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Chicago: The Hydraulic City and Its Environmental Impact

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First of all, what is a hydraulic city? It is one that is created with a close connection to waterways. It is created in the sense that its water connections are not natural but have to be made. It is a city that uses water for transportation on inland rivers and canals as well as on larger bodies of water, in this case, the Great Lakes. It draws its water for drinking and sewerage from the same sources that it uses for transportation. It also designs its waterways for hydraulic power. Also, the hydraulic city is very conscious of military defenses, which by extension it sees as related to its water transportation, so it has a hydraulic concept of military defense.

As to the environment, I do not mean environmental depredations, but rather the need for extensive changes via engineering to create harbors, inland transportation routes, sanitation and drinking needs, as well as hydraulic power. As a result, rivers are reversed, canals dug, harbors created, and a variety of other engineering projects are involved in the creation of the hydraulic city. All of the projects are intimately related; they create an indissoluble infrastructure. In the case of Chicago, it meant creating a river harbor and an inland transportation canal, the Illinois and Michigan Canal. It also meant creating a huge canal for sewage disposal, the Sanitary and Ship Canal, and a system of tunnels and intake cribs to obtain fresh water.

The site of Chicago should be examined to see the problems that must be solved to create the hydraulic city. It was situated on low-lying land drained by a sluggish river, the Chicago. A slight rise in the upper reaches of this river to the south separates it from the Des Plaines, which flowed south and west until it joined the Kankakee River to form the Illinois River, which flows into the Mississippi. The value of this site was reported by the first European to visit it, Louis Jolliet, in 1673. He noted that "The place at which we entered the lake [Lake Michigan at the mouth of the Chicago River] is a harbor, very convenient for receiving vessels and sheltering them from the wind." He also noted:

> "The fourth remark concerns a very great and important advantage which will hardly be believed. It is that we could go with ease to Florida in a bark by very easy navigation. It would be necessary to make a canal, by cutting through but half a league of prairie, to pass from the foot of Lake Michigan to the Des Plaines."[1]

Jolliet was followed by a more aggressive explorer and a more powerful one, namely, Rene Robert Cavelier, Sieur de la Salle. His observations on the future site of Chicago in 1682 were much more realistic than Jolliet's.

> "At the mouth of the Chicago River there is a sand bar that not even a canoe can pass over, at least when the lake is calm. The prairies by the lake over which travel is necessary are flooded by the great volume of water flowing down from the hills whenever it rains. It is very difficult to make and maintain a canal that does not immediately fill up with sand and gravel. The ground water is near the surface and there are some sand dunes between the lake and the river, and although a canal would be possible with a great deal of expense, it would be useless because the Des Plaines is not navigable for

> 90 miles to the great village of the Illinois [near Utica]. Canoes cannot traverse it in the summer."[2]

La Salle was accurate in his observations that the only natural advantage to the Chicago site was the small continental divide that separated the Des Plaines from the Chicago River, a separation that was breached every spring when the Des Plaines flooded into Chicago, sending a large quantity of water into Lake Michigan rather than into the Illinois River.

The value of the site was apparent to the United States government, and in 1805 the army built Fort Dearborn at the mouth of the Chicago River. Because of the sand bar at the mouth of the river, it was proposed to cut a ditch through it that could possibly allow canoes and *batteaux* to enter the river, but lake vessels had to unload their cargo on the lake.[3] The problem at the mouth of the river was that the current in Lake Michigan flowed along the shore, depositing sand and gravel so any channel cut through the sand bar would quickly fill up again. In 1830 William Howard of the United States Corps of Engineers, proposed to change the mouth of the river so it would not flow south before entering the lake, and to construct piers to the north of the mouth to control the sand deposited by the lake current.[4] As the proposal for the construction of a canal to connect Lake Michigan to the Illinois River began to take shape, so, too, did the demand for a harbor to support it. However, the work on the harbor was almost entirely done by the Federal government.[5] In 1839 Thomas Jefferson Cram of the United States Topographical Corps, suggested building piers much farther into the lake and at the end extending them on the north side of this channel. On the south side of the channel, the piers would be extended eastward into the lake. He recommended that they be constructed of stone with pilings. Also, he noted a lighthouse should be built at the end of the channel. The cost of this would be from $90,000 to $215,000, but Cram argued this money would be well spent as:

