Winnibigoshish Dam

Leech Lake Dam

Pokegama Dam

Pine River Dam

Sandy Lake Dam

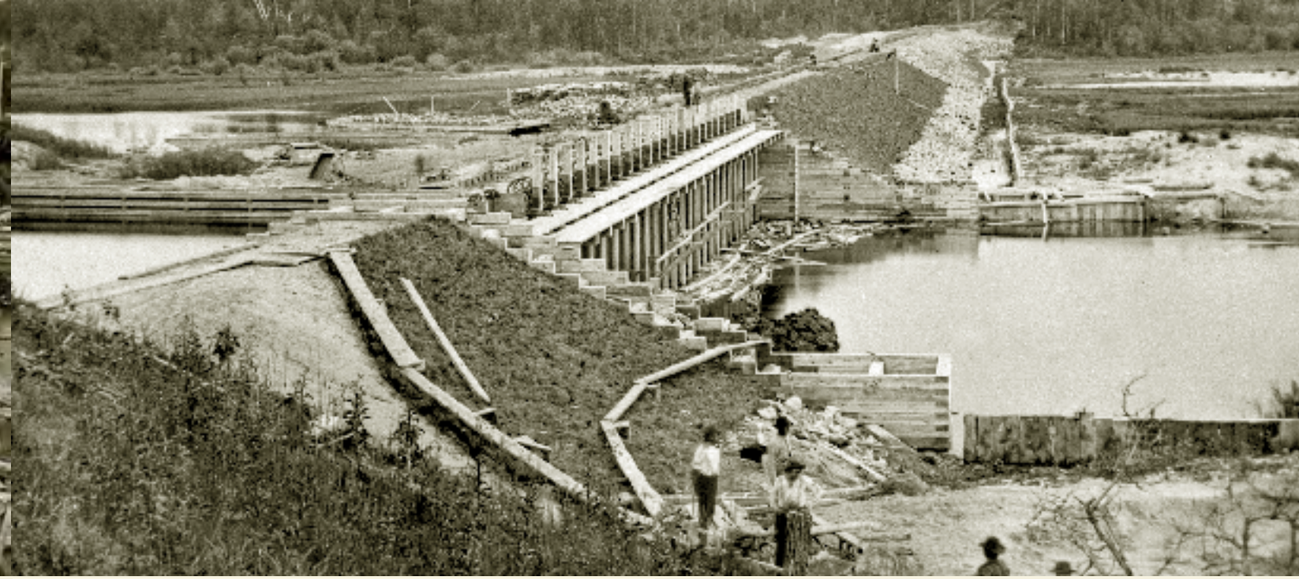
Gull Lake Dam

A History Tour:

Upper Mississippi River

Headwater Reservoirs Damsites

Pine River Dam during reconstruction, 1906.



The six dams described in this brochure are part of an early reservoir system that has a watershed of 4,535 square miles and includes more than 90 natural lakes.

The Past:

The Needs of Navigation and Industry

At the time of their construction, the dams represented a significant civil engineering undertaking accomplished in a then-remote area of Minnesota.

Prior to the construction of the Headwaters reservoirs and locks and dams on the Mississippi River, water levels in the river between the Headwaters and Lake Pepin had great seasonal variation. Early Mississippi River steamboat navigation was totally dependent upon nature providing a three foot water level in the river for weeks or months during the normal July and August seasonal dry periods. This was a huge problem to solve for a growing Minneapolis/St. Paul region relying on reliable river transportation.

Controversial proposals for the creation of a series of dams at several Mississippi Headwaters lakes were made by engineers between about 1852 and 1878. The proposals were designed to store the snow melt runoff and release the stored water during summer dry periods to increase the flow and water levels in the Mississippi River. In the 1870s, the Corps of Engineers considered a system of 41 reservoirs in Minnesota and Wisconsin.

In 1880, Congress authorized the construction of the first dam at Lake Winnibigoshish. The dam served as an experimental structure to test the design and construction methods to be used in the rest of the system. A masonry dam construction, which was standard practice of the time, would have been difficult and costly to use in the Headwaters area where roads were poor or nonexistent.

