Golden Gate University Law Review

Volume 35
Issue 3 *Environmental Law Journal: "City Rivers"*

Article 5

10-1-2010

Deep Tunnels and Fried Fish: Tracing the Legacy of Human Interventions on the Chicago River

Christopher Theriot

Dr. Kelly Tzoumis

ARTICLE

DEEP TUNNELS AND FRIED FISH:

TRACING THE LEGACY OF HUMAN INTERVENTIONS ON THE CHICAGO RIVER

CHRISTOPHER THERIOT[1] AND DR. KELLY TZOUMIS[2]

INTRODUCTION: A RIVER'S COURSE

The Chicago River first attracted the Miami Indians, a branch of the Illiniwek, who set up camp near the mouth of a small river that flowed into Lake Michigan. They called their village *Che-cau-gou* after the odor of the wild onions that grew so prevalently in the area.[3] This area was part of the Great Lakes watershed where waters drained eastward into the Great Lakes. Less than fifteen miles from the Chicago River,

---

[1] Christopher Theriot currently works as the Finance and Facility Coordinator, New Schools Development, Chicago Public Schools. He has worked as an adjunct professor at Roosevelt University where he taught a seminar on Metropolitan Environmental Problems, and has a Masters in Public Policy from the University of Chicago and a B.A. from Colgate University. The author acknowledges the contributions of Pete Mulvaney in developing the initial concept of this paper.

[2] Director, Public Policy Studies, DePaul University. Tzoumis has B.S. and Masters of Public Administration from Iowa State University and a Ph.D. from Texas A&M University. She has written several articles on environmental policy and published a book in 2001 *Environmental Policy Making in Congress from 1789-1999: Issue Definitions of Wetlands, the Great Lakes, and Wildlife Policies.* Taylor and Francis Press: New York. Author acknowledges Dave, Kaily and KJK Walker for supporting the effort in this research.

[3] *The Unofficial Paddling Guide to the Chicago River*, 3 (Naomi Cohn, ed., Friends of the Chicago River, 1996).

the Mississippi River watershed had tributaries leading westward, ultimately draining into the Gulf of Mexico.

Today, the Chicago River system stretches more than 150 miles. At the headwaters, two tributaries combine with a canal linked to Lake Michigan to form the North Branch. The North Branch travels down from the north side of Chicago through the downtown loop.[4] The river continues through the industrial south side until it meets the Chicago Sanitary and Ship Canal.

The Ship Canal provides a permanent connection between the Great Lakes watershed and the Mississippi watershed. The geographical marriage of these watersheds has been both a blessing and a burden for the city. On the one hand, the breaching of the continental ecosystem divide through the reversal of the Chicago River vastly improved Chicago's water quality and public health. Access to the Mississippi River also established Chicago as the economic hub of the heartland. On the other hand, the ship canal opens a direct avenue for invasive species migrating up the Mississippi River. One of the greatest concerns facing the Chicago River and Lake Michigan is the steady advancement of the Asian carp, arguably the most formidable aquatic bio-invader the region has faced.

Reversing the flow of the Chicago River is just one of many interventions to the natural system. In section II, the authors trace the historical use of innovative engineering approaches for managing the Chicago River. Then, the article analyzes two current engineering solutions that continue the pattern of human intervention. Section III turns to the tunnel and underground reservoir project, the vast system of deep tunnels designed to manage wastewater and storm water flooding. Section IV reviews the aquatic nuisance species dispersal barrier or electric fence as it is commonly referred to. This barrier is a last ditch effort to protect the Great Lakes watershed from the Asian carp.

[4] *Id.* at 2.

I. BACKGROUND ON EARLY INNOVATIVE ENGINEERING AND TECHNOLOGICAL APPROACHES TOWARD MANAGEMENT OF THE CHICAGO RIVER

The exponential growth of the City of Chicago, similar to other industrialized river cities, wreaked havoc on the ecosystem. The river, suffered from a combined mix of human and animal sewage combined with industrial waste that all flowed into the Chicago River and drained into Lake Michigan, which was and continues to be the region's primary source of drinking water.[5] This polluted water triggered the first in a series of public health crises in Chicago such as cholera and typhoid outbreaks.[6] Cholera became the leading source of illness for the young city, in fact, 314 people died between July 25 and August 28, 1849, creating the worst death rate for any cause in the City, a statistic that remains unbroken to this day.[7]

This accelerated environmental damage made worse by the flat geography of the Chicago area undermined the public health of Chicago. This risk of disease and death prompted the City of Chicago to enact policies and employ innovative technologies in a manner very different from other major cities. To improve drainage, Chicago raised its streets and buildings out of the muck. The city constructed offshore water cribs linked to land by two-mile hand dug tunnels. As matters worsened, the city reversed the river and then built an elaborate sewage system. History shows that every one of these interventions failed to provide Chicago with a permanent solution to its water quality and public health problems. Each engineered approach is briefly reviewed below before we examine the most ambitious intervention of all, the tunnel and reservoir project.