> "The commercial interests of all the States that border upon the lakes is intimately connected with Chicago as a place of transshipment and deposit; and the agricultural prospects of Illinois, Indiana, Iowa and Missouri, are to become greatly dependent upon facilities of business upon a large scale at some point on the southwest part of the shore of Lake Michigan, which lake is a part of the great channel by which the surplus staples of those states shall best reach the Eastern markets. The continuity of a never failing communication for so many miles, and the more favorable temperature for the preservation of produce, are advantages peculiar to the lake route.
>
> "The commerce of the lake will very naturally center more at Chicago, than at any other place of deposit and transshipment upon either side of the lake.... Its position on the west shore of Lake Michigan (the only lake exclusively within the limits of the United States) the two natural channels of water communication extending some miles into the interior by means of navigable branches of the Chicago River; the excellent site for a capacious ship basin in the very heart of the town, at the junction of the said branches; it being one of the termini of the Illinois and Michigan Canal...are advantages, which when collectively or severally considered, forcibly impress upon the mind that the present City of Chicago is but the nucleus about which there will grow up, at no remote period, one of the most important commercial towns on the lake."[6]

Needless to say, the large expenditures recommended by Captain Cram were not forthcoming. However, sufficient improvements were made so that lake boats would get into the river. Between 1842 and 1847 wheat exports doubled. Most of the traffic was agricultural products. A growing import item was lumber, which would, of course, continue to expand.[7] The effort to induce more government assistance is indicated by the calling of the 1847 River and Harbor Convention in Chicago. While federal assistance to other internal

improvements was scanty, the Federal government continued to aid in the improvement of the Chicago Harbor. In 1859 Congress appropriated $87,000 to repair the piers designed to keep the harbor open.[8] By that time the big grain elevators were clustered at the mouth of the river, and the slips (called "canals") for unloading lumber were up river on the South Branch to Bridgeport where the Illinois and Michigan Canal terminated.

The increased activity in the harbor, in the month of June 1879, had more arrivals and departures and gross tonnage than did New York for that month.[9] In order to accommodate the increased use, an anchorage basin on the lake was constructed by dredging the area off the present Grant Park and building a breakwater in 1880. In 1889 a breakwater west and north was built by the Federal government to protect vessels coming into the harbor. All of this tended to increase traffic so that by the early 1890s, Chicago's arrivals and clearances were not exceeded by any other port in the United States.[10]

Besides the lake and the Chicago River mouth, the other part of the Chicago harbor was the Chicago River, as was observed by Major W.L. Marshall in 1899.

> "The Chicago River and its branches constitute the most active and important non-tidal navigational stream of its length known."[11]

While the harbor had been developed basically by the Federal government – which assumed as a result a proprietary control over it – the river had been controlled by the city. They encouraged the construction of wharves and slips basically for lumber coming in from the north. The river had been periodically dredged so that it was commercially viable and filled with slips six miles up the South Branch to the terminus of the I. and M. Canal. With wooden schooners and other such vessels, the 15-foot depth of the river was sufficient for clearance. But in the late 19th century, the introduction of iron and steel hulls made this depth obsolete so that least 17 feet of depth was necessary. As a result of this difficulty, the Federal government was asked to assist. One of the things that had to be done was to lower the height of the tunnels under the river so its depth could be increased to 21 feet.

Another more obdurate problem affecting navigation was the bridges. As early as 1870 there was established "closed bridge period" when street traffic was at its highest. They originally started as a one-half hour period, but were increased from time to time because of the increased pressure from land-based interests.

The result of these factors plus others was a substantial reduction of harbor and river usage in the late 1890s. This despite the fact that the depth of the river increased as the Ship and Sanitary Canal began pulling more water off Lake Michigan after 1900. As a result of the problems, increased emphasis was placed on the Lake Calumet harbor on the south side of Chicago. Shipping on the Great Lakes also had changed. Steel-hulled vessels were larger, requiring more width and depth in harbors, and the cargoes changed as the principal cargo was now iron ore, not of much use on the Chicago River. The lumber trade had dried up, and grain was shipped by railroad.

The City of Chicago continued to try to develop the harbor. In 1909 it was suggested that the outer harbor created by the Federal breakwaters be developed for pleasure boats on a plan of circles and boulevards similar to Burnham's plan for Chicago.[12]

Conceived at the same time as the harbor by Jolliet in the 17th century was a canal to link the Great Lakes and the Mississippi. Agitation for this water link intensified in the early 19th century. It increased more after Illinois became a state in 1818. Illinois' northern boundary was shifted to insure that both the site of Chicago, the Chicago portage (the low land rise between the South Branch of the Chicago River and the Des Plaines River) and the area to be traversed by a canal were all within the boundaries of the "Sucker State."

