A Short History of the Chicago Diversion

At public meetings held by the International Upper Great Lakes Study over the last two years, many questions were raised regarding the Chicago Diversion and its impacts on Lake Michigan-Huron. More recently, the draft Asian Carp Control Strategy Framework[1] released by several U.S. government agencies recommends examining "modified structural operations" at the O'Brien Lock and the Chicago Controlling Works (see Figure 1) as part of a comprehensive suite of potential actions to suppress migration of Asian carp into the Great Lakes from the Mississippi River Basin. Given the public interest in the Chicago Diversion, it is important to recall both the hydrological and historical context of man's effort to "re-plumb" nature in this region.

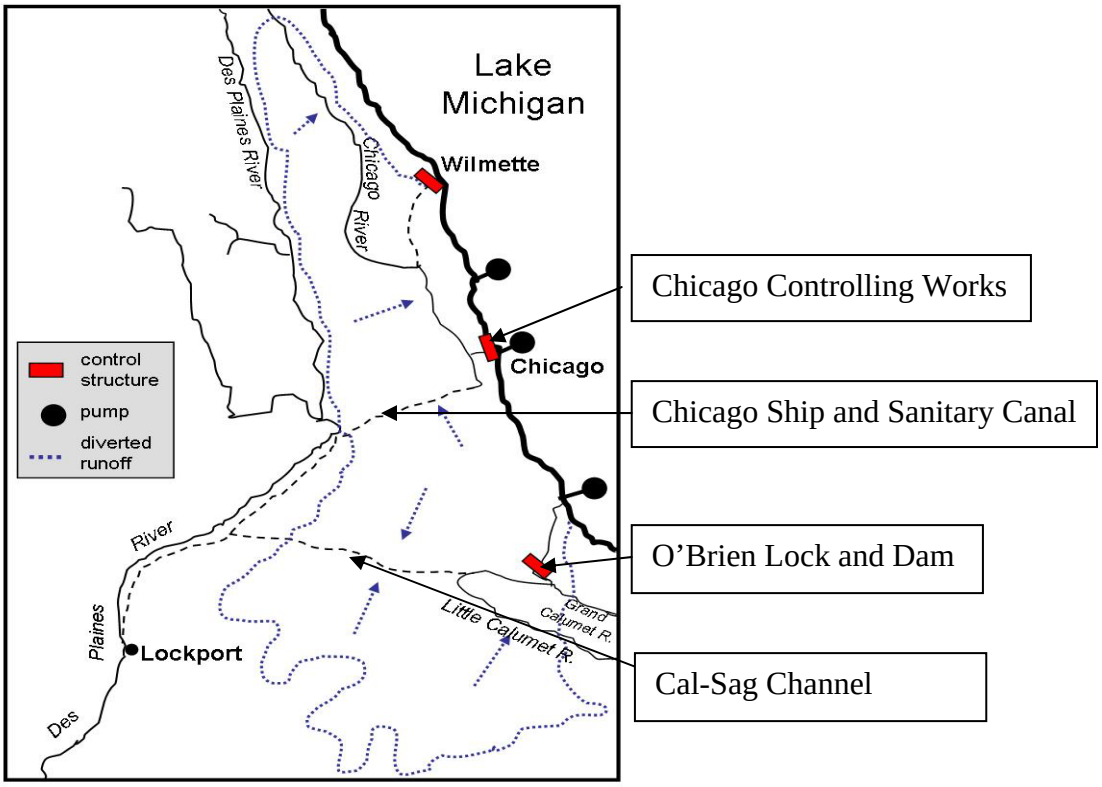

Fig. 1: Schematic showing natural rivers (solid black lines) and artificial channels (dashed black lines), along with control structures and water pumpage sites, that make up the Chicago Diversion. The extent of the Chicago and Calumet River basins that would naturally drain into Lake Michigan is outlined with a blue dotted line, while blue arrows signify the direction of storm runoff.

The continental divide separating the drainage area of Lake Michigan from the Mississippi watershed passes within 10 to 11 miles of Lake Michigan west and southwest of Chicago. While one might usually associate such a major divide with a mountain or other high ground, this divide is fairly flat, such that historically, there has long been some conveyance of

[1] Asian Carp Control Strategy Framework; Section 2.1.4, Modified Structural Operations – Efficacy Study http://www.asiancarp.org/RegionalCoordination/documents/AsianCarpControlStrategyFramework.pdf

water between the two basins bordered by the Des Plaines River to the west and Lake Michigan to the east (See Figure 1). For example, when the Des Plaines River floods, a portion of the flood waters flow over the divide into Lake Michigan, adding to the total water supply of the Great Lakes. The development of this link between the Great Lakes and the Mississippi played a critical role in the growth of Chicago as the industrial hub of the Midwest and is deeply embedded in the economic and social history of the region.