A. EARLY ENGINEERED CHANGES

Chicago has always struggled with the fact that the city was built on a flat, swampy area where the soils were saturated and the water table was high. The flatness of the city

---

[5] Nelson P. Blake, *Water and the City: Lessons from History, in* Water and the City: The Next Century, 59-67 (Howard Rosen & Ann Durkin Keating eds., Public Works Historical Society, Chicago, Ill., 1991).

[6] *Id.*

[7] Beatty, William K., *When Cholera Scourged Chicago, Chicago History.* v. 11 no, Spr. 1982, p.2-13.

meant that the river and drainage ditches were often stagnant. In response to this constraint of the land, the 1855 Chicago City Council adopted a resolution to raise the city streets and buildings between four to seven feet off the ground.[8] Buildings were jacked up and new foundations were built to provide elevation so that waste could flow down drainage ditches instead of festering in the streets.[9]

Public health improved but this early engineered approach was not enough to ensure a safe drinking water supply that met Chicago's growing demand. So, city planners then decided to pump water from further out in the lake. This plan required new tunnel technology to bring the water ashore. In 1867, Irish immigrants completed a two-mile long tunnel sixty feet under the lake.[10] This tunnel was five feet in diameter and its walls were lined with brick.[11] But like the raising of the streets and buildings, the offshore cribs failed to permanently safeguard the water supply.

In August 1885, a heavy rainstorm pushed wastewater into the Chicago River and Lake Michigan to contaminate the water supply. The resulting typhoid outbreak killed over ten percent of the city's population.[12] This public health disaster prompted the Illinois Stare legislature to create the Metropolitan Sanitary District of Greater Chicago ("Chicago Sanitary District") in 1889.[13] This government entity was charged with providing the city with a safe supply of drinking water. The District's elected commissioners held broad enforcement, legislative and taxing powers.

---

[8] Libby Hill, *The Chicago River: A Natural and Unnatural History*, 100-01 (Lake Claremont Press 2000).

[9] *Id.*

[10] Steve Jones and John Waller, 2004, *Down the Drain: Typhoid Fever City*, Chicago Public Libraries Digital Collections, available at http://www.chipublib.org/digital/sewers/history3.htm (last visited March 22, 2005).

[11] *Id.*

[12] Martin Reuss, *The Management of Storm water Systems: Institutional Responses in Historical Perspective, in Water and the City: The Next Century*, 319-38 (Howard Rosen & Ann Durkin Keating eds., Public Works Historical Society, Chicago, Ill., 1991).

[13] Illinois Act of 1889, Laws 1889, p. 125; in 1955, the Sanitary District changes its name to The Metropolitan Water Reclamation District of Greater Chicago.

B. RIVER REVERSAL

Within several years, the District concocted the most far reaching engineered change to date with plans to reverse the flow of the river away from the lake to downstream into the Mississippi watershed. To do this, a twenty-eight mile canal (Sanitary and Ship Canal) was dug starting at the southern branch of the Chicago River and connecting at Lockport. At a depth of twenty-five feet and a width exceeding 300 feet in some sections, the Ship Canal was hailed as one of the most ambitious engineered feats to date. The new canal was larger than the Suez Canal.[14]

As construction of the canal neared completion, the Great Lakes watershed was separated from the Mississippi watershed by a temporary dam only eight feet high located twelve miles west of the Lake Michigan. Cutting through that ridge would transport the wastes to the Mississippi River via the Illinois and Des Plaines rivers.[15]

Due to a pending Supreme Court injunction filed by the State of Missouri, district officials realized that the entire project was at risk. At dawn on January 2, 1900, nine Chicago Sanitary District commissioners, and a pair of reporters blew up the temporary dam, which separated the Chicago River from the new channel.[16] In this dramatic fashion, the Great Lakes watershed and Mississippi watershed became one.[17]

This redirected flow greatly improved the public health of Chicago and the water quality of the river.[18] In fact by 1908, only eight years after its completion, the typhoid rate in Chicago was reduced by ninety-one percent.[19]

Against this legacy of engineering ingenuity, we now turn to two recent technological interventions. The massive tunnel and reservoir project has been under development for more

---

[14] Cain, Louis P., *The creation of Chicago's Sanitary District and construction of the Sanitary and Ship Canal. Chicago History*, Chicago, Chicago Historical Society, Summer, 1979. v. 8, no. 2, p. 98-110.

