Steven H. Fischer, PE

SENIOR CONSULTANT

Expertise
Civil Engineering, Hydroelectric, Construction Management

Education
Bachelor of Science, Civil Engineering, Washington State University

Registrations
Professional Engineer / OR, WA

Years with Schnabel/Total
3/46

Steven Fischer has 46 years of experience in heavy civil, hydroelectric and construction management, including 40 years with the City of Tacoma before joining Deere & Ault (now Schnabel) in 2017. Much of his experience involves planning, design, permitting and construction of civil engineering projects for Tacoma Power's seven dams and power plants. He spent six early years with Tacoma Public Works on building, street and bridge projects, and many more years with Tacoma Power on substation, underground transmission, dam, hatchery and fish passage projects. In 1988, he was placed in special projects to oversee the design and construction of the Cushman No. 1 spillway and then the Wynoochee Hydroelectric Project. For both projects, Mr. Fischer oversaw the design and permitting, and then lived on site as the resident project manager.

In 1994, Mr. Fischer became the assistant to Plant Engineering and oversaw all civil projects for the Tacoma Power dams. During that term, while overseeing other projects, he designed and constructed two jet flow gate valves, a turbine generator to meet minimum instream flows, two embankment replacement projects, and a concrete embankment stabilization project. In 2007 he became Assistant Generation Manager, Plant Engineering. In 2009 he was offered a lateral position to design, build and construct over $100 million of relicensing facilities at Cushman and Cowlitz.

While serving as Assistant Generation Manager and Assistant Plant Engineering Manager, Steven was a part of Tacoma Power's management staff for 23 years. During his time there he gained direct and practical experience managing teams and developed a deeper understanding of the organizational structure, processes, and culture. In addition, in his role as the Chief Dam Safety Officer (CDSE), Steven was responsible for leading the dam safety program and communicating the dam safety program's priorities to Tacoma Power executives and Public Utility Board.

Mr. Fischer has extensive experience with all aspects of major projects including civil, structural, mechanical, electrical and control systems. He also is experienced in concrete works including mass concrete placement, fly ash mixes, self-consolidating concrete, underwater concrete, shrinkage compensating concrete, and concrete with fiber reinforcement.

Portland General Electric Faraday Hydroelectric Project / Estacada, OR

Co-Author. PGE performed a major project to upgrade the Faraday powerhouse with new units and penstocks. Schnabel Engineering was retained to perform a Root Cause Analysis for the PGE legal department. Mr. Fischer reviewed contracts and construction records, interviewed involved parties, and co-authored a 2023 report on the root causes of a construction issue that created a project delay.

Idaho Power Owners Dam Safety Program Audit 2022 / Boise, ID

Co-Auditor. Mr Fischer was an approved co-auditor on the 5-year FERC required review of the Owners Dam Safety Program. The work involved review of the Dam Safety Program, Dam Safety Surveillance Monitoring Plan, Emergency Action Plans and all dam safety related documentation with the intent to review the program and organization as opposed to looking at individual dam safety items. The review includes interviews of dam safety staff, site staff and

involved management and headquarters staff to assess training and assessing the company commitment to dam safety

Portland General Electric Round Butte Spillway Tunnel Aerator / Madras, OR

Project Manager/Engineer. As a spin off from a contract to provide technical review of a Turbine Shutoff Valve Replacement project, Schnabel Engineering identified a vulnerability of the existing spillway tunnel to severe cavitation damage. The spillway tunnel had been used only briefly in its 60-year history but was planned to be used for 3 months during the TSV project. Schnabel performed a study of the spillway and was retained to design an aerator to solve the problem. Schnabel retained Dr. Henry Falvey, an expert in the field of spillway cavitation aerator design, and Northwest Hydraulic Consultants to perform a physical model study of the design. The project is slated for construction in the summer/fall of 2023.

Portland General Electric Round Butte Powerhouse Turbine Shutoff Valve Replacement / Madras, OR

Independent Technical Review. Mr. Fischer is performing an independent review of the project to replace three 15' diameter butterfly valves at the Round Butte Powerhouse. The work encompasses technical review of the TSV procurement contract, drawings, specifications and submittals, review of power tunnel dewatering and existing liner issues, review of the project spillway and tunnel requiring use during a three-month shutdown, participation in risk assessments, and review of the installation contract specifications and contractor plans. The work began in early 2021 and the project completion is scheduled for Dec 2024.

