ladder. The fish ladder was itself modified, with the addition of a concrete wall extending out from the downstream end of the fishway, towards the face of the dam. The lowest weir of the fish ladder was modified and replaced with a wall and slot.

The large volume waterline was installed to transport water from just upstream of the dam at its face, to the base of the fish ladder just below the dam. This modification consists of a 24" diameter high density polyethylene pipe assembly that is oriented north to south along most of the width of the dam. The intake is located on the upstream face of the historic intake manifold for the power plant/irrigation diversion, near the north abutment, behind a traveling screen (conveyer type trash screen). A 26" diameter hole was drilled in the south wall of the intake downstream of the traveling screen. The waterline was attached to the upstream face of the dam for its length. The pipe traverses the upstream dam face for 72', contouring the dam face just below the crest, angling slightly downward. Another 26" diameter hole was drilled through the dam face, near the south end of the dam. Here, the waterline exits the downstream dam face at right angle to dam face, about 6' below the crest. The pipe then turns 97 degrees nearly paralleling the dam face to the south, and projects downward for a distance of approximately 30 feet, beneath the surface of the water. The last 23' of this pipe is perforated allowing the water to diffuse below the surface, thus creating the attraction flow for fish migrating upstream.

In addition to this feature a waste flow was added with an 8" polyethylene pipe which snugs the north bank just below a concrete retaining wall paralleling the old power plant.

Whether the 1995 attraction flow modifications were economically justified, is the subject of substantial debate among fisheries managers. Critics view the

modification expenditure as questionable, especially in light of other factors which contribute to low fish returns to the Columbia River system and Trout Creek.

C. Condition of Dam and Fish Ladder:

1. Dam: The dam has been assessed periodically by the Washington Department of Ecology Dam Safety Section, beginning in the mid-1970s. The last detailed safety report was prepared in 2000. The dam is currently classified for downstream safety hazard as "High, Hazard Class 1C." This classification, one of five classes, means that if the dam fails, it has the potential for major economic loss to as many as 3 to 10 structures downstream in a low density suburban area, with some industry and work sites, including primary highways and rail lines.[19]

Beginning with an inspection in 1985 the state identified the following items of concern:

a. The north buttress had numerous cracks extending to an unknown depth into the structure.

b. Large quantities of calcium precipitate were observed on the downstream face. The quantity and color were such that an alkali-aggregate reactivity (an expansive chemical reaction between the cement and minerals in the aggregate) was suspected.

c. Significant quantities of seepage were showing on the north end of the dam between the buttress and the abutment.[20]

Other inspections, cited within the body of the 2000 report, state that the dam has functioned adequately since 1935 without incident. Concrete varies from poor to fair condition, and silt is building up behind the dam. These conditions raise concerns that the original design loadings are being exceeded (citing 1987 report prepared by Civil Engineering Section, Gifford Pinchot National Forest). Reaching a slightly different conclusion; the U.S. Army Corps of Engineers opined in 1992, that the concrete exhibited excellent strength, with minor signs of alkali-aggregate reactivity, and that no signs of distress showed, permitting a conclusion that no structural calculations were required to support the adequacy of the dam design.[21]

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[19] W. David Cummings, P.E. and Douglas L. Johnson P.E., Trout Creek Dam Periodic Inspection Report. Washington State Department of Ecology. Publication 00-11-08. April 2000. pp. 3-6.
[20] Ibid., 3.
[21] Ibid., 3-6.

The conclusion of Washington Dam Safety in 2000 was that Trout Creek Dam appears to be fairly well maintained, and under normal loading conditions appears to be stable. However, given the upgrade in downstream hazard classification and the unknown stability of the dam under extreme loading conditions (flood stage), more analysis would be required if the Forest Service wishes to retain the dam and reservoir. Specific concerns were raised about dam competence for earthquake resistance [22]

The waste flow gate at the base of the dam, near the north abutment was stuck in an open position when observed in late October 2007, by an author of this HAER report. It appears there is woody debris jammed in the inlet structure, and it is unknown how long this condition has existed.[23]

2. Fish Ladder: The fish ladder does not seem to have been formally assessed for structural integrity by any regulatory agency. However, in a recent visual inspection it is noted that some of the original fish ladder weir walls, especially in the lower section, are failing, likely the result of deterioration of cement bonding at the interface of the concrete weir wall and the native basalt rock, and decomposition (rusting) of the steel reinforcing dowels or the concrete surrounding them. A few weir walls have been temporarily stabilized with 2" x 4" planks wedged between failing weir walls and an adjacent down stream weir wall which is stable, thus increasing the hydraulic loading on the downstream wall.[24]

At the entrance to the fish ladder below the dam, the expanded metal walkway grating and railing on the wall of the 1995 attraction flow modifications are damaged, and have been twisted and rotated. The cause is apparently the result of heavy debris coming off the dam crest spillway during recent flood events, possibly as recently as 2005. The attraction flow 24" water line pipe assembly and the wall itself appear to be intact. Some of this flood damage is visible in Photograph No. 5.

Electronic fish count monitoring devices are present at several locations along the ladder, especially above and below nearest chambers at the turn. These will likely remain until the dam and fish ladder are removed.

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[22] Ibid., 19.
[23] Visual inspection by Terrence L. Trembly, October 28, 2007.
[24] Ibid.

Part III. Sources of Information

A. Primary Sources:

U.S.D.A. Forest Service, Region 6, Columbia Forest. General Plan Trout Creek Dam. Dec., 1934 (Rev. July 1935). Sheet 1 of 7. (CAD file Id. 573119341W1D0l)

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B. Secondary Sources:

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Tolfree, Jamie. History of the Wind River Lumber Company in the Upper Wind River Valley, Part 2. *Skamania County Heritage* 13(4). 1985.

