

A PIPE DREAM COMES TRUE: BUFFALO'S DECISION TO MAKE WATER A PUBLIC GOOD

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ABSTRACT: *A privately owned water works opened in Buffalo, New York in January of 1854. By the Summer of 1868 the city government bought the waterworks and expanded its capacity throughout the remainder of the century. This paper addresses the decisions of Buffalo city officials to make the provision of water a public sector responsibility. Initially these decisions reflected concerns about fire fighting and fire insurance rates. The conception of a public water supply as a public health asset would gradually take shape from the 1850s to the 1890's. By the latter decade, water became an essential public service, requiring expert evaluation and administration.*

INTRODUCTION

The 1825 opening of the Erie Canal launched Buffalo on a steep population growth curve. The town went from 2,500 residents to 8,668 by 1830. In each of the next three decades Buffalo's population would double, or nearly double, reaching 81,129 in 1860. The frontier village became the nation's tenth largest city on the eve of the Civil War (Gerber, 1989).

This growing residential population was augmented by vast numbers of transients. Buffalo's antebellum economy was chiefly commercial. The city became the world's busiest inland port, serving as the main passenger and freight link between the northeast and the old northwest. There was a nearly constant flow of travelers, immigrants, emigrants and transportation workers through the city's docks and later its rail stations (Gerber, 1989).

This paper will address the decisions of Buffalo city authorities to make the provision of water a public sector responsibility. The paper will show that public health concerns played a secondary role in these decisions. Worries about fire fighting, insurance costs, and securing the city's status as a commercial center, all loomed larger in the deliberations of municipal leaders.

Contemporary medical opinion did not yet make pure water an absolute necessity for suppressing disease.

BUFFALO: WATER, WASTE AND DISEASE

The Erie Canal's opening triggered meteoric unplanned development in Buffalo. Most residents, new and old drew their water from an array of public wells, maintained through local tax assessments. Some neighborhoods near the canal and the Niagara River took water directly from those waterways. A private water cart vendor supplied some areas. More affluent Buffalonians purchased water from the Jubilee Water Works Company. This firm was organized in 1827 to serve the northern community of Black Rock from the Jubilee Springs, located on Buffalo's northern outskirts. Around 1829, the Company laid a wooden pipe water line down Buffalo's Main Street to the Canal. A 1911 source reported that by 1832, the Jubilee firm had sixteen miles of these wooden pipes, or pump-logs, in the city, charging \$7.00 a year to families and \$5.00 to offices and stores (Sauer, 1979; Larned, 1911).

Antebellum Buffalo's sanitation was haphazard. Household wastes and human excrement

were dropped into cans behind homes and businesses.

The cans were taken to nearby dumps, often the nearest vacant lots. Periodic rains washed the dumpings into the streets and down to the canal and river. Primitive sewers, consisted of shallow, brick lined trenches, were built in the 1830's simply to expedite this rain-driven flow (Sauer, 1979).

Buffalo's early water and sanitary conditions were not unique. Most North American cities, especially the Great Lakes boomtowns, were public health time bombs. Also like other North American and European cities, Buffalo was ravaged by cholera epidemics in 1832, 1835, 1849, and the mid-1850s.

Cholera was a disease endemic to central Asia, especially India. The commercial and population movements spurred by British colonization helped spread cholera to other parts of Asia, to Europe and the Western Hemisphere. The disease blanketed all of Asia by the end of the 1820's. Eastern, then western Europe were struck in the early 1830's followed quickly by the New World (Evans, 1987).

Cholera was incurable, fast acting and possessed terrifying symptoms. As described by historian Richard J. Evans,

It (cholera) began to affect the victim through a vague feeling of not being well, including a slight deafness. This was followed fairly quickly by violent spasms of vomiting and diarrhea, vast and prolonged in their extent, in which the evacuations were usually described as being like rice water. In this stage up to 25% of the victim's body fluids could be lost.

This led, not surprisingly, to a state of collapse in which, in effect, the blood coagulated and ceased to circulate properly. The skin became blue and corrugated, the eyes sunken and dull, the hands and feet cold as ice. Painful muscular cramps convulsed and contorted the body. The victims appeared indifferent to their surroundings, though consciousness was not necessarily lost altogether. At this stage death would ensue in about half the cases from cardiac or renal failure, brought on by acute dehydration and the loss of vital chemicals and electrolytes, or the victim would recover more or less rapidly. The whole progress of the symptoms from start to finish could take as little as 5 to 12 hours, more usually 3 or 4 days. (Evans, 1987).

The causal agent for cholera is now believed to be the bacillus vibrio cholerae. It causes the disease upon entering its host's digestive tract. It can live in

water, especially river water, and can survive a range of temperatures, although it prefers warm environments.

The cholera bacillus can also live for varying periods in dairy products, other foodstuffs, and even clothing, furniture, tools, and toilet facilities. Human feces can harbor active bacilli for up to 15 days (Evans, 1987).