Various efforts were made to raise the capital necessary for this undertaking. The only assistance coming from the Federal government was land grants on either side of the proposed canal. In 1830 the second Illinois and Michigan Canal Commission laid out the towns of Chicago and Ottawa, the latter located at the junction of the Fox and Illinois rivers. They did this in an effort to sell town lots in the newly created towns to finance preliminary work for the canal. Although hardly anything was raised, interest in the canal and the harbor intensified. It will be remembered that it was in that year a plan for changing the mouth of the Chicago River and protecting it with a line of piers thrust out into the lake was first proposed. The development of the canal and the harbor continued apace, one financed by the State and the other by the Federal government. The State had much less access to capital, and sought to raise the necessary funds by selling the lands given by the State by the Federal government. In 1836 the Canal Commissioners held a successful auction of lots mostly in Chicago, and a few were in Ottawa. The total realized in Chicago was $1,522,545.[13] Although this was considerably greater than the $4,362 realized in the 1830 sale, the money was not immediately forthcoming. In 1839 a depression hit and in 1840, 76 of the purchasers, including W.B. Ogden, were asking for a considerable reduction in the 1836 price.[14]

The construction of the canal began on July 4, 1836, when with much ceremony, crowds went up the Chicago River's South Branch to hail W.B. Archer as he turned over the first spade of earth. The canal would go from Bridgeport (then outside Chicago) to La Salle, where it would join the Illinois River some 96 miles south and west of Chicago. The construction was impeded by the state's lack of capital, but it was finished finally in 1848. During the first five years of its existence, the canal's principal business was the passenger traffic. These were mainly settlers who arrived at Chicago and wanted to move west. In 1853 the Rock Island - Chicago Railroad was completed, running beside the canal to LaSalle. The railroad bought out the passenger boats.

After 1853 the major business was freight, particularly grain products, lumber, stone and coal. Until well after the Civil War, the canal brought in more corn to Chicago than any other single rail line. The Rock Island, which ran alongside the canal from Joliet to La Salle, and had access to Iowa as well as Western Illinois, never equaled the canal in bushels of corn carried despite the fact that the canal was only open from April to November.[15]

The opening of the canal in 1848 soon brought a change in the status of Chicago and its older mid-western rival, St. Louis. The water connections of Chicago not only with the East via the Great Lakes, but also with the Gulf of Mexico and New Orleans, gave the City for the first time an advantage over St. Louis.[16] The first boat to traverse the canal in 1848 carried a cargo of sugar from New Orleans destined for Buffalo, as well as some passengers.

Besides transportation, the other value of the canal was the impetus to settlement. Certainly the rapid growth of Chicago after 1830, as was noted by previous observers, was in large part due to the future canal and the actual canal after 1848. In addition, to further stimulate settlement and the eventual sale of canal lands, an important part of the canal's design by its engineer, William Gooding, was the creation of hydraulic power. The water would be drawn directly from Lake Michigan and flow to Lockport 36 miles southwest, which was at the same level above seal level as the lake. This source of water on the highest level, or the summit level, of the canal gave it a unique value when compared to any other inland American canal. At Lockport the land drops 40 feet in five miles – the biggest fall on the 96-mile canal reach. Its terminus at La Salle was 150 feet below the Lake Michigan level. Gooding notes in 1839:

> "The value of waterpower here [Lockport] and at other points upon the canal, by drawing a supply of water directly from Lake Michigan, can be fully appreciated after a season of such severe drought as the past. The Des Plaines River and many other considerable streams of the country have been nearly dried up, and probably three-fourths of the watermills throughout the United States have been standing still for the last three months. But had this

> canal been completed, there would have been, during the season past, an unusual supply of water, as the surface of the lake has been nine feet four inches above canal bottom, or three feet four inches higher than was originally calculated upon for the supply."[17]

