CITY OF BEND MUNICIPAL WATER INTAKE
(City of Bend Bridge Creek Intake)
Deschutes National Forest
On Bridge Creek near its confluence of Tumalo Creek
Bend
Deschutes County
Oregon

HAER OR-182
HAER OR-182

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC WEST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
1111 Jackson Street, Suite 700
Oakland, CA 94607

HISTORIC AMERICAN ENGINEERING RECORD

CITY OF BEND MUNICIPALWATER INTAKE
(City of Bend Bridge Creek Intake)

HAER NO. OR-182

Location:

The City of Bend municipal water intake is located on Bridge Creek near its confluence with Tumalo Creek (see figure 1). Legal address is Township 18 South, Range 10 East, NE ¼ of section 7. Coordinates from NAD 83 are as follows: Latitude 44 degrees, 1' 52.91" north, longitude 121 degrees, 34' 4.07" west.

Present Owner/Occupant:

The structure is located on the Deschutes National Forest, Bend-Fort Rock Ranger District. A Forest Service special use permit has been issued for the site. The City of Bend owns the structure and water intake complex consisting of dam, intake structure, and pipelines.

Present Use:

The water intake is used to supply domestic water to Bend. Water impounded by the dam on Bridge Creek is diverted through the intake structure to two pipes running down to storage tanks for the city. The water receives preliminary screening for debris at the intake facility.

Significance:

The City of Bend Municipal Water Intake is significant in local history because of the great premium placed on good quality surface water on the semi-arid east slope of the Cascade Mountains. Water from Tumalo Creek and its tributary Bridge Creek was recognized by Euro-American settlers as a valuable commodity first for irrigation and later for domestic water supply. Protracted legal and political conflict over rights and uses for Tumalo Creek water began in the 1880s and continues to present times. Bend's struggle for rights to divert Tumalo Creek water involved the federal and state government through Carey Act irrigation projects and the state's intervention when the Carey Act project failed.

Historian:

The section 106 Determination of Eligibility and this mitigation material has been prepared by Ward Tonsfeldt, PhD, under contract to the Oregon State Museum of Anthropology/University of Oregon Museum of Natural and Cultural History.

Project Information:

Project coordination comes from the Oregon State Museum of Anthropology/University of Oregon Museum of Natural and Cultural History, which is contracting with USDOT - Federal Highway Administration/Western Federal Lands Highway Division, and cooperating with the USDA Deschutes National Forest and the City of Bend. This documentation is part of mitigation for proposed demolition of the intake structure.

PART I. HISTORICAL INFORMATION

A. PHYSICAL HISTORY

1. Date of Construction:

The facility was completed and went into service late in 1926.

2. Architect/Engineer:

In November of 1925, consulting engineers John DuBuis and R.E. Koon presented preliminary plans for the new system to the Bend City Council. DuBuis and Koon completed subsequent modifications for the initial plans and prepared the final plans. Their signatures as engineers can be found on all drawings and plans.

3. Builder/Contractor

On March 11, 1926, the Bend City Council accepted contractor A.D. Kerns' bid for $150,199 for a steel pipeline to connect the intake with the City's storage tanks west of Bend. Kerns' work was to be completed by November 1, 1926. Searches of Bend City Council meeting records and financial records do not reveal the name of any contractor selected for building the intake structure. The work may have been done by Kerns, or been done by Bend municipal crews.

4. Original Plans

The Bend City Council approved DuBuis and Koon's final plans for the Bend municipal water intake and pipeline on May 24, 1926 (see figures 4 and 5). The two-page set of plans called out design and materials for the intake structure, housing the caretaker's quarters and the screening bays, and dimensions for the dam on Bridge Creek. The screens were to be site built, as was the trash rack. Design and materials for the intake structure took into consideration the extreme depth of snow prevailing in most winters. Roofs were steep to accommodate snow load, and exterior materials for siding and roofing were corrugated galvanized steel panels. Windows were double casement steel sash, eight lights per sash with four fixed lights over the casement sashes.

5. Alterations and Additions

In 1954, the Bend City Council contracted with Portland engineering firm John W. Cunningham and Associates to design a second delivery pipe from the intake structure to the Bend water tanks. The new pipe took a slightly different route down the hill. No changes were made to the original intake structure. Minor changes to the intake structure made between 1926 and recent times include wooden security shutters on the windows of

the living quarters, replacement entry doors, and the construction and demolition of a garage near the structure. The chimney was also shortened at some point. Siding, roofing, and all windows remain original. City caretakers now live in a separate building located about 150 meters from the original structure.

