Alliance for the Great Lakes

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Protecting Public Health, Caring for Chicago's Waters

An Agenda for Action

Photo courtesy of Laura Barghusen, Openlands: Recreators enjoy canoeing and fishing in the Little Calumet River.

Table of Contents

Executive Summary……………………………………………………………………3

Recommendations Abstract……………………………………………………………....6

Background……………………………………………………………………………..9

The Case for Change – Public Health………………………………………………..15

The Case for Change – Ecology………………………………………………………27

The Case for Change – Economics…………………………………………………..29

Solutions: Prescriptions for Change…………………………………………………..39

Appendices……………………………………………………………………………41

Glossary………………………………………………………………………………56

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Environmental Law & Policy Center
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Sierra Club

Executive Summary

A century ago water in the Chicago area was valued as much for its ability to send waste elsewhere as it was a necessary ingredient for life. Lake Michigan was a place to stay away from, especially after heavy rains swept offal from the Chicago River into the lake. Later, through the construction of the Sanitary and Ship Canal, the Chicago River was diverted to send pollution to the Des Plaines, Illinois and Mississippi rivers. Still later, the North Shore Channel and the Cal Sag Canal were built to help move even more of Chicago's wastewater towards the Mississippi.

Today, some 65 million visits to Chicago's lakefront annually help make our coast significant to the region's economy, recreation, and quality of life. But also, with improved water quality, increasingly people are attracted to the Chicago River, the North Shore Channel, the Cal Sag and other portions of the Chicago Area Waterway System (CAWS) despite the fences, signs and warnings to keep them away. With its river sight-seeing, gondolas, and fishing sites, the Chicago River and other components of the CAWS have joined Lake Michigan as pillars of what makes the city a global attraction.

In 2005 over 11,500 paddlers rented canoes to use on the CAWS[1]. Countless others used the CAWS for other forms of recreation. Yet Chicago continues to be one of the few major cities across the U.S. that does not disinfect its wastewater effluent. What needs to be remembered is that the region's waters belong to all of us, and that we have an obligation to protect these uses that have only increased and flourished over recent decades.

For far too long we have looked at many stretches of the CAWS as places to avoid, rather than as places to fish, paddle and congregate.

That is the old way of looking at our waters and it needs to change.

We can attempt unsuccessfully to shield public health by keeping people away from the waters they love, or we can realize that this tactic is a relic of the old way of viewing the river and lakefront. Ultimately, we can no more shield public health by keeping people from their waterways than we can try to keep our children healthy by preventing them from going to school. People are attracted to water. They are attracted to the open space that it provides, the recreational opportunities that it offers, and the spiritual renewal that it promises.

We need a new vision for our region's waterways, a vision that treats our waters as the lifeblood of our community rather than as a way to sweep waste somewhere else. With proper care our waters can promote greater "livability" in and around the city, while

[1] Friends of the Chicago River

significantly contributing to the economy. We need to ensure that our laws and water quality standards are working to protect public health, integrating commercial and recreational uses to implement that vision, and to protect these precious natural treasures. Mayor Richard Daley understands this vision, and that is why he calls for disinfection of CAWS in his 2005 *Chicago River Agenda*.

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To help protect public health we need to improve CAWS water quality. Two key components of improvement include disinfecting the sewage discharges from the Metropolitan Water Reclamation District's massive sewage treatment plants, and significantly reducing polluted overflows from the sewer system.

Ill-treated, our waters can threaten public health. Nurtured, they can bolster it. The purpose of this report is to provide a prescription for caring for the CAWS. The CAWS consists of 78 miles of water, including:

(1) North Segment: North Shore Channel, North Branch of the Chicago River, Chicago River, South Branch of the Chicago River, South Fork of the South Branch;

(2) South Segment: Calumet River, Grand Calumet River, Little Calumet River, Lake Calumet and Cal-Sag Channel; and

(3) Middle Segment: Chicago Sanitary & Ship Canal (CSSC)

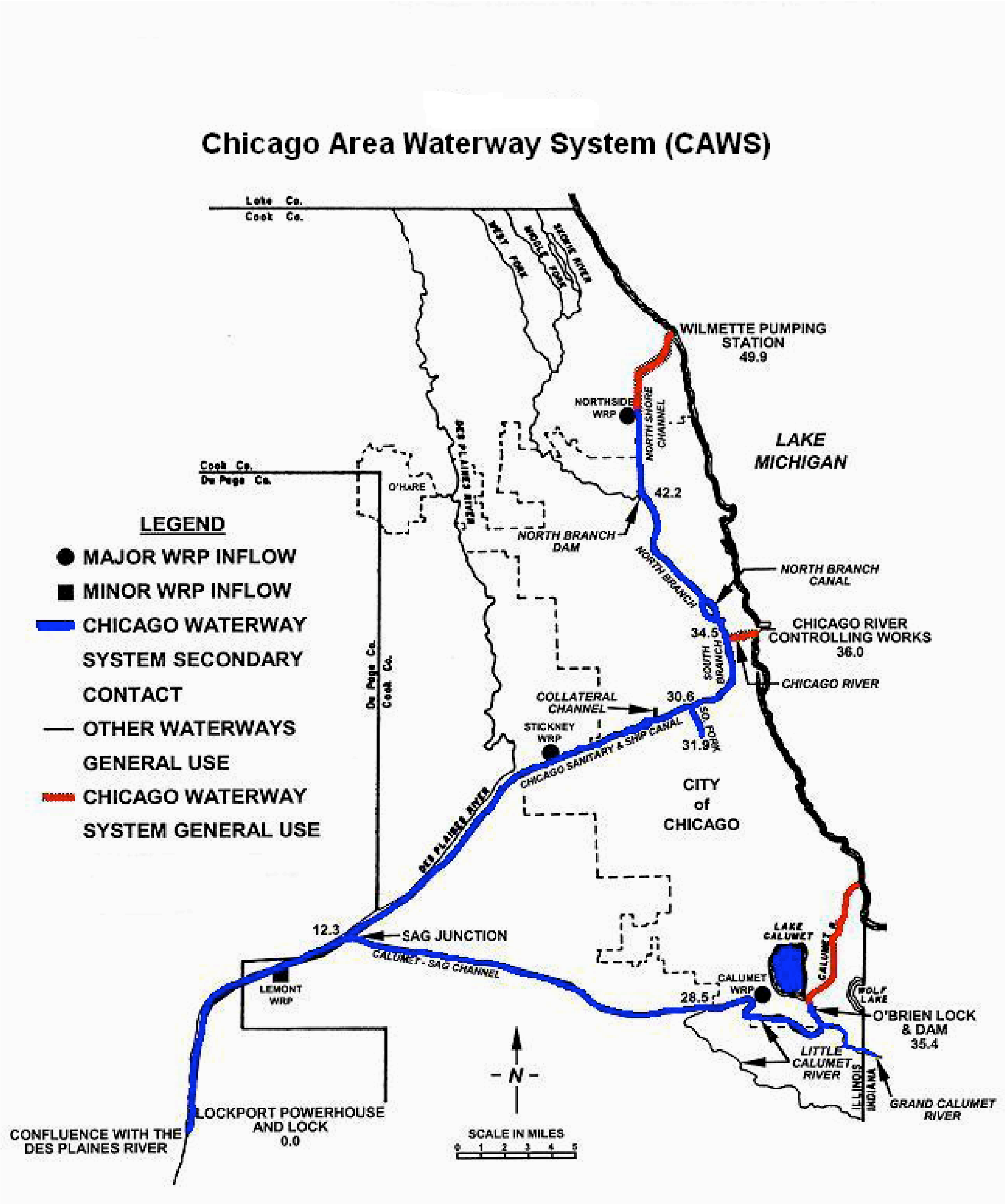

Figure 1: Chicago Area Waterway System (CAWS) Current Use Designations - Source: MWRD

Recommendations Abstract

The major sources of wastewater to CAWS, which adversely impact the full usage of the waterway, are overflows from combined sewers and discharges from three main wastewater treatment plants (WWTP) of the Metropolitan Water Reclamation District of Greater Chicago (MWRD). While MWRD and the City of Chicago work to complete adequate control of combined sewer overflows (CSOs) over the next several years, this report recommends that appropriate agencies take two immediate steps to promote public health and water quality *now*:

- Designate all stretches of CAWS for full "fishable/swimmable" uses as required by the Clean Water Act (CWA). Commendably, the Illinois Environmental Protection Agency (IEPA) has proposed strengthening water quality standards to secondary contact (boating and limited contact with the water) for the North and South Segments. However:

    - IEPA must redo its proposal to strengthen the water quality standards for CAWS by designating all of the waterways for full uses-fishable/swimmable, based on the current uses and the attainable uses in each segment of CAWS, and to fully support that proposal before the Illinois Pollution Control Board (IPCB). The effective date for the new standards should be March 1, 2010, with implementation of those standards to begin immediately at the North Side and Calumet sewage treatment plants.

    - While the Middle Segment does not receive as much public use as do the North and South Segments, current uses and attainable uses still dictate the stronger standards for all segments. Failing to designate the Middle Segment for full uses is inconsistent with protecting public health, and will mean that water quality in that segment will likely continue to be treated as industrial and domestic waste conduits consistent with the old purpose of that segment for years, if not decades, to come. Such a policy would be inconsistent with the law and intent of the CWA, as well as the Use Attainability Analysis (UAA) process, which stipulates that our nation's waterways must be reviewed every three years in order to update water quality standards that are consistent with present and attainable uses. However, attainment of these standards will occur over time and the timetable for attainment of fishable/swimmable standards in the CSSC might be scheduled for as late as 2012.

    - The Illinois Pollution Control Board must adopt the upgraded water quality standards to make them fully effective for CAWS, so that they are protective of fishable/swimmable uses.

- The MWRD must commit to disinfecting the wastewater from its three main wastewater treatment plants that discharge into CAWS.

- In 2007, the Chicago metropolitan area's wastewater treatment agency, the MWRD, is one of the only major agencies in the U.S. that does not disinfect much of its wastewater effluent,[2] where whole or partial body contact is a present or attainable use. This includes its three largest plants that discharge to the CAWS—among them the largest sewage treatment plant in the world.

- A number of disinfection technologies are available, including the use of ultraviolet (UV) light, ozone, and chlorination/de-chlorination.

- The use of one of the most increasingly preferred disinfection technologies, UV, is available at a relatively low cost of $8.52 per person per year for the greater Chicago metropolitan area (based on the MWRD's population-served density number of 5.4 million).

- To substantially reduce CSOs in CAWS, MWRD and its service communities must fully comply with the discharge permit requirements to implement the "Nine Minimum Controls" for CSOs on an expedited basis, under federal law and policy.[3] These requirements are designed to make immediate and effective use of current treatment plant facilities, thereby often avoiding larger capital costs associated with the federally mandated, "longer" term control plans for CSOs.

- The MWRD must also be required to complete the reservoir portion of its Tunnel and Reservoir Plan (TARP or "Deep Tunnel") by an enforceable date. If successfully completed, TARP may serve as MWRD's mandated long-term control plan (LTCP) for CSOs. Upon completion of TARP, it must conduct post monitoring of CAWS to determine if water quality standards are being met. If standards are not being met, then MWRD must redress implementation under the long-term control planning process required under the National CSO Policy.

- Service communities that have CSOs that are not being captured and controlled by TARP must initiate a LTCP process to bring CSOs into compliance with the CWA and National CSO Policy.

- The city of Chicago, recently making great progress on this issue, must continue its efforts to fully comply with federal law and policy for the control of CSOs.

  - The City must fully comply with the U.S. Environmental Protection Agency's (USEPA) "Nine Minimum Controls" for the control of CSOs and do so on an expedited basis.

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[2] Openlands Project, Civic Federation, Friends of the Chicago River, *Waterways for Our Future* (Chicago, 2000), p. 46.

[3] The nine minimum controls, required by federal law, are listed on the United States Environmental Protection Agency's website: http://cfpub.epa.gov/npdes/cso/ninecontrols.cfm?program_id=5

- The City must continue to work with the MWRD on controlling CSOs that will eventually be discharged into TARP.

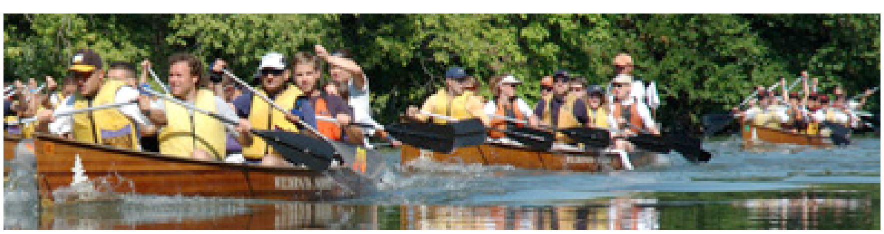
* * * * *

More and more, people are calling for MWRD to disinfect its wastewater. Many members of the IEPA's Stakeholder Advisory Committee (SAC) have consistently called for disinfection as a result of the findings of the USEPA required UAA study. Additionally, Chicago Mayor Richard M. Daley's 2005 *Chicago River Agenda* called on MWRD "to implement cost-effective disinfection technologies that improve the recreational potential of the river while limiting negative impacts on the environment." Still, some MWRD officials continue to adhere to the old vision of CAWS as a waste conduit, essentially dismissing the UAA process by refusing to disinfect: "the District will not be disinfecting the effluents from the North Side and Calumet Water Reclamation Plants."[4]

Protecting public health and advancing the new vision for our waterways is not a new idea. Nor are the actions or technologies needed to help advance that vision uncommon. In fact, they have been implemented in metropolitan areas with fewer resources than the Chicago metro region for years. In short, if they can do it, we in the Chicago metropolitan area can do it.

This report makes the case—in public health, economic, and ecological terms—why we need to upgrade all CAWS water quality standards for all three segments, and institute disinfection requirements now.

We owe it to future generations to build on past successes, to start executing the new vision now so that they do not inherit—as our generation has—an outdated, outmoded view of the region's waterways.



Flatwater Classic on the Chicago River – Friends of the Chicago River

[4] Metropolitan Water Reclamation District of Greater Chicago, Comments on IEPA Chicago Area Waterways (CAWS) Use Attainability Analysis (UAA) Draft Standards, March 16, 2007, p. 3, Section 8.

Background

Chicago's lakefront and the Chicago River have changed and continue to change over time. A glimpse at our relationship with the waters of the past shows a steady trajectory towards improved water quality and public uses in the future.

A. Historical Setting

The irony of the Chicago River is that to protect water quality in Lake Michigan, we have chosen to harm the river. For much of the last two centuries our use of CAWS has endangered public health. We reversed the river's flow away from the lake to protect our drinking water, yet failed to properly control pollution that goes into a river that we recreate on, eat fish from, and sometimes release back into Lake Michigan.

Before European settlement, the Chicago River was a slow, shallow, meandering stream that drained marshes, woodlands, and prairies into Lake Michigan. After Europeans settled in the area, they dredged and straightened the river into channels for agricultural drainage and expedited stormwater runoff in the north. They also built seawalls to accommodate commercial shipping on the lower reaches. Yet the sewerage system at that time was primitive. Wastes initially flowed out into the streets, then later through underground pipes, but it all eventually discharged either directly into Lake Michigan or into the Chicago River, which then discharged into the lake.

Throughout much of the 1800s waterborne diseases frequently created states of emergency for Chicago. Giant rainstorms washed the pathogenic wastewater of the Chicago River far out into Lake Michigan, the budding city's drinking water source. Although the water intake cribs were moved farther out into the lake away from the wastes, this did not prevent polluted wastewater from reaching the cribs and negatively impacting public health. As a result, early Chicago's population was plagued by typhoid fever, cholera and dysentery, significantly attributable to wastewater contamination. In 1854 for example, 5.5 percent of the population died from a cholera epidemic[5]. Between 1860 and 1900, typhoid fever took the lives of on average, 65 individuals per 100,000 people per year. The worst of these years was in 1891, when the typhoid death rate was 174 per 100,000 persons. (Chicago Municipal Reference Library, 1997).

Such incidents killed and sickened tens of thousands of people. In 1889, the Sanitary District of Chicago (SDC), which later became the MWRD, was created to protect drinking water supplies and improve the river's deplorable condition. The SDC began working to reverse the flow of the river so that sewage would move away from Lake Michigan, thereby sending wastewater downstream to the Illinois and Mississippi rivers.

