DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

REPLY TO
ATTENTION OF

Technical Services Division
Hydraulic and Environmental Engineering

JUN 10 2010

Mr. Alan Keller, P.E.
Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Dear Mr. Keller,

In accordance with Illinois EPA water pollution control permit number 2006-EA-0684 issued November 9, 2006 and Section 401 certification requirements, water quality data was collected during dredging of Calumet Harbor and rehandling at Chicago Area Confined Disposal Facility, Calumet Harbor, Illinois. Data was collected from October through December 2009. The Monitoring Report for this dredging event data is enclosed. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. Should you have any questions concerning the enclosed report, please contact Margaret Rauwerdink at (312) 846-5502 or Mr. Jay Semmler, Chief, Hydraulics and Environmental Engineering Section (312) 846-5500.

Sincerely,

Steve E. Hungness
Chief, Operation
Technical Support Section

Enclosure

Identical letters sent to:
Dan Injerd, IDNR
Linda Holst, USEPA
Janice Engle, USFWS
Daniel Cooper, Chicago Parks District
Anthony Ianello, Illinois Regional Port District

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

REPLY TO
ATTENTION OF

Technical Services Division
Hydraulic and Environmental Engineering

JUN 10 2010

Mr. Dan Injerd
Illinois Department of Natural Resources - OWR
Chief, Lake Michigan Program Section
160 N. LaSalle Street, Suite S-700
Chicago, Illinois 60601

Dear Mr. Injerd,

In accordance with Illinois EPA water pollution control permit number 2006-EA-0684 issued November 9, 2006 and Section 401 certification requirements, water quality data was collected during dredging of Calumet Harbor and rehandling at Chicago Area Confined Disposal Facility, Calumet Harbor, Illinois. Data was collected from October through December 2009. The Monitoring Report for this dredging event data is enclosed. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. Should you have any questions concerning the enclosed report, please contact Margaret Rauwerdink at (312) 846-5502 or Mr. Jay Semmler, Chief, Hydraulics and Environmental Engineering Section (312) 846-5500.

Sincerely,

Steve E. Hungness
Chief, Operation
Technical Support Section

Enclosure

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Linda Holst, USEPA
Janice Engle, USFWS
Daniel Cooper, Chicago Parks District
Anthony Ianello, Illinois Regional Port District

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

REPLY TO
ATTENTION OF

Technical Services Division
Hydraulic and Environmental Engineering

JUN 10 2010

Ms. Linda Holst
Chief, Water Quality Standards and Monitoring
U.S. Environmental Protection Agency
Water Division, Region 5
77 W. Jackson Blvd.
Chicago, Illinois 60604-3590

Dear Ms. Holst,

In accordance with Illinois EPA water pollution control permit number 2006-EA-0684 issued November 9, 2006 and Section 401 certification requirements, water quality data was collected during dredging of Calumet Harbor and rehandling at Chicago Area Confined Disposal Facility, Calumet Harbor, Illinois. Data was collected from October through December 2009. The Monitoring Report for this dredging event data is enclosed. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. Should you have any questions concerning the enclosed report, please contact Margaret Rauwerdink at (312) 846-5502 or Mr. Jay Semmler, Chief, Hydraulics and Environmental Engineering Section (312) 846-5500.

Sincerely,

Steve E. Hungness
Chief, Operation
Technical Support Section

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Dan Injerd, IDNR
Janice Engle, USFWS
Daniel Cooper, Chicago Parks District
Anthony Ianello, Illinois Regional Port District

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

REPLY TO
ATTENTION OF

Technical Services Division
Hydraulic and Environmental Engineering

JUN 1 0 2010

Ms. Janice Engle
Acting Field Supervisor
U.S. Fish & Wildlife Service
Chicago Illinois Field Office
1250 S. Grove, Suite 103
Barrington, Illinois 60010

Dear Ms. Engle,

In accordance with Illinois EPA water pollution control permit number 2006-EA-0684 issued November 9, 2006 and Section 401 certification requirements, water quality data was collected during dredging of Calumet Harbor and rehandling at Chicago Area Confined Disposal Facility, Calumet Harbor, Illinois. Data was collected from October through December 2009. The Monitoring Report for this dredging event data is enclosed. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. Should you have any questions concerning the enclosed report, please contact Margaret Rauwerdink at (312) 846-5502 or Mr. Jay Semmler, Chief, Hydraulics and Environmental Engineering Section (312) 846-5500.