Cholera fell upon fertile ground in nineteenth century urban societies. Virtually no European or North American cities had anything remotely approaching adequate water and sanitation services. Overcrowded housing, polluted water, sewage and animal feces festering in typically unpaved streets, were widespread urban phenomena. In the United States, the chief agents of street cleaning were freely roaming pigs, who doubtlessly made their own contributions to their places of work (Rosenberg, 1962).

This new plague spread with a terrible speed and inevitability. News of cholera's appearance in a nearby city seemed to predict its arrival in one's own. Local officials instituted hurried quarantines to quiet public anxiety, only to watch such measures backfire. Of the large cities in the United States, only Boston and Charleston were spared. Probably five thousand people died in New Orleans alone (Rosenberg, 1962).

Cholera traveled the canals and roads of America. Like other transportation and commercial centers, Buffalo suffered. There, as elsewhere, local officials were overwhelmed. Less than a decade from being a frontier village, Buffalo lacked even a hospital to house the sick and dying. In late June an ad hoc Board of Health was formed in Buffalo, under emergency authority granted by the New York State Legislature. This agency strove to clean streets and public areas, care for the afflicted and bury the dead (Goldman, 1983; Allen, 1879). By late September, the Board recorded two hundred and forty three reported cholera cases and one hundred and thirteen cholera deaths (Buffalo Patriot, 1832).

Virtually no medical or governmental authority in the New World or Europe thought cholera was a specific illness spread by dirty food, water, or feces. While officials sought to regulate these three factors, among other things, they did not do so in the belief they were attacking the cause of the disease. Rather, they saw decay and filth as facilitating cholera's propagation.

Prevailing medical opinion held that cholera was produced by miasmas in the atmosphere. Victims

contracted the disease due to a complex interaction of internal bodily processes, personal behavior and the external environment. The latter contained the miasmas. This was the commonly proposed etiology for most if not all diseases, save small pox (Rosenberg, 1962; Rosen, 1983).

The first cholera epidemic confronted a medical profession that was highly theoretic and disdainful of empiricism. Physicians were trained to regard the body in holistic terms. Disease represented an imbalance or malfunction of an entire bodily system. Doctors could merely assist the body's normal, natural recovery mechanisms, by tailoring therapy to fit the individual circumstances of the patient. Empiricism, and the conception of disease as a specific entity, treatable by specific remedies were rejected as ignorance and quackery. Miasmas was seen as more of a catalyst than an independent causal agent. Therapy focused on life style, diet, bodily fluid regulation, attitudes, etc. Poor diet, immoral behavior, intemperance, and fearfulness were all believed to produce disease (Rosenberg, 1962; Rosen, 1958).

Likewise, most contemporary practitioners dismissed popular fears of contagion. Disease could not be passed from person to person any more than indigestion. When public officials called for pure water, sanitary living conditions, or personal cleanliness, they referred only to the catalytic conditions they thought could encourage the rise of cholera (Rosenberg, 1962; Rosen, 1958).

BUFFALO'S FIRST OFFICIAL CONSIDERATION OF THE BUILDING OF A MUNICIPAL WATER SYSTEM

By the mid 1840's Buffalo, like many of its fellow Great Lakes cities, was outgrowing its system of private water providers and public wells. The Common Council spent considerable time at nearly every weekly session, addressing well maintenance and assessments for the necessary revenue. In its May 14, 1845 meeting, the Council heard from a special committee, appointed to explore the provision of pure and wholesome water to the city. The committee considered the adjacent Niagara River to be the only realistic source of water. They suggested that water be taken from the river near

the harbor or at the northern riverside village of Black Rock, forced through iron pipes to the city's highest grade and ...from thence over the city (Buffalo Courier, May 14, 1845).

In making its case for a new water system, the committee placed far more emphasis on fire fighting than on public health. The existing combination of wells and downtown fire reservoirs could only be supplemented by the private Jubilee system. The Common Council approved the committee report and appropriated \$250 for the Mayor to hire an engineer to formulate a plan and estimates for the introduction of water into Buffalo (Buffalo Courier, May 14, 1845).

Captain Fraser of the U. S. Army Topographical Engineers was the engineer the city engaged. He recommended building the intake on the Black Rock Pier with a water wheel and a forcing pump. This arrangement was to push Niagara River water through a twelve inch cast iron pipe, across the Black Rock Harbor and along a ridge to feed a double reservoir at North Street and Delaware Avenue. The reservoir was to hold 3,240,000 gallons. Captain Fraser estimated the city's population would soon reach 30,000 and would use 28 gallons per day per person. The double reservoir was calculated to meet such a demand while allowing for one half to be drained for maintenance (Buffalo Courier, August 13, and 14, 1845).

On August 14, 1845, the Mayor submitted the engineer's recommendation and cost estimates to the Council. The city's chief executive briefly sketched the project's importance for public health, especially for the poor class. However he gave more emphasis to the necessity of a more abundant supply for the Fire Department, and that the effect upon the rate of insurance is a very important consideration (Buffalo Courier, August 14, 1845).