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[5] It should be noted that while it is not specifically cited here, there is a controversy surrounding whether 90,000 people died in the region in 1885 from a cholera epidemic, as asserted by Libby Hill in her 2000 (Lake Claremont Press) book, "*The Chicago River: A Natural and Unnatural History," which gained some wide acceptance*.

The project finished in 1900, and the depth of the new flow supported barge traffic on the artificially created Chicago Sanitary and Ship Canal (CSSC)—so named for its two primary uses. In 1910, SDC completed the North Shore Channel to drain sewage effluent away from Lake Michigan into the North Branch of the Chicago River and ultimately to the CSSC (MWRD website).

Stormwater control and sewage practices of the time called for building sewers that carried sanitary waste as well as stormwater. This type of sewer system directed stormwater runoff and sanitary sewage through one combined system directly to the river. Yet as Chicago continued to grow, it outstripped the river's ability to contain the volume of stormwater and sewage without creating undesirable conditions due to bacteria, odor, toxins and other pollution prevalent in the river. In the 1920s the SDC built three treatment facilities to handle stormwater runoff and treat sewage discharges. This system's capacity was frequently overwhelmed by stormwater flow, especially after the 1950s. Still occurring today perhaps as frequently as 50-100 times a year, accumulated rainfall in the sewage system leads to Combined Sewer Overflows (CSOs) of stormwater and sewage into the river.[6] During heavy storms, the amount of stormwater and sewage influent can overwhelm the sewage system, potentially flooding highway underpasses and basements across the city and suburbs unless the water is quickly discharged to the river untreated.

During periods of extremely heavy rain, the CAWS may receive so much combined storm and wastewater that flooding along its banks may occur. The MWRD's practice has been to open gates—at the "locks"—in the river system so that the excessive "dirty" water spills into Lake Michigan. This minimizes flooding. However, because this water is heavily contaminated with untreated sewage, with a fecal coliform count 100-1000 times higher than treated sewage, the practice forces swimming bans at Lake Michigan's beaches and puts drinking water at risk. Fortunately, this practice of discharging from the river system into Lake Michigan seems to be happening less frequently, largely attributable to sections of TARP being completed. But it still happens. It last occurred in 2002, forcing beaches to close and municipal water agencies to increase the level of chlorine in public drinking water supplies.[7]

B. Aquatic Environment Setting

With CAWS being used as a vehicle for moving sewage downstream away from the lake, fish and other aquatic life in the river were limited to a few undesirable species.

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[6] This is not the case in all parts of CAWS. For example, in the North Shore Channel, roughly north of Dempster Avenue, stormwater pipes are separate from sanitary sewers, with stormwater flowing directly into the river. This helps increase sewage treatment capacity in MWRD's system for the more concentrated sanitary sewage waste.
[7] The last "reversal" to the lake in 2002 also caused swimmers of a major triathlon that occurred at about the same time, to forego that part of the competition in the lake.

Yet with commendable efforts by MWRD to provide better wastewater capture and basic treatment, including the construction of its massive underground TARP system, significant increases in the health and quality of the river's aquatic life have occurred over the years. The CAWS now has an increasing number and diversity of fish and other aquatic life. Undoubtedly with further improvements of CSO controls and habitat restoration, that trend will continue to increase (for more on the aquatic setting – see section, *The Case for Change – Ecology: B. Aquatic Health*).

C. Social & Economic Setting

As MWRD has improved water quality in CAWS through basic treatment upgrades and by completing sections of TARP, people have flocked to the Chicago River system in increasing numbers. Today, the city of Chicago has a downtown riverwalk and is planning a series of parks and a greenbelt trail system along the length of the river's edge. In addition, other communities and business are expanding their development along CAWS. The Village of Summit reopened a boat launching facility in 2005 on the Chicago Sanitary and Ship Canal. Also in 2005, over 11,500 people used the available canoe liveries on the river.[8] Whereas in previous years the river was an economic liability to nearby property owners, it is now a highly valued amenity driving citywide residential and commercial redevelopment. For example, a recent analysis performed by Friends of the Chicago River (FOCR) revealed that among 8,920 river-edged parcels, the estimated assessed property values increased by 20.1 percent (representing a total property increase of roughly $405 million, or $45,500 per property) between 2002-2003, compared to a 17.29 percent citywide baseline increase during the same period. This additional 2.81 percent river-edged increase represents about $56.7 million citywide, or on average an additional $6,360 per parcel, for proximity to the river.

Moreover, some 65 million visits to the lakefront occur every year in Chicago alone. When swimming is allowed, the metropolitan area's beaches are among the most attractive in the world, contributing to the region's appeal. When CAWS reversals occur and swimming is banned, local economies pay the price. This is evidenced by a 2000 study of Great Lakes area beaches in which the estimated loss due to just one swimming advisory can account for $690,000 in lost economic benefits per year, per beach (Murray and Sohngen, 2000).

Increased property values, visitors and economic throughput have not happened by mistake. Policy choices by city leaders in the 1960s resulted in more than $3 billion in public investment to improve CAWS, an investment that is paying off today for downstream neighborhoods and for Chicago with the revival of the downtown river as a gathering place.

As a result, our international reputation as a metropolis that prides itself on its livability, including a healthy environment, is already attracting additional economic investment.

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[8] Friends of the Chicago River

In a 2005 business investment survey of American cities, Chicago was named the top metro area for corporate relocations and expansions with $6.5 billion invested in 389 projects (Site Selection Magazine, 2005).

D. Infrastructure Setting

The MWRD operates three main wastewater reclamation plants that discharge to CAWS: Stickney at 680 million gallons/day (MGD), North Side (242 MGD), and Calumet (248 MGD), for a combined daily flow rate of approximately 1.17 billion gallons. The MWRD processes combined wastewater flows and releases them as treated "effluent" into the river. The treatment process reduces pollutants that contribute to degraded water quality, but this process does not include the basic and fundamental safeguard of disinfecting the effluent.

MWRD's TARP was started in the 1970s and continues to be worked on today. TARP is the largest public works project ever implemented in the Chicago area, with an estimated final cost of $3.4 billion. With tunnels some 240-350 feet below ground level, stretching 109 miles throughout Cook County, TARP is meant to convey wastewater to storage reservoirs until it can be treated at the WWTPs during dry weather. Though the original schedule has been pushed back by decades (presently targeted for 2016), once fully completed, TARP will enable MWRD to store and then treat up to approximately 17.2 billion gallons of wastewater before discharging it into CAWS, greatly reducing CSOs and the potential for a river to lake reversal.[9]

The tunnel portion of the TARP project is now complete but the reservoirs need to be completed. Expedited completion of the TARP system, along with aggressive implementation of the Nine Minimum Controls, is critical to the adequate control of CSOs that occur during periods of heavy rainfall. Therefore, it is imperative that an enforceable date be set for completion of all aspects of the Nine Minimum Controls and the TARP system. Until these systems are completely in place, water quality in CAWS, and therefore public health, will not be adequately protected.

Despite these and other long-standing commitments by MWRD, its processes and systems are not designed to address one significant threat to public health: pathogenic pollution from bacteria, viruses and other microbes found in its treated but not disinfected, discharged wastewater.

[9] MWRD.

E. Upgrading of Standards are Required by Law

Figure 2: The Clean Water Act System

Overall Goal: Fishable and swimmable waters.

▲

Water quality standards—based on designated "uses" for waterways—achieve overall Clean Water Act goal.

▲

Pollution discharge effluent limits in pollution discharge permits achieve water quality standards.

Two of the principal goals of the Clean Water Act are to:

• Restore and maintain the chemical, physical and biological integrity of the Nation's waters; and

• Where attainable, achieve water quality that promotes protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water. This goal is commonly known by the expression of achieving "fishable/swimmable" waters, and was supposed to be achieved by July 1, 1983. National policy further called for programs to be developed and implemented "in an expeditious manner" (CWA: Section 101 (a) (7)).

These goals are accomplished by setting water quality standards for all bodies of water (for a more detailed discussion on water quality standards, see Appendix B). A water quality standard consists of two major elements: (1) the <u>designated beneficial use or uses</u> of a waterbody or segment of a waterbody; and (2) the <u>water quality criteria</u> necessary to protect the use or uses of that particular waterbody.

Commonly used use designations include the following: drinking water; water-based recreation including primary contact (swimming, water-skiing, and other activities likely to result in immersion) and secondary contact recreation (boating, wading and rowing and other activities when immersion is unlikely); fishing; aquatic life protection for various types of warm water species including protecting their habitat; agriculture water supply; and industrial water supply. USEPA does not recognize waste transport as an acceptable use.

Water quality criteria describe the quality of water that will support each designated beneficial use. Water quality criteria are levels of individual pollutants or water quality characteristics, that, if met, will generally protect the designated use of the water. For a given designated use, there are likely to be a number of criteria dealing with different types of conditions, as well as levels of specific chemicals and other pollutant parameters (e.g. temperature). Since most waterbodies have multiple designated uses, the number of water quality criteria applicable to a given waterbody can be very substantial.

Water quality criteria may be expressed as numeric limits or as a narrative standard. An example of a water quality criterion is a dissolved oxygen level of 5 milligrams per liter to support a warm water fishery. Water quality criteria must be scientifically consistent with attainment of designated uses. This means that only scientific considerations can be taken into account when determining what water quality conditions are consistent with meeting a given designated use. Economic and social impacts are not considered relevant when developing water quality criteria.

Once such standards based on such uses have been established, pollution discharge limits in pollution discharge permits must meet those standards and uses. With public uses of CAWS intensifying, the UAA must change the Chicago River system's "designated uses". With upgraded uses must come stronger water quality standards, including bacteria limits, for CAWS.

Figure 3: Clean Water Act "Use" Levels for CAWS

- General Use: This designation means that water quality standards comply with the Clean Water Act goals in that they protect aquatic life, wildlife, agricultural use, secondary contact, and most industrial uses, and safeguard the aquatic environment's aesthetic quality. Primary contact uses are protected for all General Use waters whose physical configuration permits such use.

- Primary Contact Use: Means any recreational use in which people make "prolonged and intimate" contact with the water, such as swimming and water skiing.

- Secondary Contact Use: The rest of the Chicago River is designated Secondary Contact Use. This is reserved for waters that are not suited for general-use activities, but that can support indigenous aquatic life. Recreational secondary contact uses are those in which people make "incidental or accidental" contact with the water, like fishing, boating, and shoreline activities. In 1984, the Illinois Pollution Control Board (IPCB) eliminated the fecal coliform water quality standard for water bodies classified as secondary contact (the majority of the CAWS). Such a designation does not adequately limit harmful bacteria or pathogen levels and is unsuitable for the CAWS, given the river's increasing recreational use.

To accomplish a new vision for the CAWS, designated uses should be upgraded. Such designations must take into account how the river system is used today, but more importantly, how it can be used in the future.

USEPA guidance for water quality standards require the following: "A State must designate either primary contact recreational uses or secondary contact recreational uses for all waters of the State and, where secondary contact recreation is designated, set bacteriological criteria sufficient to support primary contact recreation" (USEPA Water Quality Standards Handbook: Second Edition, 1994; pg. 2-2). USEPA believes that a secondary contact recreational use (with criteria sufficient to support primary contact recreation) is consistent with the CWA section 101(a)(2) goal. The rationale for this option is discussed in the preamble to the Water Quality Standards Regulation, which states: "even though it may not make sense to encourage use of a stream for swimming because of the flow, depth or the velocity of the water, the States and USEPA must recognize that swimming and/or wading may occur anyway. In order to protect public health, States must set criteria to reflect recreational uses if it appears that recreation will in fact occur in the stream". The regulations also state: "Where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained" (emphasis added). "States must adopt those water quality criteria that protect the designated use. Such criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive". Moreover, Federal law requires that "existing in-stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." States are generally prohibited from removing designated uses unless the change will result in more stringent criteria. (USEPA, 40 CFR 131.10(h)).

The Case for Change – Public Health

If a new vision for the CAWS is to be implemented, we must do things differently. We must acknowledge that public uses of CAWS are intensifying. Stretches of river that in the past rarely saw any activity are now seeing active use by residents and visitors alike.

A. People are Using the Chicago Area Waterway System Like Never Before

A summer 2003 study conducted by the Alliance for the Great Lakes (formerly the Lake Michigan Federation) found unprecedented public use of CAWS, even in places that were supposed to be off limits to public access.

The study resulted from three full-day boat tours of the North Segment of CAWS, starting from the South Branch of the Chicago River and encompassing the Lower North Branch, the Upper North Branch, the Lower North Shore Channel and the Upper North Shore Channel. Four full-day boat tours of the South Segment were also performed, including the Chicago Sanitary and Ship Canal, the South Fork of the Chicago River, the Cal-Sag Channel, the Little Calumet and the Grand Calumet.

These 7.5 days of observations documented a combined total of 1,284 uses, including but not limited to activities such as canoeing, kayaking, sculling, power boating, fishing, jet skiing, wading and swimming – this last activity was seen directly in front of the main outfall of the Calumet Sewage Treatment Plant. The conclusion: restricted access or not, people are using CAWS. And they deserve to use it. The future of water quality improvements for the region demands we recognize this trend, not discourage or hide from it.[10]

Moreover, there are promising signs of accepting this new vision of the waterways everywhere, including the thousands of canoe rentals that are logged each season, the revitalization of river park development all over Chicago, and the 400 plus launches last year from a previously closed launch site on the Chicago Sanitary and Ship Canal. The river has the ability to integrate industrial and recreational uses, as an intact, vital natural resource for the community.

This was recently demonstrated by the MWRD lease of property which enabled the Village of Summit in 2005 to reopen a boat launch just downstream from the Stickney WWTP. Several types of watercraft are launched there each year throughout the months of May-October.[11] The lease is an encouraging sign that MWRD understands the future of CAWS should be directed toward responsible human use and to its credit, MWRD is beginning to foster that use.

The Illinois EPA (IEPA) is nearing completion of a UAA of CAWS to re-evaluate its uses (see Appendix B for a more complete discussion of the requirements of a UAA and its relationship to establishing water quality standards). Under the CWA, a "Triennial Review" process for water quality standards was to be implemented to ensure that the waterbody's uses and attainable uses are consistent and current. Initiated decades after the requirement, the CAWS UAA is truly an integral component of properly designating its uses. The UAA clearly shows that general fishable/swimmable uses **are** being made of CAWS. As part of its UAA process, in January 2007, IEPA commendably recommended draft proposed new water quality use standards for CAWS, to be met by March 1, 2010. The Agency held two public meetings to obtain comments on the draft standards package. The Agency is planning to develop a final package of new water quality standards for CAWS and submit it to the Illinois Pollution Control Board for consideration and final adoption.

Yet the recent standards proposed by IEPA do not fully comply with the Clean Water Act, nor do they fully take into consideration the UAA findings. IEPA's proposed standards include an "Incidental Contact Recreational" standard of 1,030 *E. coli* per 100 mL during the primary recreational period of March 1 through November 30, for the North Segment and much of the South Segment. The Calumet River (north of O'Brien Lock & Dam), which can directly discharge into Lake Michigan and so must therefore also meet Great Lakes water quality criteria for any discharges to that basin, has been given an even less strict recommendation of 2,740 *E. coli* per 100 mL. Moreover, there are also public drinking water intakes and bathing beaches downstream of these discharges, which poses a significant health risk. Finally, the majority of the Middle

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[10] Alliance for the Great Lakes, *Protecting Lake Michigan by Protecting the Chicago River Waterway System* (Chicago, 2004).
[11] 412 watercrafts were launched there in 2006.

Segment and downriver of the Stickney plant would continue to have no *E. coli* bacteria limits.

USEPA recently requested IEPA to "provide the basis for not utilizing the proposed bacteria standards and use designations that were supported by the CAW(S) UAA stakeholders and published in the 2004 Draft CAW(S) UAA," and went on to note that there is 'documented recreational use, including canoeing, kayaking, fishing and power boating, on the CSSC, where IEPA proposed no bacteria limits' (USEPA Region 5 Comments on IL EPA Draft rules; January 18, 2007). Evidence of such uses can be observed in various segments of CAWS from user groups like the Chicago River Canoe & Kayak, the Prairie State Canoeists, Chicago Kayak and the Cal-Sag Rowing Club, for instance. Some of these organizations even do Christmas and New Years Day paddles right through the downtown Chicago and other CAWS areas. In addition, Kayak Chicago is a business in Chicago that offers rentals, and runs classes and trips on CAWS.