In 1977, the City engaged John B. Donahue, PE, to design improved visitor facilities for the intake complex. These included a "visitor walk" to the structure from the Forest Service parking lot, hiking trail, rock walls, raised bed plantings, a picnic area, and a deck or gazebo at the base of the dam. The crew quarters in the structure were to be used for "visitor displays."

Examination of the site suggests that the proposed visitor facilities were not completed. A wall of basaltic ashlars was completed north of the driveway, with rather elaborate stone steps leading up to a trail. The area below the dam was stabilized with a retaining wall and filled. This area is now used as a parking lot. The proposed deck/gazebo was not built, and the crew quarters in the intake structure were not used for interpretive displays (see figure 11).

B. HISTORICAL CONTEXT

1. Bend Municipal Water Supply

The City of Bend began the 1920s drawing its municipal water from the Deschutes River at the hydro-electric dam in the center of town. A local utility, the Bend Water, Light, and Power Company (BWL&P), owned the system of delivery pipes that served residents. The utility company removed water from the Deschutes by pumping. Since Bend Water, Light, and Power produced the electricity to power their pumps, the system was economical and expedient. As long as the quality and quantity of water in the Deschutes were adequate, the system suited everyone.

In 1915, large lumber producers Brooks-Scanlon and Shevlin-Hixon had built mills on the Deschutes in Bend and began logging operations upstream from the town. The lumber companies built a dam across the Deschutes at the south end of town and impounded water for their jointly-used mill pond. Logs were dumped into the river and stored until they were fed into the mills' giant bull chains. Storing the logs in the river kept them from drying out and loosened the accumulated dirt and grit from their journey out of the woods. Impounded water in the mill pond was cloudy and warm during the summer months. Algae bloomed in the pond and impaired the quality of the water entering the city's water intake downstream.[1]

[1] John Dubuis and R.E. Koon, "Waterworks Improvement," *Bend Bulletin*, February 10, 1925, 6.

In 1921, to supply increasing demands for irrigation water from the Deschutes, irrigation districts, in cooperation with state and federal agencies, built a large storage reservoir about 40 miles upstream of Bend at Crane Prairie. The reservoir was shallow and subject to summer algae blooms. By the early 1920s, it was apparent that the quality of Bend's domestic water from the Deschutes was declining. The Bend Water, Light, and Power Company filtered the water from the Deschutes and chlorinated it, but residents were not pleased with the odor and taste during the summer months.[2] By 1924, the Bend City Council was petitioning the State Board of Health to require the Corps of Engineers to open the dam at Crane Prairie to flush water down the river.[3] The obvious long-term solution to the water situation was for Bend to find another supply.

As early as 1919, Bend had looked for a new supply, and in 1923 the City directed engineers John DuBuis and R.E. Koon to report on sources of better water. In December of 1924, they presented their preliminary findings. Good quality surface water was available from Fall River, a spring-fed stream 25 miles south of Bend, and from Tumalo Creek, a glacier-fed stream 12 miles west of Bend. Tumalo Creek presented the better opportunity since the pipeline would be half the length, and the 1500' difference in elevation assured good gravity delivery to the city.

2. Tumalo Creek

The problem with Tumalo Creek as a source of municipal water was that the rights were in constant turmoil, and development of irrigation for the Tumalo area had a 30-year history of fraud, incompetence, corruption, and abuse. In fact, the very word "Tumalo" had such negative connotations that the Tumalo residents changed the name of their water district, and the citizens of Bend changed the name of their part of Tumalo Creek to "Bridge Creek."

Irrigation projects on Tumalo Creek and the appropriation of water rights began in 1893 with the formation of the Three Sisters Ditch Company. This became a Carey Act project after 1894 when the Carey Act was passed in Congress.[4] The developers hired Bend civil engineer L. D. Weist to do some preliminary design on the system, which was projected to irrigate 27,000 acres of arid land north and east of the creek.

