JAMES MCFARLANE
Hamilton Water Supply • 1860-1910

James McFarlane was the chief engineer in charge of the pumphouse for 50 years, from 1860 to 1910.

Under his supervision the engines and buildings were all scrupulously clean, the brass was polished and the floors were scrubbed with lye. His skill and exacting standards ensured that the engines where erected in perfect working condition. His unending care over most of their working lives kept the engines in prime condition.
TABLE OF CONTENTS

HISTORICAL HIGHLIGHTS

85
Hamilton’s Need for Water

87
Acquiring a Waterworks System
  Thomas Coltrin Keefer

90
Design, Construction and Operation of the Waterworks System
  Design Population
  Water Supply
  Technical Details
  How the Pumphouse Worked
  James McFarlane
  Barton Reservoir

99
Royal Visit
  The Illustrated London News, Prince of Wales Visits Hamilton

102
Gore Park Fountain

104
Ferguson Pumping Station

107
Expansion of the Waterworks Distribution System
  Filtration and Purification Plant
  Old Low Lift Pumping Station
  High Lift Pumping Station
  Chlorine Handling Facilities
  Beach Road Low Lift Pumping Station

118
Laboratory Testing of Water and Wastewaters
  Hamilton’s Environmental Laboratory
  Hamilton’s New Environmental Laboratory and Operations Control Centre
HISTORICAL HIGHLIGHTS

Hamilton, Canada
The City of Opportunity

500 Diversified Industries

Cheapest Electric Power in the World for Manufacturing Purposes.

For more specific information about Hamilton's beauty, advantages and opportunities, write to:

C. W. Kirkpatrick,
Commissioner of Industries and Publicity
Hamilton, Ont.

“Make Hamilton Your Destination!”

You will be amazed at the progress and development of the “Birmingham of Canada.”

THE HAMILTON BOARD OF TRADE

extends to you a hearty invitation to visit the City, and requests that you will consider the organization at your service while you are here.

Special information concerning facilities, advantages, attractions, etc., gladly furnished upon request.

Address all correspondence to:

T. L. Brown,
Secretary

Telephone—Hamilton 570

American Hotel
King Street, Corner of Charles, Hamilton, Ont.

P. W. Bearman, Proprietor

This Hotel, one of the largest and most centrally located in the City, often named accommodation in Hamilton, either for business or pleasure, strangers arriving either by train or by the steamer from the Canadian.

AMERICAN HOTEL OMNIBUS
AS THE DEPOT OR WHARF.

TERMS $1.00 PER DAY

In connection with this Hotel, the Proprietor has five Omnibus Stables for the accommodation of those bringing Horses or Staging in them.

GENERAL STAGE OFFICE

Stages leave daily from this Hotel, for Port Dover and intermediate places, the Hamilton and Intercolonial, London, etc.

China Tea Store!

Co. James Street and Market Square

Wholesale and Retail Dealers in

GROCERIES, WINES, LIQUORS, &C,

Hamilton, Ont.

HAMILTON ADVERTISEMENTS

J. W. Lottridge & Co.
Prior to 1859 and the supply of clean potable water, Hamilton residents found dust an intolerable nuisance and household words such as epidemic and fire could spread fear throughout the city.

Buildings were constructed of wood and heated with wood burning fireplaces. Fires were hard to extinguish as water had to be carried by buckets from the closest cistern or well. Hamilton had a long history of devastating fires that would sweep from building to building.

Dust was a concern and frequently commented on in Hamilton newspapers during the 1840s and 1850s. The streets were unpaved so any movement or winds could create clouds of dust that worked their way through homes and businesses. The papers also pointed out the health hazards of dust and its impact on causing diseases of the throat and lungs.
Many times over the years, cholera among other water-borne diseases would sweep through Hamilton. In warmer weather, cholera would be brought in by the immigrant ships and spread rapidly through the city. Council was frequently petitioned to provide a clean, adequate water supply but the cost to provide this service always seemed too high. Throughout the summer of 1854, the worst case of cholera hit Hamilton taking 552 people.

