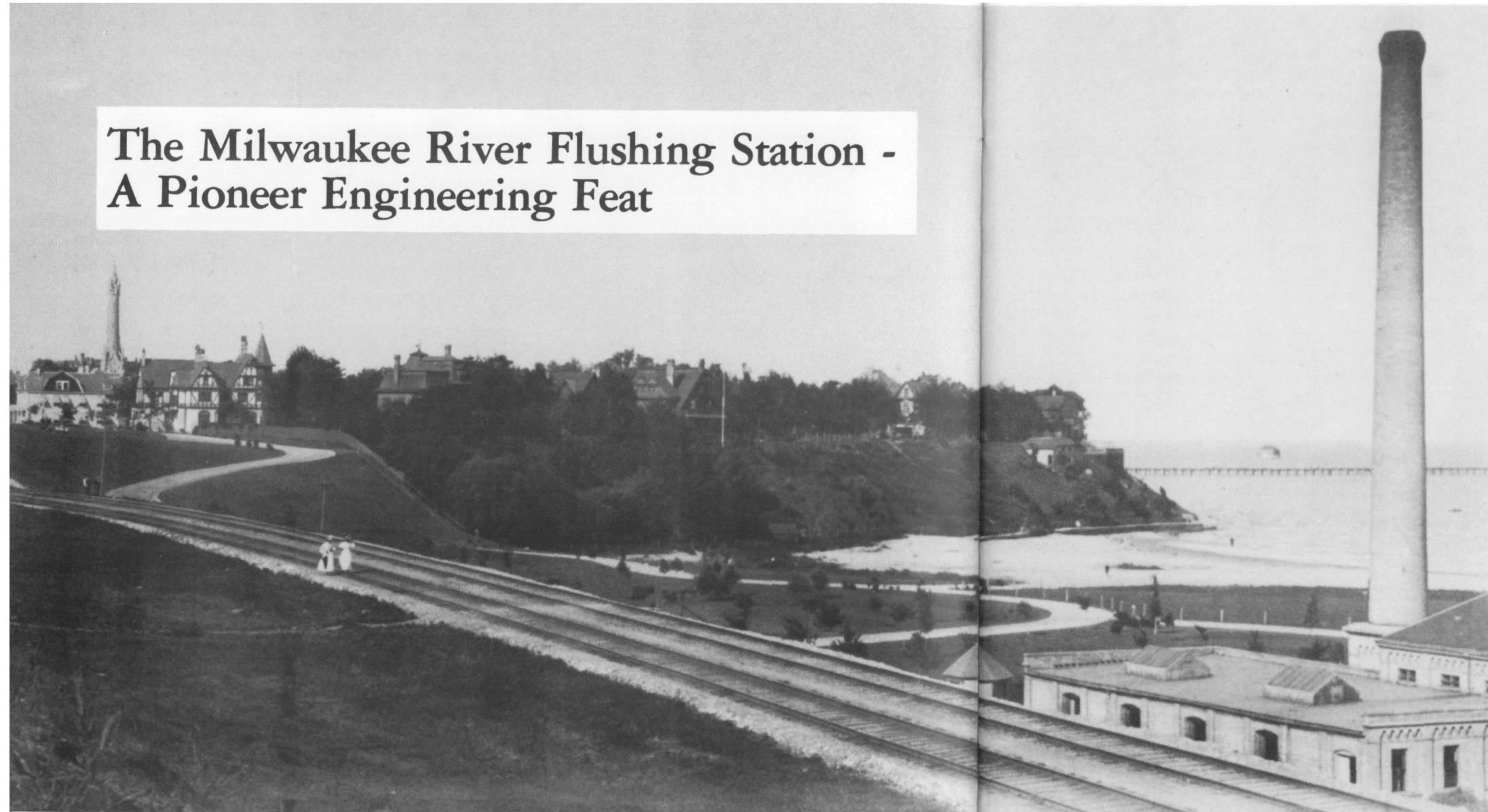


The Milwaukee River Flushing Station



**A National Historic
Mechanical Engineering Landmark
Milwaukee, Wisconsin
November 15, 1992**

The Milwaukee River Flushing Station - A Pioneer Engineering Feat



Milwaukee's lakefront looking north from the flushing station in 1891.
The railroad tracks now serve as a bike path through the city's east side.