The first headwaters dams consisted of earthen embankments filled with puddle clay. The control structure, through which the water flowed, was timber. Stop logs, wooden bear trap gates, or steel Tainter gates regulated the sluiceways. Each dam was equipped with a log sluice. The Corps of Engineers started work on the dam at Lake Winnibigoshish in 1881, followed by Leech Lake (1882), Pokegama (1882), Pine River (1884), Sandy Lake (1892), and Gull Lake (1912). A distinguishing feature of the Sandy Lake Dam was its navigational lock, which permitted the passage of steamboats and other craft. Unlike the other dams, the original Gull Lake Dam was concrete.

Although the area was sparsely populated near the dams at the time of their construction, the logging industry in the Headwaters region was very active. Lumber companies were beneficiaries of the increased summer flow as it helped drive logs downriver. The leading lobbyists for the system of reservoirs, however, were Minneapolis flour millers, particularly William D. Washburn. In the early years of reservoir operation, flour mills at the Falls of St. Anthony in Minneapolis benefited greatly from the increased flows during what had previously been dry periods.

All of the timber control structures were rebuilt in concrete between 1899 and 1909. By this time, road construction and new settlements had progressed in the vicinity of the damsites, making concrete construction possible. The reconstructed dams included log sluice and fish ladder bays.

The reservoir system was originally authorized by Congress to regulate water levels for navigation purposes. However, its impact on navigation was short lived. Mississippi River channel modification undertaken after 1907 and the series of locks and dams built in the 1930s more efficiently regulated water levels. During this time, recreational use of the Headwaters lakes and rivers by fishermen, hunters, campers, and boaters greatly increased. Reservoir resort owners and lakeshore property owners became as concerned about their water levels as Minneapolis flour millers had been 40 years earlier. Farmers, wild rice growers, and northern Minnesota paper mills and sawmill owners also added their voices to the management of Headwaters lake water levels.

Service buildings at Gull Lake Dam, 1937.

Pioneer Dam Tenders

"Weather changeable and temperature quite low, wind North. Set out some tomato plants last night and the remainder today; planted some lettuce and beets down in the woods where the sod for embankment of dam was taken from. No sign of any logs in Cross Lake yet, tho. a horn was heard this morning over at Dagget Lake. Gauge above dam 8.88, gauge below dam 9.40, head 8.48. Gate opens one foot."

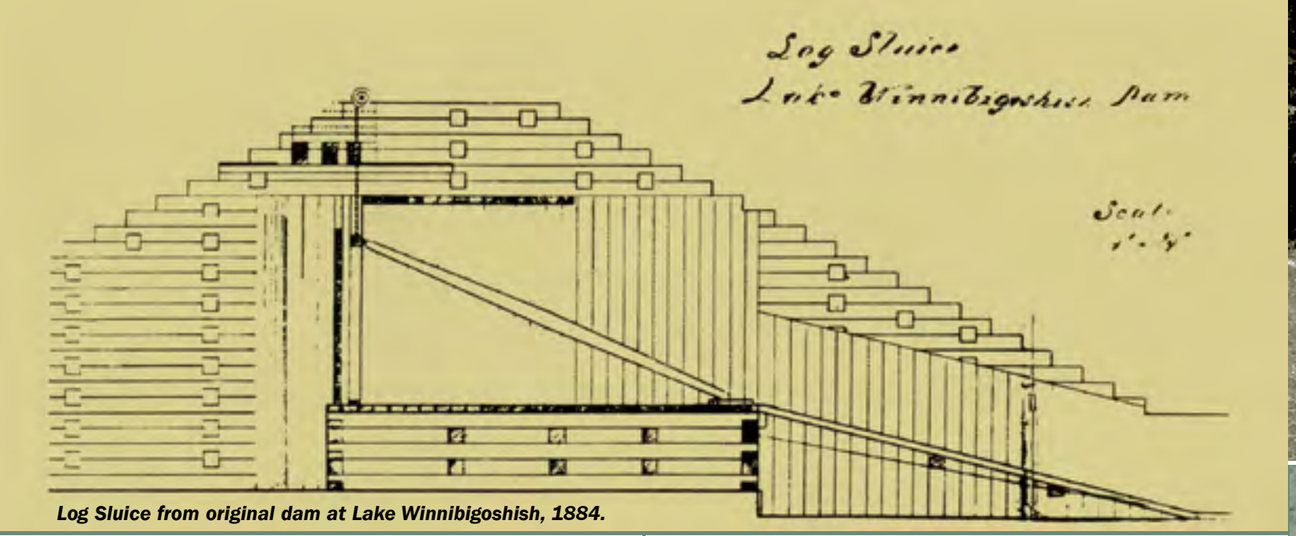
This quote is typical of the records left by the small community of dam tenders responsible for the operation of the damsites. Each Headwaters reservoir was originally a self-contained complex consisting of as many as 12 buildings. The complex typically included a house for the dam tender, an office, a barn or stable, a maintenance shop and a boathouse. To early visitors of these sparsely populated portions of the north woods, the complex must have appeared to be a small village. The shops and garages were necessary for the maintenance and repair work that the dam tender performed. The dam tender took rain and snow depth readings, monitored the river gauges and adjusted the gates on the sluiceway. He oversaw the sluicing of logs and, at Sandy Lake Dam, the passage of steamboats. He communicated with engineers at the St. Paul District office on a regular basis via telegraph and later the telephone. The dam tender's job was year-round with long winters where the temperature could reach minus 59 degrees.