The IEPA proposed standards do not provide adequate protection for the uses currently being made of the waters of CAWS nor do they allow additional uses that could be developed as envisioned under the Clean Water Act. The water quality standards that are adopted by the Illinois Pollution Control Board must protect these uses.

B. Pathogenic Pollution – The Unaddressed Public Health Threat

In order to protect public health and achieve the new vision for CAWS, the State oversight agency, IEPA, must require MWRD to disinfect its wastewater discharges from its three largest facilities, the Stickney, North Side, and Calumet water reclamation plants.

Experts estimate that millions of Americans are sickened by waterborne illnesses each year (USEPA, 1997). Illnesses caused by contact with or consumption of untreated or inadequately treated water can range from cholera, hepatitis, gastroenteritis, and respiratory infections, to giardiasis, cryptosporidiosis and dysentery (see table below, presenting a summary of the most common microorganisms found in domestic wastewater effluent and the types of human diseases associated with them).

Some 20-25 percent of the U.S. population, primarily small children, the elderly, cancer patients and others with serious illnesses, are particularly vulnerable and highly susceptible to outbreaks of pathogens.[12] A dubious record that the State of Illinois holds is the largest recorded outbreak of leptospirosis in the U.S. This outbreak occurred during the summer of 1998 at a triathlon, which included swimming in Lake Springfield. Approximately 110 cases developed out of 775 exposed persons, versus around 100-200 cases of leptospirosis reported each year in the U.S. Another record holder is

[12] Stoner, 2005. Testimony on behalf of National Resources Defense Council before the House Committee on Transportation and Infrastructure's Water Resources and the Environment Subcommittee.

Milwaukee, when in 1993 an outbreak of Cryptosporidiosis[13] resulted in an estimated 400,000 cases of acute gastroenteritis and 100 deaths, and represents the largest documented case of disease associated with contamination of drinking water in the United States.

Many other types of waterborne outbreaks undoubtedly occur each year but remain unrecognized or unreported. For instance, an estimated 20,000-30,000 cases of shigellosis occur annually in the United States, which can lead to dysentery or even death in severe cases. One of the most common transmissions of shigellosis is through water contaminated with human fecal matter. Likewise, in the U.S. approximately 1-5 percent of the population will develop mild amebiasis each year, again commonly attributed to contaminated wastewater.

Recent tests have also found giardia in a surprising 7 percent of all stool samples tested nationwide, indicating that this disease is on the rise in the U.S. and is a much more widespread problem than was originally believed. Exposure to unfiltered streams or lakes that may be contaminated by human or animal feces is a common source of giardiasis, where approximately three times more children than adults become infected.

Finally, a 1978 study demonstrated that about 75 percent of all sewage sludge samples taken in U.S. urban catchments contained ascaris ova, which since the early 1900s (when U.S. wastewater treatment practices drastically improved) was a condition normally associated much more with the developing world. Yet recent studies estimate the prevalence of ascariasis in the U.S. as affecting perhaps as many as 4 million individuals.

The evidence is clear: wastewater that is not disinfected in the U.S. is a public health liability. The continued occurrence of U.S. waterborne disease outbreaks demonstrates that contamination of water still poses a serious health risk here. This means the U.S. still has much work to do in further reducing these diseases nationwide, and stricter regulatory oversight of our nation's WWTPs is a logical first step. With up to 50 billion gallons of sewage flowing through U.S. sewage treatment plants every day, the protections provided by USEPA regulations regarding disinfection are well warranted.

And while many of the waterborne diseases listed in table 1 are more prevalent in locations around the world with poor sanitation practices, the fact that CAWS effluent is not disinfected, uniquely positions Chicago as a major U.S. city *without* adequate sanitation practices at its WWTPs.

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[13] Some types of cryptosporidia cysts have been shown to be very resistant to chlorination disinfection, though filtration may help. The cysts can also remain in the ground and water for months.

Because the numbers of pathogenic organisms present in wastes and polluted waters are difficult to isolate and identify, coliform organisms, which are more numerous and more easily tested for, are commonly used as indicator organisms (USEPA, 1997). The indicator organisms most commonly used are fecal coliform, Escherichia coli (*E. coli*), and enterococci. These microorganisms usually occur in the intestinal tracts and feces of warm-blooded animals, including humans. If high levels of these organisms are present in recreational waters, fecal contamination is likely and indicates the potential for pathogenic bacteria, viruses and parasites to also be present.

The mechanism detailed in the Clean Water Act for controlling discharges of pollution to waterways is through limits placed in National Pollutant Discharge Elimination System (NPDES)

TABLE 1:

INFECTIOUS AGENTS POTENTIALLY PRESENT IN UNTREATED DOMESTIC WASTEWATER

Organism	
Bacteria	***Disease Caused***
Escherichia coli	*Gastroenteritis*
Leptospira (spp.)	*Leptospirosis*
Salmonella Typhi	*Typhoid fever*
Salmonella (=2100 serotypes)	*Salmonellosis*
Shigella (4 spp.)	*Shigellosis (bacillary dysentery)*
Vibrio cholerae	*Cholera*
Protozoa	
Balantidium coli	*Balantidiasis*
Cryptosporidium parvum	*Cryptosporidiosis*
Entamoeba histolytica	*Amebiasis (amoebic dysentery)*
Giardia lamblia	*Giardiasis*
Helminths	
Ascaris lumbricoides	*Ascariasis*
T. solium	*Taeniasis*
Trichuris trichiura	*Trichuriasis*
Viruses	
EnteroViroses (72 types) - e.g., polio echo and coxsackie viruses	*Gastroenteritis, heart anomalies, meningitis*
Hepatitis A virus	*Infectious hepatitis*
Norwalk agent	*Gastroenteritis*
Rotavirus	**Gastroenteritis**

Source: Adapted from: Crites and Tchobanoglous (1998) permits. Because of the concern that wastewater can spread waterborne diseases, all State environmental protection agencies and public health agencies require disinfection of municipal wastewaters unless there is a compelling and unique reason for not doing so. As such, Illinois has a statewide requirement that effluent from wastewater treatment plants must not exceed a certain level of fecal coliform.[14] Yet the State has not placed a requirement in MWRD's NPDES permits that would require disinfection of wastewater effluents at its three main plants on CAWS. This is likely attributable to two main reasons:

1. The requirement to disinfect MWRD's wastewater was removed in 1984 partly due to the concerns over the negative impacts of chlorine in the environment, which was the disinfection treatment MWRD used at that time *(MWRD was not also using de-chlorination in tandem with chlorination, which might have helped ease some of these impacts, though some chlorine byproducts are not removed with de-chlorination).*

2. IEPA has somewhat limited the scope of its assessment of CAWS. The regulations applicable to most Illinois discharges state that effluents shall not exceed 400 fecal coliform units per 100 mL unless the discharger shows it will not cause a violation of fecal water quality standards. In addition, these regulations state that fecal coliform levels should generally not exceed 200 per 100 mL between the months of May through October, unless the water is not fit for primary contact.[15] IEPA has historically interpreted this last exception very broadly, implying that CAWS has not been "fit for primary contact". But this is partly attributable to the fact that wastewater discharges to CAWS *are not disinfected*. As such, Illinois' policy presents a circular argument. Regardless, as the recent UAA proceedings should confirm, CAWS is being used for such contact uses. Therefore, by law CAWS must be *made fit* for such uses.

All States have similar requirements as the Virginia Department of Health (VDH), which for example states:

> Disinfection of wastewater is a preventive method of minimizing the numbers of actual or potential microorganisms reintroduced to the environment. It is designed as one of the multiple barriers against the transmission of infectious disease. The number of pathogenic organisms that could be present in treated but undisinfected sewage effluent are sufficient to result in a reasonable probability of infection upon contact with waters to which the sewage is discharged. (VDH website, 2007)

Thus, the policy of the VDH is that "adequate protection of public health requires elimination of possible contact (with an infective dose of pathogens) through use of

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[14] Fecal Coliform is a bacteria that is used to judge how much fecal pollution is in the wastewater.
[15] IPCB: 35 Ill. Adm. 304.121; 302.209. 302.209

disinfection and dilution. Sewage effluents should be disinfected and adequately diluted when discharged" (VDH website, 2007). This is for good reason, as the adverse impact of undisinfected wastewater on an unsuspecting public raises several very serious health and safety concerns: experts estimate that a gram of human waste contains more than one billion viruses and bacteria, that there are more than 1,400 disease and chronic disease-causing microbes in humans (including bacteria, viruses, fungi and parasites), and that roughly 15 million of the estimated 57 million deaths around the world each year can be linked to infectious diseases (USEPA website, 2007).

While there are no formal studies of the adverse public health effects on the members of the public who use CAWS for recreation purposes, there *is* limited anecdotal information about people who have been exposed to the water and have become sick. The MWRD, in collaboration with partner organizations, has recently embarked on conducting a full epidemiological study to ascertain such risks specifically associated with CAWS in its current condition.

While acquiring this data, especially in an updated model, is generally beneficial, such a study must not be used as an excuse to avoid taking appropriate actions based on what has already been well-studied and is well-known: 1) high fecal coliform and *E. coli* bacteria levels are good indicators of the presence of pathogens that are dangerous to human health and aquatic life[16]; 2) extremely high levels of these indicator organisms are discharged with MWRD's wastewater into CAWS; and 3) at the present levels of bacteria, the health of users of CAWS and the aquatic life is seriously threatened. In the year 2007 it should not be necessary to wait for additional confirmation of such knowledge, in the process expending more valuable time and limited funding on studies which in the end will most probably simply document again that, 'there are adverse health impacts of human sewage that has not been disinfected…on CAWS users'. We are now decades past such knowledge, and the water pollution control profession has concluded that wastewater effluent must be disinfected to prevent the spread of waterborne diseases and to minimize the potential for public health problems.

In fact, there are critical implications for the citizens of greater Chicago should MWRD not disinfect its wastewater. Even if MWRD provides the highest level of treatment, but without disinfection, many common disease-producing microorganisms will not be removed from the effluent. Disinfection of wastewater treatment plant effluent is therefore pivotal to destroy many of these disease-producing microorganisms that can and do cause people to become sick, sometimes fatally. The risk of not disinfecting this effluent clearly outweighs the cost of doing it.

[16] This was recently reconfirmed by a February 2007 USEPA study titled, "Expert Review Report Regarding United States Environmental Protection Agency's Water Quality Criteria For Bacteria-1986: Application To Secondary Contact Recreation".

C. The Region's Wastewater Discharges – Stewardship in Need of Tending

Approximately 70 percent of CAWS' annual flow is wastewater effluent. Therefore, the water in CAWS contains greatly elevated levels of bacteria and pathogens - levels higher than the USEPA's recommended levels for human contact. Contamination by bacteria and other microorganisms significantly limits a variety of waterway uses, including recreational activities in which humans contact the water directly. Omitting some important operational areas, today MWRD complies almost 100 percent with basic existing pollutant discharge permits.[17] In the case of bacteria, however, permit limits are nonexistent for much of the river, thereby making "compliance" a hollow assurance.

In March 2007, USEPA reported that MWRD is the only agency in all major U.S. cities nationwide that does not disinfect much of its wastewater effluent where whole or partial body contact occurs or can occur. USEPA also cited three other cities (Kansas City, St. Louis and Memphis) which do not currently disinfect all of their effluent. <u>USEPA is pressing for disinfection in these three cities.</u>

> "In the case of bacteria, permit limits are non-existent for much of the river."

Illinois has limited the level of harmful bacteria allowed on small sections of CAWS. The fecal coliform limits for waters designated General Use—400 cfu/100 mL—presently applies to the North Shore Channel above the North Side Water Reclamation Plant, on the Calumet River above the O'Brien Lock and Dam, and on the Chicago River east of Wolf Point. All of these areas would be downgraded with the new IEPA 2007 proposed standards to 1,030 cfu/100 mL, with the exception of the Calumet River location, which would be downgraded to 2,740 cfu/100 mL. While much of the rest of the North and South Segments would be upgraded to 1,030 cfu/100 mL once bacteria limits are imposed with the new proposed standards, these limits would not protect for all uses and attainable uses, as previously mentioned. Furthermore, the majority of the Chicago Sanitary and Ship Canal would be "downgraded" to having no bacteria standards at all under the new proposed designations.[18] These proposed standards spell continued trouble for CAWS water quality. The river is a whole system, and people are using the whole system in a variety of ways. The method to revitalize the river system and protect public health stems from treating the whole system as "fishable and swimmable".

[17] It may be noted that MWRD self monitors, reporting their findings to IEPA.
[18] As previously noted, this is a "downgrade" because the majority of CAWS is presently designated for "Secondary Contact" use, though the bacteria limits for discharges to secondary contact waters have been removed for CAWS. As such, in actuality there will continue to be no limit to meet for the CSSC.

Table 2: Fecal Coliform Comparisons Between Wastewater Treatment Plant (WWTP) Impacts – Disinfection v. Non-disinfection			
River / Geographic Location	**Disinfection Used**	**WWTP Effluent Fecal Coliform**	**Water Quality Monitoring Station Fecal Coliform**
Little Calumet / Cal-Sag Channel	No	8,231 CFU/100 mL	948 CFU/100 mL
North Shore Channel / North Branch Chicago River	No	19,538 CFU/100 mL	10,950 CFU/100 mL
Mississippi River / Twin Cities, MN	Yes	59 CFU/100 mL	125 CFU/100 mL
Fox River / Elgin, IL	Yes	23 CFU/100 mL	279 CFU/100 mL
Delaware River / Philadelphia, PA	Yes	48 CFU/100 mL	33 CFU/100 mL

Source: USEPA – Gathered from respectively submitted State 305(b) forms

As Table 2 shows, compared to other areas with large urban treatment plants (based on flow rates and populations) that do disinfect, the CAWS has potentially 3-332 times the levels of fecal coliform on any given day. Similarly, effluent from the Chicago area's Calumet or North Side plants, may have 171 or 407 times the amount of fecal coliform levels, respectively, than are present in the effluent of Philadelphia's WWTPs. Moreover, 2004 MWRD fecal coliform and effluent sampling data for *E. coli*, shows that harmful bacteria levels are significantly higher downstream from all three plants than upstream, and at levels several times higher than the potential new proposed standards for the river would permit.[19]

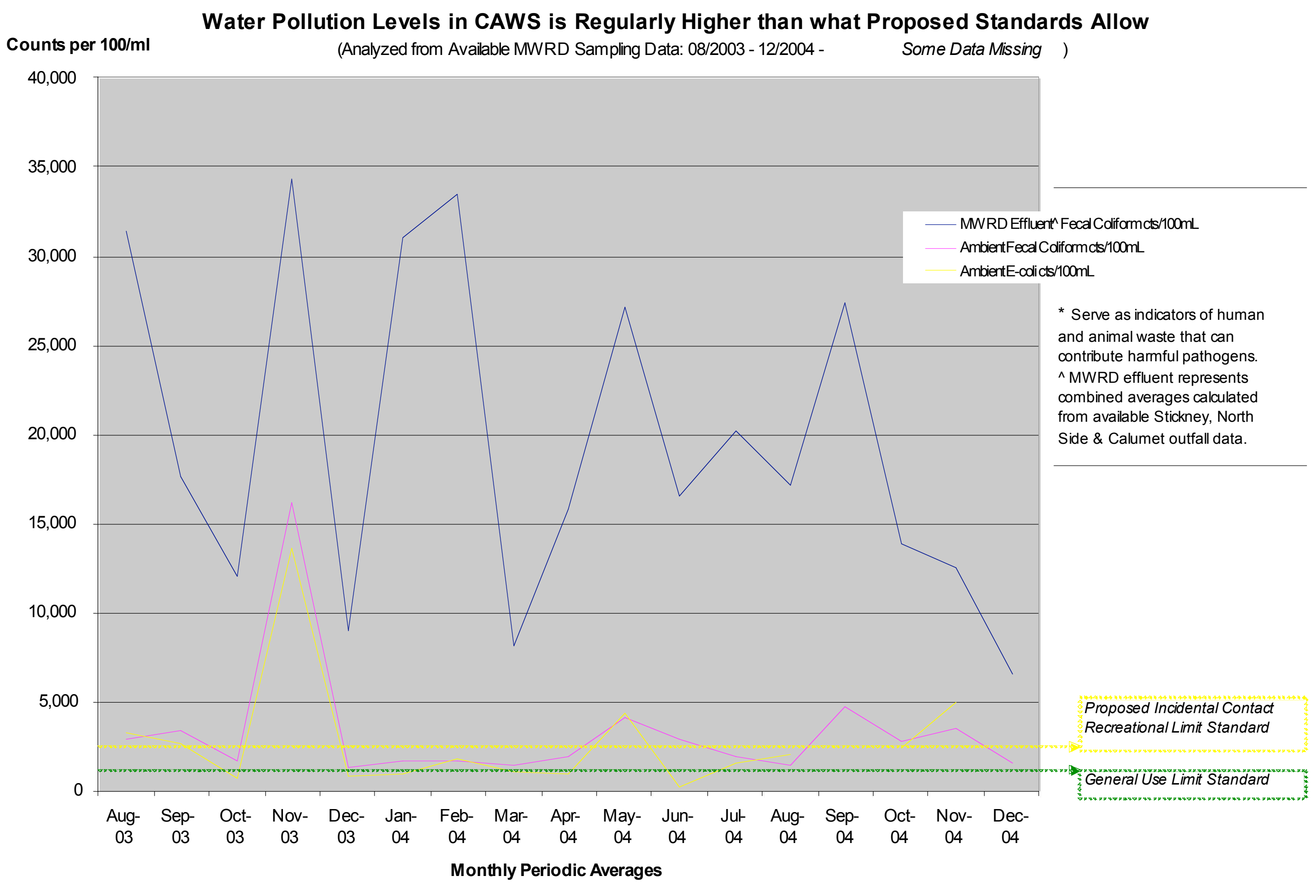
Yet MWRD appears to hold the position that based on the current water quality in CAWS during dry weather, that only about 1 in 1,000 illnesses would occur from exposure, as is stated in a letter to IEPA dated November 16, 2006 from the MWRD's General Superintendent.[20]

This is counterintuitive to the well established scientific basis for human health risks associated with fecal and *E. coli* bacteria exposure levels, which although under review, were recently reconfirmed by USEPA officials as "in effect," and adequate for present analyses. MWRD data show that treatment plants routinely discharge wastewater into CAWS that is contaminated with bacteria levels several times higher than the established safe limit. A recent analysis conducted by the Alliance for the Great Lakes utilizing MWRD's sampling data illustrates the connection between MWRD's Stickney, North Side and Calumet WWTPs' averaged/combined effluent, ambient water quality in

[19] MWRD
[20] The letter accompanied the MWRD report titled, "Interim Phase I Dry Weather Risk Assessment of Human Health Impacts of Disinfection vs. no Disinfection of the Chicago Area Waterways System (CWS)".