By 1905, the original developers had been accused of fraud and the State Land Board asked the federal government to reject their second appropriation of public land.[5] The Three Sisters group sold their holdings to the Columbia Southern Irrigation, who operated the project until 1911, when they deeded the project to the Oregon, Washington, and Idaho Finance Co. In 1906 it became clear that without a storage reservoir the water in Tumalo Creek could not irrigate more than about 3000 acres, although over 15,000

[2] John Dubuis and R.E. Koon, "Waterworks Improvement," *Bend Bulletin*, February 10, 1925, 6.
[3] Bend City Council minutes, June 9, 1924, on file, Bend Oregon City Recorder's Office.
[4] Martin F. Winch, "Tumalo—Thirsty Land, Part I" *Oregon Historical Quarterly* 85(4), 1984: 341-374.
[5] Michael Hall, *Irrigation Development in Oregon's Upper Deschutes Basin 1871-1957: A Context Statement.* Deschutes County Community Development Department, Bend, Oregon, 1994, 17.

acres had been sold with water promised.[6] In February of 1913, the Oregon Legislature passed the Columbia Southern Act, which authorized the State to take over ownership of the Tumalo Project from the Oregon, Washington, and Idaho Finance Company.

The Oregon Legislature then created the Irrigation and Drainage Securities Commission to support Tumalo irrigation bonds with the State's credit. [7] Within two years, Salem had demonstrated its progressive attitude (and financial resources) by building the Tumalo Diversion Dam on Tumalo Creek, the Tumalo Feed Canal to provide extra water, and Tumalo Reservoir to store water for delivery during the summer. Unfortunately, these solutions didn't work. The reservoir leaked most of its stored water into a lava tube, and additional water diverted through the Tumalo Feed Canal was not adequate to meet the users' needs.[8] Attempts to plug the leaky reservoir continued through1950, but at present it holds less than 5% of its capacity.

Water for the Tumalo Project required all of the water in the creek plus whatever water the State could scrounge from other projects fed by the Deschutes. The State reached a partial solution to the Tumalo problem in the early 1920s by allowing the Tumalo District to store Deschutes River water in Crane Prairie and Crescent Lake reservoirs and by building another canal—the Bend Feed Canal—to divert more Deschutes water to the Tumalo canals.[9] The Tumalo Irrigation District took the unusual step in 1922 of re-naming itself Deschutes County Municipal Improvement District in hopes that potential buyers for its bonds would not connect it with the name "Tumalo."

3. Bend's Water Plan

In the summer of 1924, then, the City of Bend formally asked Oregon land and water agencies for permission to develop a new municipal water supply. At its June 20, 1924, meeting the City Council authorized a delegation to go to Salem seeking a share of the already over-committed Tumalo Creek water.

On January 6, 1925, the Mayor and the City Attorney returned to Salem to ask again for legal access to Tumalo Creek water. Their petition to exchange Deschutes water rights for Tumalo water rights was approved by the legislature in October of 1925[10]. This action required the legislature to override the veto of Governor Oswald West, who was opposed to the exchange and believed he was protecting the Tumalo homesteaders.[11]
The city's plan was relatively straightforward: Bend would sell about $600,000 in new bonds to purchase the Bend Water, Light, and Power Company, build a pipeline from Tumalo Creek to Bend, and build municipal reservoirs on what is now the Outback Reservoir site. Bend Water, Light, and Power Company owned rights to water from the Deschutes. These would be exchanged for rights to Tumalo Creek water. Deschutes River

[6] Martin Winch, "Tumalo—Thirsty Land, Part II" *Oregon Historical Quarterly* 86(3), 1985a: 289.
[7] Martin Winch, "Tumalo—Thirsty Land, 1920-1931" *Oregon Historical Quarterly* 86(4) 1985c: 378.
[8] Michael Hall, "Irrigation Development," 18.
[9] Martin Winch, "Tumalo, Part II," 383.
[10] Bend City Council minutes, Oct. 28, 1925.
[11] Martin Winch, "Tumalo, Part II," 389.

water formerly used for Bend municipal supply would flow through the Bend Diversion Canal to the Tumalo system, and there would be no reduction in the net amount of irrigation for the Tumalo farmers.

