

National Association of Clean Water Agencies Summer Conference

Water Quality Committee Meeting,

(July 20, 2011 - Chicago, IL)

Presentation on Water Quality Issues in Chicago Area Waterway System

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Use Attainability Analysis (UAA) of the Chicago Area Waterway System (CAWS)

CAWS is 78 mile long system of man made canals or highly modified reaches of Chicago and Calumet Rivers.

Water level maintained for navigation and flows are controlled by system of locks, dams, controlling works at Lake Michigan and Lockport.

UAA Commenced in 2002

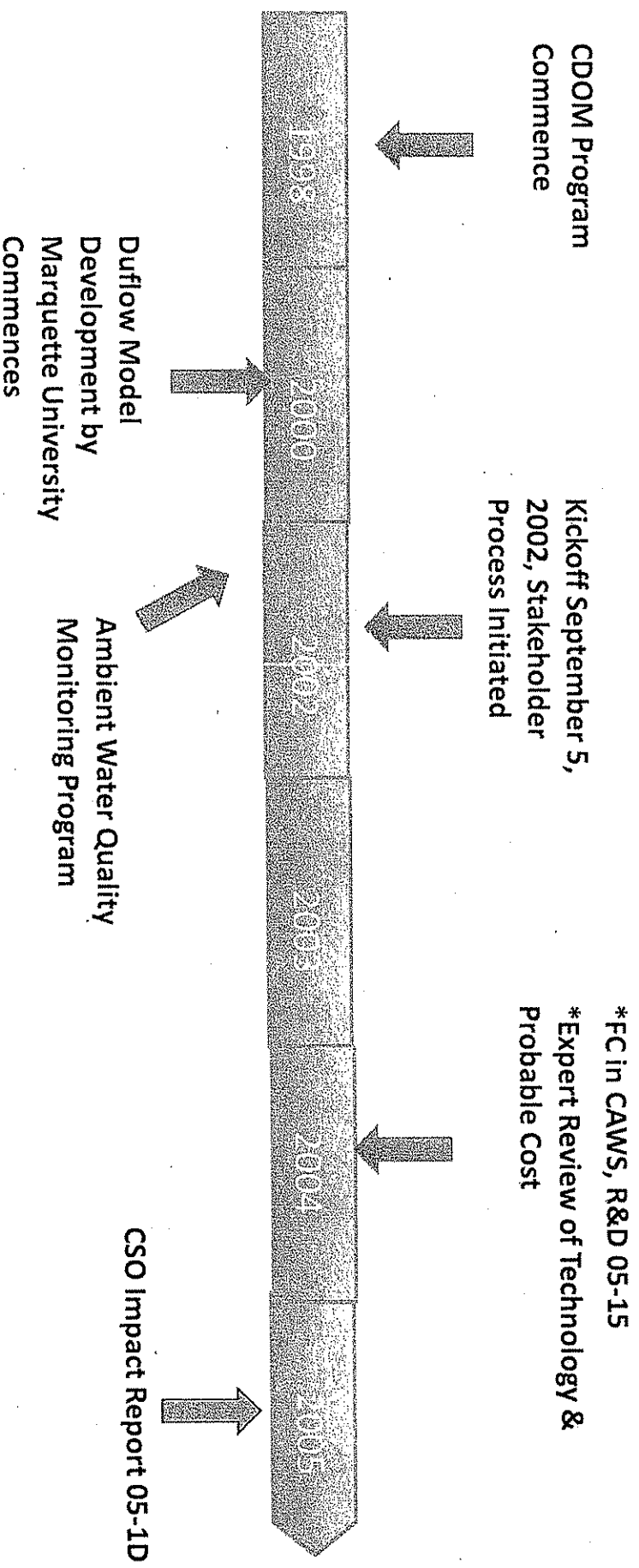
CAWS UAA included 20 Stakeholder meetings, 12 public meetings

IEPA UAA proposal submitted Oct 2007 to Illinois Pollution Control Board (IPCB) docket R08-9