CAWS during dry weather, and potential public health risks. The data represent a 17-month continuous sampling spanning a time period from August 2003 through December 2004.[21] The data show that: 1) there is a strong correlation between extremely high fecal and *E. coli* counts in CAWS and heavy MWRD CSO activity, which is to be expected; 2) there were 5 months in which there was no MWRD CSO activity, yet during that time period there were still instances of extremely high levels of *E. coli* and fecal coliform levels present in the water, beyond the proposed limits for incidental contact recreational uses for instance; and 3) egregious levels of fecal coliform from MWRD's WWTPs were discharged into CAWS for that time period, averaging at roughly just under 20,000 CFU/100 mL, but on some occasions as great as 160,000 – 260,000 CFU/100 mL.

Figure 4



While there are other potential sources of bacteria input into CAWS, such as the City's potential CSO activity, animal wastes, illegal dumping, etc., the volume of MWRD's

[21] During that time period bacteria levels in the CAWS were on average dangerously high, and for Nov. of 2003 avg. fecal counts were an extraordinary 16,162 per 100/ml, with *E. coli* counts at 13,634 per 100/ml. At least one sampling site recorded an astounding 350,000 fecal counts per 100/ml for the day: Grand Calumet River, Burnham Ave. on Nov. 24, 2003. (on Nov. 3, 2003, *E. coli* counts reached an incredible 85,000 per 100/ml at another site).

effluent discharges still represent by *several times over*, the largest introduced potential source of bacteria among these. So the connection is intuitive almost to the point of being rudimentary: MWRD's wastewater treatment plants must be contributing to the high levels of bacteria present in CAWS during dry weather and wet weather through its effluent discharges. This reiterates how important it is that *disinfection is needed* in conjunction with TARP and that TARP cannot act as a substitute in this respect.

Moreover, and somewhat at odds to its recent statement regarding its expected 1 illness in 1,000 exposures study, MWRD *seems to acknowledge* the public health risks associated with contact to CAWS in other settings. For example, in a report dated July 2006, MWRD-commissioned scientists warned in the *Forward* (p. viii) that '…kayaking activity in the CAWS needs to be prohibited...' because of a discrepancy in the definition of kayaking as a primary (according to EPA) or secondary activity (as defined by the UAA Stakeholder Advisory Committee).[22] From a legal liability standpoint there may be some justification to making such a statement. But in reality, where public health is concerned, people who are kayaking on CAWS are exposed to health risks because of high bacteria levels regardless of the use classification of kayaking.

> 'Of 23 major sewage treatment agencies… MWRD is one of the few that does not disinfect its wastewater or otherwise meet bacterial contamination standards...'

In fact, in various settings MWRD has consistently argued that CAWS should be used in essence like a sewer and for commercial navigation, implying these uses be protected rather than for other activities, like kayaking. A few examples of MWRD's "vision" for the CAWS include:

- A Chicago Tribune quote from a former MWRD General Superintendent in which he stated, *<u>'The question is whether it is practical to bring a sewage canal up to a higher standard'.</u>*

- A June 4, 2004 transmittal letter to MWRD's Board from the Committee on Research and Development, which generally depicted CAWS as *<u>"designed to support commercial navigation and the conveyance of stormwater and wastewater".</u>* (MWRD Transmittal Letter For Board Meeting of June 17, 2004; June 4, 2004).

[22] Report No. 2006-38, "Expert Review Report Regarding United State's Environmental Protection Agency's Water Quality Criteria for Bacteria – 1986: Application to Secondary Contact Recreation".

- Most recently, a MWRD letter presented at a March 22, 2007 Stakeholder Advisory Committee meeting held in Chicago: *"These are not natural rivers, but an artificially created, operated and maintained waterway system to serve the needs of the metropolitan area for urban drainage and commercial navigation".*

This position is at odds with MWRD's heritage of improving water quality for the benefit of the public throughout CAWS. Clearly, if public health is to be protected, disinfection and public access to the Chicago Area Waterway System should be encouraged. After all, the public is increasing its use of CAWS whether it is discouraged from doing so or not.

Moreover, MWRD's position is at odds with both the public and the City's historic "vision" of what the river can be, illustrated by the late Mayor Richard J. Daley, who "once spoke about a day when Chicagoans would flock to the river to fish and relax". That vision has been extended to Mayor Richard M. Daley's 2005, "Chicago River Agenda" report, in which he states:

> *"The Chicago River has a long and storied history that has captured our imaginations since Chicago's early days…Daniel Burnham pictured grand architecture and the development of the river as a recreational corridor…The Chicago River continues to inspire our imaginations today. As it has improved, our vision for it has changed to reflect possibilities that would have seemed like impossible dreams only a few decades ago. The Chicago River today is Chicago's Second Shoreline, a natural and cultural resource that plays many vital roles in the life of our city".*
>
> \- Chicago Mayor Richard M. Daley

The Mayor's Chicago River Agenda outlines numerous and exciting projects underway, many with ambitious goals targeted for as early as 2010 that will improve public access to the river (more than 13 miles of riverfront trails), restore public riverbanks (3 miles), and create multiple river parks (more than 65 acres), just to name a few.[23]

The City has also committed itself to aggressive stormwater management and CSO controls, as well as a variety of green infrastructure initiatives, which will all enhance water quality on the River. Moreover, through its River Agenda the City "encourages MWRD to implement cost-effective disinfection

The City of Chicago "encourages MWRD to implement cost-effective disinfection technologies..."

[23] The Chicago River Agenda has targeted 46 new acres by 2010, and the additional acreage was disclosed through a City presentation at the March 22, 2007 Stakeholder Advisory Committee meeting held in Chicago.

technologies that improve the recreational potential of the river while limiting negative impacts on the environment" (emphasis added).

Clearly, these are waters of the public for recreation and commerce, not just for use by MWRD as a 'stormwater and sewage conveyance system'. Regulations state that "in no case shall a State adopt waste transport of waste assimilation as a designated use for any waters of the United States" (USEPA 40 CFR 131.10(a)). The MWRD's position is at odds with the requirements of the Clean Water Act. The Act has a national objective to restore and maintain the chemical, physical and biological integrity of the Nation's waters" including "the protection and propagation of fish, shellfish and wildlife" and provide "for recreation in and on the water". The Act also states that it is national policy that programs would be "developed and implemented in an expeditious manner" to achieve those objectives. People are using CAWS for recreational purposes *now*. They are being exposed to serious risk *right now* due to the fact that wastewater effluent is not being disinfected.

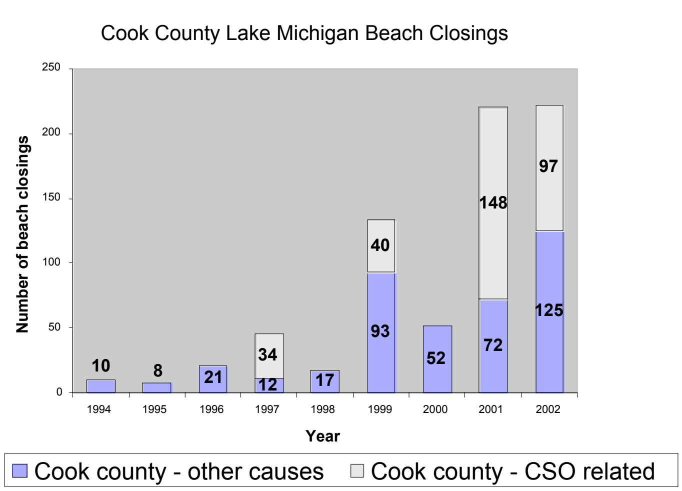
The Case for Change – Ecology

A. Beach Health

Despite the fact that CAWS flows most of the time away from Lake Michigan, the two are still connected. During times of especially heavy rains, MWRD is sometimes forced to open gates in three locations that otherwise keep the waterway system flowing away from Lake Michigan: the North Shore Channel in Wilmette, the locks at Navy Pier on the Main Branch of the Chicago River, and the O'Brien Locks near 95th Street. When these combined sewer overflow (CSO) reversals occur, public health agencies may require swimming to be banned for entire stretches of beach from MWRD's gates at Wilmette Harbor almost all the way to the Indiana border because of unsafe levels of bacteria in the water. In August 2002 for example, hundreds of millions of gallons of stormwater and untreated wastewater were released from the Wilmette and Navy Pier locks into the lake, forcing the Chicago Park District, Wilmette, and Evanston to close their beaches to swimming. In that year alone, according to Chicago Park District records, 97 of 222 total swimming bans for the season were caused by lock openings. In 2001, 148 of 220 bans were a result of lock openings.

According to Alliance for the Great Lakes research based on

FIGURE 5:



reporting by lakefront municipalities, the number of Illinois Lake Michigan beach closings and swimming bans per year has increased from 1994 to 2002 (see figure 5). Overflows that lead to lake reversals negatively impact the ecology of sensitive coastal beach and aquatic habitats, including for a variety of plants and animals that depend upon wetlands, reefs and dune areas. These overflows to our area beaches can of course be hazardous to people as well.

Though there are numerous sources of beach closings, including stormwater runoff and animal waste, overflows from CAWS to Lake Michigan are an identifiable and significant source of closings and bans. While nature cannot easily be controlled, the City of Chicago and other groups are taking steps to identify and reduce non-point source pollutants from this region's shorelines. Anthropogenic sources can more easily be mitigated, representing one of the largest contributors of pathogens in CAWS. Completion of TARP plays a very significant role in the mitigation of human wastes that potentially foul our shorelines, but that is not the only actor.

During a reversal to the lake, it has not been determined what entering concentrations of pathogens are attributable to CSOs versus normal operating discharges from MWRD into CAWS. CSO events that are large enough to cause a reversal likely contain several times over the number of pathogens than are already present in the normal flow of CAWS, which is dominated by about 70 percent of its flow as WWTP effluent. Although pathogenic levels during a reversal would most certainly breach beach safe limits even if ambient water quality in CAWS was pristine up until the point when CSOs occurred, the fact that ambient CAWS water quality contains egregious levels of pathogens to start out with, only elevates these levels at the time of a reversal, and potentially exacerbates public health risks at area beaches. Poor CAWS water quality is largely attributable to two factors: 1) lack of wastewater disinfection; and 2) CSOs.

Additionally, overflows to the river itself that do not end in reversals to Lake Michigan are continuing, increasing the number of potentially hazardous pathogens in CAWS. There were approximately 60 such overflows to CAWS in 2006. The good news is that CAWS reversals appear to be occurring less frequently thanks in large part to MWRD's progress in building TARP. Nevertheless, with the indefinite possibility of CAWS reversals, to protect the lake, we must protect the river. It is more important than ever to take steps to reduce pathogenic pollution to improve CAWS water quality. Those steps include a combination of disinfection of wastewater effluent, full implementation of the Nine Minimum Controls for CSOs and successful completion of TARP.

B. Aquatic Health

The water quality in the Chicago Area Waterway System has improved over the decades, and with increased improvements, we have witnessed a consistent resurgence in aquatic life. In the 1970s it is estimated that there were only about 10 fish species present in CAWS, whereas today, that number has increased to perhaps as many as 70. These species include popular game fish, such as smallmouth bass, which started arriving in 1988, as well as largemouth bass and bluegill, which are regularly seen in CAWS today. After the passage of the CWA in 1972, several point source pollution problems were identified and eliminated, and as a result fish species numbers tripled before the decade was over.

It is now time for CAWS to fulfill the CWA legacy and once again, eliminate the sources of contamination in the form of MWRD's CSOs and other polluted wastewater. Science indicates ecosystem functioning increases with species diversity. A cleaner, more natural Chicago River system may in turn prompt stakeholders to improve CAWS spawning areas for instance, which could lead to increased fish populations as well as early life stages for a variety of aquatic species. The natural ecosystem chain will start to regenerate. Chicago has recently identified areas in its 2005 Chicago River Agenda where it will begin to help foster precisely this kind of aquatic life change by improving and restoring integral habitat. The change does not stop underwater. Diverse bird populations that may be able to utilize CAWS for their feeding and nesting resources could increase as well. This could be expected to spread through the river ecosystem chain to creatures like beaver, foxes, muskrats, turtles, and many more species that are beginning to return, sometimes in otherwise surprisingly urban landscapes. Even the state-endangered black crowned night heron is beginning to be sighted by paddlers. Benefits to wildlife, people and the economy could be truly extraordinary.[24]

The Case for Change – Economics

A. Protecting Nature Pays

Swimming bans are not just a disappointment to people who want to have their day at the beach. Swimming bans and beach advisories can also translate into significant losses to their pocketbooks, as well as local economies. According to one recent Ohio State University study done on Lake Erie, eliminating the need for beach advisories due to bacterial contamination would have a lakewide value for beachgoers of up to $10.35 million per year for 15 beaches, or an economic benefit of $690,000 per beach, per year.[25] Chicago alone has 23 major public beaches, indicating a net economic benefit from eliminating releases (and/or vastly improving river water quality when releases occur) at approximately $15.87 million per year, if the locks do not open and swimming bans along the lakefront are prevented.

To likewise quantify some of the direct economic benefits from recreation on CAWS, we looked at a comprehensive study targeting the contribution that anglers, birders and

[24] City of Chicago River Agenda, 2005.
[25] Valuing Water Quality Advisories at Lakes, 2000.

paddlers make to the regional economy and determined that these three activities contribute $358 million annually to the Northeastern Illinois economy.

1. CAWS Provides Fishing Benefits – In Northeastern Illinois, as well as the rest of the State, the most popular fishing trips are those to lakes and ponds (61 percent), while streams and rivers are second most popular (27 percent). As the Chicago River system's water quality has improved, fishing along the river has grown more popular. Anglers catching largemouth bass on the Chicago River while standing in the shadows of downtown Chicago skyscrapers are now a common sight. Other sections of the river are popular spots for catfish, bluegill, and other pan fish.