Engineer Fraser put the cost of the proposed waterworks system at \$100,000. Such a capital outlay by the city was unprecedented. The municipal charter would require amendment before revenue bonds could be sold. Some members of the Common Council preferred to leave the entire project to the private sector. In any event, the Council abruptly dropped consideration of a new waterworks, and would not take it up again until the summer of 1848 (Buffalo Courier, August 14, 1845).

Buffalo city politics in the 1840's was

characterized by great fiscal restraint. The city's political leadership throughout the nineteenth century was drawn chiefly from the rising commercial bourgeoisie. The latter were mainly native-born white men, in business as forwarding agents, commission merchants, grain traders, lumber dealers, canal and lake shippers. Most had clawed their way to prosperity after the calamitous Panic of 1837. They were wary of any scheme requiring substantial local government spending (Gerber, 1989).

The Panic had wrought great financial carnage around the United States, particularly in boom towns like Buffalo. Buffalo had hitched its wagon more firmly to the Jacksonian star of speculation than perhaps any other new city. Grandiose schemes hatched on the Niagara Frontier, interlocking merchants, bankers, and dreamers into a vast ponzi game of investments, resting upon the illusory existence of the necessary capital (Whitman, 1996).

The most important business figure in pre-Panic Buffalo was Benjamin Rathbun. Owner of the successful Eagle Tavern, with the opening of the Erie Canal, he shifted into real estate speculation and building. By 1836 he was grossly overextended with debts far outrunning revenues. He floated around \$1,500,000 in notes using forged signatures of various business allies. His creditors soon discovered this, and brought down his entire over-leveraged empire. Rathbun drew five years at hard labor from a state court (Whitman, 1996).

The Rathbun meltdown staggered the Buffalo economy. He had employed a third of the city's workers and had built most of the major commercial structures on Main Street. He had cultivated financial links extending throughout Buffalo's business elite. The national Panic of 1837 and the ensuing depression struck an already weakened Buffalo, producing worse effects than in most of the rest of the country. Real estate values collapsed, bankruptcies proliferated, and construction halted. The state closed all three local banks. Many prominent citizens were ruined and others faced severe financial hardship (Gerber, 1989).

Buffalo's largely merchant bourgeoisie emerged from the 1830's greatly chastened. Speculation and ambitious schemes were disdained. Business practices were to be sober and cautious. Profit was to be sought with a prudent regard for cost and risk (Gerber, 1989). The merchants wanted local

government to be efficient and cheap. They looked to Albany and Washington to fund major infrastructure investments, such as harbor maintenance and expansion. Buffalo business leaders often lobbied state and federal legislators for waterfront improvement money. However local government expenditures were a different matter. City governments relied chiefly on property taxes. Increases in city tax assessments aroused opposition from both elites and small holders. Both Democratic and Whig politicians, especially the former, sought advantage in appealing to a fiscal conservatism that cut across class lines. City authorities typically found it difficult to generate adequate political support for large projects (Gerber, 1989).

Still many Buffalo business leaders wanted a municipal waterworks. Waterworks advocates cited the vulnerability of the city to fire and the costs of fire insurance. Several prominent Buffalo merchants were also in the fire insurance business (Buffalo City Directory, 1828-1860). Local business interests stood to lose, for some through rising insurance premiums, and for others, hefty claims payments (Gerber, 1989).

The Buffalo Commercial Advertiser was the newspaper voice of Whig elements of the merchant business community. It became a persistent lobbyist for a city water system, especially as a necessary measure for fire control. Commenting on an August 16, 1848 downtown fire, the editor wrote:

The only wonder is, considering the long distance to water, and the inadequate supply when reached, that any portion of the building was saved. But we believe it is a rule with our firemen to extinguish the flames, whether they have water or not, and the Council seem to rely with confidence on their ability to do so, in the outer parts of the city. It is time Buffalo had a waterworks. Not only the health of the inhabitants but the safety and protection of property require it (Buffalo Commercial Advertiser, August 17, 1848).

Later the same month the Common Council took up the subject for the first time since 1845. A Committee of Five was appointed, one Council member from each ward, to consider the city's water needs and the propriety of asking the State Legislature for the authority to establish some sort of entity to build a water system (Buffalo Courier, August 24, 1848).

The Commercial Advertiser offered the Council advice. The editor suggested the city sell long

term bonds to build a waterworks and distribution system. The bonds could be paid off with profits from selling water to the public at a moderate charge. The editor added, (I)f the City does not do this in its corporate capacity, then private citizens stand ready to do so under a proper charter (Buffalo Commercial Advertiser, August 23, 1848).

Over a year later the Committee of Five recommended the city build an extensive water system. On November 1, 1849 the Common Council ordered the City Clerk to file a formal public notice, as required by state law, that the City wished to amend its Charter to borrow \$300,000 to \$500,000 to build a suitable waterworks (Buffalo Morning Express, November 2, 1849).

The Commercial Advertiser was unimpressed by the Council's action, which had taken more than a year after the Committee of Five had been appointed, and had come more than four years after the Council had first considered the issue. On November 26, 1849, the newspaper reported the near completion of the \$40,000 waterworks in Syracuse. While criticizing Syracuse's cost saving use of logs for distribution, the editor added, It appears that all the small places in the state are to be supplied with water before our city.