[15] *Id.* at 98-110.

[16] *Id.*

[17] *Id.*

[18] Steve Jones and John Waller, *Down the Drain: The Big Ditch*, Chicago Public Library, Digital Collections, available at http://www.chipublib.org/digital/sewers/history4.html (last visited March 22, 2005).

[19] *Id.*

than three decades at the cost of billions of dollars. The electrical fish barrier on the Illinois River is a more recent invention designed to ward off the Asian carp that threatens the Chicago River and Great Lakes ecosystem.

II. STORM AND SEWAGE WATERS THREATEN THE CHICAGO RIVER

A. BACKGROUND ON COMBINED SEWERS IN CHICAGO

Chicago was one of the first municipalities to implement a combined sewer system[20] in which storm water and wastewaters commingle.[21] Due to fast snow melts and rainstorms that produce large amounts of precipitation in a short time period, Chicago has suffererd from a steady series of wastewater overflow.[22] These overflows can require that the locks to Lake Michigan must be opened. Result? Contaminated lake water, beach closures, and even the need to inject[23] chlorine into the river to kill pathogenic organisms.[24]

By the early 1970s, it was clear that this facility could no longer handle the storm water runoff and wastewater created from the rapidly expanding population of the metropolitan region.[25] The system, could handle two billion gallons of wastewater per day, but a single rainstorm could inundate the system with over five billion gallons of runoff.[26] The area impacted by this combined sewer area covered approximately 375 square miles with over 400 locations where overflows occurred in the city and surrounding suburbs.[27]

---

[20] Reuss, *supra* note 12, at 319-38 (explaining that the first combined sewers were built in 1855 by Brooklyn and Chicago. By 1892, only 28 municipalities treated their sewage with that number rising to 890 by 1920. Only after 1940, did more than half of the towns in the US have treatment of sewage).

[21] *Id.* (explaining that approximately 1,000 U.S. communities have combined sewer systems. In fact, the EPA estimates that about 40 million people or 15% of the country's population lives in communities with combined sewers).

[22] *Id.*

[23] *Id.*

[24] Chuck Murray, *Deep Tunnel Cleans Up*, POPULAR SCIENCE Oct. 1992, vol 241, no. 4, at 32-33.

[25] Reuss, *supra* note 12, at 319-38.

[26] P. Kay Whitlock, *DuPage County's Experience in Storm Water Management, in Water and the City: The Next Century*, 361-66 (Howard Rosen & Ann Durkin Keating eds., Public Works Historical Society, Chicago, Ill., 1991).

[27] Hill, *supra* note 8, at 222-23.

B. THE TUNNEL AND RESERVOIR PROJECT (TARP): DEEP TUNNELS

In 1970, Mayor Richard J. Daley proposed a new vision for the Chicago River. He called for a river that was both swimmable, fishable, and would attract residents and tourists alike to its banks.[28] In 1972, Water Reclamation District engineers conceived of the Tunnel and Reservoir Plan (commonly known as "TARP" or the "deep tunnel"), as the solution for dealing with the Chicago water quality and flood control.

Similar to previous engineered solutions, no other city had undertaken such an ambitious plan. This decision arose out of fifty-one alternatives that were considered by a committee comprised of State of Illinois, City of Chicago, Cook County and the Chicago Reclamation District representatives.[29] Under the TARP design, wastewater would flow through local sewers down interceptor drop shafts into a large tunnel system between 150 feet and 300 feet below the surface.[30] From these tunnels, the water would empty into low-lying reservoirs.[31] The overflow water would be stored in the reservoirs until it could be pumped to waste water plants without exceeding those plants' capacity.[32]

Though the tunnel technology necessary to create TARP had been used on a similar scale for flood relief,[33] the District engineers were pushing the boundaries of tunnel technology by applying an unprecedented scale to the project. EPA and the Army Corp of Engineers would assist with funding for the project. The final cost of the project is estimated at approximately $4 billion.[34]

---

[28] Chuck Murray, *Deep Tunnel Cleans Up*, POPULAR SCIENCE Oct. 1992, vol 241, no. 4, at 32-33.

[29] *Id.*

[30] *Id.*

[31] *Id.*

[32] William A. Macaitis, *Regional Storm water Management Trends, in* Water and the City: The Next Century, 306-08 (Howard Rosen & Ann Durkin Keating eds., Public Works Historical Society, Chicago, Ill., 1991).

[33] *Id.*

[34] American City & County, *Chicago Digs Deep to Better Manage Stormwater*, June 1, 1996, Primedia Businiess Magazines and Media available at http://localgovtupdate.americancityandcounty.com/ar/government_chicago_digs_deep/ (last visited April 19, 2005).

