

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

*REPORT NO. 12-32*

*BACTERIOLOGICAL MONITORING REPORT OF  
RIVER BACKFLOW IN 2011*

*July 2012*

**Metropolitan Water Reclamation District of Greater Chicago**  
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**BACTERIOLOGICAL MONITORING REPORT OF  
RIVER BACKFLOW IN 2011**

**Monitoring and Research Department  
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**July 2012**

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## **ACKNOWLEDGMENTS**

We recognize and appreciate the extra efforts of the Analytical Bacteriology Laboratory staff (Ms. Andrea Maka, Ms. Kathleen Jackowski, Ms. Amanda Saverson and Mr. David Roberts) in performing the rainstorm related backflow bacteria analyses. We also express our sincere appreciation to Mr. Richard Gore, Associate Environmental Microbiologist, for coordinating the late-night and weekend analyses related to the rainstorm sampling events. We especially appreciate the rainstorm sampling efforts of the Industrial Waste Division staff.

We acknowledge Ms. Bettina Gregor, Secretary, for proofreading, offering editorial comments and other assistance in formatting this report. Ms. Pamela Slaby, Principal Office Support Specialist, is acknowledged for typing and formatting the report. Mr. Justin Brown, Graphic Artist, is acknowledged for providing maps and color graphics.