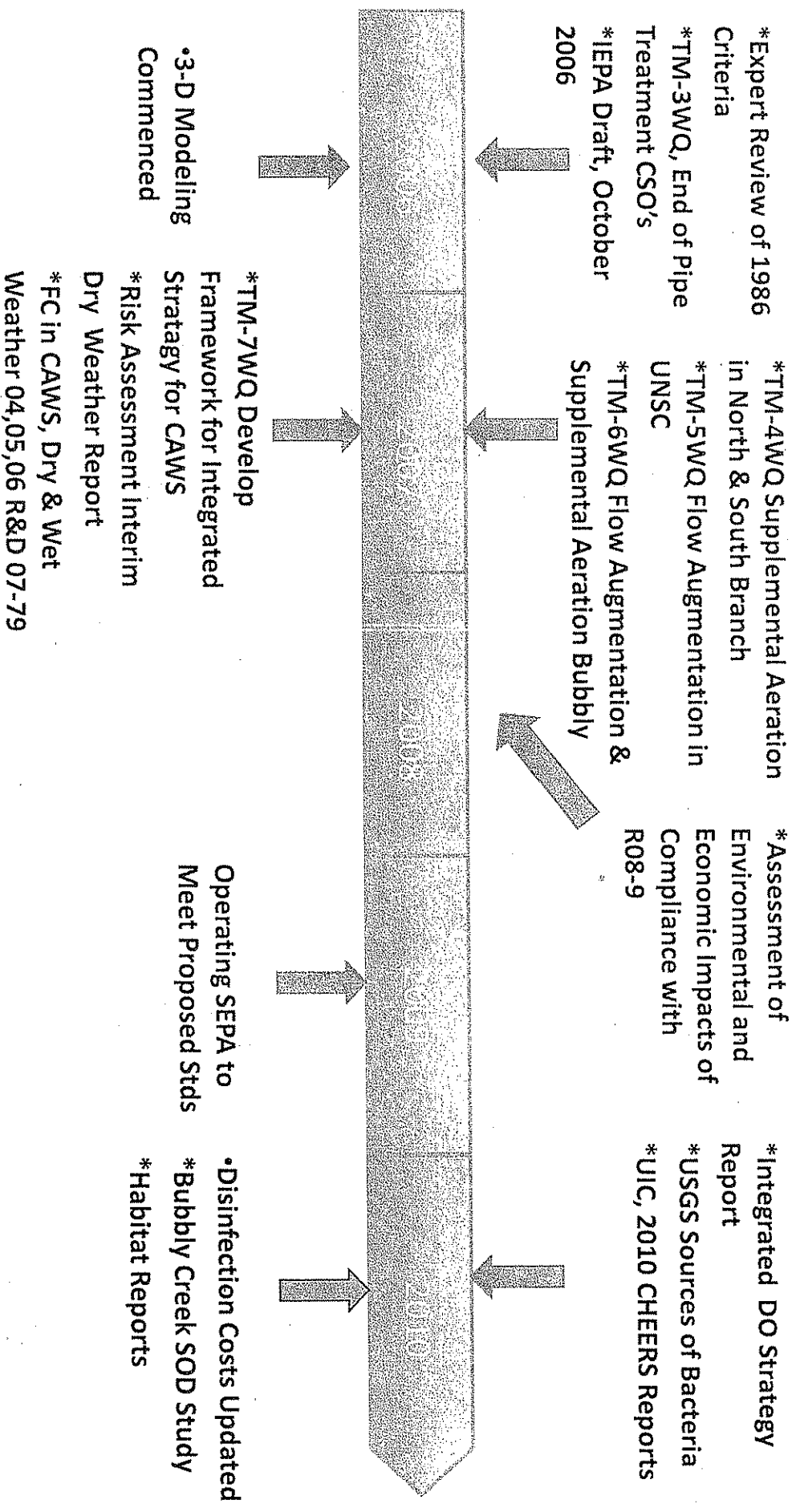
Hearing commence January 2008 (51 days of hearings to date)

IPCB splits R08-9 into Subdockets A-D in March 2010

District Studies that Informed the Process



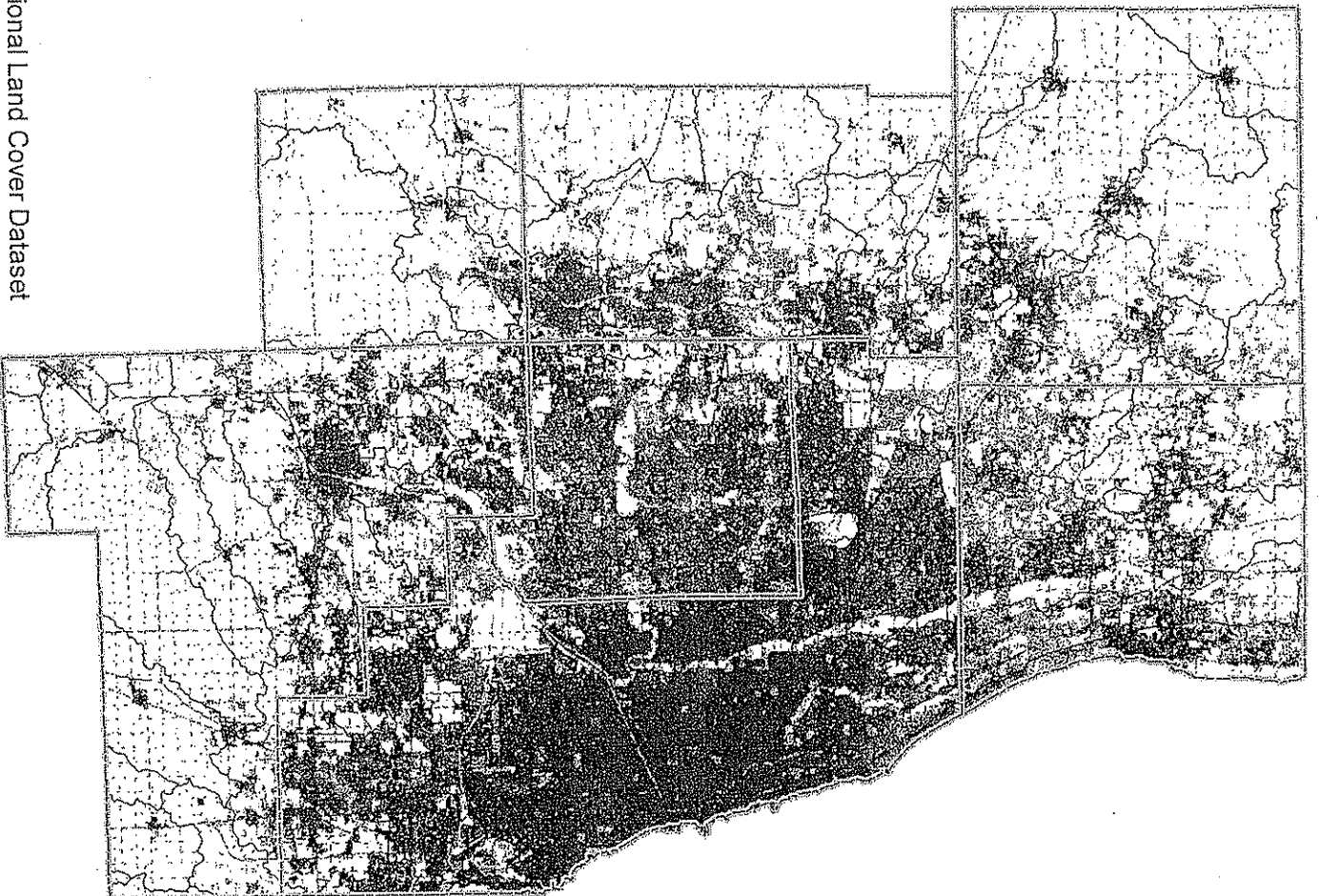
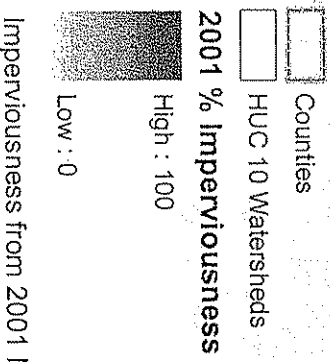
District Studies that Informed the Process