This wasn't expected as the public didn't realize cholera was a water-borne disease, and thought enhanced efforts to improve the cleanliness of the city, individual properties and personal hygiene would prevent an epidemic. The epidemic placed considerable pressure on Council.
ACQUiring A WATERWORKS SYSTEM

September 18, 1854 – Advertisement in The Hamilton Spectator announced waterworks design competition and cash prizes for winners. Six competitors submitted plans, three were successful and received cash prizes.

HISTORICAL HIGHLIGHTS

Daily Spectator
HAMILTON, FEBRUARY 21, 1857

THE WATER WORKS

The report of the consulting Engineers, Messrs. Jarvis and Crane, of New York, has at length been printed and submitted to the citizens of Hamilton. It occupies about eighteen pages, in pamphlet form, and fully corroborates the surveys made by Mr. Keeser.

While agreeing with Mr. Keeser as to the Ancaster Creek being the proper source from which to obtain a supply by gravitation, they unhesitatingly recommend that the pumping plan be adopted. They object to Burlington Bay, on the ground of the instability of the water, and say that the objections to its use are well founded now, and must become more decided every year. The choice they consider is between the Ancaster gravitation plan and pumping from Lake Ontario. Mr. Keeser’s estimate for the plan is £187, 537, while the consulting engineers reduce it to £160,000, by recommending that the mains be reduced, and one large engine left out.

They thus sum up their views in favor of the Lake plan:

In view of all the circumstances, which it is believed have been sufficiently discussed, the plan of pumping a supply from Lake Ontario, as recommended by Mr. Keeser, is regarded as the most simple—the most free from unfavorable contingencies—likely to be attended with the least ultimate cost, and capable of expansion as the wants of the City may require; it is therefore proposed by the undersigned for your adoption.

There appears no good reason to doubt that, the sum stated above (£160,000) will be sufficient, with prudent and intelligent management, to complete the works on the scale proposed. Excepting as the growth of the City will require further outlay for distribution, the works may be regarded as sufficient for your wants, until your population exceeds 55,000.

The expense of distribution must go on with the growth of your City and to provide for 55,000 people, an addition should be made to the estimate of £18,000. It may therefore be considered that, for a population of 55,000, your works will cost £174,000, or £700,000, or an annual cost of £1,256 etc. per inhabitant. This would provide a ample supply, under pressure, for Domestic use, and is well worth the cost. The economy in domestic service (aside from the convenience and comfort of being able to command water in all parts of the domicile) cannot be appreciated until it has been enjoyed. The saving on insurance, and the blessing of better protection from fire, which space neither life nor property, is of itself a consideration, worth a large portion of the whole expenditure. The tendency, moreover, of a full supply of water, to increase manufacturing operations, is calculated to promote the prosperity of your City to a very material extent. These and other desirable results, which your Citizens will find to rest in upon you, along with an abundant supply of good water, will doubtfully repay the expense that will be incurred in its introduction.

It now only remains for the Commissioners to accept or reject the recommendations of the consulting engineers, but we badly think they will do otherwise than adopt the Lake plan so forcibly recommended both by Mr. Keeser and the consulting engineers.
In 1854, Council began to lay the foundation required to implement a waterworks system for the city and offered a premium fee of $1,000 for the best waterworks proposal submitted.

Mr. Thomas C. Keefer, chief engineer of the Montreal Water Board and one of Canada’s most prominent consulting engineers was hired to act as the judge.

Waterworks proposals submitted were carefully examined. Various gravity supply options were reviewed from springs near Ancaster on the Escarpment, Lake Medad near Waterdown and Albion Mills. Mr. Keefer determined that Samuel McElroy’s proposal to obtain water from an intake well off shore lifting the water with pumps was the best proposal, but needed to be changed from using water in Burlington Bay to obtaining the water supply directly from Lake Ontario.

Council accepted Keefer’s recommendation and at the city’s request, legislation was passed June 19, 1856 to establish a Board of Commissioners empowered to secure a sufficient quantity of pure and wholesome water.

From 1857 to 1859, Keefer was Chief Engineer overseeing the design and construction of the Hamilton Waterworks. He created a waterworks system whose philosophy remains in effect today.