## **DISCLAIMER**

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

# BACTERIOLOGICAL MONITORING REPORT OF RIVER BACKFLOW IN 2011

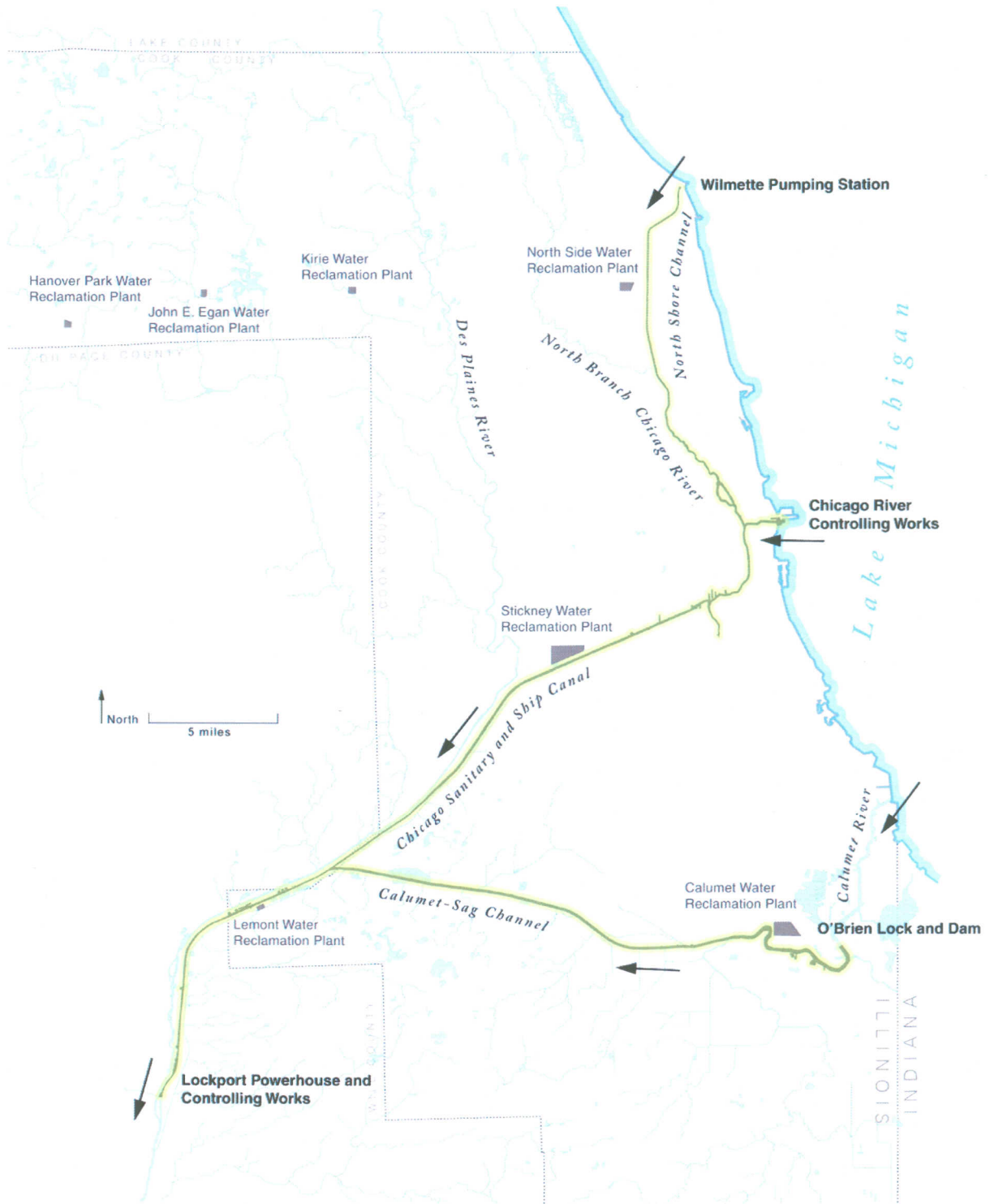
## Introduction

The Metropolitan Water Reclamation District of Greater Chicago (District) was created in 1889 to protect Lake Michigan, which is the source of the City of Chicago's drinking water supply. The District collects and treats wastewater from more than 5.25 million people and the industrial equivalent of 4.5 million people, and a combined sewer overflow (CSO) equivalent of 0.6 million people in Cook County. Treated effluent from four of the District's water reclamation plants (WRPs) is discharged to the Chicago Area Waterway System (CAWS), tributary to the Des Plaines River which flows into the Illinois River and ultimately to the Mississippi River (Figure 1). The District has continued to safeguard the lake water resource not only through capital improvements such as the Tunnel and Reservoir Plan (TARP), but also through continuing water quality monitoring programs. The District operates TARP to collect and treat CSOs and provides storm water management for all of Cook County. TARP provides additional storage for CSO during heavy precipitation that would otherwise discharge into the rivers. The ultimate storage upon completion of TARP will be 17.5 billion gallons. These efforts are crucial to protecting Lake Michigan water quality and preventing residences and business structures from flooding, while allowing the water in the CAWS to be used for recreational and commercial purposes.

Lake Michigan and the CAWS are separated by locks at the mouth of the Chicago River and the Calumet River, and by gate structures on the North Shore Channel in Wilmette, Illinois. These gates control the amount of water withdrawn from the lake, and allow release of excess river water into the lake during severe storm events. When the collection system receives excess flow which cannot be diverted into TARP, the flow to the CAWS cause water elevation rise to flood stage, and it becomes necessary to open the locks and reverse the flow of the CAWS (backflow) into the lake for controlled periods of time. The District controls the CAWS water level through its operation of lakefront structures; the Wilmette Pumping Station (WPS); the sluice gates at the Chicago River Controlling Works (CRCW); and the sluice gates at the O'Brien Lock and Dam (OLD). The number of backflows from the CAWS to Lake Michigan has been reduced with the onset of TARP. The District conducts its operations to ensure that release of excess floodwaters into the lake is always a last resort, occurring only when all the District WRPs are operating at their maximum capacity and the CAWS water levels are approaching or exceeding flood stage. During the river backflow events, the District conducts water quality monitoring to assess the impact of release of CAWS water to the lake.

This report summarizes data collected as part of river backflow to Lake Michigan as a result of two exceptionally large rainfalls in 2011.

FIGURE 1: CHICAGO AREA WATERWAY SYSTEM



## Rainfall and River Backflow

During 2011, there were two severe rainstorm events that required backflow of the North Shore Channel (NSC) and Chicago River to Lake Michigan at WPS and CRCW.

The first event was the heavy rainfall on May 29, 2011 and preceding days. Rain gauge data recorded for May 29, 2011 are shown in Table 1. Average precipitation for the north and central basin area was 1.31 and 1.12 inches. At 613 Sheridan Road in Wilmette, 1.33 inches of rain was measured.

The second event was the storm on July 23, 2011, which set a new all-time rainfall record, making it the rainiest calendar day in the history of Chicago (ABC7 Team Coverage<sup>1</sup>). About 6.86 inches fell over approximately three hours, from 1:00 a.m. to 3:00 a.m. at O'Hare airport, Chicago, Illinois. The graphic rainfall chart as shown in Figure 2 describes the record-setting rainfall. The District rain gauge data recorded for July 23, 2011 are shown in Table 2. Average precipitation for the north and central basin area was 3.12 and 2.86 inches. At 1333 Shermer Road in Glenview, 3.98 inches of rain was measured.