The canal was not able to directly tap into Lake Michigan when it opened in 1848, because the State was so short of capital it was unable to afford the "deep cut" to give the canal direct access to Lake Michigan waters. Water power at Lockport was supplied by pumping water out of the Chicago River at Bridgeport and from a feeder canal supplied by the Little Calumet River. However, in 1870 with the help of the City of Chicago, the "deep cut" was made. The Summit Lock No. 1 at Bridgeport was removed, and the flow of the Chicago River was reversed, so it flowed south and west into the Mississippi River instead of into Lake Michigan.[18] This allowed for a considerable expansion of the hydraulic basin in Lockport and an increase of its hydraulic power. The flour mill there increased its runs of stone from six to fourteen. This was the Norton flour mill, the biggest in Northern Illinois, and the hydraulic power development there was the largest in the state. Although the site was 36 miles from Chicago, because of the flat prairie lands, it was the nearest site that could tap the water power from the hydraulic city. And Chicago was the only site above the Niagara River that could effectively utilize the water power from the lakes.[19]

The history of the canal as a transportation system follows almost exactly the history of the Chicago Harbor. While passenger transportation was effectively destroyed by the railroads, freight haulage increased the largest number of boats registered on the canal in 1863. After the 1870s steam was introduced; this increased the carrying capacity, but the size of the boats was restricted by the size of the locks. The largest gross tonnage was hauled on the canal in 1882.[20] There was after this a change in the type of cargoes carried, as less stone and lumber were hauled and grain shipments also declined. By the late 1890s, traffic and income were way down on the canal. Its locks and the size of its boats were considered out of date. This concern had resulted in several studies to enlarge the canal. The first was in 1867; all these studies were based on Federal subsidies. Though the studies were federally subsidized, no money for construction was forthcoming from that source.[21] However, the State continued to press for a "deep waterway." Construction finally began in 1920; however, by 1932 the Federal government had to take over and finish the project called "The Illinois Waterway." This was a system of locks and dams from Lockport to the Mississippi with a 9-foot navigational capacity.

Besides transportation, Chicago, as it grew, became closely tied to lake water resources for drinking and the necessarily related problem of storm runoff and sewage disposal. These two needs presented difficulties to the growing town because it was built on low and marshy land; runoff caused problems because of the lay of the land and the sluggish Chicago River which, as time passed, became increasingly unable to handle the runoff from the burgeoning city.

When the village of Chicago began, its water supply came from wells. By 1836 the Chicago Hydraulic Co. was formed to pull water from Lake Michigan. By 1840 an inlet pipe extending 500 feet out into the lake had been constructed by this company. There was a pump, a reservoir and about two miles of wooden pipe.[22]

The other problem was drainage – anything laid below grade would not drain into the Chicago River. So, underground sewers could not be constructed. The solution was to raise the streets by 10 feet on those streets adjacent to the river. So, buildings had to be raised. The most famous such raising was the elevation of the Tremont Hotel using a large number of screw jacks turned simultaneously, devised by George Pullman.[23]

However, increasing runoff into Lake Michigan via the Chicago River created a new problem, as the lake became easily contaminated, thus contaminating the water supply. In 1863, the Board of Public Works was directed by the City to thrust the water intake two miles out into the lake, via a five-foot diameter tunnel 69-feet below the surface of the lake. This would end at a pumping station and standpipe; the latter is today called "The Chicago Water Tower." The standpipe was necessary to create enough pressure to distribute the

water. Subsequently, a tunnel was built to supply water to the south and east sides. This latter project cost one million dollars, the most expensive internal improvement yet in Chicago.[24]

The development of the South Side created additional pollution problems in the Chicago River, which would again affect the drinking water supply. So, in 1866 construction was started to deepen the I. and M. Canal at the summit level; this was to erase the 10-foot rise between the lake and the canal 15 miles south. This, as has been noted above, was completed in 1872. Now the hydraulic problems of the City were united. Water transportation and sewage disposal were linked, though it is obvious that the latter interest was becoming more important.

By 1889 it was apparent that a deeper cut had to be made, as the Chicago River was again polluting Lake Michigan. As a result, the Chicago Metropolitan Sanitary District was created, and its purpose was to construct a canal of sufficient depth so that it could pull off Lake Michigan a maximum of 600,000 cubic feet of water per minute. This channel would go 28 miles to Lockport. It was completed in 1900, and its width and depth made it the biggest canal constructed in the 19 century. It was unique also that though proclaimed a navigable waterway, it was really a huge flushing operation, which had no navigable outlet until 1907 when the main channel was extended four miles and a powerhouse and a lock were built to make the Sanitary Canal and Ship a navigable waterway.[25]