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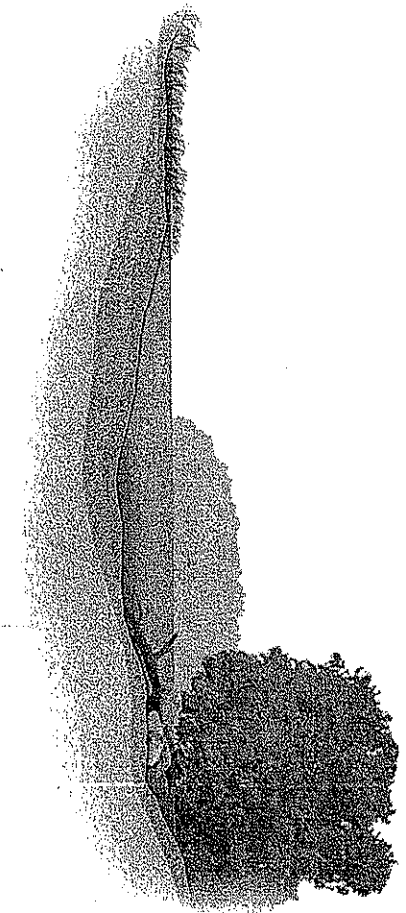
This map illustrates the Chicago Area Waterway System, specifically the Lower Des Plaines River. The river flows from the top left towards the bottom right, where it meets Lake Michigan. Key features include:

- Waterways:** The Des Plaines River, Rock Side VWP, and various smaller channels and locks.
- Roads:** Major roads such as I-55, Route 83 (Cass), Route 83 (Cass), Willow Springs Rd., and various local streets like 16th St. (Lockport), 130th St., and 150th St.
- Landmarks:** The Lockport Lock & Dam, Brandon Road Lock & Dam, and the Chicago Harbor.
- Other Features:** The map shows the city of Chicago, the city of Lockport, and the city of Joliet. It also includes the names of various streets and highways, such as 16th St. (Lockport), 130th St., 150th St., 160th St., 170th St., 180th St., 190th St., 200th St., 210th St., 220th St., 230th St., 240th St., 250th St., 260th St., 270th St., 280th St., 290th St., 300th St., 310th St., 320th St., 330th St., 340th St., 350th St., 360th St., 370th St., 380th St., 390th St., 400th St., 410th St., 420th St., 430th St., 440th St., 450th St., 460th St., 470th St., 480th St., 490th St., 500th St., 510th St., 520th St., 530th St., 540th St., 550th St., 560th St., 570th St., 580th St., 590th St., 600th St., 610th St., 620th St., 630th St., 640th St., 650th St., 660th St., 670th St., 680th St., 690th St., 700th St., 710th St., 720th St., 730th St., 740th St., 750th St., 760th St., 770th St., 780th St., 790th St., 800th St., 810th St., 820th St., 830th St., 840th St., 850th St., 860th St., 870th St., 880th St., 890th St., 900th St., 910th St., 920th St., 930th St., 940th St., 950th St., 960th St., 970th St., 980th St., 990th St., 1000th St.



Imperviousness from 2001 National Land Cover Dataset

Natural River

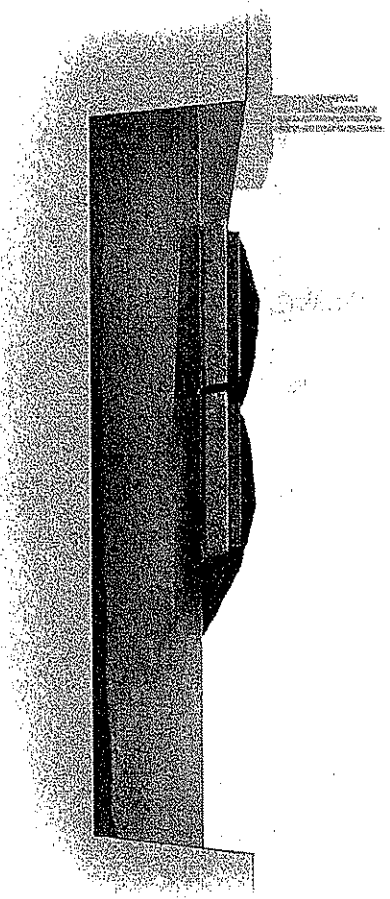


Storm water filtered by the flood plain before replenishing the river, resulting in fewer contaminants and less bank erosion.