During the summer of 1925, the *Bend Bulletin* editorialized against the bond election[12] However, the bond measure passed on August 5. In November of 1925, consulting engineers John DuBuis and R.E. Koon presented plans for the new system to the City Council. At their next meeting, November 20, the City Council opened bidding on the pipeline construction. On March 11 of the following year, the City accepted A.D. Kerns' bid for $150,199 for a steel pipeline to be completed by November 1, 1926. At the same meeting, the City asked DuBuis and Koons to prepare plans for an intake structure on the South Fork of Tumalo Creek, the name of which would soon be sanitized as "Bridge Creek." In April of 1926, the City agreed to buy Bend Water, Light, and Power Company for $238,107.56.[13] Their distribution system and their Deschutes water rights were essential to the City's plan. The water rights exchange, blessed by the Legislature but resisted by Governor West and the Tumalo farmers, was consummated in 1926 with an added cash settlement to the financially desperate Tumalo Irrigation District. However, the situation was far from clear, and litigation over water rights between the City, the Tumalo District, and other interested parties would continue for decades.[14]

[12] "What Will This Cost?" *Bend Bulletin*, July 27, 1925, 1.
[13] Bend City Council minutes, April 9, 1926.
[14] Martin Winch, "Tumalo—Thirsty Land, 1931-1984," *Oregon Historical Quarterly* 87(1) 1986: 21ff.

PART II. STRUCTURAL/DESIGN INFORMATION

A. GENERAL STATEMENT:

1. Character

The intake structure with its adjacent dam is an attractive and distinctive utility building in a scenic forested setting. Unfortunately, the 1977 plans for increased visitor access were not implemented, and current visitor access is limited by security concerns. Nevertheless, it remains a well-kept and historically significant community resource.

2. Condition of Fabric

The exterior finish materials—including siding, roofing, and windows—are original. City of Bend crews maintain the intake complex for filtering and monitoring the municipal water supply. Because of its advanced age, the structure requires annual maintenance and may soon need a new roof. The building was designed to resist the rigors of deep snow and harsh conditions and it has succeeded admirably. Entry doors have been replaced, the lower windows have been fitted with protective wooden shutters for security, and the original brick chimney has been shortened (see figure 3).

B. DESCRIPTION

The building DuBuis and Koon designed to house the intake works and provide living quarters for the crew was more imaginative and less utilitarian than we might expect. During the mid-1920s, residential designs with an Arts and Crafts flair were sweeping Portland and Seattle, and could be found in smaller regional centers like Bend and Klamath Falls. Portland architects like Wade Pipes, A.E. Doyle, and Jamison Parker applied visual ideas from the English country houses to a new environment on the American West Coast.[15] This is not to say that the intake building is "high style," but the multiple gables, prominent chimney, steeply pitched roofs, and the mullioned casement windows all reflect the popular Arts and Crafts urban residential style.

The material DuBuis and Koon chose for the roofing and siding was 28-gauge corrugated steel roofing. This material was galvanized. The "Apollo" brand of steel roofing was manufactured by the American Sheet and Tin Plate Company of Pittsburg and patented in 1915. The plans specified that the steel be attached with galvanized nails and lead

[15]See Rosalind Clark, *Architecture Oregon Style*. (Portland: Professional Book Center, 1983), 140ff; Ann Brewster Clark, 1985 *Wade Hampton Pipes: Arts and Crafts Architect in Portland, Oregon*, (Portland: Binfords and Mort, 1985), 7ff; Thomas Vaughan and Virginia Guest Ferriday, *Space, Style, and Structure: Building in Northwest America*, 2 vol. (Portland: Oregon Historical Society, 1974), 348.

washers. Windows called for in the plans were mullioned steel casement units with the glass set in steel sash with putty.

The intake building is sited at 5000' in a rather wet canyon. The steel siding and roofing were reasonable concessions to the depth of snow and long winters. Subsequent modifications to the exterior of the building are limited to replacement entry doors, wooden shutters on windows in the living quarters, and the shortening of the original brick chimney. The siding and roofing are the original material. The casement windows are original. Even the paint scheme for the interior called out by DuBuis and Koon—grey floors, white walls—has been maintained as specified.

C. MECHANICALS/OPERATION:

The new water system had three major parts: the intake and the pipeline from Bridge Creek; the storage tanks on the Outback Reservoir site; and the distribution pipes in Bend, provided by the purchase of Bend Water, Light and Power Company. DuBuis and Koon designed the intake and pipeline. Both of these have served the City since 1926. The original pipeline was 14" in diameter near the intake, then 12" for the steepest hydraulic gradient, then 16" for the last two miles to the reservoir. The pipe was 8-gauge galvanized steel pipe provided by contractor A.D. Kerns. In 1954, the city contracted with consulting engineer John W. Cunningham of Portland to prepare plans for a second steel pipeline to supplement the original pipeline. These two lines have continued to operate in tandem.