The Northeastern Illinois economy benefits from the 720,000 anglers who generate $442 million in retail sales.[26] This commercial activity ripples through the economy to generate $960 million in economic throughput for the state. Anglers spend, on average, $37 per day for fishing expenses including transportation, food, lodging, bait, and gear. Licensed anglers average 13 days per year fishing, and out-of-state licensed anglers spend an average of five days per year in Illinois. The direct annual economic benefit alone of anglers fishing in Northeastern Illinois rivers and streams is $94 million. Just a 5 percent annual increase in fishing recreation would generate an additional $94 million in economic activity over the next 20 years. While many of these figures apply outside of CAWS, the point is still the same: enhancing our waterways is an investment, not an "expense".

2. CAWS Provides Paddling Benefits – Paddling on CAWS is one of the fastest growing recreational activities in the area. One of the successful canoe rental companies states that it has 'grown 25-50 percent annually over the last five years'. Through Friends of the Chicago River (FOCR) canoe trips, interviews with canoe rental companies, and race registrations for the Flatwater Classic (Friends' annual canoe and kayak race), Friends was able to document more than 11,500 paddling trips in the 2005 season, as previously mentioned.[27]

There are also now five organized rowing clubs in the city. Several of the high-school student teams have won national recognition, and team members have gone on to receive university scholarships. These teams, which often practice five or six days a week, are among the river's most active recreational users.

Efforts are underway, on behalf of neighboring communities and organizations, to develop the Cal-Sag Channel into a rowing course. The Chicago Rowing Center is

[26] Waterways for Our Future, 2000.
[27] Friends of the Chicago River

already holding rowing events in the channel and a number of regional colleges and universities have expressed interest in using the proposed course, including Notre Dame, Indiana, Iowa, Michigan, Michigan State, Minnesota, Ohio State and Wisconsin. Opportunities to expand paddling access points and develop canoe and kayak rentals along the channel are also being explored to help meet recreational use demands of the waterway.

To determine how much the river's paddlers benefit the regional economy, Friends of the Chicago River joined with Openlands and the Northeastern Illinois Watertrails Council to conduct the first public opinion survey of area recreational paddlers.

The survey was mailed to 1,500 randomly selected individual households in the eight Northeastern Illinois counties who had registered their canoes and kayaks with the State of Illinois. It was also distributed electronically to members of the Illinois Paddling Council, participants in the Flatwater Classic, and members of the public who had requested maps from the Watertrails Council.

Findings of that survey include the following:

a. 15,000 owners have registered non-motorized watercraft in Northeastern Illinois. With an average of 14 trips per household per year, this means there were approximately 210,000 paddling trips in 2005. The economic impact of this paddling for Northeastern Illinois communities in 2005 was $7,140,000. With improvements to the CAWS, a 5 percent annual increase in paddling recreation would potentially generate an additional $7 million in economic activity over the next 20 years.

b. The Chicago River represents the greatest potential for increasing paddling recreation because of its proximity to the largest population center.

3. <u>CAWS Provides Birding Benefits</u> – Northeastern Illinois has a robust and diverse variety of birds. Each year, more than 250 species of birds stop in the area as they use the Chicago River flyway, and Lake Michigan's shoreline is one of America's most important songbird migration routes. More than five million songbirds migrate through Chicago each year.

The U.S. Fish and Wildlife Service has determined that Illinois is home to 1.8 million active birders. Backyard birding is the most prevalent form of birding, with 88 percent of birders watching from the comfort of their homes. Forty percent of birders travel more than a mile to bird, and they spend money on binoculars, field guides, bird food, bird houses, camping gear, and big ticket items such as boats, as well as travel-related costs.[28]

To better understand the economic benefit that birders provide to Northeastern Illinois, the focus was made on the four metro Chicago area counties that contain 60 percent of the state's population: Cook, DuPage, Lake and Will.

The active birding population in this area is approximately 1 million. Each birder has a net economic value of $35 per day when he or she leaves home to bird. Birders average a little more than seven trips per year, which equals $257 million in the area annually. As the river ecosystem's health continues to improve, biodiversity will be strengthened, and improved habitat areas can be developed. It can be estimated that just a 5 percent annual increase in birding recreation would generate an additional $257 million in economic activity over the next 20 years.

Several additional economic benefits to the region from recreation were identified beyond the scope of the above surveys. For instance, motorized pleasure boating, river park use and cycling all contribute to the local economy, and it is likely that the stated projected recreational benefits are conservative, given the river's growing use for recreational purposes.

The three recreation activities identified produce a total economic regional benefit of $358 million.[29] As this economic activity works it way through the region, it produces a significant but undetermined multiplier effect. As policies to improve the river's aquatic health are adopted, a conservative estimate of a 5 percent annual increase in these activities would generate approximately $358 million over 20 years in additional economic benefits.

Conversely, there are major adverse economic impacts to Greater Chicago due to the lack of disinfection by MWRD. Studies have been done to estimate the economic burden from illnesses associated with exposure to polluted recreational waters. These studies have focused on coastal waters and exposure at beaches. One study estimated the economic burden per gastrointestinal illness to be $36.58, the burden per acute respiratory disease at $76.76, the burden per ear ailment at $37.86, and the burden per eye ailment at $27.31. When using a multiplier of possible illnesses that could result from exposure to the contaminated water of CAWS, this direct economic burden becomes meaningful (e.g., in the Milwaukee scenario with 400,000 cases of

[28] Friends of the Chicago River
[29] Ibid.

gastroenteritis at $36.58 = $14,632,000 for one incident, and this is for the human health cost alone).[30]

Though the public policy debate over disinfection almost always immediately jumps to "cost," it is important to remember that upgrades to water quality standards are required under the Clean Water Act *without respect to cost.* The only exception to this is where controls that are more stringent than those to achieve secondary treatment would cause "substantial and widespread economic and social impact". This is assessed through a "feasibility test," rather than a cost-benefit test, and in the case of CAWS and MWRD, this clearly would not lead to that economic exception (see section C below, "Disinfection is an Investment Worth Making", for more on costs). Furthermore, law stipulates that existing budget constraints cannot be the sole driver of legal and public health decisions.

B. Different Disinfection Technologies are Available; No One Size Cost Fits All

<u>Chlorination/De-chlorination</u>

The majority of wastewater treatment plants across the U.S. use some type of advanced disinfection technology. Chlorination is the most popular (representing approximately 60 percent of the 20,000 wastewater treatment plants in North America), with perhaps as much as another 25 percent in North America utilizing chlorination/de-chlorination. This is because chlorination is a relatively cheap (though dependent on energy costs) and simple technology to implement. It is also effective in most cases, though protozoa such as cryptosporidium and giardia are resistant to chlorination because of their tough outer shells, and so UV or Ozone is more suitable for killing certain types of protozoa. Also, chlorination has the potential to harm biological life from chlorine and chlorine byproducts. Thus if chlorination is used, de-chlorination is necessary and should be utilized in tandem with other methods (see Appendix C for more on chlorine byproducts) to reduce the risk of harm.

<u>Ultraviolet Light</u>

UV is the most popular and rapidly growing alternative to chlorination/de-chlorination with perhaps as many as 2,000 plants (10 percent) in North America using this method. UV may be considered by many to be the most "environmentally-friendly" between it, chlorination/de-chlorination and ozone (though UV does usually involve mercury lamps and high energy requirements). UV can be very effective at destroying pathogens and inactivates some viruses. It also is generally more effective than chlorination at

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[30] It should be noted that in this example the Milwaukee case is used for economic comparisons only of waterborne aliments associated with the respective types of illnesses, and that while these ailments have been known to be associated with both recreational contact wastewater and in drinking contaminated drinking water, one should not assume that the same types of exposures as occurred in the Milwaukee scenario would occur on CAWS.

inactivating viruses, spores and cysts. However, the overall effectiveness of UV also depends on the turbidity and other related factors of the wastewater effluent. Other benefits of UV include that there are no known significant toxic byproducts, UV is generated onsite and UV disinfection is relatively safe to operate. It should also be noted that UV can usually be easily retrofitted on to existing chlorine contact chambers with minimal modifications.

Ozone

Five percent or fewer of the treatment plants in North America use ozone. This may be attributable to a few factors, including that ozone is usually the most expensive and complicated to operate of the three, and is highly toxic and therefore especially poses a risk to workers through off-gases, and other factors. It also has higher energy demands than chlorination (though usually lower than UV) and still produces some disinfection byproducts. However, ozone is extremely good at destroying many pathogens and viruses and is generated onsite. Other useful side benefits of ozone are that it elevates the dissolved oxygen (DO) concentration of the effluent and decreases its biological oxygen demand (BOD), in essence improving water quality.

C. Disinfection is an Investment Worth Making

Per capita costs

The MWRD commissioned Consoer Townsend Envirodyne Engineers, Inc. (CTE) to provide a short list of available disinfection technologies, and then produce cost estimates for the selected options at MWRD's three main treatment plants. This was done in expectation of IEPA's proposed bacterial limit standard upgrades for various designations of different sections of CAWS. The CTE report was completed in late 2005. USEPA commendably then commissioned Science Applications International Corporation (SAIC) to do an independent analysis of the MWRD commissioned report, as well as for SAIC to produce cost estimates of a third technology, chlorination/de-chlorination (since chlorination is the most widely used disinfection method, and usually at substantially lower costs than UV or Ozone). (MWRD has indicated that it decided to omit chlorine technologies from their cost study because of safety and environmental concerns if implemented). SAIC's report was completed in early 2006. The disinfection cost estimates below display probable costs as projected by each of these reports, and represent estimates of the total capital costs. Operations and maintenance costs, and annual debt service costs are reflected in the two tables that follow. It should be noted that the SAIC report concludes that proposed bacterial limits for CAWS can likely be met through disinfection without filtration, and that the MWRD commissioned report will make a more definite conclusion after pilot or full-scale tests are completed. For those reasons filtration was excluded from our comparisons below:

Table 3: Disinfection Methodology Cost Comparisons

Disinfection Total Capital Cost Estimates for the Stickney Plant

UV
MWRD Report = $358 million *(represents a $52 million increase)*
USEPA SAIC Report = $306 million

Ozone
MWRD Report = $497 million *(represents a $52 million increase)*
USEPA SAIC Report = $445 million

Chlor./De-chlor.
MWRD Report = N.A. *(excluded from study)*
USEPA SAIC Report = $138 million *(represents $168 million less than other lowest alternative)*

Disinfection Total Capital Cost Estimates for the Calumet Plant

UV
MWRD Report = $100 million *(represents a $55 million increase)*
USEPA SAIC Report = $45 million

Ozone
MWRD Report = $180 million *(represents a $56 million increase)*
USEPA SAIC Report = $124 million

Chlor./De-chlor.
MWRD Report = N.A. *(excluded from study)*
USEPA SAIC Report = $6 million *(represents $39 million less than other lowest alternative)*

Disinfection Total Capital Cost Estimates for the North Side Plant

UV
MWRD Report = $83 million *(represents a $54 million increase)*
USEPA SAIC Report = $29 million

Ozone
MWRD Report = $162 million *(represents a $54 million increase)*
USEPA SAIC Report = $108 million

Chlor./De-chlor.
MWRD Report = N.A. *(excluded from study)*
USEPA SAIC Report = $49 million *(represents $20 million more than lowest other alternative)*

TABLE 4: Total Annual Operations & Maintenance Cost Estimates (in Millions)

	Stickney			Calumet			North Side		
	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor
MWRD	$12.6	$19.0	N.A.	$4.8	$8.1	N.A.	$4.3	$7.5	N.A.
SAIC	$9.0	$19.0	$11.5	$2.0	$5.0	$3.7	$2.0	$5.0	$4.0
Difference	**$3.6**	**$0.0**	**N.A.**	**$2.8**	**$3.1**	**N.A.**	**$2.3**	**$2.5**	**N.A.**

TABLE 5: Annual Debt Services Cost Estimates (in Millions) *(based on an interest rate of 5.5% for 20 years)*									
	Stickney			Calumet			North Side		
	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor
MWRD	$30.0	$42.0	N.A.	$9.0	$15.0	N.A.	$7.0	$14.0	N.A.
SAIC	$26.0	$37.0	$11.5	$4.0	$10.0	$0.5	$2.0	$9.0	$4.1
Difference	**$4.0**	**$5.0**	**N.A.**	**$5.0**	**$5.0**	**N.A.**	**$5.0**	**$5.0**	**N.A.**

The MWRD's estimates appear to be roughly $300 million more for combined debt service over 20 years for the 3 plants, using either UV or Ozone at each plant at the prescribed bacterial limits for each plant. On average, MWRD estimates about $171 million more for Operations and Maintenance (O&M) costs for the three plants over 20 years, again using either UV or Ozone.[31]

When the higher MWRD total capital costs estimates (averaged for each plant at $53.83 million using either UV or Ozone) are added to MWRD annual O&M costs for the technology, and then this is added to MWRD annual debt service costs for the technology, measured over the 20 year period, MWRD's potentially inflated numbers for disinfection account for a total dramatic increase of approximately $633,100,000.[32] That is a difference of more than a half billion dollars above federal projections through the independent contractor, SAIC.

Moreover, the independent SAIC analysis put disinfection costs into perspective with likely average costs for residents:[33]

- <u>$8.52 per person</u> per year for UV (using an estimated 5.4 million people)
- <u>$23.28 per household</u> per year for UV (based on 2.73 people per household). This calculates out to just $1.94 per month per household.

[31] Note in the case of the Stickney Plant that Ozone O&M cost estimates were the same for both reports, so this (representing roughly $15 million) would be the one exception to the rest of MWRD inflated numbers. Therefore, in the unlikely event that Ozone would be selected for just Stickney, this would instead equal an overall inflation across all 3 plants (for O&M) of about $156 million, rather than the $171 million stated above.
[32] Without the low-lift pump costs that MWRD included for each plant and that SAIC deemed unnecessary, the total MWRD projected capital and O&M costs for UV without filtration are only roughly $10 million higher than the SAIC projections, which suggests that both reports resulted in very similar overall cost estimates for UV. Still, other potentially inflated areas are still in question, such as UV energy requirements for the Stickney plant (though varying estimates on future costs of energy could represent some of the disparity in cost differences for this as well).
[33] These numbers are actually conservative, in that they don't account for the offset of payment that would be gained by corporations also having to pay the increase in water sewage rates.

Other Municipalities Can Afford it; We Can Too

Many major metropolitan wastewater treatment plants were built during the first few decades of the 20th century. As populations in many of these areas expanded (and continue to expand today), the treatment plants' capacities were and are continuously being challenged. As a result of this population growth, along with stricter environmental laws though the 1970s and beyond, and more recently because of security concerns after September 11, 2001, these treatment facilities must continually update their facilities and upgrade their treatment processes.

These critical updates can have large capital costs, especially in the larger metropolitan areas. Standard public financing methods for these projects include:

- Increasing household sewage rates
- Using State Revolving Fund loans
- Levying special taxes
- Debt financing/bonding
- Using other federal grants
- Using a combination of the above

There are countless examples of municipal wastewater treatment facilities that effectively build new disinfection capabilities into their operations. They pay for this by one or more of the above mentioned financing options. It is a common and necessary occurrence to update and upgrade wastewater treatment facilities, including capital costs, ongoing annual operations and maintenance costs, and annual debt service costs, as they may relate to advanced disinfection treatments. Some examples:

- The **Milwaukee Metropolitan Sewerage District (MMSD)** has two main treatment plants that serve the city. The Jones Island Treatment Plant has a design capacity of about 300 million gallons per day (MGD), and the South Shore Treatment Plant has a design capacity of 250 MGD, both using chlorination/de-chlorination. The South Milwaukee Municipal System has a design flow capacity of 6 MGD and uses UV disinfection. MMSD has 2 percent increases for user charges, and 3 percent increases for the tax levy, which will help pay for additional treatment upgrades and various capital projects, including disinfection. The implications this will likely have for the average single family household in the service region in 2007 is a bill of $83.36 per year. A homeowner of a $200,000 house in Milwaukee County will pay about $260 per year toward MMSD's 2007 capital budget before any other municipal taxes, etc. have been added. As important is the fact that Milwaukee disinfects its wastewater at the same time it, like MWRD, must pay for a deep tunnel system.

- In **Detroit**, which is home to the *largest single-site* wastewater treatment facility in the United States, the water treatment plant **is able to recapture costs associated with its continual upgrades of capacity and chlorination/de-chlorination**

disinfection technologies simply through consumer rates.[34] A total of $2.6 billion was earmarked in Detroit for about a 5-year wastewater treatment capital improvement program (to extend approximately into 2010). $434 million of this budget was allocated to cover water and sewer projects for 2005-06 alone. This is the latest in a consistent series of budget allocations to the sewage agency stemming from its inception in 1940, and with direct improvements to its chlorination/de-chlorination disinfection technology dating as far back as 1957 and 1970.