Photo Courtesy of the Milwaukee County Historical Society

Located in the heart of Milwaukee's lakefront, across the street from McKinley Marina, the Milwaukee River Flushing Station is an example of engineering ingenuity that has stood the test of time.

In the late 1800's, Milwaukee found itself with a very serious problem, delicately referred to as "the river nuisance." At that time, all of the city's sewers emptied directly into the Milwaukee River. With Milwaukee's burgeoning population, the natural flow of the river wasn't strong enough to keep it clean, and the result was a stagnant and smelly waterway.

City officials decided the quickest and most practical solution would be to somehow flush the river with fresh water on a daily basis. This engineering feat was accomplished in 1888, with the pioneering design of the Milwaukee River Flushing Station.

The station took huge volumes of water from Lake Michigan and pumped it into the Milwaukee River by means of an underground tunnel. A spectacular 500 million gallons were pumped each day, making Milwaukee's the largest water pump in the world at that time.

The flushing station still serves the same purpose today as it did more than a century ago. From May until October, lake water is pumped into the river to curb the effects of modern day pollution.

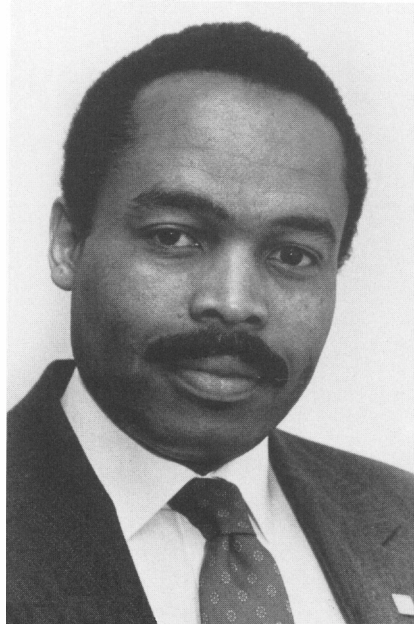
Historic Concern For Clean Water Still A Vital Part Of MMSD Mission

A Message From Executive Director Ralph Hollmon

The Milwaukee Metropolitan Sewerage District is proud to accept the historic designation of the Milwaukee River Flushing Station by the American Society of Mechanical Engineers. This honor says much about the circumstances that not only brought about MMSD's existence, but which define who we are today, as we head into the 21st century.

Back in 1888, the flushing station was built as a short term solution to a serious pollution problem, the dumping of raw sewage directly into the Milwaukee River. City planners recognized the need to build a network of sewers to intercept the waste from homes and businesses, delivering it to wastewater treatment facilities for cleansing before it was returned to Lake Michigan. But they also recognized that the planning, approval and financing of this interceptor system would take decades, so the flushing station was built to alleviate the pollution problem in the interim.

The Milwaukee River Flushing Station is indicative of MMSD's historic commitment to tackling difficult engineering problems in order to curb pollution and preserve Milwaukee's quality of life. Just as clean water and environmental protection were vital issues in 1888, they remain a driving force behind the Milwaukee Metropolitan Sewerage District today.



Ralph Hollmon

“It is the most important public improvement made since the building of the waterworks.”

*Mayor Thomas H. Brown
September, 1888*

Engineering Breakthrough Pumps New Life Into River

The thought of an open sewage canal running through the heart of a city is unappealing, to say the least. Yet, that was the situation faced by the City of Milwaukee in the late 19th century. The city's sewers had been constructed to empty directly into the Milwaukee River. The flow of the river was enough to dilute the sewage and cleanse it naturally, at first.

But by 1886, the city's population had swelled to nearly 200,000 and the Milwaukee River had become not only an eyesore, but a public health threat. Building a new sewer system to intercept and treat raw sewage would solve the problem long-range, but something needed to be done immediately.

A Milwaukee engineer working for E. P. Allis & Company came up with the plan to flush the river with fresh water from Lake Michigan via an underground tunnel. In 1887, Edwin Reynolds' unique screw pump design won approval, although many in the engineering community scoffed at it, and the digging began.

The flushing tunnel, 12 feet in diameter, extended 2,534 feet from the pumphouse site beneath East Kane Place to the river. Most of the excavated soil was used to expand the Lake Michigan shoreline, creating additional land for docking coal boats which would supply the pumphouse.