DuBuis and Koon's design and engineering work reflects the state of the art in 1920. In 1917, Amory Prescott Folwell published the third edition of his influential *Water Supply Engineering: The Design and Construction of Water Supply Systems.* Folwell notes that gravity systems (like the Bridge Creek system) are usually provided with a dam and reservoir at the intake to assure an adequate supply of water throughout the year. If the supply is adequate, however, a reservoir is not needed.

> When it is not necessary to store water in order to obtain a continuous supply, storage reservoirs may be omitted and the impounding reservoir may be limited to a slight damming up of the stream.[16]

DuBuis and Koon designed the Bridge Creek dam more to divert the water into the intake structure than to provide storage (see figure 4).

The dam consisted of a low concrete structure rising 88" (7' 4") from the stream bed to impound the creek (see figure 2). The dam was designed as a spill-over dam fitted with a

[16]Amory F. Folwell, *Water Supply Systems Engineering* (New York: John Wiley and Sons, 1917), 196.

20” spillway pipe controlled by a gate valve at the upper end. In practice, the dam impounds the creek to provide a forebay for the intake, which is attached to the dam on its north end (see figure 6).

Water impounded by the dam rises about 4’ above the original streambed and flows into the intake bay. At that point, the water goes through a steel trash rack to remove large waterborne debris. The incoming water then divides into two streams, one going to the west screen chamber and the other to the east screen chamber. With two separate chambers the maintenance crew can close and clean one screen without interrupting the flow of water through the other screen (see figures 6, 7, and 8).

Each screen chamber is essentially a concrete box 15’ 8” long, approximately 10’ deep and 6’ wide. The screen is mounted horizontally in the center of the chamber. Incoming water from the creek enters at the bottom of the chamber at the south end and rises through the screen to exit the chamber above the screen at the north end. Each chamber is fitted with a 24’ x 24” Butchart sluice gate at the south end. Closing one of these gates blocks the flow through that chamber.

Each set of screens is a series of six 30” screens mounted on hinges and set at an angle to horizontal—like saw teeth (see figure 8). The screens can be raised for cleaning and maintenance as required when the chamber is de-watered. DuBuis and Koons designed the screens and trash rack, and they were fabricated on site by the construction contractors. The screens remain essentially as they were designed and built, with some repairs and replacement of mesh.

The screens and trash rack, with the sluice gates, constitute the operating part of the intake system at the point of intake. Since this is a gravity system, the 1000’ fall of water in the pipes from Bridge Creek to the Bend reservoirs provides the pressure to move the water through the pipes and into the reservoirs above Bend. The delivery pipes are closed, but the system is still “atmospheric” since it is open at the highest point (Bridge Creek) and the pipe is vented for its entire length (see figure 10).

The pipe is vulnerable to damage if the stream of water is stopped at either end. If the stream is stopped at the top (Bridge Creek), water would continue to move through the pipe towards Bend, creating a vacuum behind it. Vents along the pipe are designed to relieve a vacuum caused by an interrupted flow. If they were to fail, or to be inadequate, the pipe could collapse (see figure 9).

If the stream of water were stopped at the bottom, the results could be more serious than a collapsed pipe. In this event, the 1000’ column of water could exert its full pressure inside the pipe, bulging or possibly rupturing it. Again, the air valves could diminish the

pressure, but if they failed, the pipe would be severely damaged. Folwell discusses this concern:

> The pressure to be resisted by the tensile strength of the wall of the conduit at any point is the hydrostatic pressure due to the difference in elevation at this point and the water in the open conduit or reservoir at the head. This pressure is not attained when the water is flowing, but only when the gate at the lower end of the pressure conduit is closed.[17]

D. SITE INFORMATION

Landscaping surrounding the structure consists of native forest, largely lodgepole pine (*Pinus contorta*), white fir (*Abies concolor*), and mountain hemlock (*Tsuga mertensiana*). Numerous grasses and forbs are also found in the area. There are two adjacent structures, both dating from the 1970s. These are the new crew quarters, located about 150 meters to the northeast, and a utility structure located about 30 meters to the east.

[17] Armory F. Folwell, *Water Supply Systems Engineering*, 218.

PART III SOURCES OF INFORMATION

A. PRIMARY SOURCES

City of Bend Engineering Department files, including design documents for the municipal water supply system, subsequent modifications, and pipeline plans.

Bend City Council meeting minutes, City Recorder's Office.

B. SECONDARY SOURCES

Bend Bulletin

1925a "Waterworks Improvement," John Dubuis and R.E. Koon, *Bend Bulletin*, February 10, 1925, p. 6, Bend, Oregon.