- In **Rockford, IL**, wastewater treatment (including disinfection) is funded by a variety of sources, 'such as user charges, county and state property taxes, connection charges, interest income, and other miscellaneous sources, such as permits, inspections, and rental income'. More specifically, "user charges fund basic operations and maintenance, capital equipment and infrastructure and replacement or updates to the treatment plant. Taxes, connection charges and cost sharing with developers and other governmental agencies provide sources for infrastructure additions and improvements" (Rock River Water Reclamation District Website). Recently on January 22, 2007, Rock River's Board of Trustees approved ordinances that will implement about a 9 percent sewage treatment rate hike, reflective on bills as of April 6, 2007. This means that the average household in the service area can expect a rate increase of about .73¢ per month, or $8.76 per year.[35]

- The **Sanitary District of Decatur (SDD), IL** was formed on Oct. 11, 1917, and became the first such district to organize under the state's Sanitary District and Sewage Disposal Act of 1917. SDD's dry weather design capacity has been increased from 27 MGD to 41 MGD, while wet weather flow capacity for full secondary treatment has been increased from 50 MGD to 125 MGD. During the 1980s the SDD **implemented chlorination disinfection technology funded by a federal grant** (procured from federal taxes). The **SDD then later switched to UV disinfection at a cost of about $150 million to implement, and financed through a state revolving fund**, which was then recaptured through user rates. More recently, SDD altered its technology once again, and now bleaches its wastewater effluent.

- In **Schererville, Indiana** (located in Northwest Indiana and served by a relatively small treatment facility with an initial design capacity of 0.5 MGD in 1964, to the

[34] The Detroit Water & Sewerage Department (DWSD) serves virtually all of Wayne, Oakland and Macomb counties, with a daily flow rate of approximately 677 million gallons (which is almost exactly the same daily flow rate of MWRD's Stickney's plant, at 680 MGD).

[35] In 2006 the Rockford City Council approved a 39 percent rate increase for water services (27 percent of that coming in the first year of the three year rate-plan increase which addresses mostly drinking water improvements). This will pay for a $75 million water improvement plan. *The city plans on borrowing the money to pay for the upgrades and pay back the debt over 20 years through the water-rate hike*.

present capacity of 8.75 MGD), **recent upgrades in 2003 included implementing UV disinfection technology**. The 8 major capital improvements needed for their facility since its inception, and precipitated by population growth in the region (presently at 35,000), **were/are funded by user fees, a state revolving fund, and/or a revenue bond, or some combination thereof**.

The message is clear: municipalities are disinfecting their wastewater discharges all the time and funding such efforts in ways that do not break the bank or their ratepayers. If they can do it, the Chicago metro region can, too.

Solutions: Prescriptions for Change

Step One: Designate all Stretches of CAWS for "Fishable/Swimmable" Uses

Commendably, in January 2007, IEPA proposed designating the North Segment and South Segment of the CAWS for upgraded water quality protections. However, it did not propose appropriate upgrades that would be protective of all current and attainable uses. Nor did it propose any upgrades for the Middle Segment. IEPA needs to upgrade protections for all three segments for full "fishable/swimmable" uses, achievable by 2010.

With the IEPA's proposed standards, most of the North Branch of the Chicago River, most of the North Shore Channel, Grand Calumet River, Cal-Sag Channel, and portions of the Lower Des Plaines River, will all likely see some water quality improvements. They will not however, be fully protective and adequate to comply with federal CWA requirements. In the case of the Chicago Sanitary and Ship Canal, it will continue with the status quo. Just North of the Lockport Lock & Dam on the Lower Des Plaines will also continue with the status quo. The standards applicable to the Calumet River (North of O'Brien Lock & Dam) will be downgraded, as will the standards applicable to the North Shore Channel above the North Side Water Reclamation Plant, and likewise for the Chicago River east of Wolf Point. These last three downgraded areas are especially sensitive due to their close proximity to Lake Michigan.

Step Two: Illinois Environmental Protection Agency Must Include a Disinfection Requirement in MWRD's Pollution Discharge Permits

Once water quality standards have been upgraded in CAWS, IEPA must require MWRD to begin disinfecting its wastewater discharges by March 1, 2010. The proper way for this to take place is to include a disinfection requirement in the National Pollutant Discharge Elimination System (NPDES) wastewater discharge permits for the MWRD's North Side (North Segment), Calumet (South Segment), and Stickney (Middle Segment) plants.

The MWRD's NPDES permits for its three main plants expired on February 28, 2007. Once reissued by the IEPA, the three NPDES permits would be subject to USEPA oversight.

Step Three: IEPA Must Require MWRD to Comply with Federal Policies

The MWRD can get the most out of ratepayer funds and its operations by complying with relevant federal law and policies. To date, MWRD has argued that its construction of TARP constitutes compliance with many of the laws and policies, including the USEPA's National Combined Sewer Overflow Control Policy of 1994. Yet MWRD acknowledges that even when TARP is complete, heavy rains could continue to cause CSOs on occasion.

The 1994 National CSO Control Policy (which was incorporated into CWA) requires the control of CSOs as part of a two-step process. First, by 1997, all CSO communities were to have accurately characterized their sewer system and demonstrated implementation of the "Nine Minimum Controls" (NMCs). The NMCs are designed to reduce CSOs through better operation and maintenance practices coupled with better monitoring of CSO discharges. The NMCs can reduce CSOs and their effects on receiving water quality, and they do not require significant engineering studies or major construction and can be implemented in a relatively short period of time. Implementation of the NMCs is the first step expected to have been taken in response to the National CSO Control Policy.[36]

The second part of the policy is for CSO communities to develop long-term control plans to further control CSOs that need to come into compliance with the CWA. In the case of MWRD, TARP is considered by IEPA and USEPA to be adequate to meet the objectives of the National CSO Control Policy.

Therefore MWRD needs to demonstrate compliance with all of the NMCs and complete the reservoir portion of TARP on an enforceable schedule (regardless of the availability of federal funds). Adequate CSO controls, in conjunction with disinfection, will significantly reduce pathogens and other pollutants to CAWS.

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[36] Best Management Practices (BMPs) dictate that stormwater flows are also contained as best as possible through water reuse, vegetation, and other practices. Additionally, if environmentally sensitive areas are identified in the affected regions then MWRD's LTCP will have to also protect these areas from CSOs under the National CSO Control Policy.

Appendices:

Appendix A – Frequently Asked Questions:
15 fundamental questions addressed by this report.

1. Why do we need to disinfect? What are the risks/benefits?
   - ***Disinfection of wastewater effluent is imperative to significantly reduce exposures to waterborne diseases that make millions of Americans ill each year, sometimes fatally. Many of these diseases affect the most susceptible individuals in our population, such as children, the elderly and our sick; but anyone who comes into contact with contaminated wastewater is at risk.***

2. What sort of illnesses are associated with wastewater/impacts on public health?
   - ***Illnesses caused by contact with or consumption of untreated or inadequately treated wastewater can range from cholera, hepatitis, gastroenteritis, and respiratory infections, to giardiasis, cryptosporidiosis and dysentery, for example. While traceable outbreaks may occur as the result of a specific exposure (e.g. recreating in contaminated water), it is also estimated that some of the referenced waterborne diseases affect as much as 1-7 percent of the U.S. population annually.***

3. What sorts of uses are there in the Chicago area?
   - ***A 2003 joint Alliance for the Great Lakes - IEPA study found unprecedented public use of CAWS, even in places that were supposed to be off limits to public access. During 7.5 days of observations, a total of 1,284 uses were confirmed, including but not limited to activities such as canoeing, kayaking, sculling, power boating, fishing, jet skiing, wading and swimming – this last activity was seen directly in front of the main outfall of the Calumet Wastewater Treatment Plant. Countless others use the CAWS each year for rowing events, paddling day trips, and more. More recently new user groups, access points and boat launches have been cropping up in all sections of the CAWS like never before.***

4. What are US EPA's current water quality standards for pathogens for primary and secondary uses?
   - ***USEPA has set a goal of "fishable/swimmable" waters for our nation. With that end objective in mind, USEPA previously set a limit of 126 E. Coli per 100 mL for full or "primary" contact waters. Where existing or attainable uses demonstrate such exposures, USEPA regulations require that States, with few exceptions 1) designate all waters of the State for primary or secondary uses; and 2) wherever secondary contact is designated, States***

must set bacteria limits that are stringent enough to support primary contact. Based on USEPA standards, many States have adopted fecal coliform limits around 200 cfu per 100 mL for primary waters (though some have significantly more stringent limits). Though they vary greatly, fecal coliform limits for secondary contact waters range from less than 100 cfu/100 mL for a few States, to 1,000 or more cfu/100 mL for many others. Part of the variance in limits from State to State is likely due to expected updates in Federally mandated standards. However, and what should be of special significance to Illinois, is that States are generally prohibited from removing designated uses unless the change will result in more stringent criteria.

5. What are the current water quality standards for IL in the Chicago Area Waterways System?
   - ***The fecal coliform bacteria limits for waters designated General Use consist of a 400 cfu/100 mL standard, which currently applies to three small sections: the North Shore Channel above the North Side Water Reclamation Plant, on the Calumet River above the O'Brien Lock and Dam, and on the Chicago River east of Wolf Point. The rest and majority of the Chicago Area Waterway System is designated Secondary Contact Use with <u>NO BACTERIA LIMITS.</u>***

6. How did we get to where we are in the CAWS with NO pathogen standards for secondary contact recreation?
   - ***This is related to the wastewater treatment practices of CAWS during the 80's. The requirement to disinfect MWRD's wastewater was removed in 1984 partly due to concerns over negative impacts of chlorine in the environment, which was the disinfection treatment MWRD used at that time. Coincidentally, the USEPA mandated "Triennial Review" of waterways of the State was not carried out by IEPA until now, decades later. If this requirement had been implemented every three years from the beginning, it may have helped to confirm secondary and/or primary type uses of the waterways earlier, requiring pathogen standards.***

7. If we do disinfect at the 3 biggest MWRD plants, what is the cost?
   - ***Recent studies find that it would roughly cost $640 million to implement UV disinfection at all three plants, including capital infrastructure & O&M costs for 20 years (an additional $32 million per year for debt service costs). This equates to approximately <u>$8.52 per person per year</u> (based on wastewater discharges to CAWS of 5.4 million users), or $23.28 per household per year (based on 2.73 people per household).***

8. Who pays this cost? Is it worth it for the amount of people it will protect?
   - ***Standard public financing methods for these projects include a variety of proven options: increasing household sewage rates, using State revolving loan funds, levying special taxes, debt financing/bonding, using federal grants, or some combination of any of the above. It is questionable whether it is reasonable or accurate to measure the worth of healthy people, or the value of even one human life, per se. Although lawsuits do monetize these values everyday. Moreover, beyond greatly reducing pathogenic exposure to perhaps 10,000 to 20,000 direct users each year, it has been estimated that disinfecting our wastewater effluent will also bring economic activity into the hundreds of millions of dollars for the Chicago region through increased tourism, recreation, and increased property values for instance, besides bringing our City's wastewater treatment practices back into the developed world.***

9. Why was chlorination/de-chlorination omitted as a potential disinfection technology by MWRD to at least do a cost estimates study on, when it is the most commonly used technique across the U.S. and is usually relatively simple and cheap to implement?
   - ***MWRD indicated that it decided to omit chlorine technologies from their cost study because of safety and environmental concerns if implemented. There is some justification to that, and UV disinfection technology may be the best overall choice in terms of effectiveness, safety and relative environmental impacts. However, because chlorination is currently the most widely used method in the U.S. and is relatively cheap and simple to implement, it seems remiss to exclude it from a comprehensive study. Furthermore, chlorine technologies would possibly be a better alternative to the current disinfection method on CAWS, which is nothing. As such, and much to its credit, USEPA commissioned Science Applications International Corporation (SAIC) to do an independent analysis of the MWRD cost estimates, as well as for SAIC to produce cost estimates for a third disinfection technology of chlorination/de-chlorination, which is contained in this report.***

10. What are the health concerns we should have with various disinfection technologies, such as chlorinated byproducts if chlorine were to be used?
   - ***While UV currently has no known significant toxic disinfection byproducts, Ozone and chlorine technologies do produce some toxic byproducts which can cause cancer. The potential for formation and type of byproducts can vary based on local water source composition and other conditions. Ozone has the potential to form bromates, for instance, yet water quality conditions in the U.S. and Europe have tended to be generally less reactive with byproducts of Ozone, or at levels that are relatively low when compared to other regions of the world. Nonetheless, and especially true of***

chlorination disinfection in the U.S., when high dissolved organic carbon concentrations are present in the wastewater, high concentrations of byproducts can result. Wastewater is then discharged into surface waters, where the byproducts may be diluted, degraded, volatized (go into the air), or get absorbed into nearby sediments. For chlorination, preventative measures that reduce risks include de-chlorination after chlorination, though this is not a totally effective safeguard. Ironically, UV is now emerging as the most effective de-chlorination method. In many cases UV is capable of removing both free chlorine and chloramines and provides a better overall water quality (somewhat dependant on conditions of the influent). Additionally, UV used as a de-chlorination method can save on maintenance costs sometimes associated with fouled equipment associated with other de-chlorination methods, such as granular activated carbon or sodium bisulphate. Finally, it is thought that because of the effectiveness of MWRD's treatment processes (in this regard), that their effluent has reduced ammonia content, which should help to minimize the formation of some chlorination byproducts.

11. How can river contamination affect Lake Michigan and the beaches potentially?
    - ***During times of especially heavy rains, MWRD is sometimes forced to open gates in three locations on CAWS that otherwise keep the waterway system flowing away from Lake Michigan. When these combined sewer overflow (CSO) reversals occur, public health agencies require swimming bans because of unsafe levels of bacteria in the water. The bans can extend for entire stretches of beach from MWRD's gates at Wilmette Harbor almost all the way to the Indiana border. Overflows that lead to lake reversals can negatively impact the ecology of sensitive coastal beach and aquatic habitats, including for a variety of plants and animals that depend upon wetlands, reefs and dune areas. These overflows to our area beaches can of course be hazardous to people as well. Also, during a reversal to the lake, it has not been determined what entering concentrations of pathogens are attributable to CSOs versus normal operating discharges from MWRD into CAWS. CSO events that are large enough to cause a reversal likely contain several times over the number of pathogens than are already present in the normal flow of CAWS, which is dominated by about 70 percent of its flow as effluent. Although pathogenic levels during a reversal would most certainly breach beach safe limits even if ambient water quality in CAWS was unusually pristine up until the point when CSOs occurred, the fact that ambient CAWS water quality contains egregious levels of pathogens to start out with, only elevates these levels at the time of a reversal, and potentially exacerbates public health risks at area beaches. Poor CAWS water quality is largely attributable to two factors: 1) lack of disinfection; and 2) CSOs.***

12. What is TARP and won't this address CSOs and reversals?

    MWRD's Tunnel And Reservoir Plan (also known as "Deep Tunnel"), began in the 1970s. TARP is the largest public works project ever implemented in the Chicago area, with an estimated final cost of $3.4 billion. It consists of reservoirs and tunnels about 240-350 feet below ground, stretching 109 miles throughout Cook County. TARP conveys wastewater to the storage reservoirs until it can be treated at the WWTPs and discharged during dry weather. Once fully completed, TARP will enable MWRD to store and then treat up to approximately 17.2 billion gallons of wastewater before discharging it into CAWS, greatly reducing CSOs and the potential for a river to lake reversal. There will, however, likely continue to be some CSOs after particularly heavy rains after the completion of TARP. Moreover, TARP is not designed to address the problem of pathogens that are constantly discharged from the Calumet, Northside and Stickney plants and will not reduce the levels of pathogens discharged from those plants.