Following his travels in the western Great Lakes in the early 1670s, the explorer and mapmaker Jacques Marquette drew an unbroken water route from what was then called Lac des Ilinois (Lake Michigan) to River St. Louis (the Des Plaines River). Indeed, records show that from time to time a muddy, shallow lake allowed travelers in canoes to cross between the two basins.

In 1674, Father Claude Dablon, the father superior of the Jesuit mission in New France (as the region was known at the time), reported on the travels of Marquette and fellow missionary Louis Joliet, suggesting a permanent inland route from the Great Lakes to the Mississippi:

> "...it should be easy to go as far as Florida in a bark.... A canal would need to be cut across in only half a league of a prairie in order to enter from the lake in the River St. Louis which discharges into the Mississippi."[2]

This vision was achieved in 1848 with the completion of the 96-mile Illinois and Michigan Canal linking the Chicago River (east of the divide) with the Illinois River (west of the divide). With commodity traffic peaking at more than one million tons in 1882, the canal was a critical factor in the development of Chicago and many towns along its banks.

Meanwhile, as Chicago grew during the second half of the 19th century, engineers recommended elevating city streets so that newly constructed sewers could take advantage of gravity to send human and industrial waste to the Chicago River. As the river (and Lake Michigan) became increasingly polluted, the Illinois and Michigan Canal was deepened and new pumps were added in 1871, effectively reversing the flow of the river under normal conditions.

But conditions were far from normal in Chicago on August 2, 1885, when in less than 24 hours, a massive storm dumped more than five inches of rain. The deluge overwhelmed the already inadequate sewage system, causing effluent to flow far out into Lake Michigan. Luckily, in this case, winds from the northeast may have kept the sewage from reaching the city's water intakes two miles out.

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[2] Cooley, Lyman Edgar, Chicago Sanitary District Board of Trustees; The diversion of the waters of the Great Lakes by way of the Sanitary and ship canal of Chicago. A brief of the facts and issues; 1913; p. 97

Contrary to some erroneous modern day accounts claiming 90,000 deaths from typhoid fever and cholera that year, records show a death rate from typhoid only slightly above average (the peak was in 1891 at 1,700 deaths) and no deaths from cholera.[3] However, having come close to a public health disaster, the newly created Sanitary District of Chicago (now the Metropolitan Water Reclamation District of Greater Chicago) began planning a massive construction project that would permanently divert Chicago's sewage away from the lakes and toward the Gulf of Mexico, connecting the Great Lakes and Mississippi River basins.

On May 2, 1900, Admiral George Dewey (hero of the Spanish-American war) dedicated the Chicago Sanitary and Ship Canal (CSSC) across the continental divide connecting the Chicago River to the Des Plaines River (see Figure 1). Construction of the $31 million project had begun in 1892 and is considered by some historians to be the largest public works excavation undertaken up to that time.[4] The resulting improvement in water quality was quickly apparent with a significant drop in the death rate from typhoid and similar water-borne diseases. Indeed, in the 30 years following completion of the canal, death rates from contagious diseases were cut in half.[5]

A similar channel (the Cal-Sag) was constructed in 1922 to connect the Little Calumet River to the CSSC and ultimately to the Mississippi River system (see Figure 1). In 1938, a controlling works and lock were built at the mouth of the Chicago River to limit direct diversions from Lake Michigan and to prevent the river from flowing back into Lake Michigan during significant storm events. Controlling works (the O'Brien Lock and Dam) were built in 1965 at the Calumet River (red rectangles in Fig. 1). A lock, controlling works, and powerhouse were also built at Lockport at the west end of the waterway system where it connects to the Des Plaines River. Finally, direct water supply pumpage from Lake Michigan occurs at several locations (the three major ones are shown in Figure 1 as black dots).

Average annual flow rates of direct (controlling works) and indirect (storm runoff and water pumpage) diversions from the Lake Michigan to the Mississippi River basin since 1900 are shown in Figure 2. Storm runoff (blue dotted arrows in Figure 1) and water pumpage are considered indirect diversions because they represent water that is not directly diverted from Lake Michigan through the controlling works at the lakefront. Rather, these flows are intercepted and polluted stormwater runoff that never reaches Lake Michigan.

After 1900, mean annual diversion rates increased steadily to a maximum of 10,000 cubic feet per second (cfs) (285 cubic meters per second, cms) in 1928. Not surprisingly, other Great Lakes basin states and Canada objected to the diversion, citing the impact on lake levels.