Lake Lure Reservoir Drain / Lake Lure, NC

Design Engineer. Schnabel Engineering designed a new low-level outlet from Lake Lure Dam to meet State Dam Safety requirements and to facilitate the Town's needs for lowering the reservoir during upcoming sanitary sewer construction. Mr. Fischer performed conceptual design of an upstream bulkhead and trashrack with the methods for penetrating the dam with the 72" penstock without lowering the reservoir. He led the effort on preparing plans and specifications for a 72" knife gate guard valve and a 60" jet flow gate discharge valve. Mr. Fischer remains involved in reviewing contractor submittals and plans. The project is slated for completion in the fall of 2023.

Box Canyon Dam, Upstream Fish Passage / Pend Oreille County PUD, WA

In 2020, Steve served as a senior consultant and startup and testing manager during the final commissioning of the Box Canyon Dam Upstream Fish Passage Facilities. The system combines many interacting mechanical, electrical, and structural components in order to transfer fish over the dam including a fish ladder, v-trap, mechanical fish crowder, brail lift platforms, fish transfer tubes, and a sorting facility. Steve's work on the project included a thorough review of the design drawings for the facility, and troubleshooting of the facilities control system during startup to ensure the system could be efficiently operated. The system was successfully started, tested, and adjusted to achieve the design performance goals.

Round Butte Dam / Portland, OR

Independent Technical Reviewer. This project is to replace three 15-foot diameter turbine shutoff butterfly valves. Schnabel (specifically Mr. Fischer) was contracted to provide senior independent technical review of the entire project to mitigate risks. The project has many peripheral aspects such as power tunnel dewatering where previous damage had

been identified, and use of a spillway tunnel with limited previous use during the planned extended outage, as well as opportunity aspects created by the outage.

Lake Lure Dam / Town of Lake Lure, NC

Design Consultant. This project is to provide a low-level outlet on the existing dam. Mr. Fischer provided the design of a permanent upstream collar with closing hatch that allows subsequent penetration of the dam from the downstream side and installation of a penstock connection. He also provided sizing and specifications for a downstream knife gate guard valve and regulating discharge jet-flow gate valve, and prepared a conceptual drawing of a prefabricated trash rack to fit over the upstream entrance.

Gene Wash Dam / San Bernardino County, CA

Consultant. This partial design-build contract consisted of replacing the low-level outlet valves, upgraded electrical supply, upgraded access, and miscellaneous improvements to the project. The project required a bulkhead designed to seal off the upstream entrance on the face of the dam; review of shop drawings for a new 48-inch guard valve; comment, review, and approval of various submittals prior to contractor submittal; assistance in planning access and installation of the new valves at the base of the dam, including temporary construction facilities; and construction inspection required during bulkhead and valve installation. Mr. Fischer provided the lead effort in these activities as well as onsite services and inspection.

Cedar Falls Dam / Seattle, WA

Inspector. This project was to provide an inspection and seismic risk hazard analysis for the project features other than the dam itself. Mr. Fischer provided inspection of the powerhouse and valve houses for both building and equipment risks, and participated in a risk rating session with Seattle employees.

Caribou 1, Pit 5 Open Conduit, Rock Creek / Various Locations, CA

Inspector. Mr. Fischer has performed several inspections of low-level outlets both as a subconsultant and directly at PG&E dams. These inspections involved condition assessment of concrete, trash racks, and valves performed visually and by divers and ROVs.

Big Hill Lake Gate Replacement / Labette County, KS

Design Quality Control Manager. This design-build project involved the replacement of five intake gates and three discharge gates in an intake tower. The gate replacement involved new actuators, electrical supply, service hoist, accessory equipment and repairs. Steve reviewed design documents and shop drawings for conformance with the U.S. Army Corps of Engineers specifications and codes.

Palisades Dam Unit 4 / Bonneville County, ID

The project involved a field investigation and document review to determine the cause of a failed commissioning of a turbine rehabilitation. This hydroelectric project rehabilitated four units with new runners, reworked wicket gates, and bearings. Three units were successfully restarted and commissioned, and one unit had several failed restarts due to both grounding issues and runout. The issues causing excessive runout and guide bearing contact were identified, and the unit

was restarted and commissioned. Mr. Fischer provided onsite inspection and analysis.