There was no backflow to Lake Michigan from the Calumet River. There were no CSO discharges from the 95<sup>th</sup> and/or 122<sup>nd</sup> Street Pumping Stations, and none to Lake Michigan at the OLD.

## Bacteriological Results of River Backflow

The fecal indicator bacteria *E. coli* (EC) was analyzed in compliance with the backflow to Lake Michigan related monitoring requirement. Samples collected in the NSC, Wilmette Harbor and Lake Michigan beaches were analyzed for EC using the Quanti-Tray/2000 (IDEXX Laboratories, Inc., Westbrook, ME). The river backflow to Lake Michigan sampling locations are shown in Figures 3, 4 and 5. The relevant information about the discharges and the bacteriological sampling results are described below.

**Wilmette Harbor.** Due to the significant rainfall on May 29, 2011, the Wilmette Harbor sluice gate was opened to divert storm-related river flow from the NSC into Lake Michigan. The reversal commenced at 2:33 p.m. (1433 hours) and continued for 3 hours and 27 minutes, until 6:00 p.m. (1800 hours), allowing 107 million gallons (MG) to flow from the NSC into Lake Michigan at Wilmette Harbor.

During the backflow at Wilmette Harbor, six water samples were collected from the lake side of the sluice gates at 30 minute intervals. The EC results from these samples are reported in

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<sup>1</sup> <http://abclocal.go.com/wls/story?section=news/local&id=8267771>

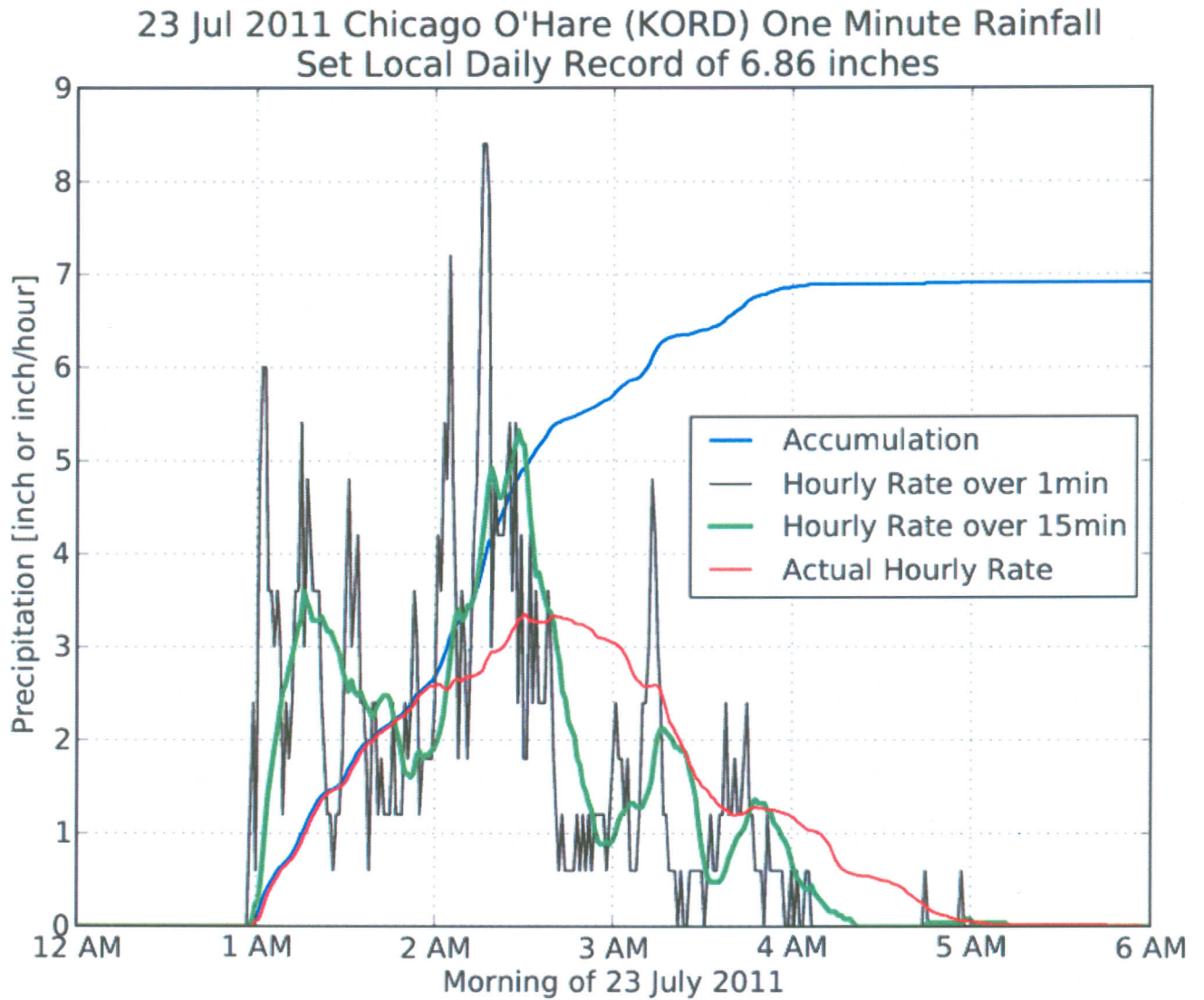
TABLE 1: DISTRICT RAIN GAUGE DATA FOR MAY 29, 2011<sup>1</sup>