Differing depths, widths, flow velocities, and bends. This variety supports diverse biotic assemblage. Shallow areas allow light to penetrate for aquatic plant growth, which provides shelter and feeding area for fish.

Variable sediment particles support diverse aquatic invertebrates. Coarse sediments more stable.

Chicago Area Waterway System

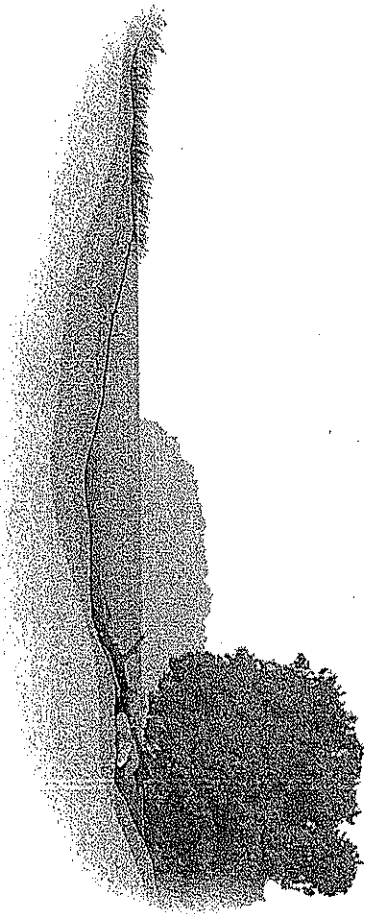


Little or no vegetated riparian zone. Combined and storm sewers convey and discharge storm water directly to river through outfalls.

Channelized basins have few shallow areas, relatively constant width and low flow velocity, with few bends. Aquatic plant growth and fish shelter minimal. Lack of riffles and pools limit more sensitive biota.

Homogenous fine sediment deposits dominate. More likely enriched with contaminants.

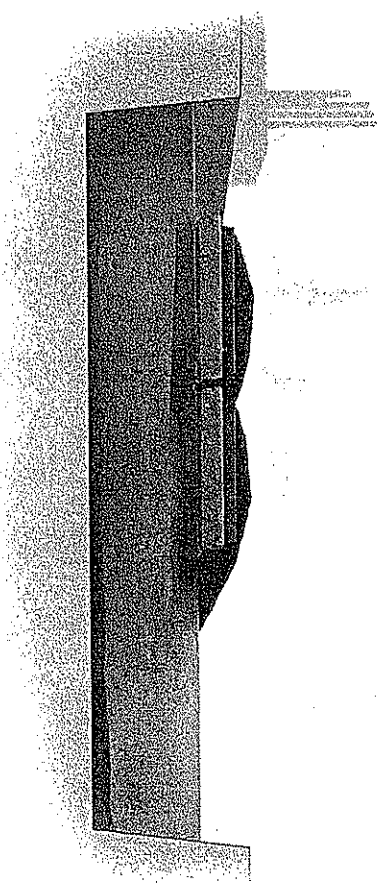
Natural River



Canopy cover provides shade for aquatic life which limits algae growth. Also provides in-stream habitat with root systems and fallen logs.

Natural fluctuations in flow velocity and water level. Floodplains periodically inundated with river water.