13. Where does the river water go to since the flow has been augmented & how is the downriver water quality?
    - ***In the late 1800s the Sanitary District of Chicago began working to reverse the flow of the river so that sewage would move away from our drinking water supply, Lake Michigan. The project finished in the early 1900s, thereby sending wastewater downstream today to the confluence with the Des Plaines River and eventually the Illinois and Mississippi Rivers. Downriver water quality is logically affected by what occurs upstream, so by not disinfecting our wastewater, we are to a certain degree "passing the buck" downstream, as well as the health and environmental risks (though through some natural aeration, dilution, decomposition and UV processes, the effluent can be improved as it moves downstream).***

14. Aren't there laws that govern the water quality standards from the CAWS to the next region? & What happens if they are broken?
    - ***Before the Clean Water Act was passed, the federal government had oversight over intrastate and interstate waters. By mid 1960, States were required to set standards for interstate waters in order to assist in determining pollution levels. This system met with some opposition by the late 1960s, but it essentially remains the precursor to similar requirements under the CWA today. If violations of the designated use for a specific section of the water body occur, and this could include interstate waters, then the violating discharger can be: 1) issued a compliance order by USEPA; 2) sued in a civil lawsuit (with penalties as high as $25,000 for each day that the violation persists); and/or 3) sued in a criminal lawsuit for negligence ($50,000 per day, or 3 years' imprisonment or both), or for willful acts ($250,000 per day, or 15 years' imprisonment or both).***

15. What would happen if after a CSO forced a gate opening river water reached the water intake system: could it happen and would we be protected and what would happen to our drinking water supply?
    - ***These are valid concerns. When Chicago River system reversals occur, municipal drinking water agencies are forced to increase the level of chlorine they must apply to drinking water supplies so as to safeguard the public from the risk of contamination. While chlorine is meant to safeguard public health and most of the added chlorine dissipates before reaching domestic taps, chlorine itself is not without its own health risks. Studies indicate that cancer-causing agents, trihalomethanes and haloacetic acids, are the two largest classes of byproducts in treated drinking waters, though a recent EPA national occurrence survey of selected public water-treatment plants reported the presence of 50 high-priority byproducts and detected more than 200 previously unidentified byproducts. Additionally, human epidemiology and animal toxicology studies report an association between chlorinated drinking water and reproductive and developmental endpoints such as spontaneous abortion, still birth, neural tube defect, pre-term delivery, intrauterine growth retardation, and low birth weight. Approximately 240 million Americans (80 percent) drink tap water contaminated with some level of disinfection byproducts today (EWG, 2001).***

Appendix B –
i. Clean Water Act Requirements Relating to Water Quality Standards

The requirements of the Clean Water Act (CWA) are very clear:

> Section 101 (a) says: "The objective of this chapter is to restore and maintain the chemical, physical and biological integrity of the Nation's waters".
>
> Section 101 (a) (2) says: "It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in an on the water be achieved by July 1, 1983:" (This is commonly referred to as the "fishable/swimmable" requirement of the Act)
>
> Section 101 (a) (7) made it national policy that programs (to meet the objectives of the Act) would be "developed and implemented in an expeditious manner".

Water quality standards are aimed at translating these broad goals of the CWA into waterbody-specific objectives. A water quality standard consists of two major elements: (1) the <u>designated beneficial use or uses</u> of a waterbody or segment of a waterbody; and (2) the <u>water quality criteria</u> necessary to protect the use or uses of that particular waterbody. A single water quality standard need not be applied to the entire waterbody (for example, for the entire length of a stream); different water quality standards may be set on different segments of the same waterbody.

Included in the "fishable/swimmable" goal identified in the Section 101(a)(2) of the Act is the requirement that water bodies must be reexamined every three years (triennial review) to determine if new information has become available that would warrant a revision of the water quality standards. If new information indicates that "fishable/swimmable" uses can be attained, such uses must be designated.

USEPA has developed implementing regulations associated with the water quality standards program.

Section 40 CFR 131.10(d) of those regulations states*: "(d) At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limits required under sections 301(b) and 306 of the Act and cost-effective and reasonable best management practices for nonpoint source control". Under 40 CFR 131.10(g) States may remove a designated use or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

> "-Naturally occurring pollutant concentrations prevent the attainment of the use;

or

> -Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
> -Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
> -Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
> -Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
> -Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact".

Section 40 CFR 131.10(h)(2)(i) states: "(i) Where existing water quality standards specify designated uses less than those which are <u>presently being attained</u>, the State shall revise its standards to reflect the uses actually being attained" (emphasis added). Section 131.11 states: " (a) Inclusion of pollutants: (1) States must adopt those water quality criteria that protect the designated use. Such criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive".

USEPA has developed and issued a document titled "Water Quality Standards Handbook". The following information was extracted from that Handbook (Second Edition):

> -"A State must designate either primary contact recreational uses or secondary contact recreational uses for all waters of the State and, where secondary contact recreation is designated, set bacteriological criteria sufficient to support primary contact recreation. EPA believes that a secondary contact recreational use (with criteria sufficient to support primary contact recreation) is consistent with the CWA section 101(a)(2) goal. The rationale for this option is discussed in the preamble to the Water Quality Standards Regulation, which states: " . . . even though it may not make sense to encourage use of a stream for swimming because of the flow, depth or the velocity of the water, the States and EPA must recognize that swimming and/or wading may occur anyway. In order to protect public health, States must set criteria to reflect recreational uses if it appears that recreation will in fact occur in the stream".

> -"The most significant misperception about designated uses and UAAs is that UAAs need only address the current condition of a waterbody: that a designated use may be removed simply by documenting that protective criteria are exceeded. However, it is the prospective analysis of future attainability of designated uses that provides the demonstration necessary to support a use change. A related misconception is that UAAs are only a means to remove a designated use. In fact, UAAs have supported both removing uses and adding uses. The program experience and future direction reflects a growing practice of "sub-categorizing" or "refining" designated uses; that is, making them more specific and precise as opposed to removing them".

> -"Many of our waters do not meet the water quality goals envisioned by the Clean Water Act. Many of the problems have been produced over many years and may take many years to resolve. Some problems may take substantial changes in resource management to implement solutions. A process of setting incremental water goals through refined designated uses, that in turn advances progress toward an ultimate goal, can help us achieve our long term goals faster".

It is the primary right and responsibility of the State of Illinois to establish water quality standards for all waterbodies in the State. The Illinois EPA develops and proposes water quality standards, including designated uses to the Illinois Pollution Control Board. Once the Board formally adopts the water quality standards, they become fully effective and guide water pollution decisions made by the IEPA.

USEPA reviews new or revised water quality standards that States adopt to determine whether the standards meet Clean Water Act requirements. USEPA disapproves a State's water quality standards, or determines that a new or revised water quality standard is necessary to meet the requirements of the Clean Water Act. Opportunities for public comment on proposed water quality standards are provided at a minimum of two steps in the overall approval process.

Once water quality standards are established, the Clean Water Act requires a State to review those standards at least once every three years (the "triennial review"). Designated uses may be revised during this periodic review. <u>It is very important to note that IEPA has not conducted a triennial review of the water quality standards on the CAWS for over 20 years.</u>

ii. Designated Uses and Existing Uses

The water quality standards program categorizes water uses in two ways: designated uses and existing uses. A designated use is the legally applicable use specified in the adopted water quality standards for a waterbody or segment of a waterbody. A designated use is a use that, presently, may or may not be met or "attained". In effect, the designated use is the goal set for the waterbody. All pollution control activities associated with a waterbody (such as the conditions established in NPDES permits) are designed to attain the designated uses. It is very important to note that designated uses for a waterbody can be changed. Changing a designated use also results in a change in the applicable water quality criteria associated with that new designated use.

Designated uses include recreation; protection and propagation of fish and other aquatic life and wildlife; agriculture; industrial processes; and navigation. USEPA does not recognize waste transport as an acceptable use.

The term "existing use" has a somewhat different meaning in the context of the CWA. Rather than actual or current uses, it refers not only to those uses the waterbody is <u>capable</u> of supporting at present but also any use to which the waterbody has <u>actually attained</u> since November 28, 1975. Even if the waterbody is currently not supporting a use attained since November 28, 1975, for purposes of the CWA, it is still an "existing use" (even if there has been no documentation that a use has occurred since November 28, 1975, evidence that water quality has been sufficient to support a given use at some time since November 28, 1975, can be the basis for defining an "existing use" for a waterbody).

Commonly used use designations include the following:

Drinking water
Water-based recreation
- **Primary Contact: partial body/whole body contact**
- **Secondary Contact: limited contact**

Fishing
Aquatic life
- **Warm water species and habitat**
- **Cold water species and habitat**

Agriculture water supply
Industrial water supply

The terms listed in bold text are examples of subcategories of uses. The subcategories under water-based recreation refer to the proportion of time in which someone engaging in certain types of activities would come into direct contact with the water. Recreational uses have traditionally been divided into primary contact and secondary contact recreation. The primary contact recreation classification protects people from illness due to activities involving the potential for ingestion of, or immersion in, water. Primary contact recreation usually includes swimming, water-skiing, skin-diving, surfing, and other activities likely to result in immersion. The secondary contact recreation classification is protective when immersion is unlikely. Examples are boating, wading, and rowing. These two broad uses can be logically subdivided into an almost infinite number of subcategories (e.g., wading, fishing, sailing, power boating, rafting). Obviously, it can be difficult to draw distinct lines between these different activities, because the extent of exposure can be affected by factors such as the skill of the recreationist and weather conditions. Nevertheless, such distinctions can be very important, as concentrations of pathogens and other key pollutants need to be lower in waters used for primary or long-term contact activities than for short-term activities, if the health of users is to be protected adequately. Warm water fisheries are those characterized by species of fish and other animals that can tolerate higher temperatures in the surrounding water than can species such as trout and salmon, whose body chemistry requires them to be in colder waters. Bass and perch are examples of warm water fish.

In general, different waterbodies, and different portions of a given waterbody, are assigned various combinations of the designated uses. A given segment will almost always be classified for more than one designated use. When a waterbody has been classified for more than one designated use, as is usually the case, regulatory activities and other programs are "driven" by the designated use that requires the cleanest water. This is simply because if one designated use requires a concentration of pollutant "x" of

50 mg/L or less and a second designated use requires 25 mg/L or less, then meeting the second designated use (and the corresponding water quality criteria of 25 mg/L) automatically results in meeting the first designated use and its corresponding water quality criteria.

iii. Water Quality Criteria

Water quality criteria describe the quality of water that will support each designated beneficial use. Water quality criteria are levels of individual pollutants or water quality characteristics, or descriptions of conditions of a waterbody that, if met, will generally protect the designated use of the water. For a given designated use, there are likely to be a number of criteria dealing with different types of conditions, as well as levels of specific chemicals. Since most waterbodies have multiple designated uses, the number of water quality criteria applicable to a given waterbody can be very substantial.

Water quality criteria may be expressed as either numeric limits or as a narrative standard. Examples of water quality criteria are a dissolved oxygen level of 5 milligrams per liter to support a warm water fishery. Water quality criteria must be scientifically consistent with attainment of designated uses. This means that only scientific considerations can be taken into account when determining what water quality conditions are consistent with meeting a given designated use. ***Economic and social impacts are not considered when developing water quality criteria.***

Water quality criteria can be divided up for descriptive purposes in many ways. For instance, numeric criteria (e.g. "weekly average of 5 mg/L dissolved oxygen") can be contrasted with narrative criteria (e.g. "no putrescent bottom deposits"). Criteria can also be categorized according to what portion of the aquatic system they can be applied to: the water itself (water column), the bottom sediments, or the bodies of aquatic organisms (fish tissue). The duration of time and effect to which they apply is another way of dividing water quality criteria, with those dealing with short-term exposures that have the 'capacity to cause mortality or other adverse effects' (acute), being distinguished from those addressing long-term exposure that have the capacity to 'cause injurious or debilitating effects' (chronic).

EPA publishes recommended water quality criteria corresponding to a number of key designated uses. For aquatic life uses, criteria for both acute and chronic exposures are provided. Many human health criteria, *except certain pathogens*, address chronic exposures.

iv. Use Attainability Analysis Process (UAA)

When establishing a designated use for a waterbody that does not meet the "fishable/swimmable" goal of the Clean Water Act, USEPA water quality standards regulations require that a State conduct a UAA to determine the achievable uses of a waterbody. A UAA is a structured scientific assessment of the physical, chemical, biological, and economic factors that affect the attainment of a use. The UAA enables the State to answer the following questions about the conditions of a waterbody: (1) What is the existing use to be protected? (2) To what extent does pollution (as opposed to physical factors) contribute to impaired uses? (3) What level of point source control is required to restore or enhance the use? (The term "point source" refers to pollution resulting from discharges into receiving waters from pipes, ditches, or sewers). (4) What level of nonpoint source control is required to restore or enhance the use? (The term "nonpoint source" refers to pollution sources that are diffuse and do not have a single point of origin. Run-off from agriculture, forestry, and construction sites are examples of nonpoint source pollution).

The process of changing a use designation is called use reclassification. The terms downgrading and upgrading are sometimes used in this context. Removing a designated use and replacing it with a "lower" use is often referred to as "downgrading". "Upgrading" is just the reverse. It is important to note, however, that in the parlance of the CWA, the difference between a "higher" and "lower" use is a reflection of the quality of water needed to support each use. Those uses needing cleaner water are considerably "higher". The terms "high" and "low" are not intended to suggest that one use of a waterbody (fishing, for example) is inherently more important than another (industrial water supply, for example). Hence, removing one use from the designated uses of a waterbody that required an average daily concentration of pollutant "x" of 20 mg/L or less, so that the next highest use was one needing concentrations of 30 mg/L or less, would be a "downgrading".

IEPA is in the process of completing a UAA on the Chicago Area Waterway System. The draft report has been issued and IEPA is expected to announce their proposed water quality standards for the CAWS in early 2007. To restate this, included in the "fishable/swimmable" goal uses identified in the Section 101(a)(2) of the Act is the requirement that water bodies must be reexamined every three years to determine if new information has become available that would warrant a revision of the water quality standards. ***<u>If new information indicates that "fishable/swimmable" uses can be attained, such uses must be designated.</u>***

v. The State of Illinois Water Quality Standards for the CAWS

The IEPA and the Illinois Pollution Control Board are responsible for and have established water quality standards including designated uses and water quality criteria for all waterbodies within the State.

'Illinois presently has two major uses designations that apply to the CAWS: (1) General Use, and (2) Secondary Contact and Indigenous Aquatic Life Use. The General Use water quality standards comply with the goals of the Clean Water Act because they protect aquatic life, wildlife, agricultural use, secondary contact, most industrial uses and they safeguard the aesthetic quality of the aquatic environment (Primary contact uses are protected for all General Use waters whose physical configuration permits such use). Secondary Contact and Indigenous Aquatic Life use standards were established for those waters Illinois felt were not suited for general use activities, but which are appropriate for all secondary contact uses and are capable of supporting indigenous aquatic life limited only by the physical configuration of the body of water, characteristics and origin of the water and the presence of contaminants in amounts that do not exceed the water quality standards set by Illinois. Illinois has defined Secondary Contact as any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimum, such a fishing, commercial and recreational boating (e.g. canoeing and kayaking) and any limited contact incident to shoreline activity. Primary contact uses are protected for all General Use waters whose physical configuration permits such use. Illinois defines primary contact as: any recreational or other water use in which there is a prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing' (IPCB Statute - TITLE 35: SUBTITLE C, CHAPTER I, PART 302: WATER QUALITY STANDARDS).

The State of Illinois has limited the level of harmful bacteria allowed on a small section of the Chicago River system. The fecal coliform bacteria limits for waters designated General Use—400 cfu/100 mL—applies to the North Shore Channel above the North Side Water Reclamation Plant, on the Calumet River above the O'Brien Lock and Dam, and on the Chicago River east of Wolf Point. The rest of the CAWS is designated Secondary Contact Use at present.

Summary of Appendix B (i.-v.)

The following is a brief summary of some of the key items from the above discussion.

1. Most of the waters in the CAWS have not established water quality standards that meet the goals of the CWA some 20+ years after the established deadline.
2. The goal of "fishable/swimmable" is achievable on the CAWS.
3. The CAWS has had a tremendous increase in usage over the past several years. That increase will continue.
4. The water quality standards for the waters of the CAWS need to be upgraded to reflect the increased and types of usages.
5. The water pollution control programs, such as NPDES permit issuance, storm water control, etc, need to establish more stringent controls on all point and nonpoint sources of pollution if the water quality standards are to be met and the users of the CAWS are to be adequately protected.

Appendix C – Chlorine Byproducts (Drinking Water/ Wastewater)

Drinking Water: Other risks from pathogenic pollution also exist. For example, when Chicago River system water flows into Lake Michigan, municipal drinking water agencies are forced to increase the level of chlorine they must apply to drinking water supplies so as to safeguard the public from the risk of contamination. While chlorine is meant to safeguard public health and most of the added chlorine dissipates before reaching domestic taps, chlorine itself is not without its own health risks.