CHOLERA RETURNS TO BUFFALO

The above discussion of a waterworks extended on into 1850. Yet, at no time were any direct references made to a renewed cholera epidemic which struck Buffalo at the end of May in 1849. There were general references to pure water and public health but no conception that building a water works would combat a specific disease. The City confronted the 1849 epidemic with an already established Board of Health, but this agency confined itself to reporting cases, arranging treatment, and opening an emergency cholera hospital to augment the efforts of the Sisters of Charity hospital, Buffalo's first permanent hospital. The Board also directed the industrious spreading of lime on streets, yards, and garbage heaps, all to control the Miasmas. Cholera stricken cities all over North America bought vast quantities of lime in the 1849 continent wide epidemic (Buffalo Commercial Advertiser, May 30, 1849; Cotter and Patrick, 1981).

The medical profession faced the 1849 cholera outbreaks with a greater interest in empirical research. Many American medical educators had trained in Paris and had brought back a rigorous emphasis on observation, clinical research and measurement. American medicine was in transition from the older, theoretical, counter-empirical practice to its modern form (Rosenberg, 1989; Rosen, 1958).

Buffalo's physicians recorded their observations from private practice, along with cases treated at Sisters of Charity Hospital and the Board of Health's Cholera Hospital. Dr. Austin Flint, a prominent physician, published a contemporary account of the 1849 epidemic in the *Buffalo Medical Journal* (Flint, 1849).

Flint and his colleagues noted that the disease chiefly affected the laboring classes, including transients and manual workers. He attributed the epidemic to unidentified secondary causes and a specific unidentified special cause. Flint argued that the secondary causes must always be present, but could not on their own produce cholera epidemics. Such an outbreak occurred only when the special cause was present. Presumably, this pattern of causation explained the episodic appearance of cholera.

Reflecting the majority medical thinking of his time, Flint rejected the principle of contagion. He pointed out that cholera had attacked people simultaneously in widely separated parts of the city. Therefore people had become ill without direct exposure to cholera afflicted patients. He also noted the low incidence of cholera cases among doctors and the Sister of Charity nurses.

Although Flint does not say so explicitly, his 1849 article clearly implies that the secondary causes are the personal cleanliness, lifestyles, living conditions, and psychological states of its victims. This analysis is consistent with the miasmatic theory, which specified such factors as key catalysts of cholera infection. However, in keeping with the 1840's emphasis on empiricism, Flint does not pronounce the unobservable miasmas as the special cause nor as the product of the combined special and secondary causes. Flint needed a separate and specific special cause to explain why cholera appeared in some years and not others. But he left this cause unspecified as it was not empirically verifiable.

Flint reported that the laboring classes

accounted for nine-tenths of the 1849 cholera fatalities. He mentioned the laborers overcrowded living conditions, poor diet, ...ignorance, recklessness, intemperance, and other vices... He suggested that such people were ripe for the taking by any epidemic when the special cause entered the environment (Flint, 1849).

The 1849 Buffalo physicians were more empirical than most doctors had been in 1832, but their analysis of the epidemic was essentially the same. Cholera was seen as a disease with a specific causal agent, but predisposing, factors of dirt and personal behavior were still necessary. Flint's etiological speculations contended that the Special cause was necessary but not sufficient, and peculiar to cities. In the cities, one found the poor and laboring class (Flint, 1849).

More recent research by J. V. Cotter and L. L. Patrick (1981) supports Flint's description of the distribution of disease incidence. According to the 1855 New York State Census, native born family heads equaled 40% of Buffalo's family heads and averaged \$3,854 in value of their dwellings. The native born population accounted for only 3% of the cholera mortalities. The Irish born comprised 23% of family heads in 1855 with average dwelling values of \$1,000. They made up nearly 42% of cholera mortalities. The German born were 43% of household heads with average residence values of \$1,243. They were almost 50% of cholera deaths. Other ethnic groups such as the Canadian born accounted for the rest (Cotter and Patrick, 1981). Note that Buffalo's population rose from around 42,000 in the 1850 U. S. Census to around 74,000 in the 1855 state census (Gerber, 1989). Ideally one would prefer to use the 1850 numbers to study the 1849 population especially given the great demographic expansion that came between 1850 and 1855. However only the state census provided Cotter and Patrick the highly useful figures on housing values, broken down by ethnicity. The 1855 data does furnish a reasonable reference point to extrapolate backwards in time. Poverty and ethnicity would have varied in the same pattern, along with cholera mortality.

The poor suffered more from cholera. Of the city's five wards, the heavily Irish First and Third Wards and the predominately German Fourth contained around 81% of cholera fatalities for whom home addresses are known. The Second Ward was home to the impoverished Hydraulics neighborhoods, a poorly

drained, low lying area filled with cheap houses and small scale manufacturing, clustered around a fetid waste filled water power canal. The Hydraulics had 15% of the city's cholera deaths. The death rates per 1,000 population per ward show the poorest wards with the highest rates (Cotter and Patrick, 1981).