Gauge Number	Precipitation <sup>1</sup> (Inches)	Gauge Name	Address
<b>North Basin</b>			
1	Out <sup>2</sup>	Glenview	1333 Shermer Road, Glenview
2	Out	North Side WRP	3500 Howard Street, Skokie
3	1.29	North Branch Pumping Station	4840 N. Francisco Ave, Chicago
4	1.33	Wilmette	613 Sheridan Road, Wilmette
<b>Average</b>	<b>1.31</b>		
<b>Central Basin</b>			
5	1.09	West Side	6001 W. Pershing Road, Cicero
6	1.31	Springfield	1747 N. Springfield Ave, Chicago
7	1.02	Racine Ave. Pumping Station	3838 S. Racine, Chicago
8	1.05	MOB	100 E. Erie Street, Chicago
<b>Average</b>	<b>1.12</b>		
<b>South Basin</b>			
9	0.50	Melvina Ditch	8644 S. Natchez Ave., Burbank
10	0.43	87 <sup>th</sup> & Western Pumping Station	87 <sup>th</sup> St. & Western Ave., Chicago
11	0.56	95 <sup>th</sup> Street Pumping Station	9525 S. Baltimore, Chicago
12	0.50	Calumet WRP	400 E. 130 <sup>th</sup> Street, Chicago
<b>Average</b>	<b>0.50</b>		

<sup>1</sup>Source: District website (<http://apps.District.org/cso/displayrain.aspx?passdate=5/29/2011>).

<sup>2</sup>Out = out of service.

FIGURE 2: RAINFALL GRAPHIC RECORD OF JULY 23, 2011



Rainfall graphic source:

[http://www.crh.noaa.gov/news/display\\_cmsstory.php?wfo=lot&storyid=71218&source=0](http://www.crh.noaa.gov/news/display_cmsstory.php?wfo=lot&storyid=71218&source=0)

TABLE 2: DISTRICT RAIN GAUGE DATA FOR JULY 23, 2011<sup>1</sup>

Gauge Number	Precipitation <sup>1</sup> (Inches)	Gauge Name	Address
<b>North Basin</b>			
1	3.98	Glenview	1333 Shermer Road, Glenview
2	2.84	North Side WRP	3500 Howard Street, Skokie
3	2.54	North Branch Pumping Station	4840 N. Francisco Ave, Chicago
4	Out <sup>2</sup>	Wilmette	613 Sheridan Road, Wilmette
<b>Average</b>	<b>3.12</b>		
<b>Central Basin</b>			
5	2.21	West Side	6001 W. Pershing Road, Cicero
6	3.50	Springfield	1747 N. Springfield Ave, Chicago
7	2.96	Racine Ave. Pumping Station	3838 S. Racine, Chicago
8	2.75	MOB	100 E. Erie Street, Chicago
<b>Average</b>	<b>2.86</b>		
<b>South Basin</b>			
9	1.38	Melvina Ditch	8644 S. Natchez Ave., Burbank
10	2.58	87 <sup>th</sup> & Western Pumping Station	87 <sup>th</sup> St. & Western Ave., Chicago
11	3.48	95 <sup>th</sup> Street Pumping Station	9525 S. Baltimore, Chicago
12	2.89	Calumet WRP	400 E. 130 <sup>th</sup> Street, Chicago
<b>Average</b>	<b>2.58</b>		

<sup>1</sup>Source: District website (<http://apps.District.org/cso/displayrain.aspx?passdate=7/23/2011>).