In 1974, scientists identified the presence of chlorination byproducts, specifically trihalomethanes (THMs), in public water supplies- a discovery that would lead to one of the greatest risk-benefit balancing acts in US environmental regulations[37]. Within a few years of the discovery of THMs in drinking water, the substantiation of their harmful effects was significant. Epidemiology and toxicology studies have shown a link between bladder, rectal and colon cancers and disinfection byproduct exposure. Additionally, human epidemiology and animal toxicology studies report an association between chlorinated drinking water and reproductive and developmental endpoints such as spontaneous abortion, still birth, neural tube defect, pre-term delivery, intrauterine growth retardation, and low birth weight. Approximately 240 million Americans drink tap water contaminated with some level of disinfection byproducts today (EWG, 2001).

In recent years, there has been significant discussion about chlorination practices during drinking water treatment and the associated formation of THMs and other halogenated organic compounds which may be harmful to human health. Concentrations of byproducts in drinking water are subject to government regulations and concern has led to the development of standards for the THMs and HAAs, while standards for other common byproducts are expected in the near future[38].

Wastewater: Good public policy suggests preventative action: disinfecting wastewater discharges at the source to reduce the risk of pathogenic pollution and chlorine over-exposure later. Other preventative measures include "de-chlorination" after chlorinating, and with current progressive technologies widely available, another more obvious choice would be to utilize alternative disinfection techniques, such as UV.

Nonetheless, chlorination is still the most widely used technology for disinfecting wastewater. And the potential for formation and type of byproducts from chlorine can vary based on local water source composition. When high dissolved organic carbon concentrations are present in the wastewater, high concentrations of byproducts can result[39]. Wastewater is then discharged into surface waters, where the byproducts may be diluted, volatized (go into the air), or get absorbed into nearby sediments[40].

Gradually researchers have come to recognize that all forms of disinfection commonly in use, including chloramines, chlorine-dioxide and ozone, will alter the composition of trace chemicals that are found in potable water and subsequently consumed at the

[37] Rook, 1974, Bellar et al, 1974.
[38] Pontius, 1996, 1999.
[39] Jekel and Roberts, 1980, Fujita et al, 1996
[40] Rostad 2002.

tap[41]. Studies indicate that THMs and haloacetic acids (HAAs) are the two largest classes of byproducts in treated drinking waters, though a recent EPA national occurrence survey of selected public water-treatment plants reported the presence of 50 high-priority byproducts and detected more than 200 previously unidentified byproducts[42].

The USEPA initiated a strategy to strengthen barriers to pathogens and limit exposure to disinfection byproducts in 1998 with the Stage 1 Disinfectants and Disinfection Byproducts Rule. The purpose was to improve public health protection by reducing exposure to disinfection byproducts. This rule, the first of a set that would reduce the allowable levels of byproducts in drinking water, established seven new standards and a treatment technique of enhanced coagulation or enhanced softening to further reduce byproduct exposure. The rule was designed to limit capital investments and avoid major shifts in disinfection technologies until additional information was available on the occurrence and health effects of byproducts. Also, this rule eliminated the long standing exemption from health standards for systems serving less than 10,000 people. The Stage 2 Disinfection Byproducts Rule, published January 2006, supplements existing rules by requiring water systems to meet byproduct standards at each monitoring site in the distribution system. It also contains a risk-targeting approach to better identify monitoring sites where customers are exposed to high levels of byproducts. This regulation applies to all systems that add a disinfectant other than UV[43].

[41] Johnson et al, 1981.
[42] Pourmoghaddas et al, 1993, Krasnser, 1989; USEPA, 2002.
[43] USEPA, 2006.

Glossary

BMPs — **Best Management Practices** - *Methods that have been determined by the U.S. Environmental Protection Agency to be the most effective and practical means of preventing or reducing pollution with a goal of increasing efficiency. The USEPA works with partners in industry and the academic community to establish and publish BMPs for different industries.*

BOD — **Biochemical or Biological Oxygen Demand** - *The amount of oxygen required by aerobic biological processes to break down organic matter in water. BOD is a measure of the "level of pollution" of biodegradeable waste on dissolved oxygen in water.*

CAWS — **Chicago Area Waterways System** – *A waterway system consisting of 78 miles of rivers, streams and Lake Calumet, located within Cook and surrounding counties. It's main arteries include the North Shore Channel, North Branch of the Chicago River, Chicago River, South Branch of the Chicago River, South Fork of the South Branch, Calumet River, Grand Calumet River, Little Calumet River, Lake Calumet, Cal-Sag Channel & the Chicago Sanitary & Ship Canal (CSSC).*

CFU — **Colony Forming Unit** - *A bacterial colony presumed to have originated from a single bacterium present in the sample. Commonly used as a measurement for indicator organisms such as E. coli and fecal coliform.*

CSO — **Combined Sewer Overflow** – *CSOs occur in sewage systems that have combined sewage and storm pipes. When heavy rains overwhelm the sewage system's capacity to transport, store and/or treat the wastewater and stormwater, a pipe discharges the "overflow" into the receiving water body so that toilets, sinks, etc. do not backflow with raw sewage. CSOs may consist of raw sanitary waste and storm water, as well as untreated industrial wastes, floating debris, and other contaminants. CSOs usually contain high concentrations of disease-causing pathogens, and 1.2 trillion gallons of CSOs are dumped into the environment each year, posing major health concerns.*

CSSC — **Chicago Sanitary & Ship Canal** – *The CSSC, as part of the Chicago Area Waterways System, was artificially modified and created to transport wastes away from Lake Michigan, and was completed in 1900.*

CTE **Consoer Townsend Envirodyne Engineers, Inc.** – *The international engineer firm hired by MWRD to conduct the costs and other studies related to disinfection at MWRD's three largest plants.*

CWA **Clean Water Act** – *The Clean Water Act, passed in 1972, has a goal of "restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." The Act is primarily designed to manage and greatly reduce pollutant discharges into our nation's waterways by a variety of regulatory and non-regulatory means, including financing of municipal wastewater treatment facilities. One of the main goals of the CWA is to make our waterways "fishable/swimmable." State decisions regarding water quality are made with federal oversight from USEPA, as part of the Clean Water Act.*

DESIGNATED USE *A designated use is the legally applicable use specified in the adopted water quality standards for a waterbody or segment of a waterbody. A designated use is a use that, presently, may or may not be met or "attained." In effect, the designated use is the goal set for the waterbody. All pollution control activities associated with a waterbody (such as the conditions established in NPDES permits) are designed to attain the designated uses. Changing a designated use also results in a change in the applicable water quality criteria associated with that new designated use. USEPA requires that States and Tribes specify appropriate uses for water bodies to be achieved and protect for public water supply, fish and shellfish, wildlife, as well as for recreational, agricultural, industrial and navigational purposes. "Where water quality standards specify designated uses less than those which are presently being attained, the State or Tribe is required to revise its standards to reflect the uses actually being attained."*

DO **Dissolved Oxygen** - *Oxygen dissolved in water and readily available for fish and other aquatic organisms.*

DWSD **Detroit Water & Sewerage Department** – *Detroit's WWTP is the largest single site wastewater treatment facility in the U.S. In operation as of February 1940, DWSD today serves virtually all of Wayne, Oakland and Macomb counties. With a daily flow rate nearly identical to MWRD's Stickney plant, DWSD disinfects it effluent.*

E. coli **Escherichia Coli** - *A subgroup of fecal coliform bacteria that is present in the intestinal tracts and feces of warm-blooded animals (including* *humans). It is used as an indicator of the potential presence of pathogens. Measured in number of bacteria per 100 milliliters of water.*

EXISTING USE *Under the CWA, an existing use refers to any uses the waterbody is capable of supporting at present, as well as any use which the waterbody has already attained since November 28, 1975. Even if the waterbody is currently not supporting a use attained since November 28, 1975, for purposes of the CWA, it is still an "existing use."*

FECAL COLIFORM *A group of bacteria found in the intestinal tract of humans and animals, and also found in soil, that are commonly used as indicators of the presence of pathogenic organisms and other disease-causing bacteria, such as those that cause typhoid, dysentery, hepatitis A and cholera. Measured in number of bacteria per 100 milliliters of water.*

FOCR **Friends of the Chicago River** – *Formed in 1979, FOCR "has been working to improve the health of the Chicago River for the benefit of people and wildlife and by doing so, has laid the foundation for the river to be a beautiful, continuous, easily accessible corridor of open space in Metropolitan Chicago."*

HAAs **Haloacetic Acids** - *Are a group of carcinogenic chemicals that may form as byproducts of disinfection (e.g. chlorination) when they react with organic and inorganic matter in treated water. HAA and THM limits are regulated by USEPA.*

IEPA **Illinois Environmental Protection Agency** - *On July 1, 1970, Illinois passed its Environmental Protection Act (the first comprehensive measure of its kind in the U.S.), thus creating a triumvirate of Illinois regulatory bodies which today includes the: 1) Illinois Pollution Control Board, with oversight over regulations; 2) Department of Natural Resources, with oversight over research; and 3) Illinois Environmental Protection Agency, which functions as the enforcement arm. IEPA's mission "is to safeguard environmental quality, consistent with the social and economic needs of the State, so as to protect health, welfare, property and the quality of life." As such, IEPA makes recommendations to IPCB on bacteria limits in CAWS. This is done in concert, as are all of IEPA's actions, with applicable USEPA federal regulations.*

IPCB **Illinois Pollution Control Board** – *Created in 1970 under the Environmental Protection Act, the IPCB is an independent agency responsible for adopting environmental regulations and making decisions on contested cases in Illinois. IPCB makes decisions regarding our air, land and water, and can limit the level of pollutants that we allow into our* *environment. As such, IPCB will review and decide on IEPA's proposed bacteria standards for the Chicago Area Waterway System.*

LTCP **Long-term Control Plan** - *USEPA's National Combined Sewer Overflow Control Policy of 1994 requires for the control of CSOs as part of a two-step process. The first step was for all CSO communities to implement the Nine Minimum Controls by 1997. The second part of the policy is for CSO communities to develop long-term control plans to further control CSOs that need to come into compliance with the CWA. In the case of MWRD, TARP is considered by IEPA and USEPA to be adequate to meet the objectives of the National CSO Control Policy, and therefore needs to be completed by an enforceable date.*

MGD **Million Gallons per Day** – *Common measurement of discharges of WWTPs.*

mL **Milliliters** – *Metric volume unit; 1,000 mL = one Liter; indicator organisms commonly measured in 100 mL (0.1 Liter) of water.*

MMSD **Milwaukee Metropolitan Sewerage District** - *As a regional government agency, MMSD provides wastewater treatment for approximately 1.1 million people over a 420 square mile service area, inclusive of 28 communities in the greater Milwaukee area.*

MWRD **Metropolitan Water Reclamation District** – *As a separate government agency that is not part of the City of Chicago nor part of the Cook County government, MWRD operates and maintains seven wastewater treatment plants in the greater metropolitan Chicago area under the oversight of nine elected commissioners. "Over the years, the responsibilities of the Metropolitan Reclamation District have expanded along with the increased awareness of the importance of clean water and environmental protection." Three of MWRD's plants are among the largest WWTPs in the world and discharge into the Chicago Area Waterways System, but do not currently disinfect their wastewater effluent.*

NMC **Nine Minimum Controls** - *USEPA's National Combined Sewer Overflow Control Policy of 1994 requires for the control of CSOs as part of a two-step process. First, by 1997, all CSO communities were to have accurately characterized their sewer system and demonstrated implementation of the NMCs (the second step is to implement a long-term control plan). The NMCs are designed to reduce CSOs through better operation and maintenance practices coupled with better monitoring of CSO discharges. The NMCs can reduce CSOs and their effects on the receiving water quality. Additionally, they do not require significant* *engineering studies or major construction, and can be implemented in a relatively short period of time.*

NPDES **National Pollutant Discharge Elimination System** – *The passage of the CWA in 1972 also established the NPDES. Under USEPA oversight, the system was designed to "eliminate polluting materials from municipal and industrial discharges to the nation's waterways." Its mechanism is by regulating point source pollution and placing limits in discharge permits.*

O&M **Operations & Maintenance** – *Standard practices and upkeep of a wastewater treatment facility (for instance), often used in relating the cost associated with those mechanisms.*

PATHOGENS *Microorganisms that can cause disease in other organisms (i.e. humans, animals and plants). They may be bacteria, viruses, parasites or fungi, and are found in sewage or in runoff from livestock for example.*

SAC **Stakeholder Advisory Committee** - *As part of the Use Attainability Analysis study, IEPA forms and holds SAC meetings to bring together all parties who use or have an opinion on the proposed uses of the waterways. This is done in order to make the process as inclusive and informative as possible.*

SAIC **Science Applications International Corporation** – *An independent research and engineering firm that has consulted and worked with a variety of clients (including the U.S. government) on a variety of issues. SAIC performed an independent analysis of CTE's disinfection cost estimates for MWRD's three largest plants.*

SDC **Sanitary District of Chicago** - *In 1889, the Sanitary District of Chicago, which later became the MWRD, was created to protect drinking water supplies and improve the Chicago River's deplorable condition. The SDC reversed the flow of the river during the first decade of 1900 so that sewage would move away from Lake Michigan, thereby protecting the region's drinking water supply.*

SDD **Sanitary District of Decatur** - *The Sanitary District of Decatur was formed in 1917, and serves the wastewater and industrial treatment needs of the City of Decatur, as well as other villages.*

TARP **Tunnel & Reservoir Plan ("Deep Tunnel")** - *Began in the 1970s, TARP is the largest public works project ever implemented in the Chicago area, with an estimated final cost of $3.4 billion. It consists of reservoirs and tunnels about 240-350 feet below ground, stretching 109 miles throughout*

Cook County. TARP conveys wastewater to storage reservoirs until it can be treated at MWRD's WWTPs and discharged during dry weather. Once fully completed, TARP will enable MWRD to store and then treat up to approximately 17.2 billion gallons of wastewater before discharging it into CAWS, greatly reducing CSOs and the potential for a river to lake reversal.

THMs **Trihalomethanes** - *Are a group of carcinogenic chemicals that may form as byproducts of disinfection (e.g. chlorination) when they react with organic and inorganic matter in treated water. HAA and THM limits are regulated by USEPA.*

UAA **Use Attainability Analysis** – *Mandated from USEPA, a UAA "is a structured scientific assessment of the factors affecting the attainment of uses specified in Section 101(a)(2) of the Clean Water Act (the so called 'fishable/swimmable' uses)." This analysis "must be conducted for any water body with designated uses that do not include the 'fishable/swimmable' goal uses," and the water bodies must be reexamined every three years to determine if standards need to be revised, to either downgrade or upgrade the designated uses. "If new information indicates that 'fishable/swimmable' uses can be attained, such uses must be designated." The factors that may be used in the analyses include physical, chemical, biological and economic use criteria.*

USEPA **United States Environmental Protection Agency** - *The USEPA was created in 1970 as an independent regulatory agency responsible for the "implementation of federal laws designed to protect the environment." USEPA programs include: establishing protective environmental standards and enforcing those standards, carrying out research on pollution proliferation, effects and mitigation, and assisting others in eliminating pollution from our environment though technical capabilities, grants, and so forth.*

UV **Ultraviolet (disinfection)** – *UV is the most popular and rapidly growing alternative to chlorination/de-chlorination with perhaps as many as 2,000 plants (10 percent) in North America using this method. UV can be very effective at destroying pathogens and inactivating viruses by damaging their genetic structure. It also is generally more effective than chlorination at inactivating viruses, spores and cysts. However, the overall effectiveness of UV also depends on the turbidity and other related factors of the wastewater effluent. There are no known significant toxic byproducts with UV disinfection. UV is generated onsite and is relatively safe to operate.*

VDH **Virginia Department of Health** – *With a central office in Richmond that links to 35 local health districts, VDH promotes public health through optimization, disease prevention and environmental protection, and as such, has extensive programs relating to a variety of public health concerns, including wastewater treatment.*

WWTP **Wastewater Treatment Plant** – *WWTPs are facilities designed to remove pollutants from wastewater. The three main components of treatment usually include the following (descriptions and processes have been significantly simplified here): 1) primary, in which easily separable matter is filtered out using techniques such as screening and sedimentation; 2) secondary, in which sludge is usually activated through dissolved oxygen and aeration to promote growth of biological microorganisms which process and further break down material; and 3) tertiary, in which further processes designed to enhance the water quality of the effluent before final discharge to the environment take place, including filtration, nitrogen and phosphorus removal, and disinfection.*

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