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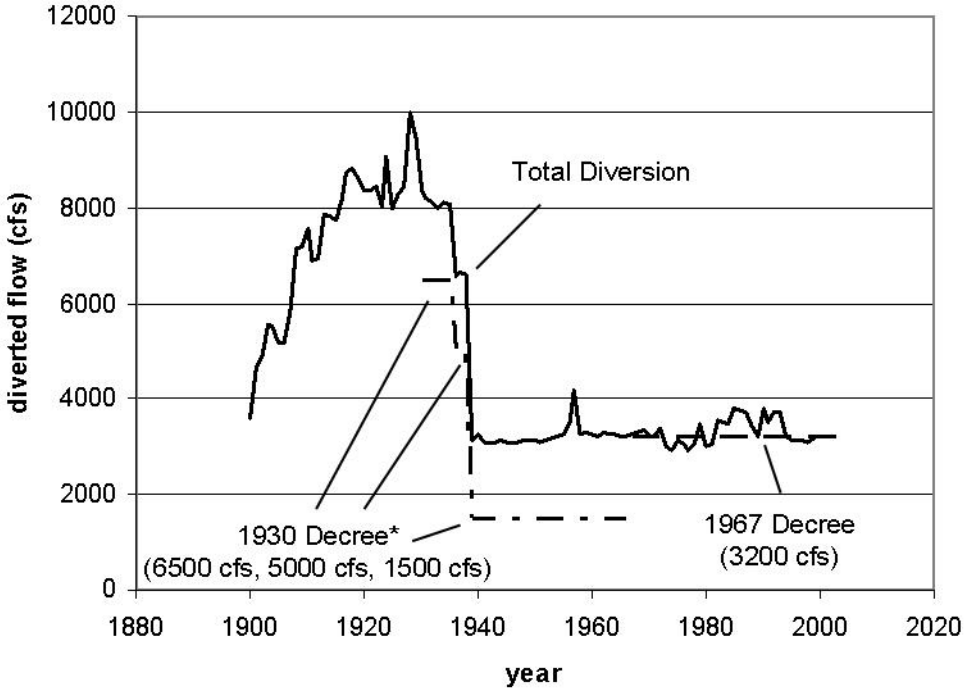
[3] Libby Hill, *The Chicago River: A Natural and Unnatural History*, 2000.
[4] Encylopedia of Chicago, Sanitary and Ship Canal Album, 1892 – 2000; http://www.encyclopedia.chicagohistory.org/pages/300018.html
[5] Encylopedia of Chicago, Epidemics; http://www.encyclopedia.chicagohistory.org/pages/432.html Improvement in death rates due to contagious diseases was also due to pasteurization, chlorination of the city water supply and diphtheria vaccinations.

The Canadian government, for example, filed six protests with the U.S. government between 1912 and 1924. The case reached the U.S. Supreme Court, and in a series of rulings, the high court repeatedly lowered the allowable diversion (excluding domestic water pumpage) to 1,500 cfs (42.5 cms) by 1938 (see Figure 3 for details). In 1967, Illinois agreed to a consent decree that limited the total diversion for navigation, domestic water use, and sanitation to 3,200 cfs (90.6 cms). The decree was modified in 1980 to allow Illinois to provide water to additional communities. In 1996, Illinois reached an agreement with Michigan and other Great Lakes states to restore water taken in excess of 3,200 cfs (2.1 billion gallons/day) since 1980 to Lake Michigan.[6]



* The 1930 Supreme Court decree excludes domestic water pumpage.

*Fig. 2: Total diverted flow (direct + indirect) out of Lake Michigan to the Mississippi River basin. * The 1930 Decree excludes all water pumpage extracted for domestic purposes.*

The reversal of flow between basins and the diversion of Lake Michigan water has long been a source of contention among competing interests. Therefore, such flows are routinely measured and reported to provide policy makers and managers with important information for decision-making. Currently, water that flows directly from Lake Michigan through locks and controlling works accounts for between 10 and 15 percent of the total diversion (see Figure 3 for a breakdown of specific components of the diversion in the 1990s). In contrast, nearly 60 percent of the total volume of water diverted is for municipal supply uses with the resulting effluent also diverted away from Lake Michigan. The balance of the diversion (between 25 and 30 percent of the total) is actually an interception of highly polluted urban runoff from the

[6] http://michigan.gov/documents/deq/deq-ogl-diversions-decreesummary_260214_7.pdf

Chicago River and Calumet River basins that previously would have reached Lake Michigan. Together, these two sources of polluted water (between 85 and 90 percent of the total diversion) do not reach Lake Michigan, preventing eutrophication (when excess nutrients from runoff promote plant growth and decay, severely compromising water quality) and a host of associated adverse ecological impacts. For example, the O'Brien Lock and Dam help to prevent toxic industrial pollution from reaching Lake Michigan.