<sup>2</sup>Out = out of service.



FIGURE 3: SAMPLING LOCATIONS FOLLOWING BACKFLOW TO LAKE MICHIGAN FROM WILMETTE PUMPING STATION

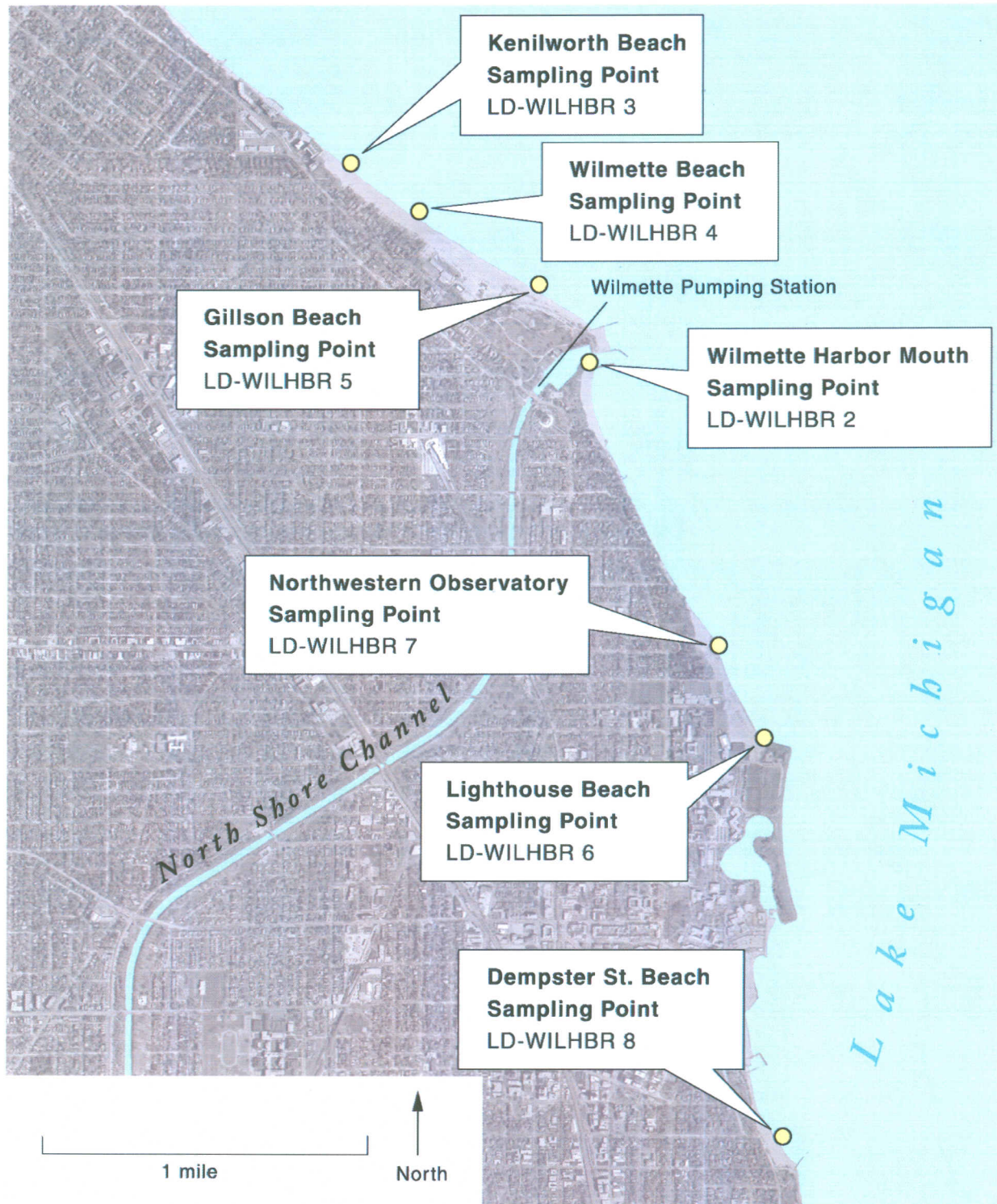


FIGURE 4: CHICAGO RIVER BACKFLOW TO LAKE MICHIGAN SAMPLING LOCATIONS

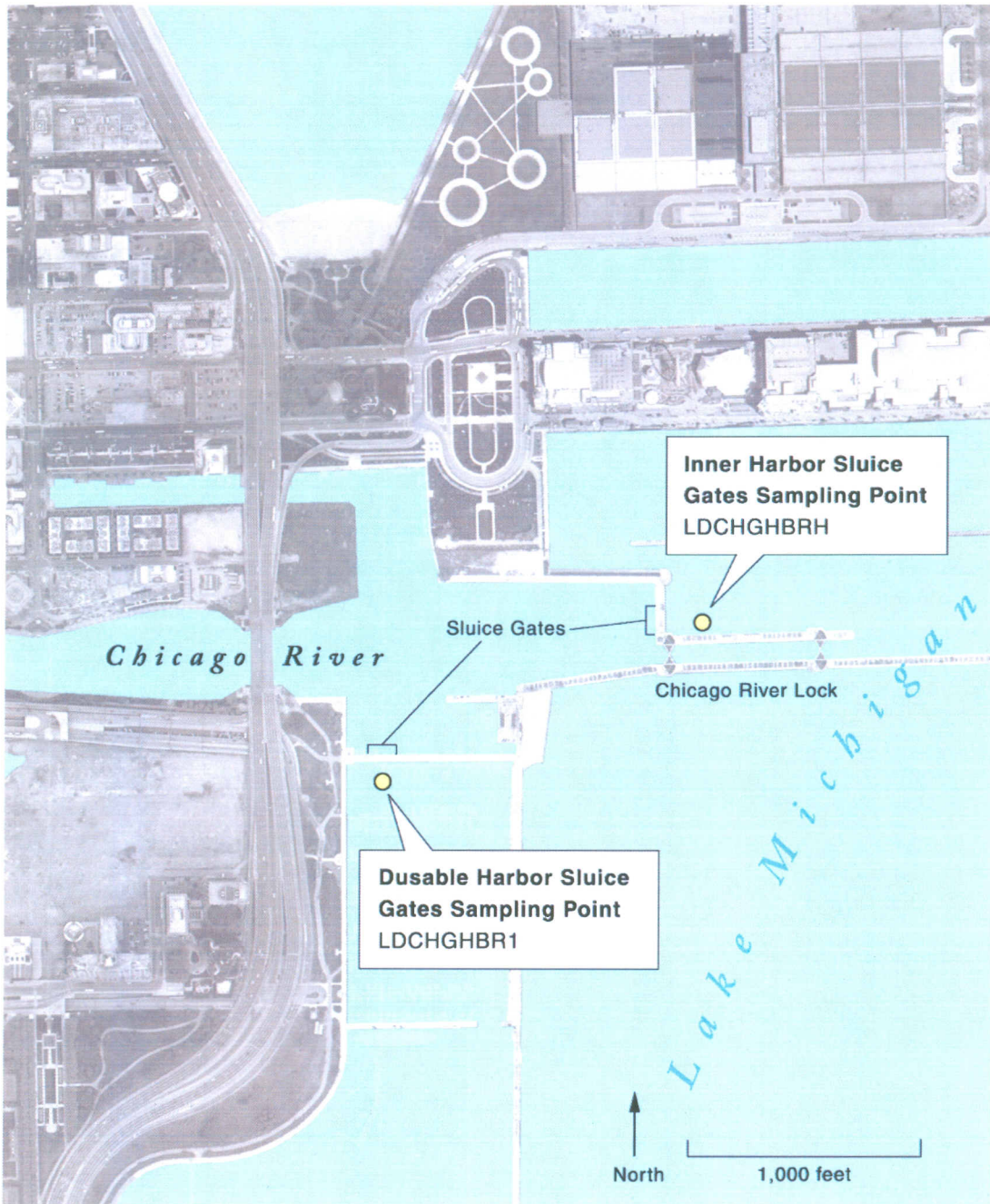




FIGURE 5: LAKE MICHIGAN BEACH SAMPLING LOCATIONS



Table 3. Post-river backflow monitoring continued on May 29, 2011 and May 30, 2011; samples were collected and analyzed from seven lake shore sites north and south of Wilmette Harbor. EC results are presented in Tables 4 and 5, respectively.