The Canadian Illustrated News
Saturday, September 24, 1863
Article highlights Thomas C. Keefer
Thomas Keefer was born in Thorold on November 4, 1821. His education began in Grantham Academy, a small private school later to become St. Catherines Collegiate Institute. Later, he attended Upper Canada College in Toronto, 1833 – 1838. He then proceeded to serve his initial civil engineering apprenticeship working on the Erie and Welland Canals. In 1845, at age 24 he was made Chief Engineer of the Ottawa River Works. Eight years later, in 1853, he was appointed Chief Engineer of the Montreal Harbour Commission, involved in the deepening of the St. Lawrence River. Keefer’s greatest contributions as a civil engineer were in the form of his hydraulic works for major Canadian cities. He was known as the country’s most prolific and innovative hydraulics engineer. In 1856, McGill University introduced civil engineering as one of its courses. Thomas Keefer was appointed the first professor of engineering at McGill University.

During Keefer’s career he became well regarded and respected as a consultant for the design and construction of waterworks systems throughout Canada. Thomas Keefer could be considered a formidable leader, second to none as a Civil Engineer and the standard that he set for himself and in turn the Canadian Engineering profession.
The design and construction of Hamilton’s waterworks system was undertaken from 1857 to 1859 and included:

**Design Population:**
The waterworks system was designed to accommodate a water supply for 50,000 with alterations made possible to accommodate 100,000. This was forward thinking as the current population was approximately 25,000.

**Water Supply:**
A large basin (1200’ long, 78’ wide and 16’ deep) was created at the lakeshore at approximately Confederation Park. Water from the lake seeped through the sand and filled the basin. This filtered the water. From the basin, the water flowed by gravity to the suction well at the pumping station through a 33-inch diameter wooden pipe that was 1,920-feet in length.

---

The Chimney of the waterworks stands 150’ tall and was used by sailors as a landmark.
Technical Details

**Engine Type:** Woolf Compound, Rotative, Double Acting house built Beam engines

**Boilers:** Four Cornish style boilers, each 6’ x 30’

**Chimney:** Brick, 150’ tall

**Designed by:** Thomas C. Keefer, C.E.

**Built by:** Dundas Iron and Brass Foundry, Dundas, Canada West

**Power Output:** Approximately 100 horsepower at 30 p.s.i. and 15 r.p.m.

**Cylinders:** High pressure is 24” by 72” stroke, Low pressure is 42” diameter by 96” stroke

**Steam Pressure:** Originally 30 p.s.i. Raised to 60 p.s.i. in 1882 because of new boilers. Raised to 70 p.s.i. in 1892

**Valve Gear:** Double beat popper valves in separate vale chests, cam operated

**Linkage:** Watt’s parallel motion linkage on both cylinders, air pump and main pump rod

**Beams:** Twin plate cast iron, 30-feet long, weighing approximately 14 tons

**Water Pump:** Bucket and Plunger type, 48-inch stroke, 30-inch diameter, 1.6 million gallon per day rated capacity, forcing water to Barton reservoir

**Flywheel:** 24-feet diameter, weighs approximately 22 tons

**Condenser:** Jet condenser immersed in water tank with separate air pump

**1882:** Rebuilt with Single Horizontal Return Tube Boilers(6’ x 16’) and double Acting Displacement Pumps by Copp Bros. and Barry, Hamilton

**1910:** Last year running for daily service, on stand-by service until 1938
In 1861, the city took over the waterworks system from the Board of Commissioners.
How the Pumphouse Worked

The Gartshore engines powering the first water pumps were beam engines, each estimated by Thomas Keefer, the designer, to be capable of generating 100 horsepower. The beams are fabricated from two 30-foot long pieces of cast iron, and weigh close to 25 tons. They rest on pillow blocks and balance like a teeter totter, above the engines.

The expanding force of steam generated in the boilers acts on pistons within cylinders. Piston rods push and pull one end of the beam, rocking it up and down. On the opposite beam end, a rod operated the pump, which sucked water from the supply well and pushed it under pressure into pipes leading to the reservoir.