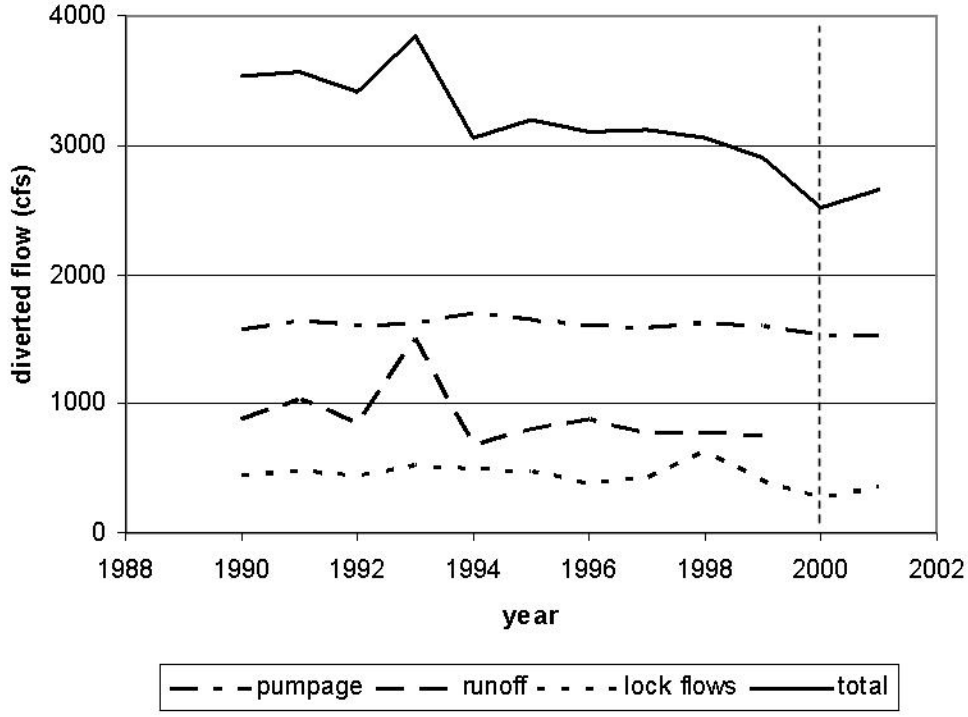


Fig. 3: Breakdown of total water diversion in cubic feet per second by Chicago out of Lake Michigan. These percentages are generally stable during the decade, with the exception of 1993, when historic floods throughout the Midwest caused runoff nearly to double.

Given the important role the Great Lakes play in both the ecology and economy of the region, the Chicago Diversion is certain to be the subject of further discussion and debate. For example, the U.S.-only Great Lakes Compact (2008) and a similar nonbinding agreement among the Great Lakes states and provinces commit those jurisdictions to seeking the permission of all the other jurisdictions if they wish to divert water outside the Great Lakes basin. Communities surrounding Milwaukee, Wisconsin (but on the other side of the continental divide) are engaged in this process. However, since water conservation efforts have reduced the diversion to below the limit set by the consent decree, Chicago area water authorities are currently looking at providing Great Lakes water to outlying suburban communities outside the basin. Such action would not need the approval of other states or provinces.

Most recently, in response to the Asian Carp threat, Michigan's attorney general asked the Supreme Court to reconsider the decree in light of the potential harm an invasion of Asian carp could cause if they were to enter the Great Lakes via the Chicago diversion.[7] While the high court did reject a request for a preliminary injunction asking for the closure of the O'Brien and Chicago locks, the court has not yet ruled on reopening the original consent decree.

Closing those locks would effect little change in water levels. A previous report by an expert binational task force convened by the International Joint Commission estimates that the Chicago Diversion lowers long term mean levels on Lake Michigan-Huron by six centimeters (2.4 inches).[8] Since, as described above, less than 15 percent of the diversion flows through the locks, the estimated potential impact of permanent closure may be less than a one centimeter (0.4 inches) increase in mean levels. But such a closing would have other impacts, all of which will certainly be considered in future decision making regarding the Chicago Diversion.

[7] Supreme Court of the United States;
http://www.supremecourtus.gov/SpecMastRpt/Orig%201,%202%20&%203%20Motion%20to%20Reopen.pdf

[8] 1993 Levels Reference Study