Within a year, Reynolds' critics were turned into believers. On September 14, 1888, the steam engines were fired up and within 13 minutes lake water began pouring into the polluted river. In a short while, the upstream current was reversed and black sludge began to move downstream. One day and 500 million gallons later, the river had returned to its natural color and transparency. The noxious fumes had dissipated.

The Reynolds' screw pump was the largest water pump in the world at the time. A coal-fired steam engine drove the pump, which consisted of a 4 bladed propeller-type screw 14 feet in diameter. The blades could move an astonishing 41,764 cubic feet of water per minute. In 24-hours of operation, the pump virtually replaced the entire volume of water in the river from the North Avenue dam to the Milwaukee harbor.



In the late 19th century, the flushing station played an important role, protecting Milwaukee waterways for public-recreation.

Photo Courtesy of the Milwaukee County Historical Society

The Cream City brick flushing station consisted of two rooms, the largest housing 4 horizontal tubular boilers for the steam engine, and the other housing the pump

In 1912, the steam engine was replaced with a 350 horsepower electric motor. A year later, the motor was rewound to deliver 450 horsepower, and it is this motor which is still in use today.

In 1955, ownership of the flushing station was transferred to the Milwaukee Sewerage Commission. The ink was barely dry on the sale when the station's long history of trouble-free operation ran aground. Backflow from the river carried a giant tree stump into the pumphouse. When the wood hit the whirring impeller, two of its blades were damaged beyond repair.

With its remaining two blades, the pump was put back in business, but its effectiveness was greatly reduced. In 1985, the Sewerage Commission decided to restore the pump to its original capacity. A new 4-bladed impeller replaced the damaged one, and the pump was restored and automated.

In 1988, the exterior of this late-Victorian, romanesque-revival structure underwent its own renovation. The masonry was cleaned and the roof, windows and doors were all replaced in accordance with historic preservation guidelines.

More than a century after it was built, the Milwaukee River Flushing Station still serves the city well. Operational from late spring to early fall, this pioneering landmark improves water quality, boosts dissolved oxygen levels for fish and wildlife, and subtly enhances Milwaukee's quality of life.



Swimmers enjoyed the expanded shoreline at McKinley Beach, made possible through the excavation of the Milwaukee River Flushing Station tunnel.

Photo Courtesy of the Milwaukee County Historical Society

Edwin Reynolds (1831-1909)



Edwin Reynolds

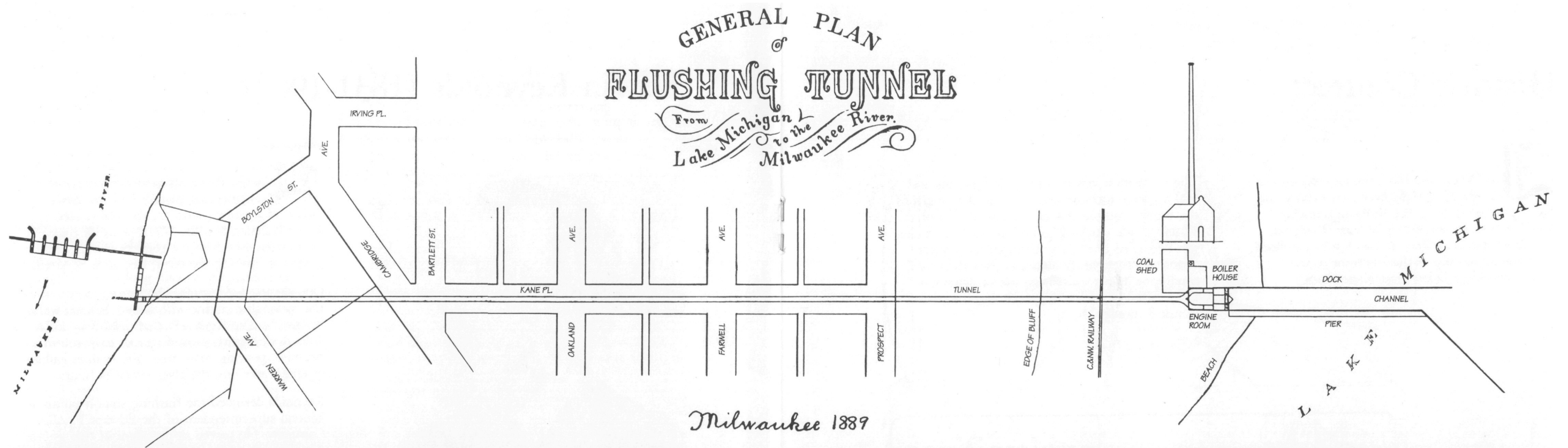
Edwin Reynolds earned his mark in engineering history with his design of a screw pump for the Milwaukee River Flushing Station. While some of the greatest engineers in the country condemned his plans for flushing the river, Reynolds persisted.