In the early years of dam operation (ca. 1884-1920), the root cellars, chicken coops and barns assisted the dam tender and his family in maintaining a degree of self sufficiency. Electrical service was supplied to the damsites after 1918. In addition to the dam tender's house, there was sometimes another house for the use of visiting Corps officers and other personnel. The dam tender's wife provided meals for the visitors.

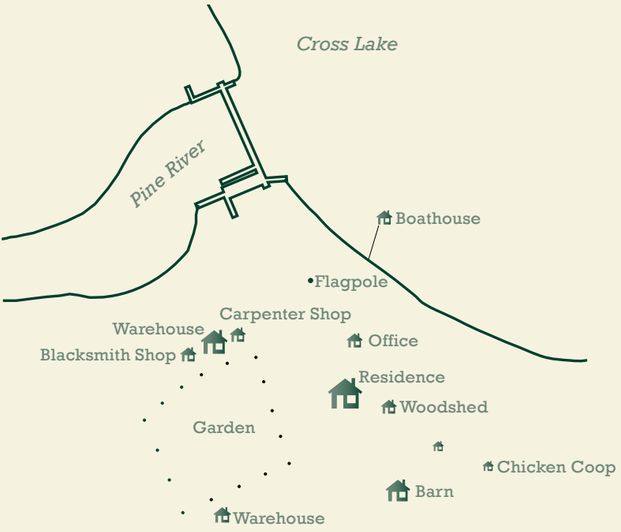
The daily logs kept by the dam tender, however, indicate that there was a trickle of other visitors and passersby such as mail and delivery persons, Native Americans, lumbermen and occasional land dealers.

At first, the dam tender's dwellings were very utilitarian buildings. At Winnibigoshish, the first house was of log, and at Pokegama, the first house was covered with tar paper. During reconstruction of the dams, many of the older houses were rebuilt or replaced. The later generation of houses showed that the Corps engineers attempted to create a comfortable and even stylish dwelling. This was particularly true at Pokegama (1908, demolished) and at Gull Lake (1913), the last house built. As of July 2012, the house at Gull is still on-site and is being used by the Corps for office space.

The dam tenders and their families were witness to a great transformation of the Headwaters wilderness. In the beginning, it was a pioneer experience with the gates adjusted to facilitate navigation and augment the flow downstream. By the 1930s boaters, campers, fishermen and hunters visited the reservoirs regularly. The nation was now beginning to experience an increase in leisure time recreational pursuits and tourism. The dam tender's job thus evolved to that of today's Park Manager and Park Ranger responsibilities, which include operating the gates for purposes of flood risk reduction.



Log Sluice from original dam at Lake Winnibigoshish, 1884.



Plan of Pine River Damsite, 1929.

Mississippi River Headwater Dams and Reservoirs.

The Present:
Recreation

At Leech Lake, the Corps began providing basic facilities for public recreational users as early as 1909. Most of the damsites accommodated tent campers on an informal basis until the completion of Master Plans for recreational site development between 1964 and 1977. Today the regulation of the reservoirs acknowledges diverse needs, including those of fish and wildlife conservation and shoreline property owners, as well as those for flood risk reduction and water supply.

Present recreation area, 2012.

Lake Winnibigoshish
Recreation Area

The Winnibigoshish Lake Dam is located on the Mississippi River at the outlet of Lake Winnibigoshish. It controls the runoff from a 1,442-square-mile drainage area containing 28 lakes.