Construction began in 1975 on the tunnels between Wilmette and McCook. By 1985, the completed portions of the tunnels began operation. This section of the whole system included about fifty-eight miles of tunnels up to thirty-five feet in diameter and as much as 300 feet below ground. Since Chicago has a thick layer of dolomite (limestone), these depths posed a complicated engineering challenge.[35]

The Army Corp of Engineers was concerned about the volume of treatable water that would result because of the combined sewers when considering alternatives to TARP.[36]

In October 1986 and August 1987, Chicago had storms that caused significant flooding in the city's center as well as residential areas. "The August 15-17, 1987 storm has the record of causing over $77 million in damages"[37] with over thirteen inches of rainfall occurring in twenty-four hours at the Chicago O'Hare International Airport and during one hour rainfall that exceeded six inches.[38] To supporters of TARP, this event provided evidence for the continued need for TARP.

The most recent cost estimates for the project total surpass the original cost estimate.[39] The system includes over 109 miles of tunnels completed with the largest being about thirty-three feet in diameter and three reservoirs with a total holding capacity of over 15 billion gallons.[40] Because of the innovative

---

[35] American City & County, *Chicago Digs Deep to Better Manage Stormwater*, June 1, 1996, Primedia Businiess Magazines and Media available at, http://localgovtupdate.americancityandcounty.com/ar/government_chicago_digs_deep/ (last visited April 19, 2005). "Tunnels of this size had never been bored because no tunnel boring machines (TBMs) large enough to do the job existed. On the first TARP project in the late '70s [the construction company] shut down preliminary drilling for a month and brought in experts from the Colorado School of Mines to reconfigure existing TBMs for the task, thus eliminating the need for blasting."

[36] US Army Corp of Engineers *Water Resources: Hydraulics and Hydrology. 199*1. Oral History, John Greenwood, Office of History, Interview with Vernon K. Hagen. Pages 164-66. TARP was considered a really special project because it was designed not just for flood control but also for water quality.

[37] Macaitis, *supra* note 32, at 306-08.

[38] Whitlock, *supra* note 26, at 361-66.

[39] *See* Ross Sandler, *Water and Sewer Fees Rise as Capital Costs Increase*, CityLaw, 4 City Law 73, July / August, 1998, Center for New York City Law. There is some controversy in other cities like New York City where people have questioned the need and costs for dealing with combined sewers, see Ross Sandler, *Water and Sewer Fees Rise as Capital Costs Increase*, CityLaw, 4 City Law 73, July / August, 1998, Center for New York City Law.

[40] Metropolitan Water Reclamation District of Greater Chicago, December 1, 2003, *TARP Report Status*. The reservoirs cost approximately $993 million and the tunnels $2.3 billion.

approach, this system has won awards as the model for wastewater management for urban areas worldwide.[41] The tunnels were completed in 2005, with the last of the reservoirs scheduled for completion in 2014.

TARP is the ultimate example of employing bold engineering approaches to improve the quality of Chicago River and Lake Michigan. The actual construction of the tunnel has set world records for tunnel construction.[42] And while the TARP approach is being used in other cities, it is on a smaller scale and the Chicago River remains the model for the strategy of using deep tunnels connected to a series of reservoirs for handling sewage and floodwaters.[43]

III. ASIAN CARP THREATEN THE CHICAGO RIVER AND GREAT LAKES BASIN

A. BACKGROUND ON THE ASIAN CARP

The federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990,[44] with amendments contained within the federal National Invasive Species Act of 1996,[45] sets forth national guidelines with mandatory controls for combating in-

---

[41] The American Public Works Association 2003 Environmental Project of the Year. The American Society of Civil Engineers awards are numerous and include for most outstanding Civil Engineering Project of 1986, and District's wastewater treatment system a "Civil Engineering Monument of the Millennium" in 2000. For a complete listing of the technology and engineering awards *see* http://www.mwrdgc.dst.il.us/awards.htm (last visited December 23, 2004).

[42] Lawrence Williams, *Record Breaking Robbins Chews Through Little Calumet Leg Limestone*, World Tunnelling, Vol. 16, No. 4 (May 2003). *See also*, http://www.insituform.com/corporate/featured_project1.html (last visited April 25, 2005). Best daily advance of 116.7 meter, best single shift advance of 45.75 meters, and most excavated rock in 24 hours at 2,836 cubic meters.