One skeptical alderman who vowed to “drink all the water that engine will throw” had to swallow his words. The Reynold’s pump, built by E.P. Allis & Company, proved true to its inventor’s promise, pouring more than 500 million gallons of lake water into the river every 24-hours.

Reynolds designed the flushing station pump as general superintendent of the Edward P. Allis Company. He served as president of the American Society of Mechanical Engineers in 1902.

“Through the ingenuity of Edwin Reynolds came pump designs previously unheard of and which much of the engineering community scorned until Reynolds and Allis proved they were right.”

The Allis Chalmers Story



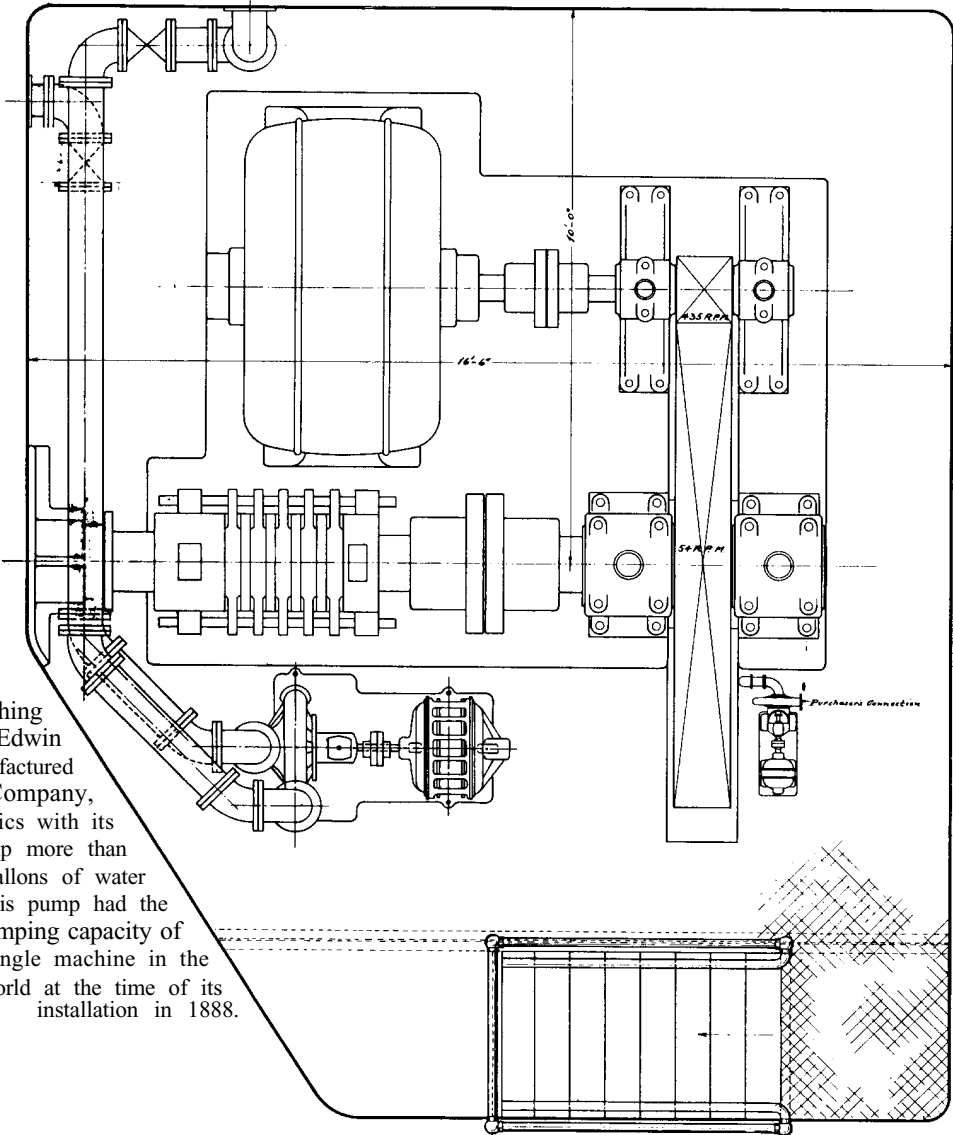
At 126 feet, the flushing station's brick smokestack was a prominent feature along Milwaukee's lakefront for many years. It was removed after the pump's power supply was converted from coal to electricity in 1912.