The Corps of Engineers began construction of the original timber dam at “Winni” in 1881. It was put into operation in 1884. Nearly 2 million feet of white and Norway pine were cut from the lakeshore and used in constructing pilings, dams and other structures. Logging operations, labor and material shortages, weather problems and the difficulties of constructing roads and installing machinery in near-wilderness conditions caused construction delays. The project employed 300 skilled and unskilled laborers, including local members of the Chippewa Tribe. In 1882, the Corps of Engineers announced that “The Winnibigoshish Dam is the inauguration of the reservoir system for the entire country.”

The present concrete structure was constructed between 1899 and 1900. In 2006, the stop logs and gates were replaced with two concrete bulkheads and one leaf gate in each of the five main spillway gate bays. A leaf gate was installed in the 12-foot log sluice bay. A 5-foot fishway constructed in 1912 is no longer in use.

Winnibigoshish House, 1937.

Prior to 1899, during the first phase of dam construction, workmen built 17 buildings across the channel to the west, opposite the present site. All of the buildings were of log construction. At the time of dam reconstruction between 1899 and 1900, the complex of buildings was also reconstructed at the opposite side of the dam. The Lake Winnibigoshish Dam was listed on the National Register of Historical Places in 1982.

Leech Lake
Recreation Area

Leech Lake Dam is located on the Leech Lake River at the outlet of Leech Lake. It is 27 miles above the junction of the Leech Lake River and the Mississippi River. Construction began in 1882; the dam was the second to be built in the Headwaters reservoir system. It was put into operation in 1884. The riverbanks are about 3,500 feet apart at the dam site, the largest span in the system.

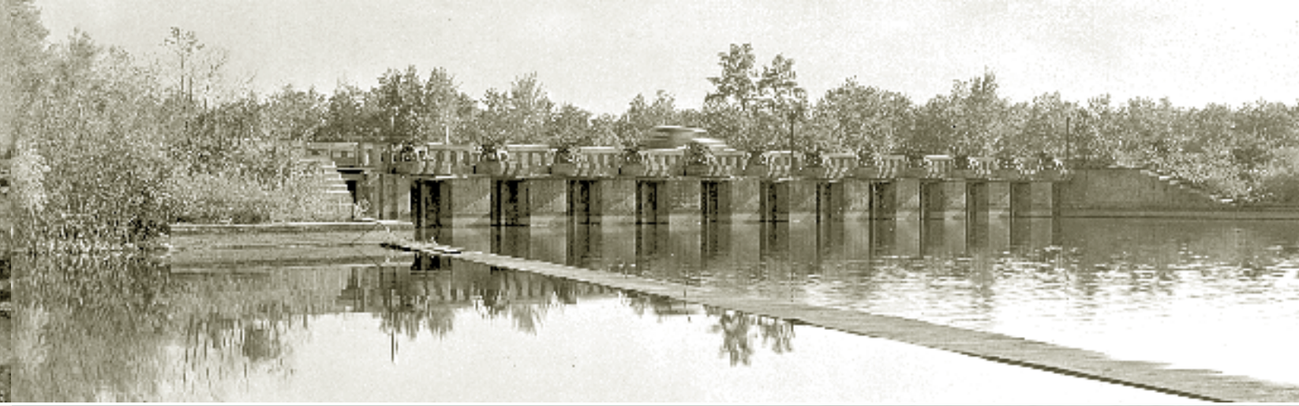
Between 1900 and 1903, reinforced concrete was used to replace the timber abutments and bays. The present 294-foot control structure consists of reinforced concrete abutments and piers supported by timber pilings with slide gates installed into five of the 25 6-foot sluiceways and one 12-foot log sluice.

The Leech Lake dam tender’s house was built between 1902 and 1904. The dwelling was oriented north with a view of the dam and marshes of Leech Lake. A garage at the rear dated from about 1910. The house has been moved and is no longer on-site. A searchlight, that was located north of the house, was installed during World War II when the dams were carefully guarded as part of wartime security. There was also a searchlight at Winnibigoshish Dam.

Dam tender’s house at Leech Lake, ca. 1904.

A variety of seasonal businesses such as bait shops and fishing boat rentals occupy the floodplain along the outlet channel. The Corps first leased a part of the shoreline for a public launch spot in 1909.

Leech Lake Dam , ca. 1905.