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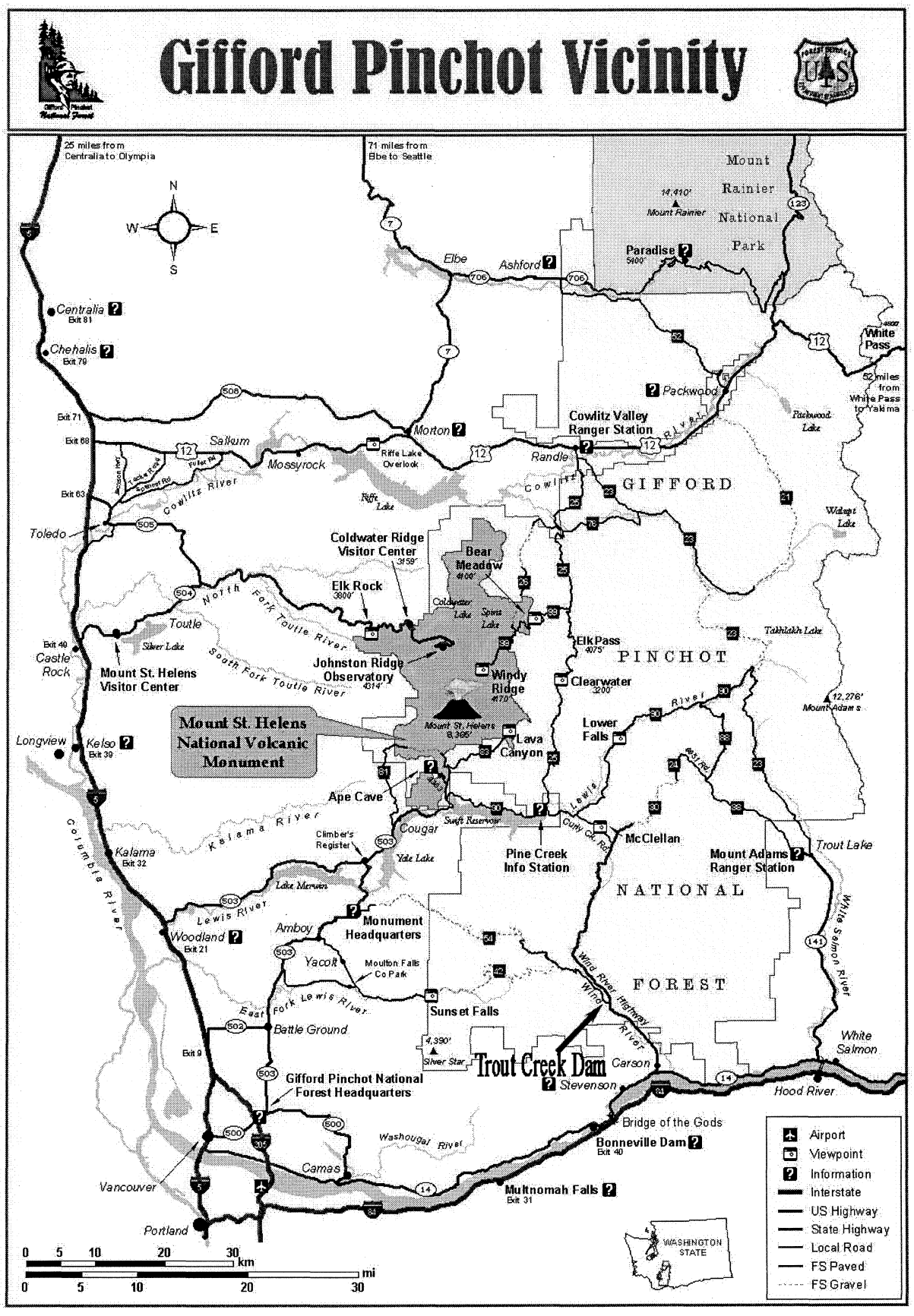
C. Likely Sources Not Yet Investigated

No additional reference sources are known to exist relating to the 1934-1936 design, construction and operation of Trout Creek Dam and the fish ladder. The current belief is that they were accidentally destroyed or lost. These files are thought to have contained engineering information on construction of the dam, power plant and reservoir (and possibly the arch bridge). Trout Creek Dam and CCC Camp Hemlock were selected for archiving during the first years of operation of the National Archives (NARA). It is the authors' understanding, some information was returned to the Forest Service–Region 6, by NARA, Pacific Northwest Region, in the 1980's. It is not clear what information was returned. However, it is

possible, although not highly probable, some historic materials may exist at Region 6, Portland, OR, or the Gifford Pinchot National Forest, Vancouver, WA, and have been temporarily lost or improperly filed.

Additional documentation on the 1995 Attraction Flow Modifications are available at the Gifford Pinchot National Forest Supervisors Office and Mount Adams Ranger District, Trout Lake, WA.