North Fork Skokomish Powerhouse / Olympic Peninsula, WA

Major Projects Manager (Tacoma Power). As part of the Cushman Hydroelectric Project Relicense, Tacoma undertook the design and construction of Cushman No. 2 Dam's second powerhouse, the North Fork Skokomish Powerhouse. The work required complex construction on a site that could be isolated but not dewatered. Instead, underwater facilities were constructed above water and lowered into place in the tailwater of Cushman No. 2 dam.

The North Fork Skokomish Powerhouse was designed in house under the direction of Mr. Fischer who did the siting and layout. Notable features of the design include an upstream fish collection structure connected to the draft tubes of the new powerhouse, and a fish tramway ascending through vertical, 60°, and finally 45° slopes up the canyon wall. At the top, a crane transfers fish hoppers into a fish sorting facility. The transport system also works in reverse to move juvenile fish downstream. Mr. Fischer performed startup and commissioning of the two-unit powerhouse with turbine/generator manufacturers and Tacoma staff who had designed the integrated control systems for all dam functions.

Steven also worked closely with Deere & Ault to design a custom 66-inch x 42-inch rolling offset bifurcation in the penstock, and personally designed both a concrete buttress stabilization and the installation of a 1,850 cfs jet flow gate valve to replace a butterfly discharge valve at the Cushman No. 2 dam.

Cowlitz Falls North Shore Downstream Migrant Fish Collector / Lewis County, WA

Major Projects Manager (Tacoma Power). The North Shore Fish Collection Facility at Cowlitz Falls Dam is a downstream fish collection facility consisting of an attraction flow passage through the dam, pumping 500 cfs through dewatering screens; a return of that water through a pumped siphon to the reservoir; and a flume way transporting fish to a holding facility. The collector had many interesting design elements, including drilled shafts extending below reservoir level; a sheet-pile cofferdam encased in a bedrock trench; the cutting of two major openings through a gravity dam section; numerous drilled tiebacks both into rock and soil; a 50-foot-tall soldier pile wall; concrete protection of an emergency spillway chute; a 10-foot diameter reservoir pump back pipeline running in siphon mode; and an aerial suspended fish flume. Startup was conducted by Mr. Fischer on the four 125 cfs pumps, siphon-maintaining vacuum pump system, screen backwash systems, traveling dewatering screens, computer control system, and many other subsystems and monitoring devices. The facility went into operation for its first outmigration collection season the same month that Mr. Fischer retired.

Cushman Floating Surface Collector and Cushman Hatcheries / Mason County, WA

Major Projects Manager (Tacoma Power). As part of the Cushman Hydroelectric Project's relicensing, Tacoma constructed a $40M Cushman Floating Surface Collector. The floating pump station and fish assembly was constructed at the Cushman No. 1 Dam to safely guide juvenile salmon around two high dams on the Olympic peninsula of Washington State. The facility uses 10 submerged pumps located behind Deere & Ault's custom designed rotating fish screens to attract fish, and a series of specialty gates and valves to closely balance the floating structure. Steven directly oversaw final commissioning and startup testing aboard the FSC. The Floating Surface Collector was configured and hydraulically designed by Mr. Fischer during negotiations with agencies. Control systems were designed by Tacoma Power engineers. Mr. Fischer

supervised and was the lead participant in the startup, calibration, and adjustment of the hydraulic systems and pumps to meet agency criteria and design goals. He then worked with Tacoma controls engineers to adjust and automate the facility to achieve the desired functions.

Cushman Floating Surface Collector / Hoodsport, WA

While at Tacoma Power, Steve served as the project engineer for the FSC. The floating pump station and fish assembly was constructed at Cushman No. 1 Dam to safely guide juvenile salmon around two high dams on the Olympic peninsula of Washington State. The facility uses 10 submerged pumps located behind Schnabel's custom designed rotating fish screens to attract fish, and a series of specialty gates and valves to closely balance the floating structure. Steve was integral to the initial conceptual design of the facility, completing preliminary structural calculations of the NTS and FSC, and also directly oversaw final commissioning and startup testing performed by Schnabel aboard the FSC.