During the second rainfall event on July 23, 2011, there was a backflow from Wilmette Harbor to Lake Michigan. The river backflow commenced at 02:30 a.m. (0230 hours) and continued for about 10 hours and 23 minutes, until 12:53 p.m. (1253 hours), allowing 504.3 MG to flow from the NSC into Lake Michigan at Wilmette Harbor. During the river backflow at Wilmette Harbor, 13 water samples were collected from the lake side of the sluice gates at approximately 30-minute intervals. The EC results from these samples are reported in Table 6. Post-river backflow monitoring samples from seven lake shore sites north and south of Wilmette Harbor were sampled at approximately 30 minute intervals and again at approximately eight hours later on July 23, 2011. EC results for these samples are presented in Table 7.

**DuSable Harbor/Chicago River Controlling Works.** During the July 23, 2011 rainstorm event, there was a reversal from the Chicago River to Lake Michigan. The North Side WRP had to discharge storm water and CSO to the NSC. As a result of the rainstorm's impact on the river system, a backflow to Lake Michigan at the CRCW was necessary at 3:30 a.m. (0330 hours) which allowed the Chicago River to flow into the lake until 12:50 a.m. (1250 hours). The CRCW sluice gates and locks were open for a total of 9 hours and 20 minutes. Shortly after the sluice gates were opened, water samples were collected at approximately 30-minute intervals from the lake side of the DuSable Harbor sluice gates, and the Chicago River Inner Harbor sluice gates. A total of eight samples were collected at the CRCW for EC analyses. Results are presented in Table 8. As part of the river backflow beach water quality monitoring, five lake shore sites north and south of the CRCW were sampled on July 24, 2011. EC results for these samples are presented in Table 9.

**Calumet Area Pumping Station.** The OLD gates, located near 130<sup>th</sup> Street and Torrence Avenue, were not opened during the May 29, 2011 and July 23, 2011, storm events, and no CSOs were discharged at the 95<sup>th</sup> and 122<sup>nd</sup> street Pumping Stations. Therefore, no storm-related sampling and monitoring was conducted.

TABLE 3: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED AT WILMETTE HARBOR<sup>1</sup> ON MAY 29, 2011

LIMS Number	Sample Time <sup>2</sup>	<i>E coli</i> <sup>3</sup> MPN/100mL
6329946	1535	29,100
6329947	1605	199,000
6329948	1635	98,000
6329949	1705	130,000
6329950	1735	105,000
6329951	1805	92,100

<sup>1</sup>Location Description/Sample Point - Wilmette Sluice Gate (WILHBR1).

<sup>2</sup>Military Time.

<sup>3</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).

TABLE 4: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED NEAR WILMETTE HARBOR AREA BEACHES ON MAY 29, 2011

LIMS Number	Sample Time <sup>1</sup>	Location Description/Sample Point	<i>E. coli</i> <sup>2</sup> MPN/100mL
6329955	1830	Wilmette Harbor Mouth/WILHBR2	46,100
6329956	1855	Kenilworth Beach/WILHBR3	20
6329957	1845	Wilmette Beach/WILHBR4	585
6329958	1835	Gillson Beach/WILHBR5	3,440
6329959	1910	Lighthouse Beach/WILHBR6	100
6329960	1920	Northwestern Observatory/WILHBR7	373
6329961	1940	Dempster Street Beach/WILHBR8	10

<sup>1</sup>Military Time.

<sup>2</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).

TABLE 5: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED NEAR WILMETTE HARBOR AREA BEACHES ON MAY 30, 2011

LIMS Number	Sample Time <sup>1</sup>	Location Description/Sample Point	<i>E. coli</i> <sup>2</sup> MPN/100mL
6330293	0630	Wilmette Harbor Mouth/WILHBR2	11,200
6330294	0655	Kenilworth Beach/WILHBR3	134
6330295	0645	Wilmette Beach/WILHBR4	1,480
6330296	0635	Gillson Beach/WILHBR5	1,050
6330297	0615	Lighthouse Beach/WILHBR6	299
6330300	0605	Northwestern Observatory/WILHBR7	305
6330299	0555	Dempster Street Beach/WILHBR8	10

<sup>1</sup>Military Time.