Gifford Pinchot Vicinity
25 miles from Centralia to Olympia
71 miles from Elbe to Seattle
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W
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Mount Rainier National Park
14,410' Mount Rainier
Paradise 5400'
Elbe
Ashford
Centralia
Exit 81
Chehalis
Exit 79
White Pass
52 miles from White Pass to Yakima
Packwood
Cowlitz Valley Ranger Station
Morton
Randle
Salkum
Mossyrock
Riffe Lake Overlook
Riffe Lake
Cowlitz River
GIFFORD
PINCHOT
NATIONAL
FOREST
Toledo
Coldwater Ridge Visitor Center 3759'
Bear Meadow 4100'
Elk Rock 3800'
Coldwater Lake
Spirit Lake
Elk Pass 4075'
Takhlakh Lake
Toutle
North Fork Toutle River
South Fork Toutle River
Silver Lake
Castle Rock
Exit 49
Mount St. Helens Visitor Center
Johnston Ridge Observatory 4314'
Windy Ridge 4170'
Clearwater 3200'
Mount St. Helens 8,365'
Mount St. Helens National Volcanic Monument
Lava Canyon
Lower Falls
12,276' Mount Adams
Longview
Kelso
Exit 39
Ape Cave
Kalama River
Columbia River
Kalama
Exit 32
Climber's Register
Cougar
Swift Reservoir
Yale Lake
Pine Creek Info Station
McClellan
Mount Adams Ranger Station
Trout Lake
Lake Merwin
Lewis River
Woodland
Exit 21
Amboy
Monument Headquarters
Yacolt
Moulton Falls Co Park
East Fork Lewis River
Battle Ground
Exit 9
Sunset Falls
4,390' Silver Star
Wind River Highway
White Salmon River
White Salmon
Trout Creek Dam
Carson
Stevenson
Hood River
Gifford Pinchot National Forest Headquarters
Bridge of the Gods
Bonneville Dam
Exit 40
Washougal River
Camas
Vancouver
Portland
Multnomah Falls
Exit 31
WASHINGTON STATE
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Airport
Viewpoint
Information
Interstate
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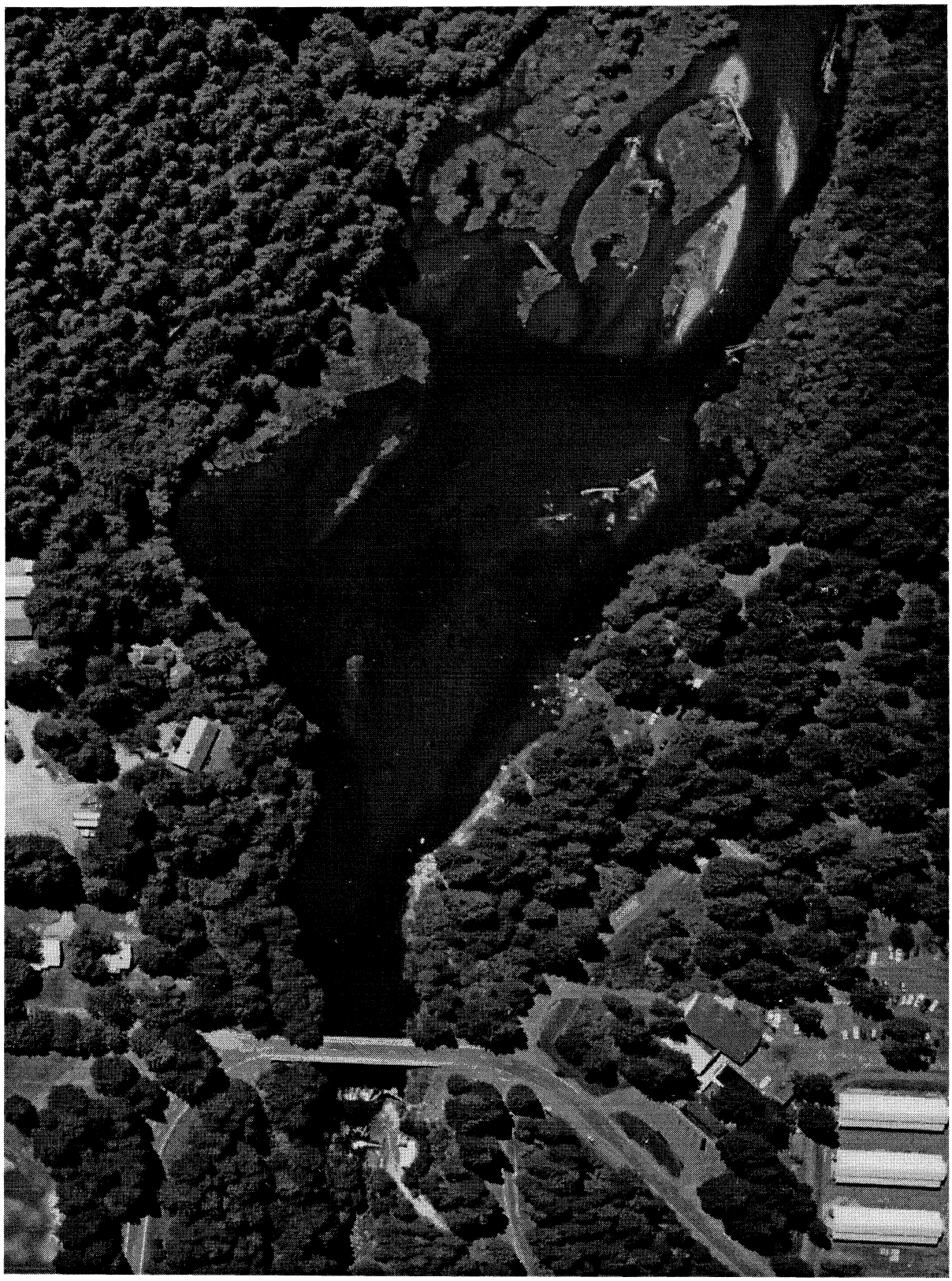
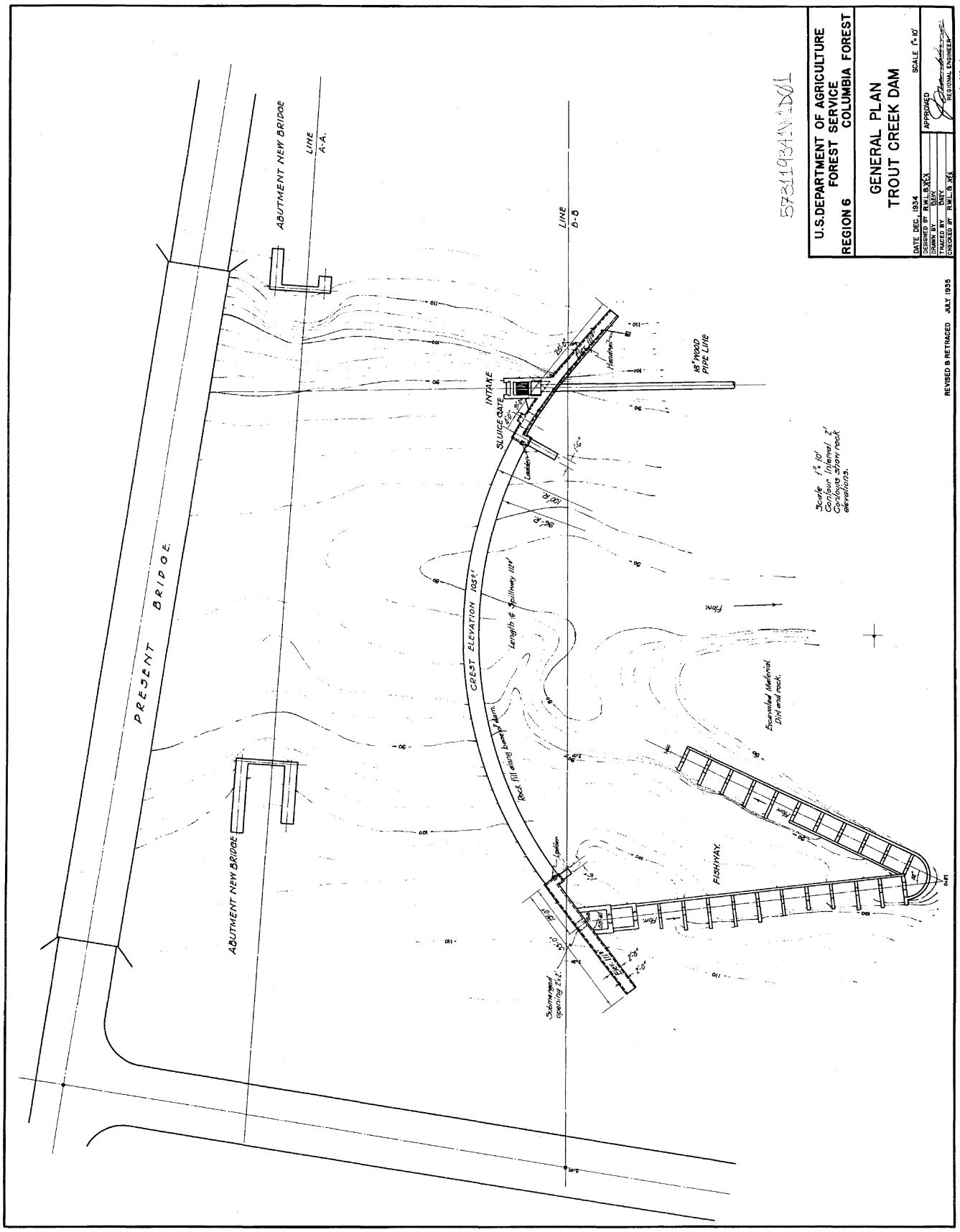
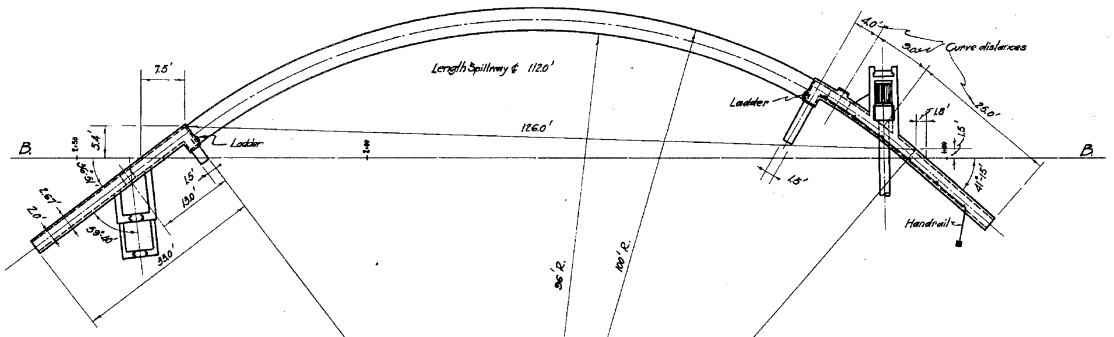
State Highway
Local Road
FS Paved
FS Gravel



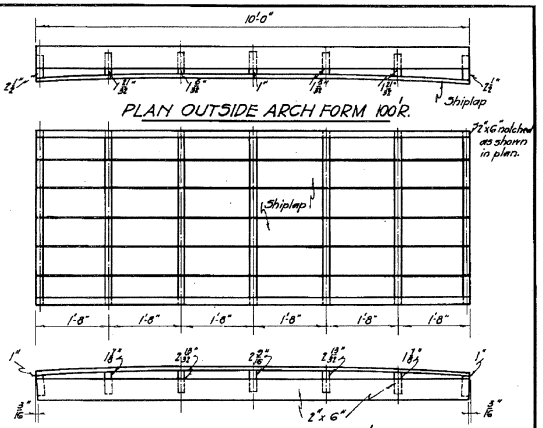
TROUT CREEK DAM AND HEMLOCK LAKE N ⟶

Source: USDA Forest Service, Gifford Pinchot National Forest (aerial photograph)