Photo Courtesy of the Milwaukee County Historical Society

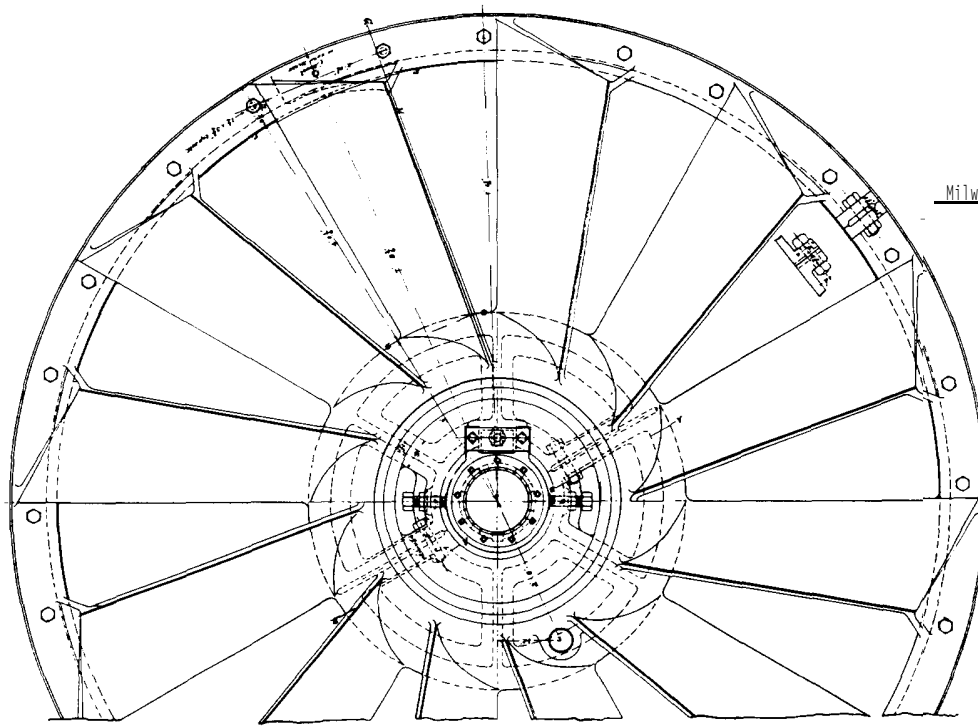
Historic Contract

In December, 1887, the largest contract in the City of Milwaukee's history was granted to build the flushing tunnel. For \$114,000, Milwaukeean William Forrestal completed the brick lined tunnel which extended from the intake slip at the lakefront to the Milwaukee River below East Kane Place.

The excavation was no easy task. Cave-ins and foul air were a major problem and the length of the tunnel, combined with a diameter of only 12-feet, made working conditions difficult. Then, just one-third of the way through the project, Forrestal's crew hit hardpan, or very dense soil conditions, that required the use of dynamite. Despite the obstacles, the work was completed in just 8 months.



The Milwaukee River Flushing Pump, designed by Edwin Reynolds and manufactured by the E.P. Allis Company, astounded skeptics with its ability to pump more than 500 million gallons of water each day. This pump had the highest pumping capacity of any single machine in the world at the time of its installation in 1888.



Propeller Wheel
for
Milwaukee Flushing Engine.