Cushman Sockeye and Salmon Hatcheries / Mason County, WA

Major Projects Manager (Tacoma Power). The two state-of-the-art fish hatcheries ($13 million) were completed in 2016 to reintroduce, restore, and enhance anadromous fish populations in the North Fork Skokomish watershed as part of the Cushman Hydroelectric Project Settlement Agreement. The hatcheries raise 2.5 million fish annually and feature a total of 74 Cornel FRP circular tanks for adult holding and final rearing. The two fish hatcheries had many notable features requiring startup and commissioning. These were perhaps the most computerized hatcheries constructed to date, with systems built on the same computer control platforms used by Tacoma's hydroelectric plants. Water supply systems required adjustment and calibration of flows to troughs and circulars, and computer driven valves and pumps maintain flows. A sophisticated control system drives alternate periods of chilled water for otolith marking of incubating sockeye. The system operates a six-stage cooler and 120 individual valves to incubating jars to create unique otolith marks required for tracking, research, international agreements and study. Another notable feature is the water supply and discharge of the salmon hatchery, where both lines cross an underwater ravine in Lake Kokanee on their route from the intake and en route to the dam. The discharge travels to the dam and then down the face to the intake grizzly for the powerhouse to prevent potentially diseased discharge water from re-entering the hatchery. Mr. Fischer spent many days personally running the systems, debugging control programs, and solving issues in the commissioning process.

Cushman No. 1 Dam Spillway / Mason County, WA

Project Manager/Engineer (Tacoma Power). In 1986 a major dam safety issue was confronting Tacoma Power and total replacement of the Cushman No. 1 spillway was required. Mr. Fischer was assigned the task of developing options, preparing an EIS, permitting, designing, and constructing a new radial gate facility in a structure separate from the dam. He personally performed the reservoir routing through the two Cushman dams using hourly and month specific PMF inputs and user selected options for maximum reservoir level and spillway capacities in a custom spreadsheet calculation. He managed the two-year construction from a field office. During design and construction, Steven oversaw the demolition of an existing overflow weir separate from the dam, and the construction of a new 85-foot-tall concrete gravity dam housing two 40 x 20-foot submerged radial gates with 40,000 cfs capacity. Steven reviewed the design of the gates, the hydraulic lift system, and the controls. He personally inspected the gates in Germany and reviewed installation procedures prior to shipping. He commissioned the gates and control system with manufacturers' representatives and trained Tacoma staff on their operation.

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LaGrande Dam and Powerhouse / Nisqually River, WA

Project Manager/Engineer (Tacoma Power) Mr. Fischer personally designed the hydraulic and structural installation of a 1,200 cfs powerhouse relief valve at the LaGrande powerhouse. This valve is fed from a 5-foot diameter penstock tunneled through the back wall of the powerhouse to intercept a 10-foot diameter steel lined penstock. It then traverses the powerhouse floor in a 4-foot diameter pipe, exits the wall to the powerhouse downstream deck, turns a 22^{o} angle and discharges through a 42-inch jet flow gate valve. Velocity at the orifice is 120 fps. He also designed a small installation of a 435kW generator to make power from a required discharge of 30 cfs at the base of LaGrande Dam. For each of these projects Mr. Fischer performed startup and commissioning with representatives from the manufacturers.

Wynoochee Hydroelectric Project / Grays Harbor County, WA

Project Manager/Engineer (Tacoma Power) Mr. Fischer was assigned the design and construction of the Wynoochee Hydroelectric Project. This became the first entirely automated powerplant for Tacoma Power. The design phase involved selecting from several preliminary powerhouse options; permitting; negotiating mitigation and implementation plans only vaguely spelled out in the FERC license; and receiving approvals from the Corps of Engineers who owned the project at that time. The single largest result of these efforts was the agreement by Tacoma to construct a 22.5-mile underground transmission line after its partner, the City of Aberdeen, agreed to release a $3M fund to Tacoma for its use on the project. Two separate legislative bills were also required to ultimately place Tacoma in charge of operations and maintenance and to provide its partner Aberdeen with ownership of the dam. The completed project involves a temperature regulating intake, dam penetration, a 1,300-foot-long and 10-foot diameter buried penstock, a powerhouse with a single Kaplan turbine and generator, and a 22.5-mile-long underground transmission line with new substation equipment at each end. Mr. Fischer managed the construction phase while living on site. He personally configured the control system screens to operate the existing dam outlets and new computer run facilities. He supervised commissioning with representatives of the turbine, generator, electrical equipment, and control systems suppliers. Mr. Fischer then trained staff on operation and maintenance of the new power plant.