U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 6
COLUMBIA FOREST
GENERAL PLAN
TROUT CREEK DAM
DATE DEC. 1934
SCALE 1"=10'
DESIGNED BY R.W.L. & W.K.
DRAWN BY B.E.W.
TRACED BY B.E.W.
CHECKED BY R.W.L. & W.K.
APPROVED
REGIONAL ENGINEER
SHEET 1 OF 7 SHEETS
1-W-1
REVISED & RETRACED JULY 1935
PRESENT BRIDGE
ABUTMENT NEW BRIDGE
LINE A-A.
LINE B-B
INTAKE
SLUICE GATE
18" WOOD PIPE LINE
CREST ELEVATION 105.0'
Length of Spillway 112'
Rock fill along base of dam.
Excavated Material. Dirt and rock.
FISHWAY.
Submerged opening 2'x2'.
Scale 1"=10'
Contour Interval 2'
Contours show rock elevations.

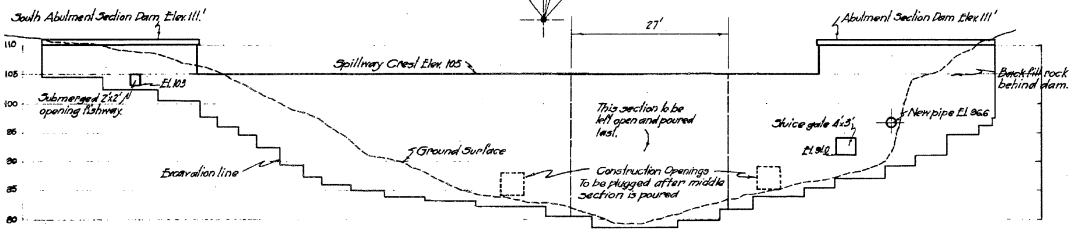


PLAN ARCH DAM.
Scale 1" = 10'

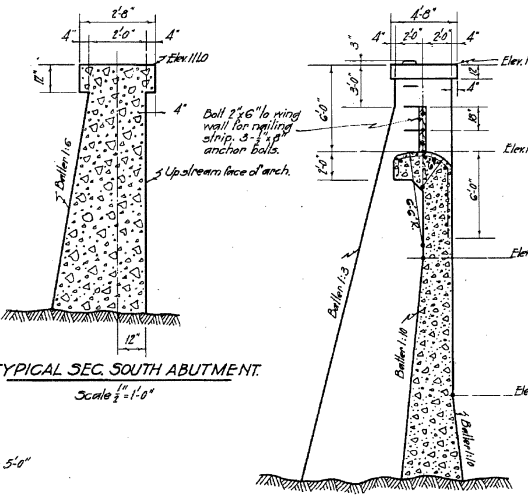


PLAN OUTSIDE ARCH FORM 100'R.

PLAN INSIDE ARCH FORM. 96'R.
Scale 3/4" = 1'-0"

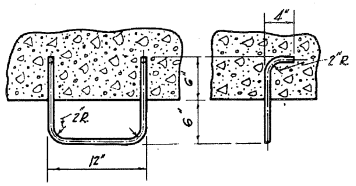


PROJECTED PROFILE ON ℄ DAM.
Horiz. Scale 1" = 10'

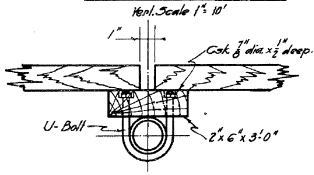


TYPICAL SEC. SOUTH ABUTMENT.
Scale 3/4" = 1'-0"

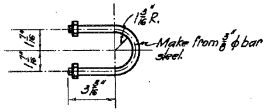
TYPICAL SEC. SPILLWAY PART DAM.
Scale 1/4" = 1'-0"



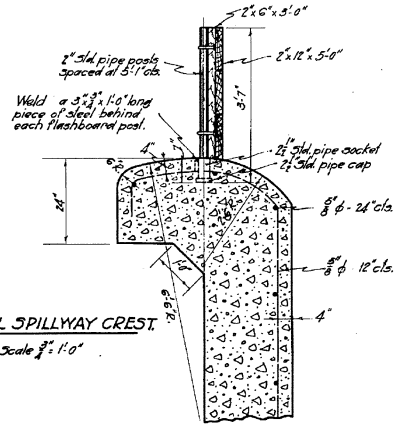
DETAIL LADDER RUNG.
Scale 1 1/2" = 1'-0"
Make ladder rungs from 3/4" ø bar steel x 44" long. 8 Reqd.



DETAIL FLASHBOARD SPLICE
Scale 3" = 1'-0"



DETAIL U-BOLT
Scale 3" = 1'-0"



DETAIL SPILLWAY CREST.
Scale 3/4" = 1'-0"

REVISED & RETRACED JULY 1935

5731 1934 1W2D02

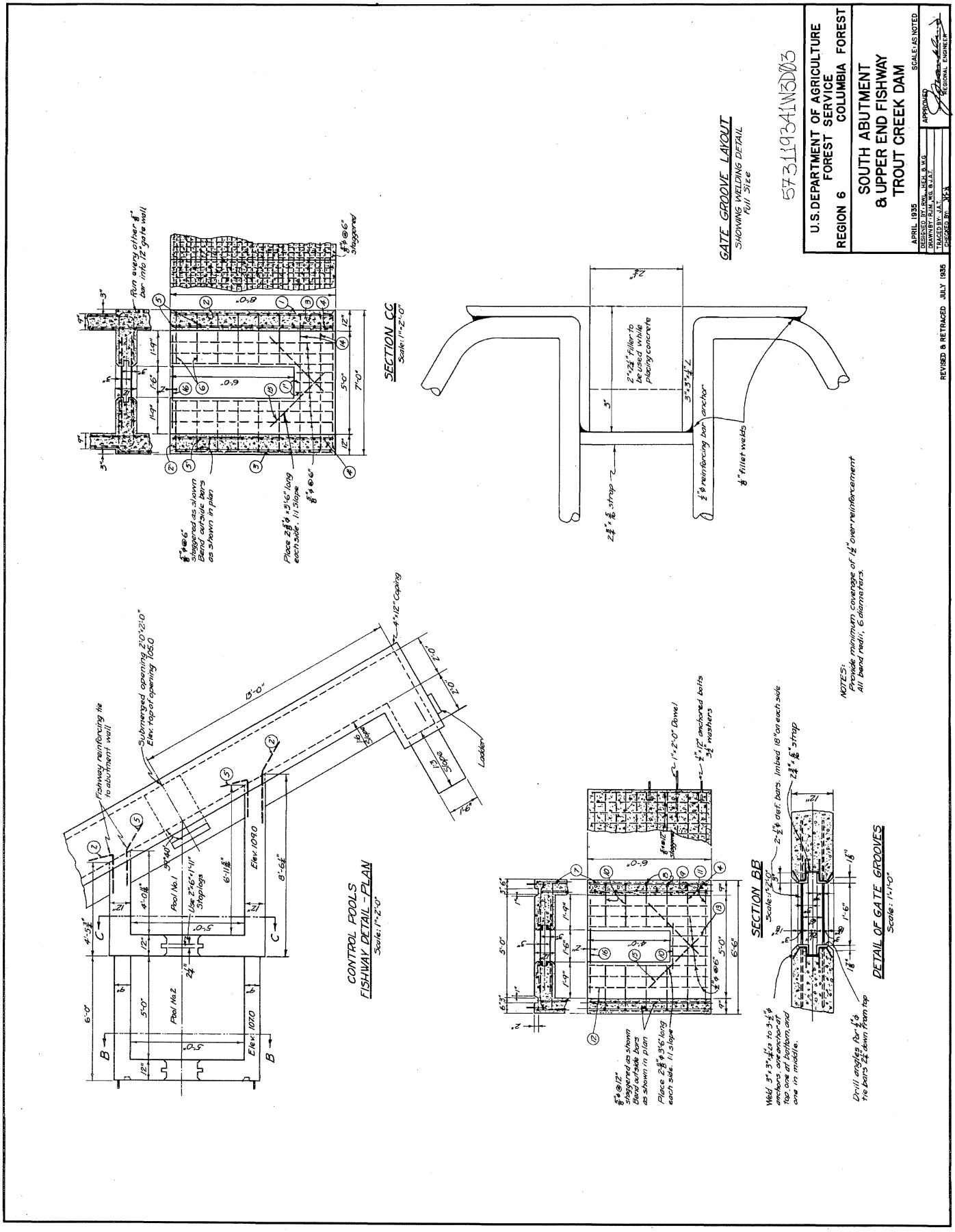
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 6 COLUMBIA FOREST