The construction of the Ship and Sanitary Canal necessitated cutting its base down 26 feet below the floor of Lake Michigan. This meant that the possibility existed of dropping the level of Lake Michigan and the other lakes so that the Niagara River would dry up. This theoretical possibility existed because Joliet was 40 feet below Lockport, six miles away. Therefore, the Sanitary District designed the controlling works at Lockport, so the lake extended 36 miles inland. The controlling works consisted of a “Bear Trap Dam” or a variable level dam that would rise and fall as the water level did. It also included a set of traintor or lift gates that could divert more water off the Sanitary Canal and into the Des Plaines River tail race. In constructing this canal, the Des Plaines River bed had to be moved in several sections between Chicago and Lockport. Besides this, the flow of the Chicago River was permanently reversed and its level raised. [26] This indicates how the hydraulic city was extending its water tentacles in an even more important way than when the “deep cut” was made in 1871 allowing a direct connection between Lake Michigan and the I. and M. Canal. All of these developments relate to the unique geographical location of Chicago, that is, the small elevation and distance separating Lake Michigan and the Mississippi drainage in that city area.

After the completion of the Sanitary and Ship Canal, the Sanitary District realized it had certain inadequacies. First of all, it was not navigable, and therefore objections were raised that Chicago was diverting water from Lake Michigan for non-navigable reasons; secondly, it was obvious that much of the increased flow in the Des Plaines caused by the diversion could be used to produce hydro-electric power. Finally, there were complaints from Joliet particularly that not only was Chicago sending its sewage downstate, but was also endangering Joliet, because if the controlling works at Lockport failed, Joliet would be engulfed with thousands of feet of lake water, as it was about 40 feet below those controlling works.

For these reasons between 1903 and 1907, the main channel was extended four miles downstream. At the new terminus, a hydro-electric power plant was constructed.[27] This would, after 1907, generate power for the City of Chicago as well as the Sanitary District. The Sanitary District was slow to adopt the hydro-electric possibilities available because of the diversion. In Joliet and Marseilles, two inter-urban electric firms had by 1902 built dams and hydro-electric plants for their use. However, neither of them are now operating, while the Sanitary District’s plant is. The possibility of constructing hydro-electric plants on the Des Plaines and Illinois Rivers became a major concern. In 1911 Governor Deener informed the special session of the General Assembly, called to authorize the construction of a deep waterway from Lockport to the Mississippi, that the construction of a new hydro-electric plant on the waterway would generate 2.5 million dollars annually, which could easily pay off the 20 million dollar cost of the project.[28]

In addition to the hydro-electric plant, the Sanitary District constructed a lock to connect the Ship and Sanitary Canal to the I. and M. Canal, making the former navigable. At the controlling works four miles north, the Sanitary District engineer, Isham Randolf, designed a unique structure never built again– butterfly dam designed to control the Sanitary Canal flow by means of 18 valves or gates individually controllable and operated electrically.

The controlling devices were mostly removed or made inoperable when by law the Sanitary District was restricted in what it could divert from Lake Michigan, and so erected a guard lock at the mouth of the Chicago River, and used other methods for drawing water from the lake.

Besides the use of Chicago's hydraulic infrastructure for the purposes of trade and commerce, water and sewage disposal, the last aspect of this hydraulic system was for national defense– a concern that is frequently motivated by irrational fears, yet it does move the people of this nation in strange but forceful ways. Since Lake Michigan was the only one of the Great Lakes entirely within the borders of the United States, and since this country and Great Britain had agreed not to put armed vessels on the Great Lakes, there was a fear that in case of war, Great Britain could send armed vessels from canals like the Rideau to gain control of what was called the Northern Frontier. In 1839 Captain Cram pointed out that one of the needs of a good harbor at Chicago was for defense. He wrote:

> "The importance of Lake Michigan in a military point of view should not be overlooked. Its position with respect to the facilities of procuring provisions and for transportation, and its unequaled adoption for harbors into which armed steamers, and other armed vessels might retire for repairs and supplies, would add peculiar value to the inland sea. And in the event of war between the United States and the power in possession of all the lakes, Lake Michigan might become the scene of contention. A loss of its possession would be attended with consequences of serious import to the commerce, agriculture, and safety, of a large part of the West."[29]

Cram's argument was that this need necessitated Federal money for the Chicago port, as it was the best place to construct such a harbor.