The engines were double acting, with steam pushing from both the top and the bottom of the cylinders. The steam first entered the smaller high pressure cylinder, and after expending half its pressure, flowed into the larger low pressure cylinder to do further work. Eventually steam found its way to a condenser where it turned back into water and

WATERWORKS PERSONNEL

THE CITY ENGINEER, WILLIAM HASKINS, OVER 40 YEARS

JAMES MCFARLAND, ENGINEER IN CHARGE OF THE WATERWORKS, 50 YEARS

WILLIAM CALDER, SUPERVISOR OF THE BARTON RESERVOIR, 35 YEARS; UPON HIS DEATH HE WAS SUCCEEDED BY HIS SON
enough 24 hours. If the pumps had been run at the contract speed, namely, 220 feet of plunger per minute the delivery would have been 3,506,000.91 imperial gallons in 24 hours. These figures are based on the plunger displacement and from measurements of the several parts of the pumps very carefully made by us at the termination of the tests. On Monday, Jan. 10, we made the six-hour test, pumping the water over the stand pipe, which we are informed is only 35 feet above the reservoir. The engine behaved very well while running this test, and without doubt can easily raise the water over a 50-foot stand pipe.

From a personal examination of the material, construction and arrangements of the pumps we can without fear of contradiction say that for strength, durability and correctness of design they have never been excelled. The general arrangements of the engines are in accordance with the best modern practice. They contain no objectionable features and are free from everything that has not been proven by actual use to be reliable. The general design is good and leaves little to be desired in this respect. The castings throughout are excellent. We do not think the pumps would raise water satisfactorily at 15 feet below zero level as given to us, which is 10 feet 5 inches below the engine room floor; this would make the lift to the center of the pump cylinder 27.33 feet; with this the pump cylinders would not fill if run at the contract speed. We regret that we have not our report completed at this time. We, however, expect to have it ready in detail early next week. The figures herein given are taken from our work thus far and are substantially correct. Duty per 100 pounds of coal in feet pounds, 114,566,301; capacity during test in imperial gallons, 4,118,587; capacity at contract speed in imperial gallons, 2,058,699; mean steam pressure during test, 112 pounds on the square inch. All of which is respectfully submitted.

THOMAS WOODS.

Ald. Moore asked if the specifications of the contract had been fully carried out.

Ald. Stevenson said that every test called for had been carried out except the test of running the engine six days, supplying the city with water. The expert stated that that was not necessary, as the tests completely covered everything.

One of the clauses of the contract refers to water being raised at "15 feet below zero."

Ald. Mason asked if that had been complied with.

Ald. Stevenson replied that the expert and none else seemed to know exactly what was meant by that clause, and thought it was merely a mistake. Regarding the six-day run, he said it simply amounted to keeping the money from the engine builders for six days in order to see that the engines ran all right. The report was adopted.

FINANCE COMMITTEE.

Ald. Moore presented the report of the above committee as follows:

Your standing committee on finance submits this its second report: Having had under consideration the question of the fusion of the Grand Trunk railway with the Northern and Northwestern railways your committee recommends that Mayor Deau, the chairman of finance, Ald. Mason and the city solicitor be authorized to visit Mr. Hodge, and, in conjunction with a delegation from the board of trade, make arrangements in the interests of the city regarding the fusion, and report to this council.

The report was adopted and the committee then adjourned.

returned to the boilers. A connecting rod on the far end of the beam operated a flywheel whose rotary motion kept the engine running smoothly.

A camshaft, driven off the flywheel, lifted and dropped valves, allowing steam to enter and leave the cylinders. A simple lever allowed variable timing of the intake valves, to speed or slow the engine.

To attach the linear motion of the piston rods to the rotary motion of the beam was a difficult engineering problem solved here with the use of James Watt's parallel motion linkage.

Combining double action, compounding, condensing and rotative motion into one engine, this design closely resembled Woolf Compound engines. They were modeled by Mr. Keefer on the Thames Ditton engines which supplied water to the City of London.
James McFarlane was of Scottish descent; he trained as an engineer in Glasgow and immigrated to Canada in 1854 at the age of 25.

He arrived in Dundas in 1857 and started working at Gartshore Foundry on Hatt Street about the time that Gartshore attained the contract to build the pumping engines. This was quite an undertaking as it was the first time that engines of this type were to be built in Canada.