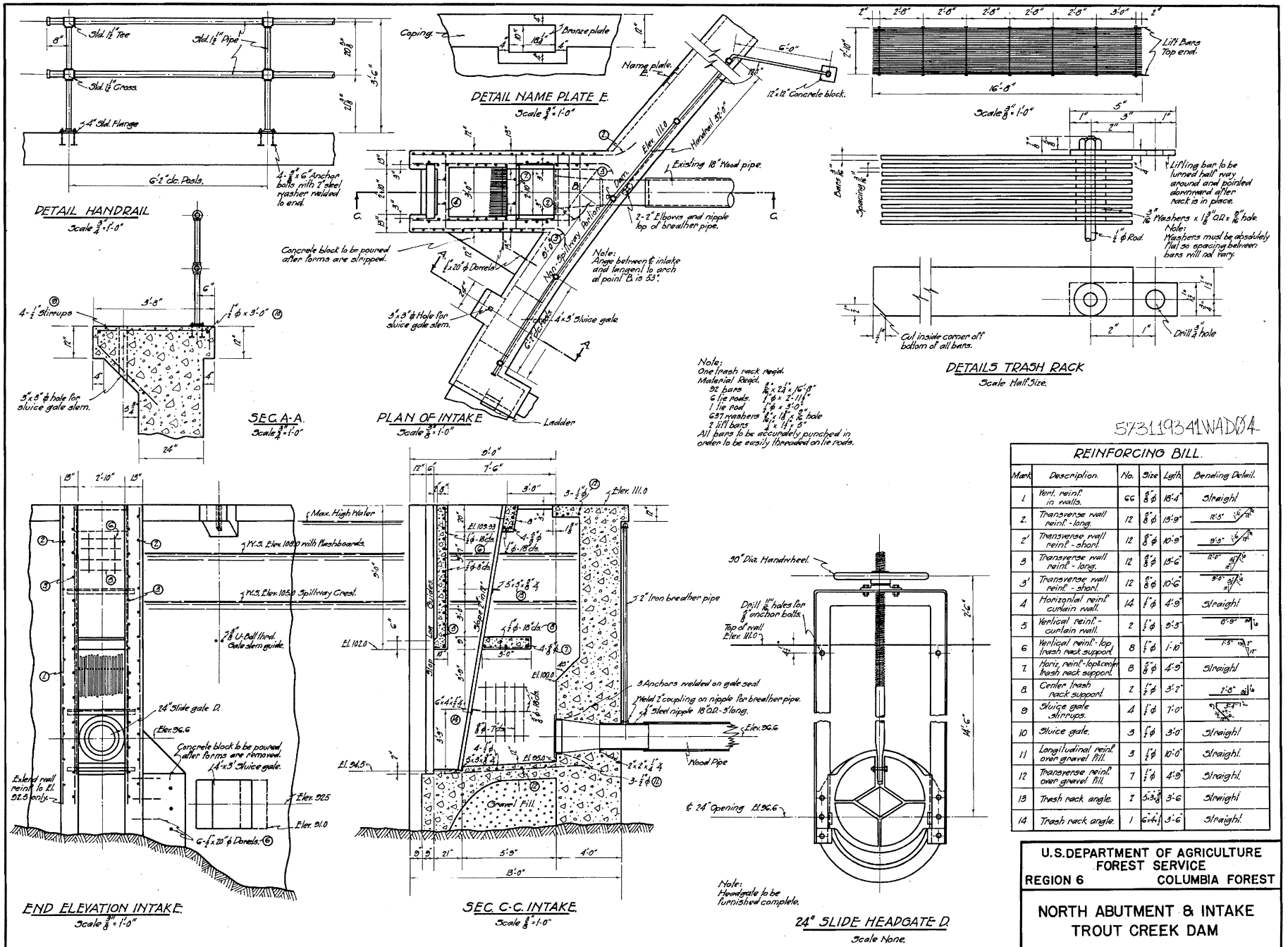
DETAILS OF DAM
TROUT CREEK DAM

DATE APRIL 1935	SCALE NOTED
DESIGNED BY R.W.L. B.W.K.	APPROVED
DRAWN BY R.J.M.	
TRACED BY D.E.P.C.	REGIONAL ENGINEER
CHECKED BY R.W.L.	

SHEET 2 OF 7 SHEETS I-W-2

TROUT CREEK DAM
(Hemlock Dam)
HAER No. WA-182
(Page 32)


U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 6 COLUMBIA FOREST
SOUTH ABUTMENT
& UPPER END FISHWAY
TROUT CREEK DAM
APRIL 1935
SCALE: AS NOTED
DESIGNED BY: RWL, HEL & WG
DRAWN BY: RJM, WG & J.A.T.
TRACED BY: J.A.T.
CHECKED BY: W.G.
APPROVED
REGIONAL ENGINEER
REVISED & RETRACED JULY 1935
SHEET 3 OF 7 SHEETS
I-W-3
573119341W3D03
SECTION CC
Scale: 1"=2'-0"
GATE GROOVE LAYOUT
SHOWING WELDING DETAIL
Full Size
CONTROL POOLS
FISHWAY DETAIL - PLAN
Scale: 1"=2'-0"
SECTION BB
Scale: 1"=2'-0"
DETAIL OF GATE GROOVES
Scale: 1"=1'-0"
NOTES:
Provide minimum coverage of 1/2" over reinforcement
All bend radii, 6 diameters.



5731193411WADD04

REINFORCING BILL.