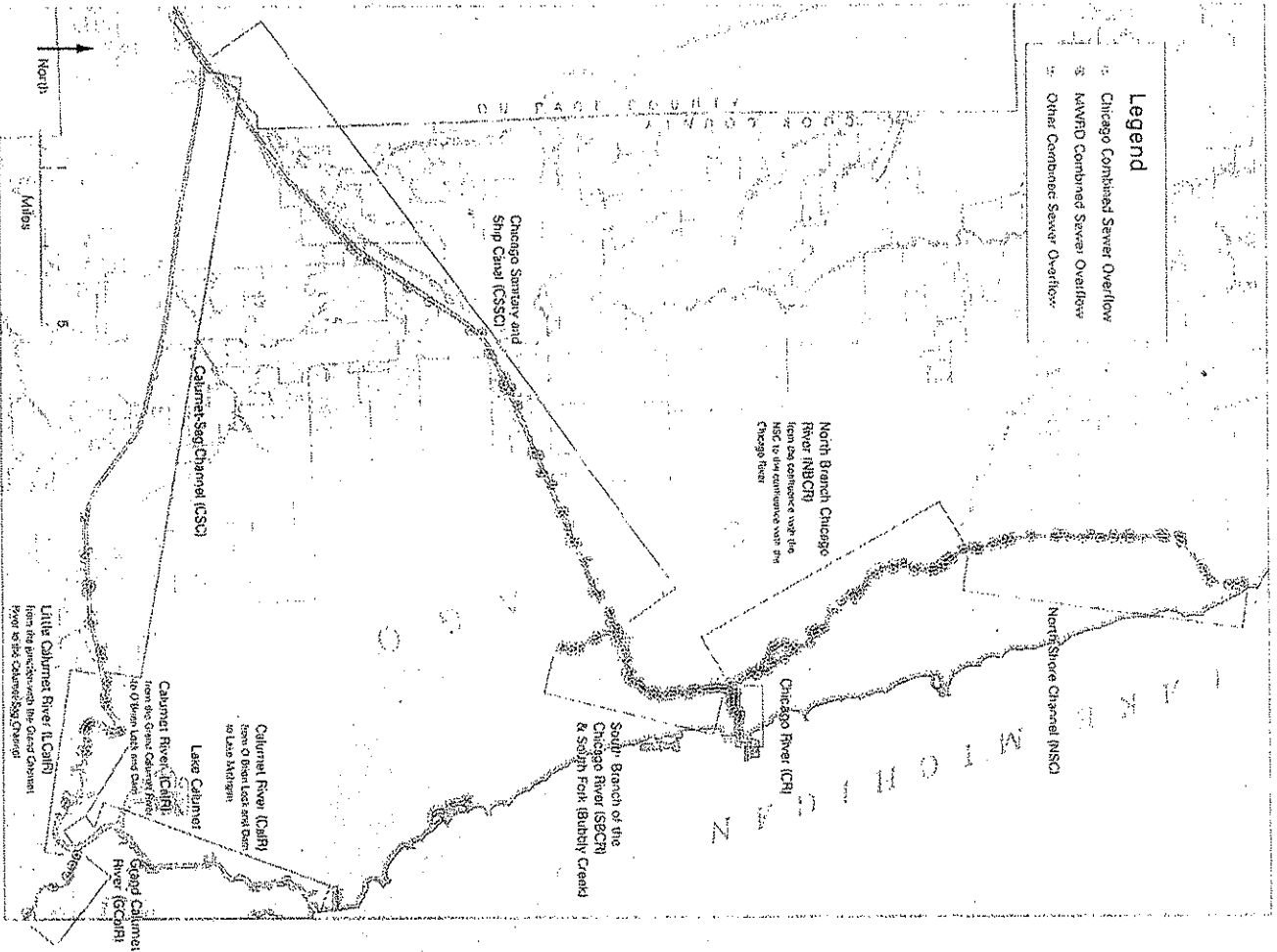
Chicago Area Waterway System



Receives little shade from trees relative to the overall channel width, especially in urban or industrial land-use areas. Fewer fallen logs and roots.

Hydrologic control structures adjust water levels to prevent flooding. Very low flow most of the time with periods of high flow during these water level adjustments.

Chicago Area Waterway System Combined Sewer Overflows



CAWS Habitat Evaluation & Improvement Study

Assess physical habitat characteristics

Develop Habitat index specific to the CAWS

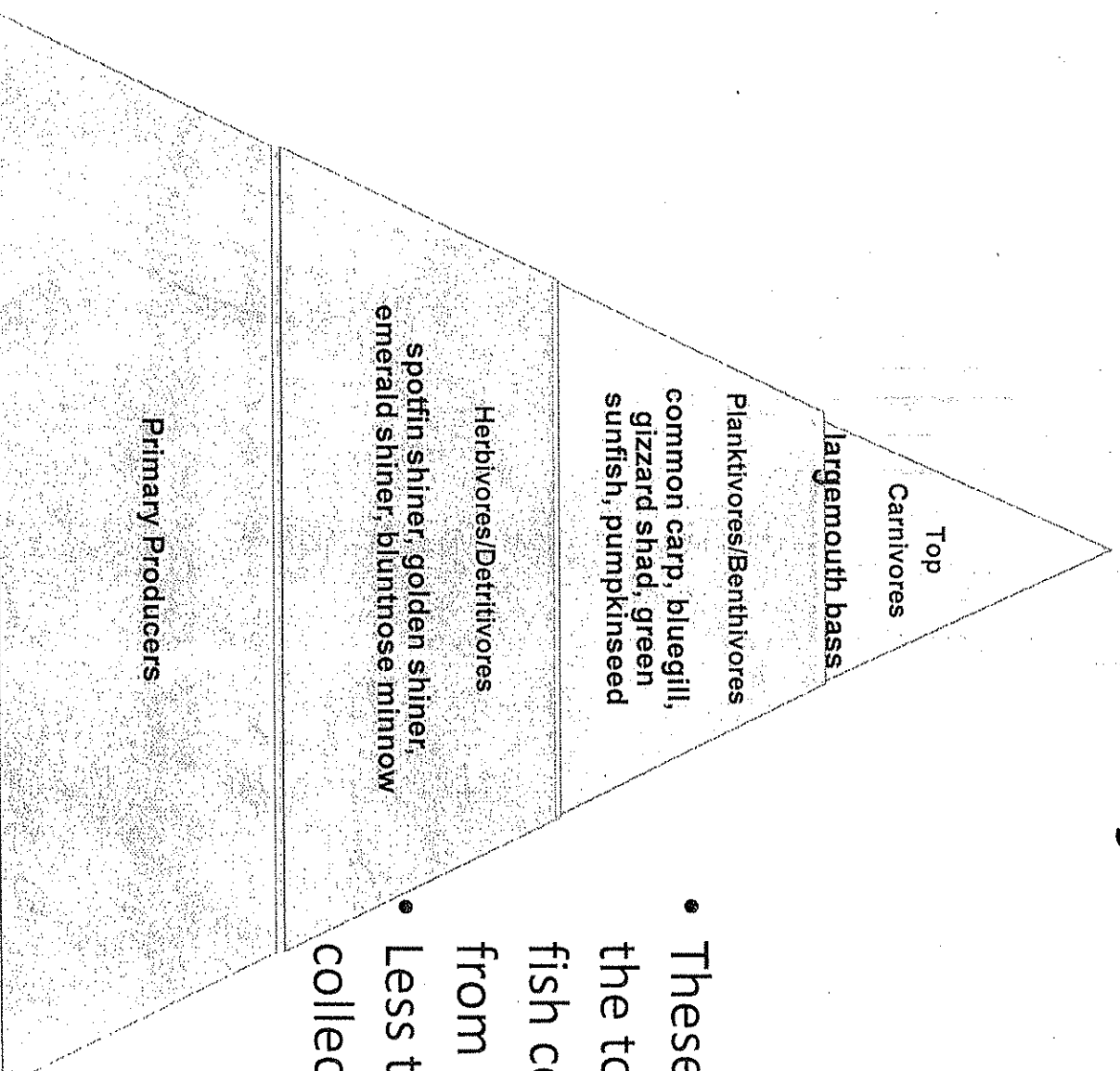
Habitat Index & fish data used to assess relative importance of physical habitat compared to other WQ factors