While working for Gartshore, McFarlane worked on the pumping engines as they were constructed and was given the task of overseeing their installation on site. This wasn’t an easy feat as all the parts had to be transported from Dundas to the Woodward Street location where they were carefully constructed in unison with the pump house. McFarlane’s uncompromising standards made him ideal for this job.

Upon completion of the work, the Hamilton Water Commissioners drew up a 1 year contract hiring James McFarlane to oversee the operations. In return he was given $1.87½ cents per day and...
a home to live in located on the property. While it isn’t known how many contracts were signed over the years, James McFarlane remained as the Chief Engineer in charge of the pumphouse for the 50-year period from 1860 to 1910. He lived in the home allotted to him and raised two families. He had 7 children with his first wife and an additional 4 with his second.

It is stated that under his supervision the engines and buildings were all scrupulously clean, the brass was polished and the floors were scrubbed with lye. His skill and exacting standards ensured that the engines were erected in perfect working condition. His unending care over most of their working lives kept the engines in prime condition.
Barton Reservoir

Hamilton’s first reservoir was called the Barton Reservoir as it was located in Barton Township. It was completed in 1859, and was built along what is currently the Kenilworth Access.

This elevated reservoir on the edge of the city limits was built to hold an ample amount of reserved water. It was felt it was located in the most beneficial area as it was close to the Beach Pumping Station and was 190’ above Lake

*Photo to right: Adam Brown at the Barton Reservoir. He was a member of the Waterworks Board of Commissioners.*

*Photo below: Barton Township and Reservoir, 1890 - 1895*
Ontario and placed less stress on the pumps by using the assistance of gravity to move the water.

The reservoir was an open oval shape, using puddling clay, broken stones and rubble masonry with a cement border, with a capacity of 11,000,000 gallons and filled the needs of the city for many years.

A residence for the superintendent of the waterworks was built on this property and it was maintained by a groundskeeper. To this date, you can see a very old stone tower approximately 50’ high that was built in the late 1860s to act as a standpipe increasing the water pressure to the hydrants in the city below.

The opening of the James Street Reservoir changed the use of the Barton Reservoir to a source of reserved water for emergencies.

Distribution:
The water moved by gravity from the lakeshore basin to the pumphouse where it was pumped to the Barton Reservoir, moving again by gravity through a large distribution pipe under Main Street to James Street. A network of smaller connecting pipes was also laid to flow water through the city.

---

Photo of: Work being completed on King Street Watermain, 1926
September 19, 1860 saw the inauguration of the waterworks by the Prince of Wales.

In Adam Brown’s address on behalf of the Water Commissioners, he stated that “The engines to which your Royal Highness is directed are specimens of Canadian workmanship, the most powerful and highly finished of their kind in the province. The fact that a city of 25,000 inhabitants has carried to completion an undertaking of such magnitude, shows that protection of life and property from fire, sanitary considerations, and social comfort, are as well understood and as highly appreciated here as in larger and older communities.”

Following Adam Brown’s speech the Prince, Councilmen and distinguished guests crossed to the other side of the steps in the engine room and the Prince started the engines by turning a small handle. The pumps started working and water flowed.
VISIT OF THE PRINCE OF WALES TO AMERICA
HIS ROYAL HIGHNESS AT HAMILTON, CANADA WEST
During the construction of Hamilton’s waterworks system, the Water Commissioners proposed to Council that a water fountain be built in the Gore (presently Gore Park) showcasing Hamilton’s water supply. Council referred the proposal to another committee for further study.

Council then received a letter from Isaac Buchanan and others proposing a joint venture. If the city would put up $1,200 they would match it. The local papers joined in stating that if a few thousand dollars was all that was needed to convert an eyesore into an ornament they should do it by private subscription. The fountain was built and the new look of the Gore on King Street was unveiled May 24, 1860.

On September 18, 1860, during the Prince of Wales’ first ever official visit to Hamilton he stopped briefly at Gore Park to hear school children sing “God Save the Queen” and “Hurra! Hurra! All hail the Prince of Wales” composed for the royal visit.