Mark	Description.	No.	Size	Lgth.	Bending Detail.
1	Vert. reinf. in walls.	66	⅝" ϕ	18'-4"	Straight
2	Transverse wall reinf. - long.	12	⅝" ϕ	13'-9"	11'-5"
2'	Transverse wall reinf. - short.	12	⅝" ϕ	10'-9"	9'-5"
3	Transverse wall reinf. - long.	12	⅝" ϕ	13'-6"	11'-0"
3'	Transverse wall reinf. - short.	12	⅝" ϕ	10'-6"	8'-0"
4	Horizontal reinf. curtain wall.	14	1" ϕ	4'-9"	Straight
5	Vertical reinf. - curtain wall.	2	1" ϕ	9'-3"	6'-9"
6	Vertical reinf. - lap trash rack support	8	1" ϕ	1'-10"	1'-3"
7	Horiz. reinf. - lap & cent. trash rack support.	8	⅝" ϕ	4'-9"	Straight
8	Center trash rack support.	2	1" ϕ	3'-2"	1'-8"
9	Sluice gate stirrups.	4	1" ϕ	7'-0"	3'-1"
10	Sluice gate.	3	1" ϕ	3'-0"	Straight
11	Longitudinal reinf. over gravel fill.	3	1" ϕ	10'-0"	Straight.
12	Transverse reinf. over gravel fill.	7	1" ϕ	4'-9"	Straight.
13	Trash rack angle.	1	5"x3½"	3'-6"	Straight
14	Trash rack angle.	1	6"x4½"	3'-6"	Straight

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 6 COLUMBIA FOREST

NORTH ABUTMENT & INTAKE
TROUT CREEK DAM

DATE APRIL 1935 SCALE NOTED

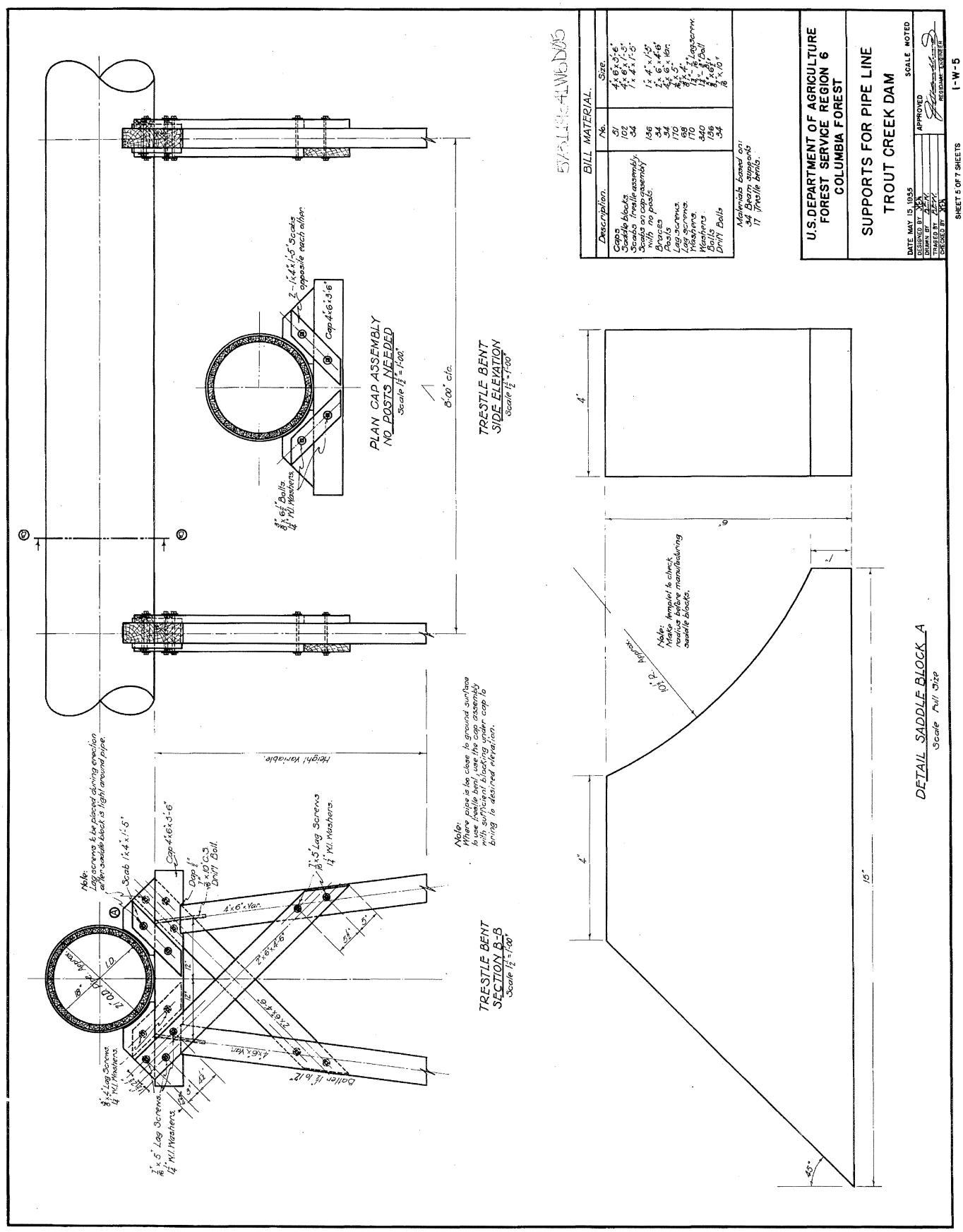
DESIGNED BY	W.K.S.
DRAWN BY	D.E.W.
TRACED BY	D.E.W.
CHECKED BY	W.K.S.