[43] Fact Sheet, City of Atlanta, *Department of Watershed Management,* 2003, available at http://www.cleanwateratlanta.org/CSOTunnels/FAQ.htm, (last visited April 19, 2005). "A 2002-2003 inventory of other large tunnel projects for such use identified more than 47 tunnel projects in the United States and overseas. These projects ranged from 7 feet to 33 feet in diameter and from 2 miles to 33 miles in length. The Chicago Tunnel and Reservoir Plan (TARP) is one of the best examples of the most successful and large-scale application of tunnels. Other large tunnel projects are in operation in Austin, Boston, Cleveland, Houston, Detroit, Los Angeles, New York, Minneapolis, and San Francisco.", *Id.*

[44] Title I of P.L. 101-646 (104 Stat. 4761, 16 USC 4701, enacted November 29, 1990). It established a new federal program to prevent and control introduction of invasive species.

[45] P.L. 104-332 (110 Stat. 4080, 16 USC 4701-4751, enacted on October 26, 1996).

vasive species.[46] Because of a rise in species from other parts of the world entering and taking over native habitats, in 1999, President Clinton issued an Executive Order, which established the National Invasive Species Council with representatives from twelve departments and agencies.[47] Moreover, the Executive Order calls for working towards common environmental goals to solve the problem of invasive species.

One of the areas most impacted by what is termed, alien,[48] exotic species,[49] bio-invaders, or nuisance species is the Great Lakes ecosystem. "At least 25 non-native species of fish have entered the Great Lakes since the 1800s, significantly impacting the food chain."[50] In addition to these fish species, over 140 exotic aquatic organisms of all types that have become established in the Great Lakes since the 1800s.[51]

One of the more recent fish bio-invaders into the Great Lakes basin watershed is the Asian carp. It was found in the Illinois River, just outside the Chicago River which links directly to Lake Michigan.[52] Like other exotic species, these fish have rapid rates of reproduction, which has alarmed federal and local agencies that have jurisdictional authority over the

---

[46] US Environmental Protection Agency, available at, http://www.epa.gov/grtlakes/glwa/usreport/part5.html (visited Dec. 15, 2004).

[47] Exec. Order No. 13,112, 64 Fed. Reg. 6183 (Feb. 3, 1999).

[48] Executive Order 13,122 defines alien species "as an invasive species whose introduction is likely to cause economic or environmental harm or harm to human health." Exec. Order No. 13,122, 64 Fed. Reg. 6183 (Feb. 3, 1999). Also the definition used for alien species is explained with international examples in Clare Shine, Natterley Williams & Lothar Gundling, *A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species,* Environmental Policy and Law Paper No. 40, International Union for Conservation of Nature and Natural Resources (2000).

[49] *See* Fred Bosselman, *A Dozen Biodiversity Puzzles*, 12 N.Y.U. Envtl. L.J. 364 (2004).Not all non-native species are exotic, nuisance or bio-invaders. Definitions and priorities of which species need to be protected or eliminated from a habitat are related to concepts of impacts to biodiversity.

[50] *U.S.Environmental Protection Agency* (visited April 18, 2005), available at http://www.epa.gov/glnpo/invasive/index.html.Other major invaders include the zebra mussel, round goby, sea lamprey, and alewife.

[51] Jerry L. Rasmussen, *The Cal-Sag and Chicago Sanitary and Ship Canal: A Perspective on the Spread and Control of Selected Aquatic Nuisance Fish Species*, U.S. Fish and Wildlife Service, Jan. 1, 2002 at 1-3.

[52] Al Swanson, *Frankenfish in the Great Lakes,* United Press International, Oct. 15, 2004. "One Asian carp was discovered in the Chicago River's Burnham Harbor as late as October 2004 past the barrier. State conservation officials concluded that a pet owner put the fish in the Chicago River, thus determining that the fish was not a survivor of the electric barrier."

protection of the Great Lakes.[53] Before TARP, the Chicago River was so toxic that many clean water organisms could not survive. This poor water quality served as a defense against the commingling species traveling up the Mississippi River to the Chicago River and Great Lakes watershed.[54] For the past twenty-five years,[55] the water quality has improved significantly in the Chicago River making it more hospitable to many forms of aquatic life, and ironically, a wonderful location for the habitat and transport of exotic species into the Great Lakes ecosystem.

The grass carp (*Ctenopharyngodon idella*) native to eastern Asia was first imported in 1963 to aquaculture facilities in Alabama and Arkansas. The stock came from Taiwan and Malaysia.[56] In the 1960s and 1970s, fish farmers introduced Asian carp from China to help remove pond scum in hatcheries.[57] Through flooding and other ways, the Asian carp has escaped from the farms.[58] The tendency for carp species has been to move steadily upstream from the initial infestation (Arkansas, and Mississippi) with the only barrier to their passage being high dams.[59]

By the 1990s, the Asian carp had migrated into the Mississippi River and traveled as far north as the Illinois River.[60] These adaptive fish are well suited to the temperate waters of

---

[53] Reports included a 600-fold increase in carp numbers between 1999 and 2000 in LaGrange, IL in the Illinois River navigation dam which links to the Chicago River. Mississippi Interstate Cooperative Resource Association, River Crossings, May/June 202, volume 11, number 3; Rasmussen *supra* note 51 at 1-3; *See also* Asian Carp Invasion of the Upper Mississippi River System, Upper Midwest Environmental Sciences Center Project Status Reports 2000-05.