The poor suffered more largely because they lived in the most poorly drained areas in the city, and had the least access to clean water. Most Buffalonians got their water from some ninety wells. Only those who could afford the subscription rates bought water from the Jubilee Springs Company. This firm was well positioned to serve the more affluent First Ward and the central business and trade districts, as these places were closest to the springs. Throughout the city, the lack of adequate sewers meant that sewage ran in the streets, especially after heavy rains. Low lying, down hill wells stood a good chance of receiving some of the migratory filth. Even those First Ward residents who used wells were advantaged by their area's higher elevation and superior drainage (Cotter and Patrick, 1981).

Contemporary political leaders saw the lack of a sewerage system as a potential source of miasmas. A receiving trunk sewer was built in the late 1840's to serve south Buffalo. Lateral sewers were constructed to link nearby streets. Like all other sewerage provision in that era in Buffalo, the collected sewage was drained into the Buffalo River. In 1848, a Common Council Committee on Paving, Sewers and Lights, called for a more extensive city wide sewerage system of underground drainage lines. The Committee produced a plan to accomplish this, citing the miasmatic threat poor sewerage posed to the city. According to the Committee, Buffalo's sewage removal lagged behind the efforts of other large cities (Rossi, 1995; Steele, 1866). However, it would not be until the 1880's that the city built a more comprehensive system (Rossi, 1995).

THE BUILDING OF BUFFALO'S FIRST WATERWORKS: 1850'S

While sewage was seen as a source of miasmas, expert opinion still saw unclean household water along with poor personal hygiene only as catalysts for disease. Buffalo elites might make

general references to the need for clean water for public health and sanitation, but the miasma theory held sway.

Fire fighting remained the most frequently mentioned justification for building a water system, along with references to the need for more water for street cleaning.

Meanwhile, private investors got the State Legislature to charter a private corporation, dubbed the Buffalo Water Works Company. In February, 1850, the Company put its authorized \$400,000 in stock on sale in downtown Buffalo. After four weeks only \$500 worth of shares had been sold (Buffalo Commercial Advertiser, March 11, 1850).

It would take a horrendous fire in the downtown itself to spur more investor interest. This occurred on March 10, 1850, just after the underwhelming response to the waterworks stock offering. Strong winds from the lake blew flames and embers along Main Street, destroying the huge American Hotel, the smaller Globe Hotel and many businesses. Nearby churches and municipal buildings barely escaped. This was one of Buffalo's worst fires, outside of the immediate waterfront. Contemporaries believed the conflagration could have been controlled in its early stages had the street side reservoirs not run dry. Damage estimates ranged from \$200,000 to \$300,000. Only some of the property had been insured. Few owners had coverage for the full loss (Buffalo Morning Express, March 11, 1850).

To put such numbers in perspective, the capital assets of the city's four largest banks totaled less than \$500,000 (Buffalo City Directory, 1851). On the day after the fire, the Common Council urged the State Legislature to grant Buffalo the authority to buy \$100,000 in Buffalo Water Works Company stock. (Common Council Minutes, March 11, 1850). This was undoubtedly a symbolic gesture as a newly elected Common Council took office the next day.

In May of 1850, a special committee of the Common Council held a meeting with the directors of the Buffalo Water Works Company. By now the Company reported it had sold \$234,850 of its stock. Some \$183,000 of this was subscribed by Battin, Dungas and Company, with the provision they would build the waterworks and distribution system. The project was estimated at \$375,000. The Waterworks Company invited the City to buy its remaining stock. (Buffalo Common Council Minutes, Special Meeting,

June 4, 1850). The special committee hired the Albany Waterworks superintendent, W. J. McAlpine to evaluate the Battin and Dungas plan. McAlpine found fault with the proposed pump machinery and cost estimates. He recommended the city not invest in the system (Buffalo Common Council Minutes, Special Meeting, June 4, 1850).

The special committee agreed with McAlpine. They were also unhappy with the plan's provision for only thirteen miles of distribution pipes. Committee members estimated that at least twenty miles of pipe were needed to serve the commercially busiest and the most densely populated areas. They recommended the Common Council not buy the Company's stock but to allow the system to be built if the private money could be found. If such funding was not available, the City could go to the State Legislature for the authority to sell bonds and build its own system. The Council accepted the committee report (Buffalo Common Council Minutes, Special Meeting, June 4, 1850).

Nevertheless, the Buffalo Water Works Company soon raised enough private money, and built their intake plant down on the Bird Island pier in the Niagara River, near Black Rock harbor. The Company constructed a reservoir near downtown, on Buffalo's West Side, and laid their thirteen miles of pipe (Buffalo City Records, September 17, 1850; April 1, 1851).

Public Hydrants were installed at City expense. These were to supply the general public and also City firemen without a user charge. The City would pay a flat rate for the water used from the hydrants. People could obtain private service in their homes and businesses by subscribing, to have pipes and a faucet installed. Such customers would pay a flat yearly fee. Otherwise consumers could use the Public Hydrants (Buffalo City Records, March 25, 1851). On January 6, 1852, The Company announced it was ready to supply the city with water (Buffalo City Records, January 6, 1850).