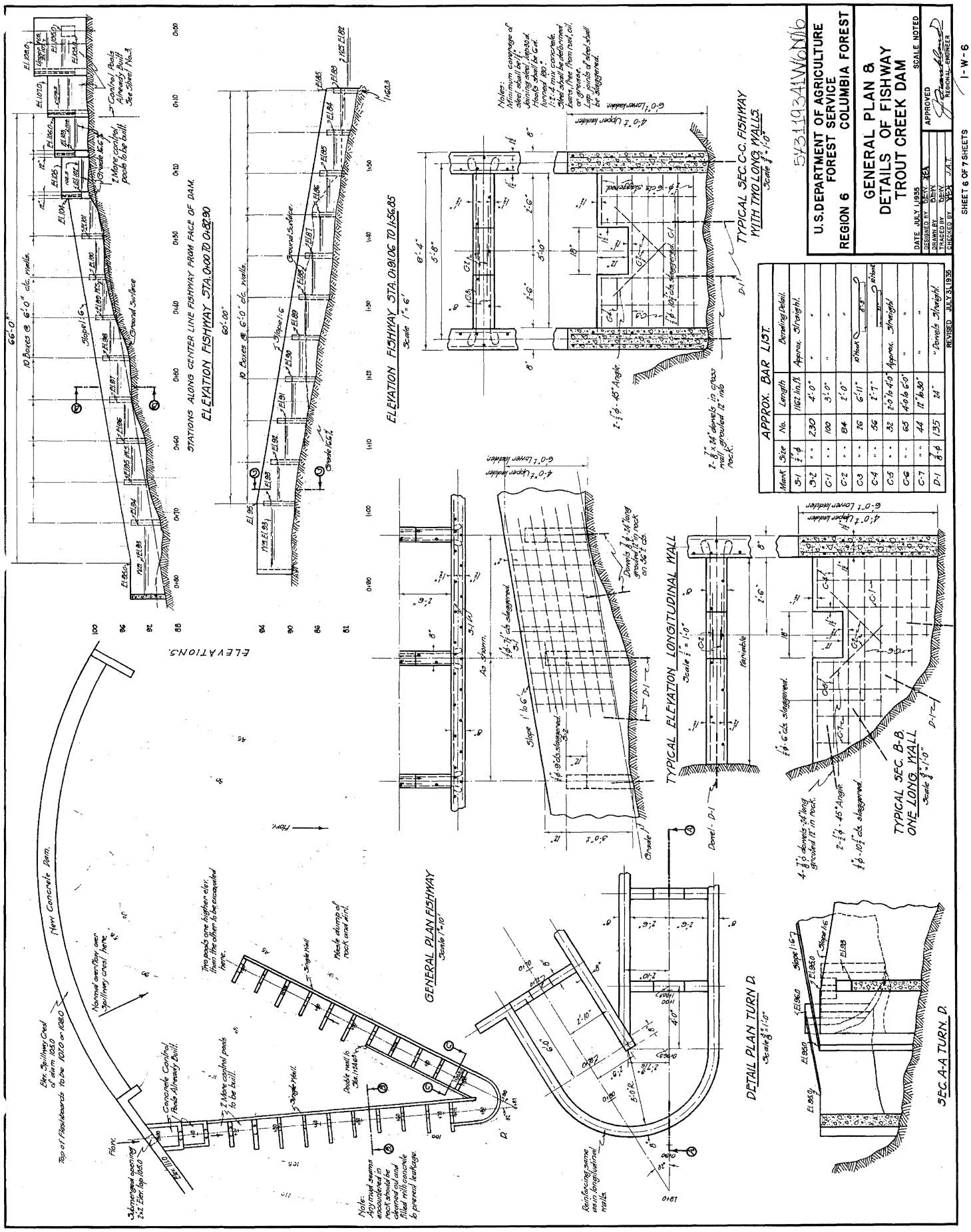
APPROVED
REGIONAL ENGINEER

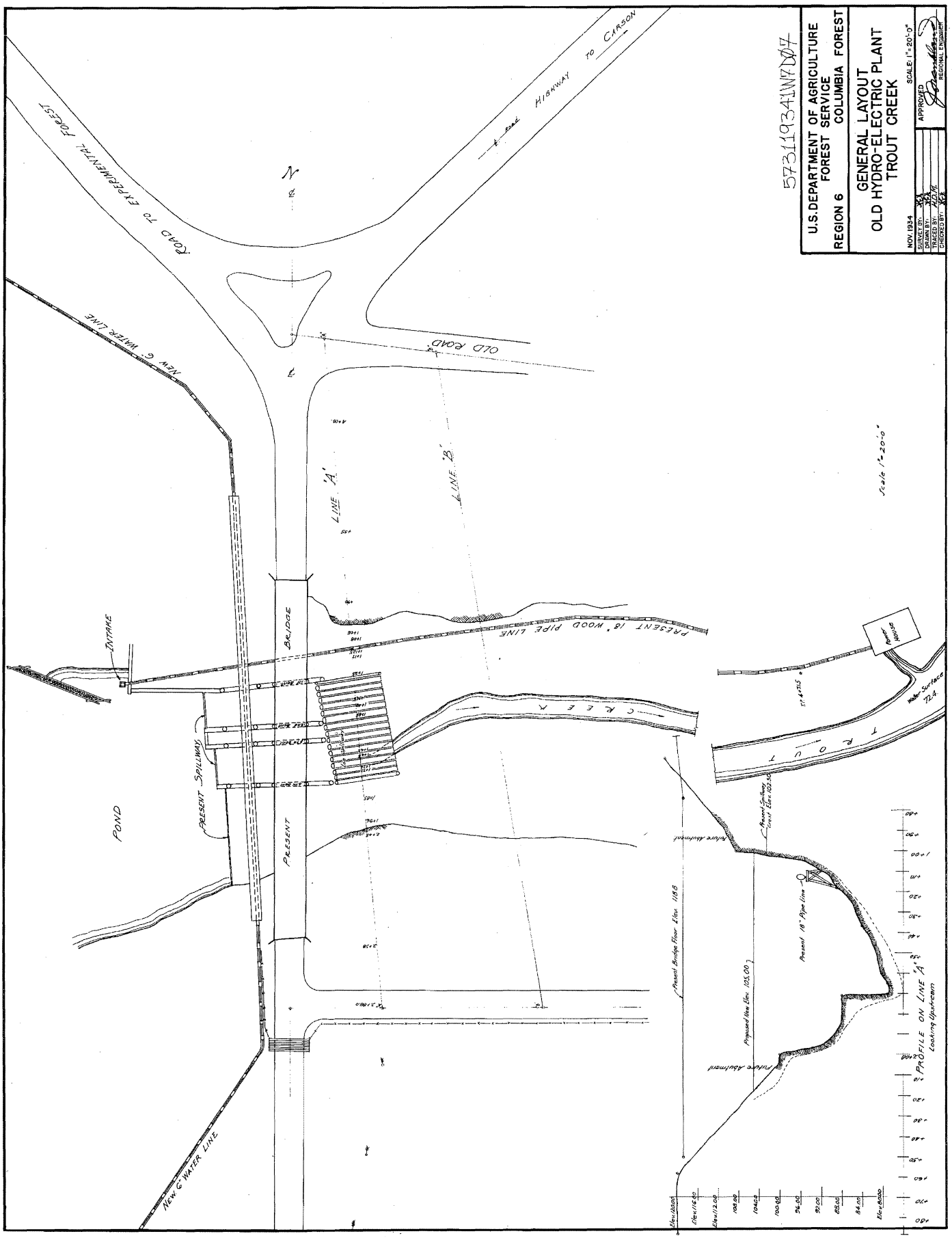
REVISED & RETRACED JULY 1935

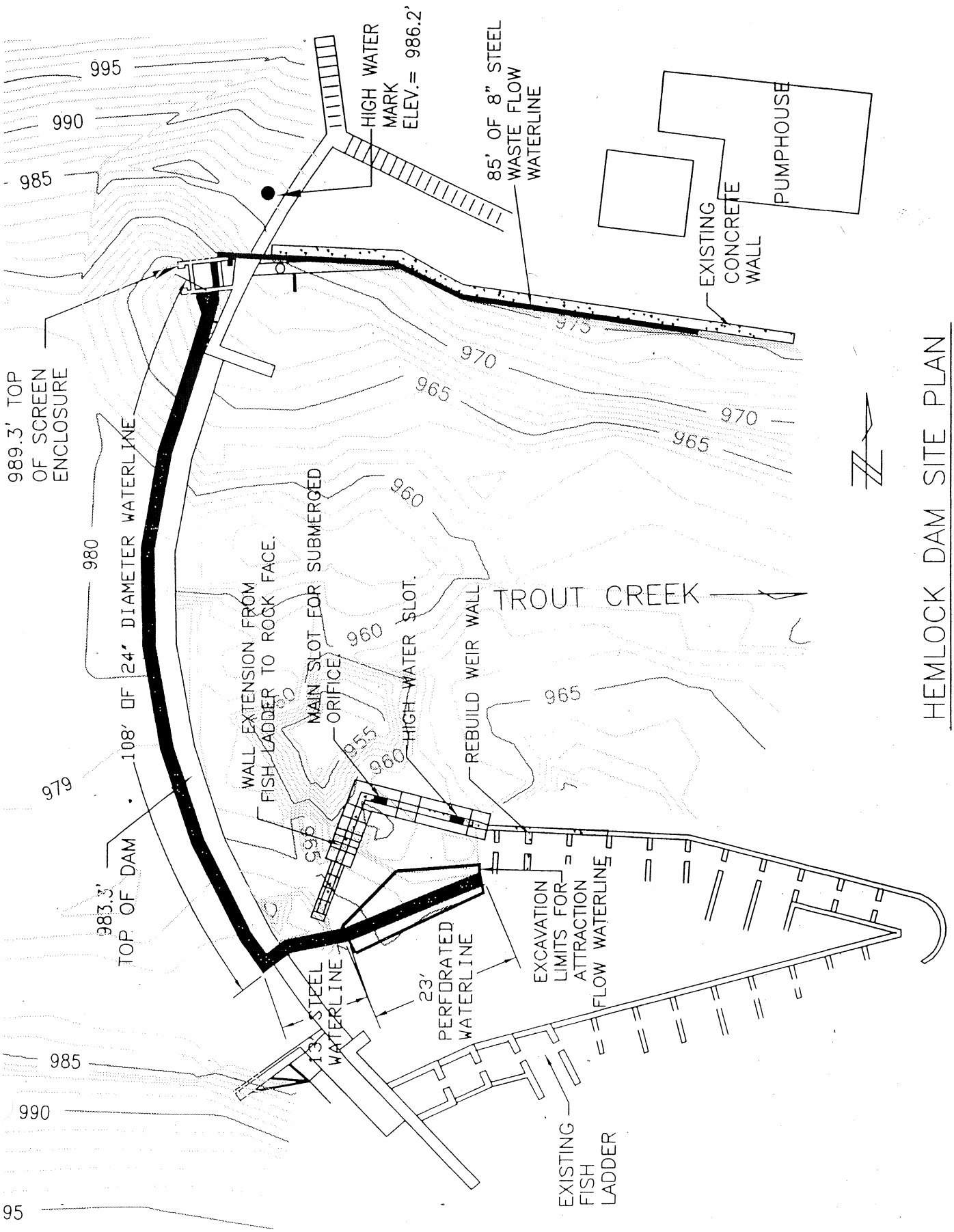
SHEET 4 OF 7 SHEETS I-W-4

TROUT CREEK DAM
(Hemlock Dam)
HAER No. WA-182
(Page 34)


U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE REGION 6
COLUMBIA FOREST
SUPPORTS FOR PIPE LINE
TROUT CREEK DAM
DATE MAY 15, 1935
SCALE NOTED
DESIGNED BY
DRAWN BY
TRACED BY
CHECKED BY
APPROVED
REGIONAL ENGINEER
SHEET 5 OF 7 SHEETS
1-W-5
BILL MATERIAL.
Description. No. Size.
Caps 51 4"x6"x3'-6"
Saddle blocks 102 4"x6"x1'-5"
Scabs on cap assembly with no posts. 34 1"x4"x1'-5"
Braces 136 1"x4"x1'-5"
Posts 34 2"x6"x4'-6"
Lag screws 34 4"x6"x Var.
Washers 170 3/8"x5"
Washers 68 3/8"x4"
Bolts 170 1 1/4"-7/16" Lag screw.
Drift Bolts 340 1 1/4"-3/8" Bolt
Materials based on: 34 Beam supports 17 Trestle bents.
PLAN CAP ASSEMBLY
NO POSTS NEEDED
Scale 1 1/2" = 1'-00"
TRESTLE BENT
SIDE ELEVATION
Scale 1 1/2" = 1'-00"
TRESTLE BENT
SECTION B-B
Scale 1 1/2" = 1'-00"
DETAIL SADDLE BLOCK A
Scale Full Size
Note: Lag screws to be placed during erection after saddle block is light around pipe.
Note: Where pipe is too close to ground surface to use trestle bent, use the cap assembly with sufficient blocking under cap to bring to desired elevation.
Note: Make templet to check radius before manufacturing saddle blocks.
Height Variable.
8'-00" c.t.c.
Cap 4"x6"x3'-6"
Scab 1"x4"x1'-5"
4"x6"x Var.
2"x6"x4'-6"
Batter 1 1/2" to 12"
Approx.
15"
45°


U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 6
COLUMBIA FOREST
GENERAL PLAN &
DETAILS OF FISHWAY
TROUT CREEK DAM
SCALE NOTED
DATE JULY 1, 1935
DESIGNED BY
DRAWN BY
TRACED BY
CHECKED BY
APPROVED
REGIONAL ENGINEER
SHEET 6 OF 7 SHEETS
1-W-6
REVISED JULY 31, 1935
APPROX. BAR LIST.