[54] Rasmussen *supra* note 51 at 1-3.

[55] *Id.*, at 1-3.

[56] *Id.*

[57] Dan Majors, *A Big Fish in a Great Lake* Pittsburg Post-Gazette, Oct. 14, 2004, available at, http://search.post-gazette.com/default.asp (visited December 15, 2004). US Fish and Wildlife Service, Asian Carp Fact sheet, La Crosse Fishery Resource Office, Onalaska, Wisconsin, November 15, 2002.

[58] Reports included a 600-fold increase in carp numbers between 1999 and 2000 in LaGrange, IL in the Illinois River navigation dam which links to the Chicago River. Mississippi Interstate Cooperative Resource Association, River Crossings, May/June 202, volume 11, number 3. Rasmussen *supra* note 52 at 1-3.; *See also*, US Geological Survey, November 2000. Asian Carp Invasion of the Upper Mississippi River System. Project Status Reports PSR-2000-05.

[59] Mississippi Interstate Cooperative Resource Association, River Crossings, May/June 2002, volume 11, number 3.

[60] Rasmussen *supra* note 51 at 2,3.

the Chicago River and Great Lakes basin.[61] Because Asian carp consume forty percent of their body weight each day and can grow to a whopping 100 pounds, the species will compete directly with the sport and commercial fish of Lake Michigan.[62] Experts fear that the carp could become the dominant species in the lake and an overwhelming threat to the sport and commercial fisheries.[63]

One unique, albeit infrequent, danger posed by the Asian carp is the fish's ability to become a projectile that leaps out of the water at the sound of loud noises like boat engines.[64] Amazingly, a woman water-skiing in a Peoria, Illinois lakes basin was struck unconscious by a jumping carp.[65]

Catfish farmers in the 1970s imported bighead and silver carp from Asia hoping to remove algae and suspended matter from their ponds.[66] In the summer of 2002, both species were seen within twenty-five miles of Lake Michigan in the Chicago Sanitary and Ship Canal.[67] The canal connects the Mississippi River to the Chicago River via the Des Plaines River.[68] This caused the Great Lakes Commission to issue a resolution on October 15, 2002 to urge the US Army Corp of Engineers to

---

[61] Mississippi Interstate Cooperative Resource Association, River Crossings, May/June 202, volume 11, number 3.

[62] Rasmussen *supra* note 51.

[63] *Id.*

[64] Dan Wilcox, St. Paul District, US Army Corp of Engineers, May 2004 Engineer Report Update, *Invading Asian Carp post Unusual Threat*, *available at* www.hq.usace.army.mil/cepa/pubs/may04/story9.htm, (visited December 15, 2004).

[65] Tom Meersman, *Jumping Carp Maul Boaters on Illinois River in Peoria,* Minneapolis-St. Paul Star Tribune, June 18, 2004. (According to the victim, "'I'm sitting there and all of a sudden this big fish flops out of the river literally and hits me right between the eyes," I'm not kidding. It knocked me completely out.' [The victim]... revived quickly, but she found herself floating face down in the river, bleeding profusely. She saw her watercraft floating away in the current, heading toward a towboat that was blasting its horns. She passed out again, but a nearby boater, alerted by the warning blasts, came to her rescue. [The victim] suffered a broken nose, concussion, black eye, injured back and a broken foot. Other boaters along the Illinois, Missouri and Mississippi rivers have reported dislocated jaws, facial cuts, broken ribs and serious bruises. Hundreds have been startled as the thin-skinned carp shot into their boats and flew to pieces as they hit seats, coolers, fishing equipment and depth finders.").

[66] US Environmental Protection Agency, *Great Lakes, available at* http://www.epa.gov/glnpo/invasive/asiancarp/index.html (visited Oct. 15, 2004)

[67] Great Lakes Commission, *available at* http://www.glc.org/about/resolutions/02/asiancarp.html (visited Mar. 2, 2005).