Assess if the feasible habitat improvements could lead to improvements in the fish

Findings of Habitat Evaluation & Improvement Study Relative to Dissolved Oxygen

- What is the aquatic life potential of the CAWS and what is limiting further “improvement” of existing fish community?
- Study found habitat factors explain most variation in fish
- DO less important factor than physical habitat (changing DO levels will not positively impact aquatic life)
- Making feasible changes in CAWS habitat is unlikely to improve fish community significantly
- Likely that current fish assemblage represents aquatic life potential of CAWS due to habitat limitations—more stringent DO standards will not make much difference in aquatic community
- Goal to have sustainable populations of game fish species that can tolerate permanent habitat features in the CAWS, e.g. Largemouth bass and other sunfish

The current fish community consists of tolerant or moderately tolerant species



- These fish represent 92% of the total number (25,493) of fish collected in the CAWS from 2001 to 2008.
- Less than 2% of the total fish collected were intolerant.

Comparison of DO Criteria Proposals

Category	Minimum	7-Day Mean of Minima	Minimum
	(mg/L)	(mg/L)	(mg/L)
A or 1	5.0 (Mar-Jul) 3.5 (Aug-Feb)	4.0 (Aug-Feb)	4.0
B or 2	3.5	4.0	3.5
3	-	-	Narrative

District proposal includes a Wet Weather Limited Aquatic Life Use standard that supersedes the criteria above during some defined wet weather impacted periods

Basis for Wet-Weather Limited Use Designation

DO levels are significantly reduced for up to a week in certain reaches

Existing biotic community tolerates these conditions (no fish kills except for extremely rare occurrences)

Criteria cannot be met during and for periods after wet weather events

District is proposing a trigger be established to determine when wet weather limited use applies

Limited use would apply when: (1) precipitation is more than 0.25 inch; (2) depression of DO below criteria occur during the wet weather event; and (3) DO was above criteria before the event

The Wet Weather Limited Use (WWLU) Trigger

Wet Weather Limited Use Trigger	Wet Weather Limited Use Trigger
0.25 to 0.49	2 Days
0.5 to 1.0	4 Days
> 1.0	6 Days

Estimated Cost of Technologies to Meet IEPA Versus District Proposed DO Standards for the CAWS

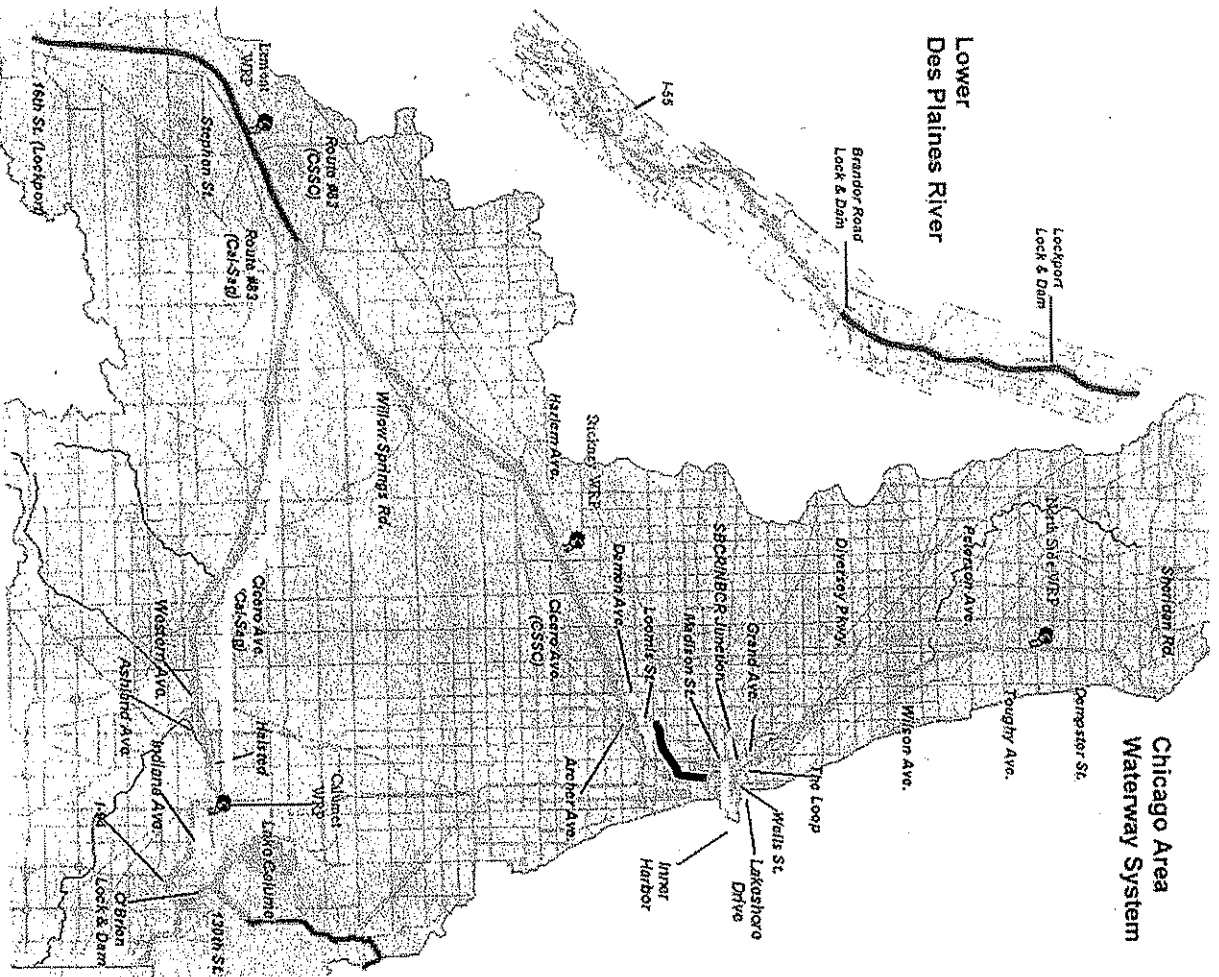
Number Supplemental Aeration Stations	28	2
Number Flow Augmentation Stations	3	1
Total Capital Cost	\$594,300,000	\$54,300,000
Annual O&M Cost	\$3,900,000	\$530,000
Total Present Worth Cost	\$669,900,000	\$64,600,000