For the next sixteen years the City and the Buffalo Water Works Company would have a stormy relationship. The Company repeatedly sought increased payments from the City, while Public officials and local newspapers complained the system lacked sufficient capacity (e.g. Buffalo Morning Express, December 23, 1857). The City finally did buy stock in the Company to furnish the capital to expand the distribution network (Buffalo City Records, April 12, 1858).

Still, city leaders and editors were unhappy with the water works charges and services. As early as 1857 the Common Council considered buying the company out. The intake was proving inadequate as Niagara River levels sometimes dropped too low, to allow the siphons for the pumps to work (Buffalo Morning Express, December 23, 1857).

WATER, DISEASE AND THE NEW WATER WORKS

The intake was down river from the Buffalo River entrance. This river was Buffalo's harbor and de facto sewage outfall. All sewer lines ran into the Buffalo River. Either the lines emptied directly into the Buffalo River or they emptied into the Erie Canal or one of the lesser canals, all of which fed in to the river. Sewage from the streets wound up in the same place. This created a waste plume which meandered out of the Buffalo River and down along the banks of the Niagara River and toward the water intake (Sauer, 1979).

The waste plume was made worse by the harbor improvement projects. These activities had widened and deepened the Buffalo River. Formerly a swift running stream, this river was now sluggish and slow. Shore run off and sewer drainage made deposits in the river that stayed in it for longer periods of time, thus increasing the chances of eventually arriving at the intake. The natural dispersion in moving water that the era's engineers took for granted would not scatter and dilute the pollution as expected. In a 1978 study, D. Sauer found a strong relationship between residence times for river pollutants and Buffalo death rates in the 1850's. Residence times were the longest in the summer-early fall months when river flow rates were the lowest. This corresponded with the annual trends of death rates from all causes (Sauer, 1979).

In the summer of 1854, two years after the opening of the waterworks, Buffalo had its last major cholera epidemic, apart from smaller outbreaks late in the century. In absolute numbers, the 1854 epidemic was Buffalo's worst cholera attack, killing 574 out of a population that would reach 74,000 the following year. The reported number of cases was 1,036, yielding a case fatality rate of 55.2% (Buffalo Board of Health, 1854).

James Newman, MD was the City Health Physician during the 1854 epidemic and he wrote the Board of Health report, the only Board report that survives on nineteenth century Buffalo's cholera outbreaks. In his report, Newman broke with previous analyses of previous cholera epidemics. While making several references to predisposing causes, personal behaviors, and the large resident foreign population with their peculiarities of habits.... Newman devoted most of his attention to basic urban sanitation problems as being the most likely to produce cholera morbidity (Buffalo Board of Health, 1854).

Newman indicted the city's dirty streets, its lack of waste removal, and its impure sources of public water as causal factors in cholera. In the latter instance he pointed to sewage contaminated public and private wells as explaining the worst concentrations of cholera cases, especially on the heavily German east side and the predominately American born areas of North and South Division Streets. The Irish dominated east side Hydraulics region also received his censure for the industrial and residential filth poured into the water power canal. Also, during the epidemic, repairs to this canal led to the water flow being temporarily dammed up. This exposed the filth to sun and air for several days, and according to Newman, produced a miasma which he blamed for much of the cholera morbidity in the Hydraulics (Buffalo Board of Health, 1854).

The Buffalo Health Physician did not see the water works intake as a contributory factor in the 1854 cholera epidemic, nor as causal in any other disease. Instead he called for the water system to be used to furnish abundant supplies of wholesome water to flush out Buffalo's gutters and sewers. Unlike other contemporary public health officers he opposed using such water to wash down streets, until they were paved. He believed that pumping water on dirt streets would merely expedite organic decay and produce dangerous miasmatic vapors. Instead, blasting gutters and sewers with clean water works water would prevent such vapor formation. Otherwise, Newman's beliefs well reflected contemporary public health ideas. To sanitary engineers of the period, the most important reason to build municipal water systems was to clean streets, gutters and sewers, not to serve domestic consumption needs. Clean drinking and bathing water was of secondary concern (Rosenberg, 1963; Buffalo Board of Health, 1854).

Dr. Newman blamed sewage polluted well water to explain many cholera cases, perhaps because this was consistent with the findings of Dr. John Snow the English physician who first linked polluted water with cholera. The water works drew its water from a flowing river. The miasmatic theory considered standing or still bodies of water to produce disease. Running water was seen as pure (Rosen, 1958).

Even when contemporary observers thought the water works water to be, at times, filthy or impure, they seemed to regard it the way late twentieth century people regard rotten fruit - unpleasant but unlikely to be dangerous. Some affluent city residents reportedly used filters to clean the water works water at their home faucets (Buffalo Commercial Advertiser, January 5, 1866).