<sup>2</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).

TABLE 6: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED AT WILMETTE HARBOR<sup>1</sup> ON JULY 23, 2011

LIMS Number	Sample Time <sup>2</sup>	<i>E coli</i> <sup>3</sup> MPN/100mL
6373867	0330	105,000
6373868	0400	155,000
6373869	0430	199,000
6373870	0500	130,000
6373871	0530	105,000
6373872	0600	77,000
6373873	0630	86,600
6373874	0700	68,700
6373875	0730	72,700
6373876	0800	72,700
6373877	0830	72,700
6373878	0900	68,700
6373879	0930	81,600

<sup>1</sup>Location Description/Sample Point - Wilmette Sluice Gate (WILHBR1).

<sup>2</sup>Military Time.

<sup>3</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).



TABLE 7: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED NEAR WILMETTE HARBOR AREA BEACHES ON JULY 23, 2011

LIMS Number	Sample Time <sup>1</sup>	Location Description/Sample Point	<i>E. coli</i> <sup>2</sup> MPN/100mL
6373886	1000	Wilmette Harbor Mouth/WILHBR2	68,700
6373889	1025	Kenilworth Beach/WILHBR3	100
6373888	1014	Wilmette Beach/WILHBR4	51
6373887	1007	Gillson Beach/WILHBR5	2,600
6373885	1038	Lighthouse Beach/WILHBR6	9,210
6373884	1047	Northwestern Observatory/WILHBR7	6,490
6373883	1104	Dempster Street Beach/WILHBR8	191
6374300	1810	Wilmette Harbor Mouth/WILHBR2	13,000
6374301	1745	Kenilworth Beach/WILHBR3	100
6374302	1755	Wilmette Beach/WILHBR4	9800
6374303	1820	Gillson Beach/WILHBR5	7,700
6374304	1830	Lighthouse Beach/WILHBR6	96
6374305	1840	Northwestern Observatory/WILHBR7	62
6374306	1850	Dempster Street Beach/WILHBR8	96

<sup>1</sup>Military Time.

<sup>2</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).

TABLE 8: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED AT CHICAGO RIVER CONTROLLING WORKS ON JULY 23, 2011

LIMS Number	Sample Time <sup>1</sup>	Location Description/Sample Point	<i>E. coli</i> <sup>2</sup> MPN/100mL
6373901	0830	Inner Harbor Sluice Gates/CHGHBRH	10,100
6373902	0945	Inner Harbor Sluice Gates/CHGHBRH	26,000
6373903	1110	Inner Harbor Sluice Gates/CHGHBRH	32,800
6373904	1310	Inner Harbor Sluice Gates/CHGHBRH	48,800
6373905	0740	Dusable Harbor Sluice Gates/CHGHBR1	199,000
6373906	0900	Dusable Harbor Sluice Gates/CHGHBR1	179,000
6373907	1020	Dusable Harbor Sluice Gates/CHGHBR1	120,000
6373908	1230	Dusable Harbor Sluice Gates/CHGHBR1	105,000

<sup>1</sup>Military Time.

<sup>2</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).

TABLE 9: LAKE MICHIGAN BACTERIA MONITORING RESULTS FOR SAMPLES COLLECTED NEAR CHICAGO RIVER HARBOR AREA BEACHES ON JULY 24, 2011

LIMS Number	Sample Time <sup>1</sup>	Location Description/Sample Point	<i>E. coli</i> <sup>2</sup> MPN/100mL
6374294	0825	31 <sup>ST</sup> Street Beach/CHGHBR7	<10 <sup>3</sup>
6374293	0845	12 <sup>th</sup> Street Beach/CHGHBR6	30
6374292	0910	Monroe Harbor/CHGHBR5	2,060
6374291	0930	Oak Street Beach/CHGHBR4	10
6374290	0945	North Ave. Beach/CHGHBR3	459

<sup>1</sup>Military Time.

<sup>2</sup>*Escherichia coli*: Standard Methods for the Examination of Water & Wastewater, 18<sup>th</sup> Edition, 1992, Most Probable Number (MPN), Method 9223B (Quanti-Tray/2000).

<sup>3</sup>Less than 10 MPN/100 mL.