Pokegama

Pokegama Recreation Area

The Pokegama Dam is located on the Mississippi River, three miles upstream of Grand Rapids. Construction began at this damsite in 1882 and the dam was put into operation in 1885. The Corps of Engineers completed reconstruction in concrete in 1904. Pokegama is considered the distributing reservoir for the two upper reservoirs at Winnibigoshish and Leech, the water from which passes through this dam.

The current control structure is 225 feet long and contains 13 8-foot sluiceways and one 12-foot long log sluice. In 2011, 7 leaf gates were installed and the slide gates in the remaining sluiceways were rebuilt. A leaf gate was also installed in the log sluice bay. The earth-filled embankments have timber diaphragms filled with puddled clays, and rest on the quartzite outcrop that occurs in this area.

Eleven buildings were first erected at the start of construction of the original timber dam. In 1909, a temporary dam tender's dwelling was replaced with a 2 ½-story dwelling that had plumbing and a hot-air furnace, the first dam tender's dwelling to be so equipped at the time of construction.

A one-story office was constructed on this site in 1909. The stylish clapboard-clad building featured a flared hip roof and an eyebrow dormer.

Dam tender's house at Pokegama, ca. 1909 (razed).

Pokegama Dam, Sep. 17 1908.

Cross Lake Reservoir/Pine River Dam

Cross Lake Recreation Area

The Pine River Dam is located on the Pine River at the outlet of Cross Lake, 18 river miles above the junction of the Pine and Mississippi rivers.

Pine River was the fourth Headwaters reservoir to be constructed. The original timber dam dates from 1884 and was put into operation in 1886. Corps engineers reused machinery and supplies from the construction of the Winnibigoshish and Leech Lake dams at this site.

The dam was constructed to its present appearance between 1905 and 1907. The control structure is 233 feet in length and consists of reinforced concreted supported on timber piles. There are 13 sluiceways. In 2002, leaf gates were installed in each sluiceway and the dam was raised. A series of perimeter dikes built around the dam between 1899 and 1914 allowed it to be filled to capacity.

In 1934, representatives of the Portland Cement Association reported the Pine River Dam was the "finest concrete structure from the point of view of durability that they were aware of." The arched openings of the Pine River Dam give it a distinctive appearance. There are no structures remaining from the 17-building complex constructed by the Corps of Engineers in 1884. Included were a dam tender's dwelling, laborer's quarters, engineer's quarters, dining hall, office building, officer's house, woodshed chicken coop, barn, warehouse, sawmill, and carpenter and blacksmith shops. The Corps removed a number of these buildings immediately after the dam construction was finished. A new dam tender's dwelling built in 1911 was later destroyed by fire. The replacement dwelling was destroyed by fire in 1959 and was not rebuilt.

Dam tender's house at Pine River Dam, 1904

Sandy Lake

Sandy Lake Recreation Area

The Sandy Lake Dam is located on the Sandy River, 1 ¼ miles above the junction of the Sandy and Mississippi rivers.

The original timber dam dates from 1892-1895. In 1896, a navigation lock, the only one in the Headwaters reservoir system, was completed. The original timber structure showed deterioration by 1904 and reconstruction began in 1908. Steamboats and horse-drawn wagons transported the concrete plant used at the Pine River Dam to this site. The lock was also reconstructed and the operating machinery installed in 1912. The metal-sided shelter house was built over the machinery building in 1914. The 30-foot wide lock is no longer in use. In 1957, it was converted to a spillway containing five sluice bays.

Eight buildings were constructed at the beginning of work on the dam in 1892. In addition to the watchman's quarters there were a dining room and kitchen, a warehouse, carpenter and blacksmith shops, a tool house, a stable, and laborer quarters. Conversion of the watchman's quarters into a dam tender's house began about 1910. The house was removed in 1991.

The dam site was near the terminus of the Savanna Portage, which connected Sandy Lake and the Upper Mississippi River with the St. Louis River and Lake Superior. Explorers, fur traders and missionaries used the portage between 1755 and 1855. In 1794, to the south of the dam site at Brown's Point on Big Sandy Lake, the Northwest Company established a fur trading post. In 1830, the American Fur Company established a post at Sandy Lake at the junction of the Mississippi and Sandy rivers, just to the west of the present dam. William Aitkin, the operator and several missionaries resided here between about 1832 and 1855. A steamboat landing at this site operated after about 1870, bringing supplies and settlers to the area.