By the 1860s, the concept of defensive needs had shifted to a canal which would provide a defensive link to the Mississippi and the Gulf of Mexico. This argument was put forward during the Civil War and after. In the summer of 1863, a National Ship Canal convention was held in Chicago to try and persuade the Federal government to construct larger canals into Lake Erie and from Lake Michigan at Chicago to the Mississippi. Naturally, part of the argument for such an effort was the commercial advantages in moving farm products east and south. However, the defense needs were heavily stressed. The memorial at the conclusion of the convention was sent to the President and to Congress. It states:

> "We must, if practical, do as Great Britain has done–construct military canals adequate in capacity to admit our gunboats to the Lakes. Thus, we shall be placed upon an equality with our neighbors....
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> "Prominent among others, is that of enlarging the present Illinois and Michigan Canal from Lake Michigan to Joliet, a distance of 36 miles, and the improvement of the Illinois and Des Plaines Rivers, so that steamers and gunboats which navigate the Mississippi can pass directly into Lake Michigan at Chicago.
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> "The military position is, in a few words, this: On the American side, the Northern Frontier is defenseless. It is amply defended on the British side. England can take her gun-boats from the ocean through the canals and the

> St. Lawrence into the Lakes with facility. We cannot do it at all. Great Britain has constructed canals for this express purpose. We have no such military canals."[30]

The concern about Great Britain and a possible naval attack did not lessen after the end of the Civil War. In 1867 the United States Congress commissioned a report on enlarging the I. and M. Canal, amongst other studies aimed at making the waterways above St. Louis larger so river boats could travel to the Great Lakes. The officer-in-charge of these surveys was Brevet Major General J. H. Wilson. In his report on the survey, he lays a heavy emphasis on the defense needs. His report to the Secretary of War and Congress is to our eyes startling, but it expounds on what could be called a hydraulic concept of defense.

> "A thorough discussion of these improvements [of the Illinois River] in their military, commercial, and political aspects, if necessary, would be out of place at this time, but I cannot forgo a passing allusion to them. The recent confederation of the British American provinces shows the anxiety felt by the English government in this behalf, and must be regarded as a movement in hostility to the people and institutions of the United States.
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> "While it does not actually increase the aggregate British strength on our Northern Frontier, nor in any way encroach upon our territorial rights, it consolidates the policy in regard of canals, as well as other matters, and renders available the entire force of those provinces in any difficulty that may arise between England and the United States. The English are already able, by means of a system of internal canals, to pass gun boats of nine feet draft into Lake Erie and Ontario, and are contemplating a new canal which will enable them to reach Huron without coming in reach of American territory at any point. The canals already finished were constructed avowedly for military as well as commercial purposes, and in case of war will enable the English to drive our commerce from the lakes and destroy or lay under construction nearly every important city on our Northern Frontier. But in addition they can inflict upon us a still more vital injury when they have gotten possession of the Lakes by severing the <u>main line of our communication with the east for heavy products</u>. [emphasis in the original]
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> "...We are debarred by treaty stipulation from keeping a navy upon the Lakes, as this may be well enough [for it saves the cost of building ships]....But as we have no communication between the Lakes and the sea coast suitable for vessels of war, we cannot expect to meet the enemy upon anything like terms of equality when the emergency arises. It will not do to depend upon permanent defenses for the purposes of barring the entrance to the Lakes, for unfortunately they cannot be so situated, nor so constructed, as to completely subserve the object in view.
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> "There are but two ways in which we can thoroughly protect our Northern Frontier in time of war, and relieve ourselves of a continuous menace in times of peace. The government must either <u>connect the lakes and the Mississippi river by a canal of sufficient capacity to accommodate gun boats suitable for service on the lakes, or prepare for the annexation or conquest of Canada</u>. [emphasis in the original] As a military measure the construction of a canal will be effective, and fortunately for this country this can be done at an expense which must be regarded as insignificant when compared with the objects to be obtained."[31]

This might seem a little overwrought, or it might be a way of inducing Federal expenditures by shifting from commercial concerns which the United States government at that time felt was the responsibility of the states, to the needs of defense which was a Federal obligation. However, whatever the motives, the argument is based upon a hydraulic view of Chicago, the Midwest and the Great Lakes, and land defenses are not sufficient to protect this fluid frontier.

In 1900 George Stone, the Secretary of the Chicago Board of Trade, wrote the Secretary of War pleading for Federal assistance in constructing a deep waterway from Chicago to the Mississippi.