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1985b Tumalo—Thirsty Land, 1915-1919. *Oregon Historical Quarterly* 86(3):267-297.

1985c Tumalo—Thirsty Land, 1920-1931. *Oregon Historical Quarterly* 86(4): 371-418.

1986 Tumalo—Thirsty Land, 1931-1984. *Oregon Historical Quarterly* 87(1): 21-66.

C. LIKELY SOURCES NOT YET INVESTIGATED

At present, we have no historic photos of the intake structure. Files of the City of Bend Engineering Department, the Deschutes County Historical Society, the Oregon Historical Society, and the on-line archive of the *Bend Bulletin* were consulted without good results. Additional possibilities to consult would be the Deschutes National Forest Special Use files, files of the State of Oregon Water Resources Department, files of the Tumalo Irrigation District, or files of the Deschutes County Watermaster.

FIGURES

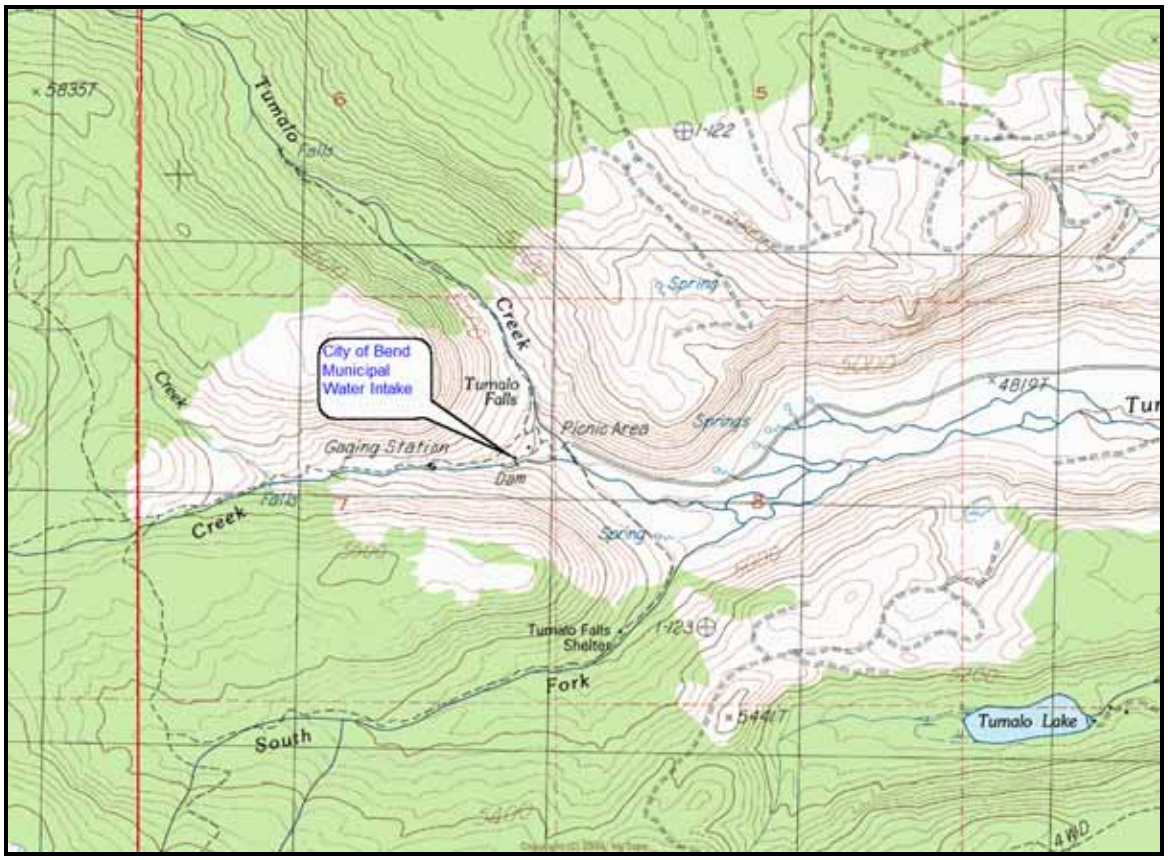

Figure 1 Location of Bend Municipal Water Intake Structure, Township 18 South, Range 10 East, NE ¼ of section 7. From USGS 7.5' Tumalo Falls quadrangle.