THE CITY BUYS THE WATER WORKS- 1860'S

In the late 1860's the Common Council decided to buy out both the Buffalo Water Works Company and the old Jubilee Water Works. The city's chief Republican paper had called for this purchase since 1857 (Buffalo Morning Express, December 23, 1857). The newspaper voice of Buffalo's business elite, the Commercial Advertiser also endorsed a municipal takeover in 1865 as the Buffalo Water Works kept pushing for ever higher yearly rates. The 1860 rate for the City had been \$12,720. After holding almost even for two years, the 1863 rate was \$14,438.

In 1864, it was \$16,878 and the following year it jumped to \$30,000. For 1866, the Company wanted \$36,000 (Buffalo Commercial Advertiser, December 31, 1865).

The Commercial Advertiser decried the escalating cost of Buffalo's water along with its impure and filthy quality. The editor argued that a private profit seeking firm was incapable of meeting public needs for such important services such as water and gas.

The cost, quality, and quantity of water service would never be satisfactory when profits relied on cost control. He called for public ownership of both the water and gas works (Buffalo Commercial Advertiser, December 21, 1865).

The Common Council was distressed at the

waterworks company's rising prices and the inadequate capacity of both the intake and the system of mains. (Buffalo City Records, February 26, 1866). The Council directed the city engineer to develop a plan and estimate for building a system to provide better capacity and cleaner water. The engineer reported to the Council in September of 1866, a plan for a new intake to be built at the head of the Niagara River, connected to the shore by a tunnel under the river bed. Also included in the plan were a new reservoir, pumping engines, and an expanded distribution network. The estimated cost was \$2,500,000 (Buffalo Commercial Advertiser, September 11, 1866).

The Council had to choose whether to subsidize the water works company to provide for the expansion and improvement of the system, or to take the firm over and finance the work directly. The company had already offered to sell out to the City for \$600,000 back in March of 1866. If the City chose not to buy, the company director proposed to apply to the State Legislature for the power to issue more stock to build a new system (Buffalo Commercial Advertiser, March 6, 1866). After the engineer's report, the company raised its buy-out price to \$760,000 (Buffalo City Records, September 10, 1866)

No agreement between the City and the Buffalo Water Works Company came in 1867, but in January, 1868, the Mayor endorsed buying the company and building the engineer's proposed new system. (Buffalo City Records, January 6, 1868). The Mayor offered \$677,000 which the company declined (Buffalo City Records, March 30, and April 6, 1868). The Mayor then offered \$705,000, which the company accepted on April 13, 1868 (Buffalo City Records, April 6, and 13, 1868). At first, the Common Council balked at approving the bonds to raise the necessary funds. Fiscal conservatism had to be placated. Not until July 20 did they agree to finance the purchase (Buffalo City Records, July 20, 1868).

THE BUILDING OF THE NIAGARA INLET PIER-1870'S

In March of 1871, construction began on the new inlet pier intake at the head of the Niagara River. A local editor thought this new location would save

city residents from the dirty water that was seen as largely coming from storms and canal dredge dumping.

The Buffalo River sewage connection with the old intake still escaped contemporary mention (Buffalo Morning Express, March 28, and April 15, 1871).

The inlet pier project went slowly, as workers tunneling under the river with steam drills encountered solid rock, gas pockets and subsurface streams. The tunnel ultimately was not drilled out under the river as far as planned due to leaking ground water. By late fall, 1874, the inlet pier had finally reached completion (Buffalo Morning Express, June 2, and September 30, 1873; March 19, 20, and October 30, 1874).

Throughout the building of the inlet pier, local papers were primarily concerned with the inadequate capacity of the old intake to address the city's vulnerability to fire, especially given the ...recent conflagrations in Boston and Chicago. A windstorm once drove the Niagara River's level below where the old inshore intake siphons could reach. Many areas of the city had been without water. Also the city reservoir was designed in the 1850's for 50,000 people. In 1870, Buffalo had a population of 117,714 and growing (e.g. Buffalo Morning Express, September 30, 1873).

The new city-owned Buffalo City Water Works Company gradually expanded its distribution system, pumping stations and reservoirs. There were thirty five miles of lines in 1868, seventy seven in 1872, one hundred and sixteen in 1875. In 1871, the system pumped over 2.7 billion gallons, in 1872, over 3.2 billion, in 1875, over 3.8 billion and in 1880, over 5.9 billion (Buffalo City Water Works, 1869-1881). By 1880, Buffalo's population reached 155,134 (Historical Statistics of the U. S.). While the city's population rose by around 31.7% between 1870 and 1880, the quantity of pumped water increased by 118.5%. Buffalo would soon lead most North American cities in per capita water use (Buffalo City Water Works, 1881).

The new inlet pier intake greatly reduced the sewage going into the water system. Water quality was further improved by the Great Interceptor Sewer which caught sewage headed for the canals and the Buffalo River and channeled it to a tunnel under the Erie Canal on the city's northern edge. This waste was discharged into the Niagara, down river from the inlet pier. Once in the Niagara, the sewage floated toward Tonawanda, supposedly dispersing in the free flowing water (Sauer, 1979). Buffalo continued to pipe raw sewage into the

Niagara River until the 1930's. Under pressure from the state health department, and with bond and federal grant financing, the City built a state of the art treatment plant which opened in 1938 (Rossi, 1995).