Proposed Recreational Uses

Incidental Contact
is where the probability of
ingestion of water is unlikely

Non-Contact
is where human contact with
water is unlikely

Non-Recreational
is where no recreational
boating is likely



Studies to Inform UAA Rulemaking – Effluent Limitations to Protect Recreational Uses

- Expert Review USEPA's Water Quality Criteria for Bacteria (1986): Application to Secondary Contact Recreation
 - EPA 1986 criteria not suitable for effluent dominated waters
 - Recommendation: perform a risk assessment, epi study
- Risk Assessment – 2005, 2006
- Epidemiology Study (CHEERS) 2007 - 2009

The Chicago waterway microbial risk assessment study shows no elevated health risk to boaters, fishermen and paddlers

Results

WHAT IS THE CURRENT RISK OF ILLNESS?

Total Expected Illnesses per 1,000 Exposures Using Estimates of Pathogen Concentrations^a

WITH NO DISINFECTION

Exposure Input ^b	Waterway	
	North Side	Stickney
Dry Weather	0.36	1.28
Wet Weather	2.78	2.34
Combined	1.53	1.74
Weather Samples		0.20

WITH DISINFECTION

	Waterway		
	North Side	Stickney	Calumet
No Disinfection	1.53	1.74	0.20
UV Irradiation	1.32	1.48	0.17
Ozone	1.45	1.65	0.19
Chlorination	1.43	1.63	0.19

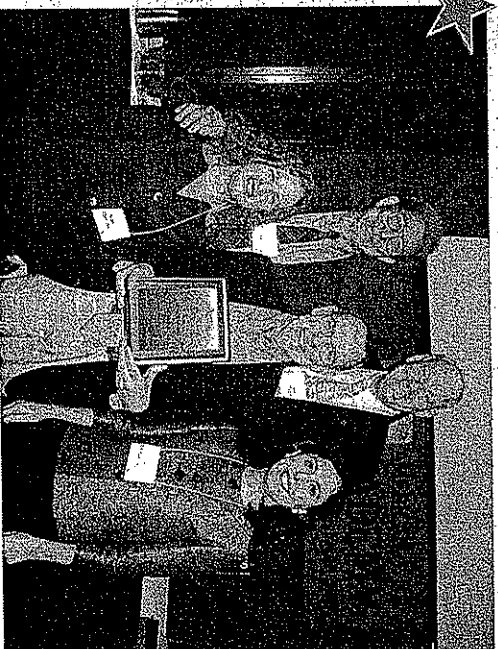
^a Includes all primary gastrointestinal illnesses from estimated pathogenic *E. coli*, *Salmonella*, enteric viruses, adenoviruses, *Calicivirus*, *Giardia*, and *Cryptosporidium* expected from the waterway exposures.

^b CAWS concentration inputs for the simulations were randomly selected (bootstrap sampled) from the sample data sets

Conclusions

The microbial health risks associated with non-swimming recreational practices on the CAWS are below the risk threshold that EPA applies to criteria for swimming.

Disinfection has virtually no effect on overall risk reduction.



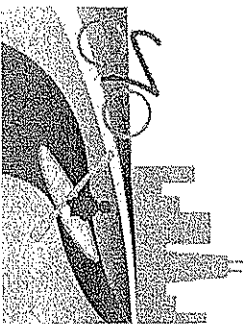
★ Recipient of 2010 American Academy of Environmental Engineers Research Honor Award for the Excellence in Environmental Engineering & public health/environmental protection

CHICAGO WATERWAY EPIDEMIOLOGY RESEARCH

The Chicago Health Environmental Exposure and Recreation Study (CHEERS) was conducted by the University of Illinois – Chicago School of Public Health.