[68] Rasmussen *supra* note 51 at 2,3.

construct a barrier to remain permanent for protecting the Chicago River and ultimately the Great Lakes ecosystem.[69]

Large floods in the 1990s resulted in the overflowing of catfish ponds, thereby releasing Asian carp into the Mississippi River basin.[70] The silver and the bighead carp entered the Mississippi River from aquaculture fisheries in the early 1990s also as a result of flooding.[71] Steadily, the carp have moved up river, "becoming the most abundant species in some areas of the Mississippi, out-competing native fish, and causing severe hardship to the people who fish the river."[72]

The goal of deterring Asian carp from reaching the Great Lakes has fallen upon several agencies, primarily the US Fish and Wildlife, US Environmental Protection Agency, City of Chicago, and the US Army Corp of Engineers, has been to prevent the carp from entering the Chicago River. Other agencies such as the International Joint Commission, the State of Illinois, and the Great Lakes Fishery Commission along with stakeholders are working together to create something unique to prevent further migration of these visitors into the Chicago River.[73]

In May 2003, nearly seventy scientists, policy makers, and engineers from around the country gathered in Chicago for the Aquatic Invasive Species Summit.[74] Convened by Chicago's Mayor Daley, the Summit was designed to introduce experts to the region's man made waterway system and to develop solutions on how to halt the introduction and spread of invasive species.[75]

---

[69] Great Lakes Commission, *available at* http://www.glc.org/about/resolutions/02/asiancarp.html (visited Mar. 2, 2005).

[70] US Environmental Protection Agency, *Great Lakes, available at* http://www.epa.gov/glnpo/invasive/asiancarp/index.html (visited Oct. 15, 2004).

[71] Great Lakes Fishery Commission, *available at* http://www.glfc.org/fishmgmt/carp.asp (last visited March 2, 2005).

[72] *Id.*

[73] US Environmental Protection Agency, Great Lakes, *available at* http://www.epa.gov/glnpo/invasive/asiancarp/index.html (visited Oct. 15, 2004).

[74] Christine Esposito, *Chicago Summit Generates Possible Solutions*, Chicago Field Office, Fish and Wildlife Service, *available at* http://midwest.fws.gov/Chicago/summit.pdf (last visited April 18, 2005).

[75] Four general approaches emerged: "1. Separate the Great Lakes and Mississippi watersheds by the introduction of a physical barrier, 2. Establish a biological eradication zone—a section of the waterway where oxygen could be removed from the water and high temperatures would prevail, 3. Employ technologies that impact animal behavior, 4. Physically remove all aquatic life through a filter or bypass system.", *Id.*

B. INNOVATIVE ENGINEERING TO CONTROL CARP: AQUATIC NUISANCE SPECIES DISPERSAL BARRIER

It has been difficult to manage carp due to the migratory behavior of the fish which transverse geopolitical boundaries.[76] Various technologies were considered to deter the fish from moving into the Chicago River such as electric barrier, sonic bubble curtains, and pheromones.[77] A joint Federal and state venture constructed an electrical fish barrier near Romeoville, Illinois to research its efficacy in preventing fish from moving between the Chicago River and the Lake Michigan.[78]

The temporary electronic barrier was built by the Corps of Engineers in the Chicago Sanitary and Ship Canal.[79] Located near Romeoville, Illinois, the barrier was activated in April 2002, with a total cost of $2.2 million.[80] The complete cost from planning and design to maintenance and start up operation was estimated to be at $3.1 million. The temporary barrier served as a demonstration project until the construction of a permanent barrier was approved.[81]

The Illinois Natural History Survey has tagged and tracked 100 native carp near the Chicago Sanitary and Ship Canal.[82] The barrier has proven extremely effective, as only one fish passed the barrier, and it was probably carried past as a result of turbulence from a barge.[83] The permanent barrier is designed to prevent this type of breach from reoccurring.[84]

---

[76] Tracy Dobson, Henry A. Regier & William W. Taylor, *Fish and Other Migrating Species in the Canada / US Context: Governing Human Interactions with Migratory Animals, with a Focus on Humans Interacting with Fish in Lake Erie: Then, Now and in the Future*, 28 Can.-U.S. LJ 389 (2002) (explaining the legal history and use of Asian carp in fish hatcheries in the United States pertaining to Lake Erie since 1850).

[77] Wilcox *supra* note 64.

[78] US Environmental Protection Agency, *Great Lakes, available at,* http://www.epa.gov/glnpo/invasive/asiancarp/index.html. (visited Oct. 15, 2004).

[79] *Id.*

[80] *Id.*

[81] A demonstration barrier was necessary to ensure different sizes and species of fish react differently to different electric fields. Thus, the electric charge had to be carefully calibrated to stop movements of the carp. Mississippi Interstate Cooperative Resource Association, *River Crossings*, May/June 2002, volume 11, number 3.