Specifications

Flushing tunnel length	2,534 feet
Flushing tunnel average depth	95 feet underground
Flushing tunnel diameter	12 feet
Pump impeller diameter	14 feet
Pump capacity	525,000,000 gallons/day

Power

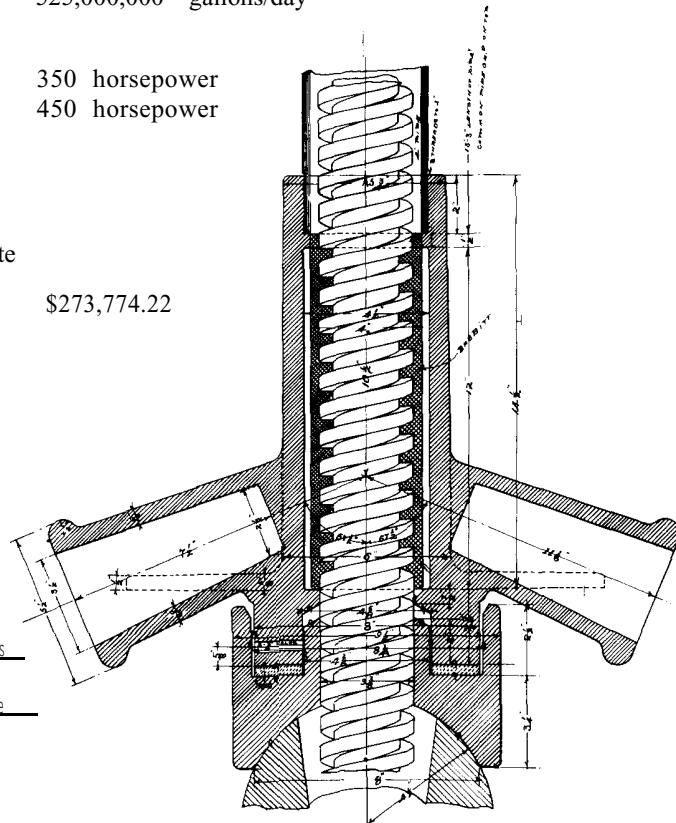
1888 vertical compound steam engine	350 horsepower
1912 3-phase, 440 volt electric engine	450 horsepower

Normal Operating Conditions

53 revolutions per minute
788 cubic feet of water per revolution
41,764 cubic feet of water pumped per minute

Cost

\$273,774.22



Lifting Gear for 12' Gates
for
Milwaukee Flushing Engine

**NATIONAL HISTORIC
MECHANICAL ENGINEERING LANDMARK
MILWAUKEE RIVER FLUSHING PUMP
1888**

THIS PUMP, DESIGNED BY EDWIN REYNOLDS (1831-1909) AND BUILT BY THE EDWARD P. ALLIS COMPANY, IS THE MAJOR COMPONENT OF ONE OF THE EARLIEST WATER POLLUTION CONTROL SYSTEMS. IT WAS CAPABLE OF PUMPING MORE THAN A HALF BILLION GALLONS OF WATER A DAY, THE HIGHEST CAPACITY PUMP IN THE WORLD WHEN INSTALLED. IT STILL IS USED DURING THE SUMMER TO PUMP WATER FROM LAKE MICHIGAN INTO THE MILWAUKEE RIVER UPSTREAM OF THE DOWNTOWN AREA. THIS MAINTAINS A CURRENT IN THE LOWER PORTION OF THE RIVER AND GREATLY REDUCES THE CONCENTRATION OF POLLUTANTS.



The American Society of
Mechanical Engineers

1992

Designation As Landmark

The Milwaukee River Flushing Station is the 106th National Historic Mechanical Engineering Landmark to be designated. Since the ASME Historic Mechanical Engineering Recognition Program began in 1971, 154 Historic Mechanical Engineering Landmarks, 6 Mechanical Engineering Heritage Sites, and 4 Mechanical Engineering Heritage Collections have been recognized. Each reflects its influence on society, either in its immediate locale, nationwide, or throughout the world.

An ASME landmark represents a progressive step in the evolution of mechanical engineering. Site designations note an event or development of clear historical importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The ASME Historic Mechanical Engineering Recognition Program illuminates our technological heritage and serves to encourage the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers. It helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

The History And Heritage Program Of The ASME

The ASME History and Heritage Recognition Program began in September 1971. To implement and achieve its goals, ASME formed a History and Heritage Committee, initially composed of mechanical engineers, historians of technology, and curator (emeritus) of mechanical engineering at the Smithsonian Institution. The Committee provides a public service by examining, noting, recording, and acknowledging mechanical engineering achievements of particular significance. The History and Heritage Committee is part of the ASME Council on Public Affairs and Board on Public Information. For further information please contact Public Information, American Society of Mechanical Engineers, 345 East 47 Street, New York, NY 10017-2392, 212-705-7740.

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Ralph Hollmon

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