CHEERS is the first US Epidemiology study for fishing, paddling and motor boating conducted on the CAWS secondary contact water. Modeled after US EPA's National Epidemiological and Environmental Assessment of Recreational Water (NEEAR) study and the CHEERS was independently peer reviewed by selected USEPA, Academia, consultants, Center for Disease Control (CDC) personnel.

Study recruited 11,297 participants including recreators on the CAWS and General Use waters (such as Fox and Des Plaines Rivers, forest preserve lakes, Lake Michigan) over three recreation seasons from 2007 through 2009.



CHEERS
WATER CHICAGO SPORTS

Illness Cases Compared with Non-Water Recreation (UNX) as the Reference Group

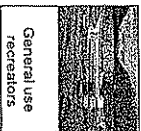
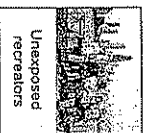
ILLNESS PER 1,000	Gastrointestinal	Eye Symptoms	Respiratory	Skin	Ear
CAWS	12.5	15.5*	-1.6	-4.7	2.4
GUW	13.4	5.4	1.7	-11.1	1.6

**CAWS mild eye symptoms - comparable to GUW with hand washing adjusted analysis*

➤ Study found no difference in the disease risk to recreators between CAWS, where effluents are not disinfected and recreators in GUW where effluents are disinfected or where no effluent is discharged

➤ There was no relationship between high level of bacteria and occurrence of disease among people who recreated on the CAWS.

➤ The disease causing bacteria which are responsible for symptoms like vomiting or diarrhea among people who use the CAWS for recreation were not detected.



GUW: Lake Michigan, several small inland lakes (Busse, Crystal, Skokie lagoons, Tampier, and others), and area rivers (Des Plaines, Fox, DuPage).

UNX: outdoor recreational activities that do not involve water (logging, walking, cycling, playing sports). These individuals are recruited at locations and times that coincide with recruiting CAWS and GUW participants.

USEPA Intervention into Rulemaking Process and Current Status

IPCB was preparing to issue second notice of rulemaking on Recreational Uses and first notice of rulemaking on Effluent Limitations when USEPA conveyed letter to IEPA on May 11, 2011

Acting Assistant Administrator conveys intent to exercise discretionary authority to impose primary contact use designations on most of the CAWS and directs IEPA to establish protective water quality criteria

No analysis is provided of attainability of the new use designation

IPCB adopts primary contact use designation as proposed by USEPA in second notice of rulemaking on June 2, 2011

IPCB proposes imposition of effluent limitations requiring disinfection on WRPs discharging to reaches receiving new primary contact use designation in first notice of rulemaking on July 7, 2011

IPCB did not impose effluent limitations on WRPs discharging to reaches designated for incidental contact recreation (paddling, fishing, etc) and requested comment on establishing water quality criteria for all uses.

Status of Nutrient Standards in Illinois

January 21, 2011 letter from USEPA Region 5 to IEPA

- IEPA to immediately include nutrient limits in NPDES permits based on the current narrative WQ standard
- Section 302.203 Offensive Conditions – “Waters of the State shall be free from sludge or bottom deposits, floating debris, visible oil, odor, plant or algal growth, color or turbidity of other than natural origin.”

Applies to dischargers upstream of stream segments with impairments potentially caused by aquatic algae or plants

Phosphorus “impairment” currently determined using 85th percentile threshold of state ambient WQ data – 0.61 mg/L P

USEPA provided a list of dischargers with pending permits for which they wanted IEPA to add nutrient effluent limits, including MWRDGC. Permits for new and expanding P dischargers have to be submitted for review by Region 5 after June 30, 2011.

Status of Nutrient Standards in Illinois

Issues with using the current narrative standard to issue effluent permit limits

- What is “unnatural” plant or algae growth?
- How to define “cause or contribute”
- What would the effluent limit be?

IEPA wants to revise existing narrative standards to clarify these definitions

IEPA plans to continue working on numeric water quality nutrient criteria in addition to utilizing the narrative criteria

- USEPA still trying to utilize various statistical methods with Illinois WQ data to justify specific numeric limits

Current IEPA/stakeholder focus in P, but USEPA is also concerned with Nitrogen, and includes both in their January letter to IEPA

Status of Nutrient Standards in Illinois

Recent stakeholder meetings with IEPA on March 21 and May 16

IEPA drafted regulatory language for a revised nutrient narrative standard

- “Cultural Eutrophication” will be determined by DO below applicable WQ standard and exceeding 100% saturation within 24 hour period, and there is an aquatic life use impairment.

Draft technology based P effluent standards for new or expanding WRRPs with placeholders for actual limits to various size plants

- Need to define “significant contributors” to culturally eutrophied water bodies

IEPA to solicit volunteers for various workgroups to help expand language on “cultural eutrophication”, define “significant contributor”, and determine appropriate technology based P limits for dischargers

- Timeframe to complete new draft language 6 months from May 16 meeting

Status of Nutrient Standards in Illinois

*** April 29, 2011 letter to IEPA from environmental groups**

- P impairment listing criteria should be in range of 0.05 – 0.1 mg/L instead of existing 85th percentile criterion of 0.61 mg/L
- Must implement existing narrative WQ standards in NPDES permits
- Amend interim P standards to lower the technology based limits from 1 mg/l to 0.6 mg/L as monthly average and 0.3 mg/L as annual average
- Add interim N standard of 8 mg/L monthly average