[82] Environmental Protection Agency, Great *Lakes: Big-Head Carp, Asian Carp and the Great Lakes, available at* http://www.epa.gov/glnpo/invasive/asiancarp/, (last visited Mar. 2, 2005).

[83] *Id.*

[84] *Id.*

Field tests have shown that this type of barrier is equally effective at preventing fish from moving into Lake Michigan.[85]

C. CHICAGO BUILDS SECOND ELECTRIC BARRIER

In late October 2004, construction began on a second, more permanent barrier.[86] Scheduled for completion in summer 2005, the barrier is comprised of two rows of electrodes that cross the canal approximately 220 feet apart.[87] The DC current, which poses no threat to people and is not lethal to the fish, repel the fish and prevent them from crossing the barrier.[88]

The new design creates a more constant, yet stronger electric field.[89] Two sets of electrodes will be operated from a second control house, which will allow for a backup system in case of failure of the first set of electrodes.[90] As a prevention measure, these alterations will mitigate ship turbulence from pushing fish through the barrier inadvertently.[91] The estimated cost of this barrier is $9.1 million with seventy-five percent coming from the federal government and the remainder consisting of non-federal contributions.[92] Illinois has promised $1.7 million to the project.[93]

Congress increased the limit on federal spending for the project by authorizing $6.825 million, which is seventy-five percent needed to finish the permanent barrier.[94] The Army Corps of Engineers will manage the project and will finance the federal portion.[95] With the State of Illinois' funding, the Great

---

[85] *Id.*

[86] *Id.*

[87] *Id.*; *See also* Detailed Proj. Rep. *Aquatic Nuisance Species Dispersal Barrier*, US Army Corps of Engineers, Chicago District (Dec. 2002).

[88] *Id.*

[89] Detailed Proj. Rep. *Aquatic Nuisance Species Dispersal Barrier*, US Army Corps of Engineers, Chicago District (Dec. 2002).

[90] US Environmental Protection Agency, *Great Lakes, available at* http://www.epa.gov/glnpo/invasive/asiancarp/index.html. (visited Oct. 15, 2004)

[91] *Id.*

[92] *Id.*

[93] Press Release, US EPA, Federal Funding Available for Enhanced Protection Against Asian Carp, (Oct. 13, 2004) Cynthia Bergman.

[94] *Id.*

[95] The operating cost of running a high voltage wire for multiple years will be significant.

Lakes governors have supplied funding for the remaining non-federal share of $575,000.[96]

"Even before it becomes fully operational, concerns are emerging about the safety of the electrical barrier and who will pay for the operation of the system."[97] Army Corp of Engineers had scheduled activating the fish barrier in February 2005, but safety issues are being evaluated before the activation will occur.[98] An important special interest, the shipping industry, has lobbied state and federal officials to postpone the barrier for safety considerations.[99]

IV. CONCLUSION

The Chicago River is on the rebound in terms of economic development and environmental quality based on a series of innovated technologies and infrastructure investments.[100] In the past five years, the city and its sister agencies have invested nearly $26 million on a system of riverside parks and a 28-mile river walk way. Water taxis, tourist boats and pleasure craft have become mainstays of the river. Even the once highly toxic area called "Bubbly Creek," made famous in Upton Sinclair's book *The Jungle*,[101] is lined by new residential properties commanding prices over a million dollars.[102]

It is true that Chicago's legacy of engineered technologies has brought many dividends, but at a significant cost. It is also true that engineered solutions, no matter how innovative, will not solve every problem or even work as designed. Therefore, each succeeding generation must be prepared to invent new technologies and make more investments to manage the tension between the built environment and natural systems which

---

[96] *See* US EPA press release *supra* note 94.

[97] Michael Hawthorne, CHICAGO TRIBUNE, Jan 12, 2005, Metro Section, at 1.

[98] *Id.*, at 6.

[99] In 2002, a barge flotilla collided with the barrier causing electrical flashes between the barges.

[100] Alby Gallun, *The Working River*, Crain's Chicago Business, June 2, 2003.

[101] UPTON SINCLAIR, THE JUNGLE (Grosset & Dunlap) (1906).

[102] Michael Hawthorne, *A Whiff of Success: Million-Dollar Homes along a long-polluted stretch of the Chicago River fuels new interest in cleaning up Bubbly Creek*, CHICAGO TRIBUNE, Nov. 21, 2004, at pg. 1, pg. 5 Metro Section. Bubbles from decaying animal carcasses discarded from slaughterhouses cause this section of the Chicago River to bubble up. Some of these odorous smells may be a result of untreated sewage. *Id.*

the city depends on. Clearly, this is a balancing act that never will reach equilibrium.