> "A ship waterway, free from foreign control, from the Gulf of Mexico to the chain of Great Lakes, and hence to the Atlantic Ocean was the plan for the internal transportation and national defense foreshadowed by the genius of Albert Gallatin....The National Government should without delay enter upon this great work, the commercial and military importance of which could hardly be exaggerated."[32]

This plea again emphasizes the defense needs in inland water transportation development. The deep waterway on the Illinois Waterway would be built, started by the State of Illinois in the 1920s, and finished in 1933 by the United States Army Corps of Engineers. The only tangible connection to defense needs was its use during World War II to ship boats and submarines made on Lake Michigan down to New Orleans.

Andre Guillerme in his work *The Age of Water* traces the cycle of urban development and decline in Northern France. Development reached a peak in the Middle Ages with the use of water technology for power, sanitation and defense. However, in the 17th and 18th centuries this system was viewed as basically polluted and a threat to health. As a result, the water networks were buried, water went underground as underground sewers were built and canals were filled. All of this was designed to make the water invisible.[33]

Currently in Chicago, the hydraulic city is expending billions to build a Deep Tunnel project. These tunnels, 150-300 feet below ground, will carry off storm water runoff. In addition, old quarries will be used to store water until it can be treated.

Guillerme in his work says the burying of the water networks was the result of urban decay, particularly of the cloth-producing northern hydraulic cities. But, of course, Chicago was never a purely hydraulic city, even though its hydraulic development required and still requires constant environmental modifications as a result of the City's relationship to Lake Michigan and the inland waterways to the west and south of its corporate limits.

FOOTNOTES / REFERENCES

1. Father Claude Dablon's Report, *Jesuit Relations and Allied Documents*, Reuben G. Thwartes, ed., Cleveland, OH 1896-1901, Vol. 58, p. 105. It should be noted that I have changed the names of rivers and lakes to those currently in use instead of the French names

2. Plase, Theodore O. and Werner, Raymond, ed., *The French Foundations 1680-1693*, French Series Vol. I Collections of the Illinois State Historical Library, Springfield, Ill. 1934, Vol. XXXIII, p. 3,.

3. Andreas, A. T., *History of Chicago, From The Earliest Period to The Present Time*, Chicago, 1884, Vol., I., p. 233.

4. Ibid., p. 113.

5. Pierce, B. L., *A History of Chicago 1673-1848*, University of Chicago Press, 1937, Vol., I., pp. 48-49.

6. Cram, Capt. T. J., "Report on the Harbor Improvements on Lake Michigan" *Report of the Sec't of War*, 26th Congress, 1st Session, Senate [140] Jan. 31, 1849, Washington, D.C., p. 18.

7. Thomas, Jesse B., *Report of Jesse B. Thomas as a Member of the Executive Committee appointed by the Chicago River and Harbor Convention of the Statistics concerning the City of Chicago*, Chicago, ILL., 1847, p. 3.

8. op. cit., Pierce, *History of Chicago*, Vol. II, p. 69.

9. Porter, Robert P., *The West From the Census of 1880: A history of the Industrial, Commercial, Social and Political Developments of the States and Territories of the West from 1800-1880*. Rand McNally Co., 1882, pp. 184-185. The total "arrivals" at Chicago in June, 1978, were 1,702of 537,082 tons burthen [burden] and clearances 1,716 of 551, 235 tons burthen. An increase of arrivals of 435 and in clearances of 44.

10. *World Ports*, Chicago Number, Vol. XIX, No. 4., Monthly Bulletin of the American Association of Port Authorities, Feb. 1831, p. 372.

11. Marshall, W. L. Major, Corps of Engineers, *Preliminary Examination of the Chicago River Illinois*, Dec. 7, 1899, 56th Congress House of Rep. Doc. No. 95, 1st Session, Washington, D.C., p. 5.

12. *Report to the Mayor and Aldermen of the City of Chicago by the Chicago Harbor Commission*, Appendix B, "Letter to the Harbor Commission from the Commercial Club Committee on the Plan of Chicago," Chicago, 1909, p. 252.

13. Mss. *Account of Sales of Lots in the Town of Chicago, sold by William Montgomery by Order of the Canal Commissioners*," June 1836, located at Lewis University Canal and Regional History Special Collection.

14. Mss. *Petition of Diverse Citizens of Chicago Concerning Lots in Said Town"* Nov. 13, 1840, Lewis University Canal and Regional History Special Collection.

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