Fredrick Ayer established a mission and school near the dam site in 1832-33. A later school building stood northwest of the dam. It was moved off the damsite in the 1950s but a rubble foundation remains. A cemetery containing the graves of Native Americans and early settlers is found on the small hill near the site of the dam tender's house.

Dam tender's house at Sandy Lake, ca. 1937 (razed).

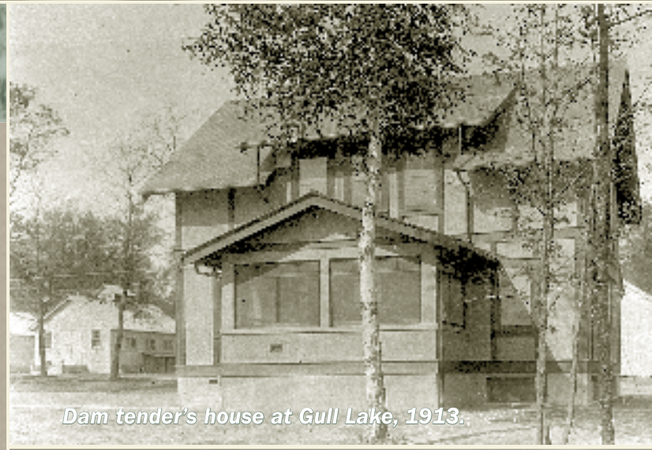
Gull Lake

Gull Lake Recreation Area

The Gull Lake Dam is located on the Gull River about one-half mile below the outlet of Gull Lake. It was put into service in 1912, the last of the Headwaters reservoir dams constructed. The designers were Col. Francis R. Shunk and George Freeman. This team also designed Lock and Dam No. 1 built on the Mississippi River between Minneapolis and St. Paul in 1917.

The control structure is built of reinforced concrete supported on timber piling. There is a log sluice and a 5-foot fishway in addition to five sluiceways.

The 7-room dam tender's house, completed in 1912, is of concrete beam construction. The exterior is finished with concrete panels. It is a good example of the then popular "Craftsman" style of architecture. One characteristic of the style is its "honest," straightforward treatment of materials. Brick, stucco and frame Craftsman style houses were built in many Minnesota cities and towns between 1905 and 1920. The exposed rafter ends at the eaves, grouped windows and simple board trim are notable details associated with this style. The dam tender's house is eligible to be listed on the National Register of Historic Places.



Dam tender's house at Gull Lake, 1913.

Service building at Gull Lake, 1937.

House and office at Gull Lake, 1937.

DAM CONSTRUCTION TERMS

Bear Trap Gate: A type of gate with an upstream leaf and a downstream leaf.When lowered both leafs rest in a horizontal position with one leaf overlapping the other. When raised the leafs form a “tent” like structure over which water can flow.

Cofferdam: A watertight enclosure from which water is pumped to expose the bottom of a body of water and permit construction of pilings or other structures.

Dam: A wall that holds back water.

Dike or Levee: A bank of earth constructed to block water rather than regulate its flow.

Gate: A barrier across a water channel that can be removed so as to regulate the flow of water.

Leaf Gate: A type of gate with an upper and lower gate section. During normal operations the lower section is raised to release water. As the flow increases, and the lower gate section is raised higher, it eventually engages the upper section so that both sections raise together. At Winnibigoshish Dam, the upper section of the log sluice can also be lowered to allow water to flow over the top of the gate.

Log Sluice: A passage fitted with a gate or valve that can be opened to pass logs downstream.

Puddled Clay: An earthy mixture worked while wet into a compact mass that becomes impervious to water when dry.

Sluiceway: An artificial channel that admits water by means of a sluice.

Spillway: A passage in or about a dam for the escape of surplus water.

Spillway Apron: A concrete or timber floor at the bottom of a spillway to prevent soil erosion from heavy or turbulent flow.

Stop Logs: Planks, precast concrete beams, or steel joists that fit between vertical grooves in walls or piers to close up a spillway or other water channel.

Tainter Gate: A radial spillway gate, named for its inventor J. Burnham Tainter (1836-1920). Tainter was a member of the prominent Menomonie, Wisconsin, lumber family. The gate rotates on a horizontal axis on the downstream end and can be closed under its own weight.

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