Mark | Size | No. | Length | Bending Detail.
S-1 | 1/2"φ | | 1162 lin. ft. | Approx. Straight.
S-2 | " | 230 | 4'-0" | " "
C-1 | " | 100 | 3'-0" | " "
C-2 | " | 84 | 2'-0" | " "
C-3 | " | 26 | 6'-11" | 10" Hook
C-4 | " | 56 | 2'-7" | 10" Hook
C-5 | " | 32 | 2'-0" to 4'-0" | Approx. Straight
C-6 | " | 65 | 4'-0" to 6'-0" | " "
C-7 | " | 44 | 12" to 30" | " "
D-1 | 7/8"φ | 135 | 24" | " Dowels Straight.
STATIONS ALONG CENTER LINE FISHWAY FROM FACE OF DAM.
ELEVATION FISHWAY STA. 0+00 TO 0+82.90
ELEVATION FISHWAY STA. 0+91.06 TO 1+56.85
TYPICAL SEC. C-C. FISHWAY WITH TWO LONG WALLS
TYPICAL ELEVATION LONGITUDINAL WALL
TYPICAL SEC. B-B. ONE LONG WALL
GENERAL PLAN FISHWAY
DETAIL PLAN TURN D.
SEC. A-A TURN D.
ELEVATIONS.
New Concrete Dam.
Flow.


U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 6 COLUMBIA FOREST
GENERAL LAYOUT
OLD HYDRO-ELECTRIC PLANT
TROUT CREEK
NOV. 1934
SCALE: 1" = 20'-0"
APPROVED
REGIONAL ENGINEER
SHEET 7 OF 7 SHEETS
1-W-7
ROAD TO EXPERIMENTAL FOREST
HIGHWAY TO CARSON
OLD ROAD
NEW 6" WATER LINE
LINE 'A'
LINE 'B'
PRESENT 18" WOOD PIPE LINE
BRIDGE
INTAKE
PRESENT SPILLWAY
POND
PRESENT
CREEK
TROUT
Power House
Water Surface
Present Bridge Floor Elev. 1188
Proposed New Elev. 105.00
Present 18" Pipe Line
Future Abutment
PROFILE ON LINE 'A'
Looking Upstream
NEW 6" WATER LINE


HEMLOCK DAM SITE PLAN
TROUT CREEK
HIGH WATER MARK ELEV.= 986.2'
85' OF 8" STEEL WASTE FLOW WATERLINE
PUMPHOUSE
EXISTING CONCRETE WALL
989.3' TOP OF SCREEN ENCLOSURE
108' OF 24" DIAMETER WATERLINE
983.3' TOP OF DAM
WALL EXTENSION FROM FISH LADDER TO ROCK FACE.
MAIN SLOT FOR SUBMERGED ORIFICE
HIGH WATER SLOT.
REBUILD WEIR WALL
EXCAVATION LIMITS FOR ATTRACTION FLOW WATERLINE
23' PERFORATED WATERLINE
13' STEEL WATERLINE
EXISTING FISH LADDER
995
990
985
980
979
970
965
960
955
950
95