Sewage from the Buffalo River still managed to get into the water system through the new intake. The inlet pier had not been built far enough out in the Niagara River to escape some flow from the Buffalo River (Sauer, 1979). In addition the water works continued to use the original Bird Island intake when February and March ice buildups clogged the inlet pier intake. The city water authorities were chiefly concerned with keeping up enough pressure in the mains for fire fighting. This practice persisted until the mid 1890's (Pendleton, 1997).

THE FINAL CLOSING OF THE 1852 BIRD ISLAND INTAKE-1894

By the 1890's germ theory had transformed medical thinking about disease causation. The work of Pasteur and Koch and others identified microscopic bacteria as causes of a number of air and water borne diseases. In 1894, Dr. Ernest Wende, Buffalo's first Health Commissioner trained in germ theory, discovered the water work's use of the 1852 intake. His new, microscope equipped Bacteriology (sic) laboratory discovered typhoid bacteria in the city water system and traced it to the Bird Island intake. He also noted the repeated increased incidence of early spring typhoid cases in parts of the city (Pendleton, 1997).

Dr. Wende demanded the water works close the old intake for good. He embarked on a highly public campaign in the Buffalo newspapers against resistant water works officials and city politicians, who defended the use of the Bird Island intake as necessary for fire safety. Wende had the support of most of the city's medical profession and the University of Buffalo medical faculty, but his research and analysis did not obtain automatic acceptance from the water works and the City. Germ theory was still in the process of gaining paradigmatic authority in medicine and public health. However, soon Wende had his way, as officials sought to silence the sometimes sensational newspaper stories about contaminated water and to restore public confidence in the municipal water system. The Mayor

and the Board of Public Works had the old intake closed and concreted over, despite business sector complaints about fire risks and possibly higher insurance costs (Pendleton, 1997).

Wende remained concerned about the bacterial count in Buffalo's water. He determined that Buffalo River sewage was still getting into the water system through the Niagara inlet pier. He later championed a successful campaign to have a new intake built out in Lake Erie, well away from Buffalo River pollution. The new intake opened after his death in 1910 (Buffalo Health Department, 1908; Pendleton, 1997).

BUFFALO AND THE REINVENTION OF WATER

The story of Buffalo's decision to establish water, and later clean water, as a city service involved the redefinition of water itself. Of course, Buffalonians did not invent the need for water for cleaning, bathing, drinking, etc. But all the latter activities underwent a redefinition along with water in the nineteenth century.

In the 1840s, policy questions concerning water were raised in Buffalo. The city was outgrowing its *ad hoc* system of wells and private delivery services.

Elites were chiefly anxious about the availability of water for fire fighting and property protection. Secondary concern was expressed for the water needs of the poor class. The poor class had no voice, at least in official local records or the English language press.

Public officials focused almost exclusively on the quantity issue from the 1840's to the 1860's. By the latter decade, water quality also became a concern, but still a minor one compared to quantity. Fire fighting continued to be the main elite concern. Contemporaries might have thought the water works' water was at times filthy, but this condition only made water unpleasant to drink or use. The presence of dirt or a bad odor in water were warning signs that it was impure or perhaps spoiled.

Buffalo elites were hardly unique in overlooking public health dangers in degraded water sources. Bacteriology was in its infancy and required medical practitioners and government officials to accept a contagionist paradigm. Well into the 1890's a leading

international authority on cholera epidemics, Max von Pettenkofer, was quite contemptuous of a contagionist model of cholera propagation. He contended that while cholera was caused by a germ, such a creature was harmless unless it fermented in the soil, after being activated by a rise and fall of ground water levels (Evans, 1987).

The work of Pasteur gradually found its way into elite consciousness and much later into mass consciousness. In 1884 Robert Koch identified the cholera bacillus. By the 1890's germ theory would achieve a nearly paradigmatic authority in medicine and public health. Public officials would come to defer increasingly to professional opinion (Evans, 1987).

Germ theory radically altered water's role in society, by redefining clean and unclean. No longer could the layperson reliably determine the cleanliness of the water they used. Smell, taste and clearness were inadequate guides to water's safety. The state, in conjunction with science, emerged as the ultimate arbiter of acceptably clean water. The state became responsible for public health in a more fundamental way than ever before (Goubert, 1986).

The diffusion of germ theory transformed the social definition of water. Now water needed to be a carefully regulated industrial product. Personal and household hygiene were also changed. One's body, public behavior, and domestic space were to be governed with reference to a new sanitary culture. Plentiful clean, and therefore disease free, water was a central element in this culture. Medical professionals and state officials became the guarantors of a new essential service (Goubert, 1987).

The public provision of water in Buffalo began as a fire fighting aid and an amenity for the affluent. It became a social necessity, a protector of public health and it brought a significant expansion of the role of urban government. Cities became healthier places as water born disease rates fell (Rosen, 1958).

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