Sincerely,

Steve E. Hungness
Chief, Operation
Technical Support Section

Enclosure

Identical letters sent to:
Allan Keller, IEPA
Dan Injerd, IDNR
Linda Holst, USEPA
Daniel Cooper, Chicago Parks District
Anthony Ianello, Illinois Regional Port District

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

Technical Services Division
Hydraulic and Environmental Engineering

JUN 1 0 2010

Mr. Daniel Cooper
Chicago Park District
Environmental Project Manager
541 North Fairbanks Court
Chicago, Illinois 60611

Dear Mr. Cooper,

In accordance with Illinois EPA water pollution control permit number 2006-EA-0684 issued November 9, 2006 and Section 401 certification requirements, water quality data was collected during dredging of Calumet Harbor and rehandling at Chicago Area Confined Disposal Facility, Calumet Harbor, Illinois. Data was collected from October through December 2009. The Monitoring Report for this dredging event data is enclosed. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. Should you have any questions concerning the enclosed report, please contact Margaret Rauwerdink at (312) 846-5502 or Mr. Jay Semmler, Chief, Hydraulics and Environmental Engineering Section (312) 846-5500.

Sincerely,

Steve E. Hungness
Chief, Operation
Technical Support Section

Enclosure

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Linda Holst, USEPA
Janice Engle, USFWS
Anthony Ianello, Illinois Regional Port District

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

JUN 10 2010

Technical Services Division
Hydraulic and Environmental Engineering

Mr. Anthony J. Ianello
Executive Director
Illinois Regional Port District
3600 E. 95th Street
Chicago, Illinois 60617-5193

Dear Mr. Ianello,

In accordance with Illinois EPA water pollution control permit number 2006-EA-0684 issued November 9, 2006 and Section 401 certification requirements, water quality data was collected during dredging of Calumet Harbor and rehandling at Chicago Area Confined Disposal Facility, Calumet Harbor, Illinois. Data was collected from October through December 2009. The Monitoring Report for this dredging event data is enclosed. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. Should you have any questions concerning the enclosed report, please contact Margaret Rauwerdink at (312) 846-5502 or Mr. Jay Semmler, Chief, Hydraulics and Environmental Engineering Section (312) 846-5500.

Sincerely,

Steve E. Hungness
Chief, Operation
Technical Support Section

Enclosure

Identical letters sent to:
Allan Keller, IEPA
Dan Injerd, IDNR
Linda Holst, USEPA
Janice Engle, USFWS
Daniel Cooper, Chicago Park District

REPORT ON MAINTENANCE DREDGING OF CALUMET HARBOR
Water Quality Monitoring Year 2010

Prepared by:

U.S. Army Corps of Engineers, Chicago District
111 North Canal Street, Suite 600
Chicago, Illinois 60606

June 2010

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers, Chicago District is responsible for maintaining commercial navigation in the Calumet River and Harbor by periodic dredging to authorized depths. During the period from October 20 through December 22, 2009 the Calumet Harbor was dredged and the dredged material was disposed of in the Chicago Confined Disposal Facility (CDF). Water and sediment samples were collected between October 20 and December 22, 2009 and were analyzed to assess the impact of this dredging/disposal event.

The purpose of this report is to summarize the monitoring activities for the maintenance dredging of the Calumet Harbor from October 20 through December 22, 2009 as part of compliance with Illinois EPA Water Pollution Control Permit number 2006-EA-0864 and Section 401 certification requirements. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010.

The report contains the analytical results for the filter cell effluent (treated CDF discharge), total suspended solids monitoring at the dredging and rehandling areas, and dredged sediment. Also included is a discussion relating to the potential for impact of the filter cell effluent on the Calumet River and an analysis of filter cell performance. In addition to the above, the water quality data in and around the CDF were analyzed in order to determine if the 2009 dredging and disposal event or the CDF operation was adversely impacting water quality in Calumet Harbor.

Analytical results indicated that the treated effluent from the filter cells did not adversely impact Calumet River water quality. Suspended solids were effectively removed below the action level of 15 mg/L by the filter cells. During monitoring around the dredge or rehandling areas, suspended solids levels were above background, but the increase was localized and short term.

The monitoring of the 2009 Calumet Harbor dredging and disposal operation complied with the Illinois EPA Water Pollution Control Permit and Section 401 certification requirements. The analytical results indicate that there is no evidence that the CDF operation or the 2009 dredging and disposal event negatively impacted long term water quality in Calumet Harbor.

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1. Purpose

The U.S. Army Corps of Engineers, Chicago District is responsible for maintaining commercial navigation in the Calumet River and Harbor by periodic dredging to authorized depths. Because the sediment in the Calumet River is contaminated, the dredged sediment is placed in the Chicago Area confined disposal facility (CDF). There are two monitoring programs associated with this facility. The first program is the routine monitoring of the water quality in and around the CDF conducted on an annual basis. Routine monitoring is summarized in an annual water quality report during years in which no dredging occurs. The second monitoring program only occurs during maintenance dredging operations. This involves weekly monitoring of the water quality in and around the CDF as well as suspended solids monitoring around the dredging and unloading areas. In addition, suspended solids levels are monitored in the effluent from the filter cells and the discharge area of the Calumet River.

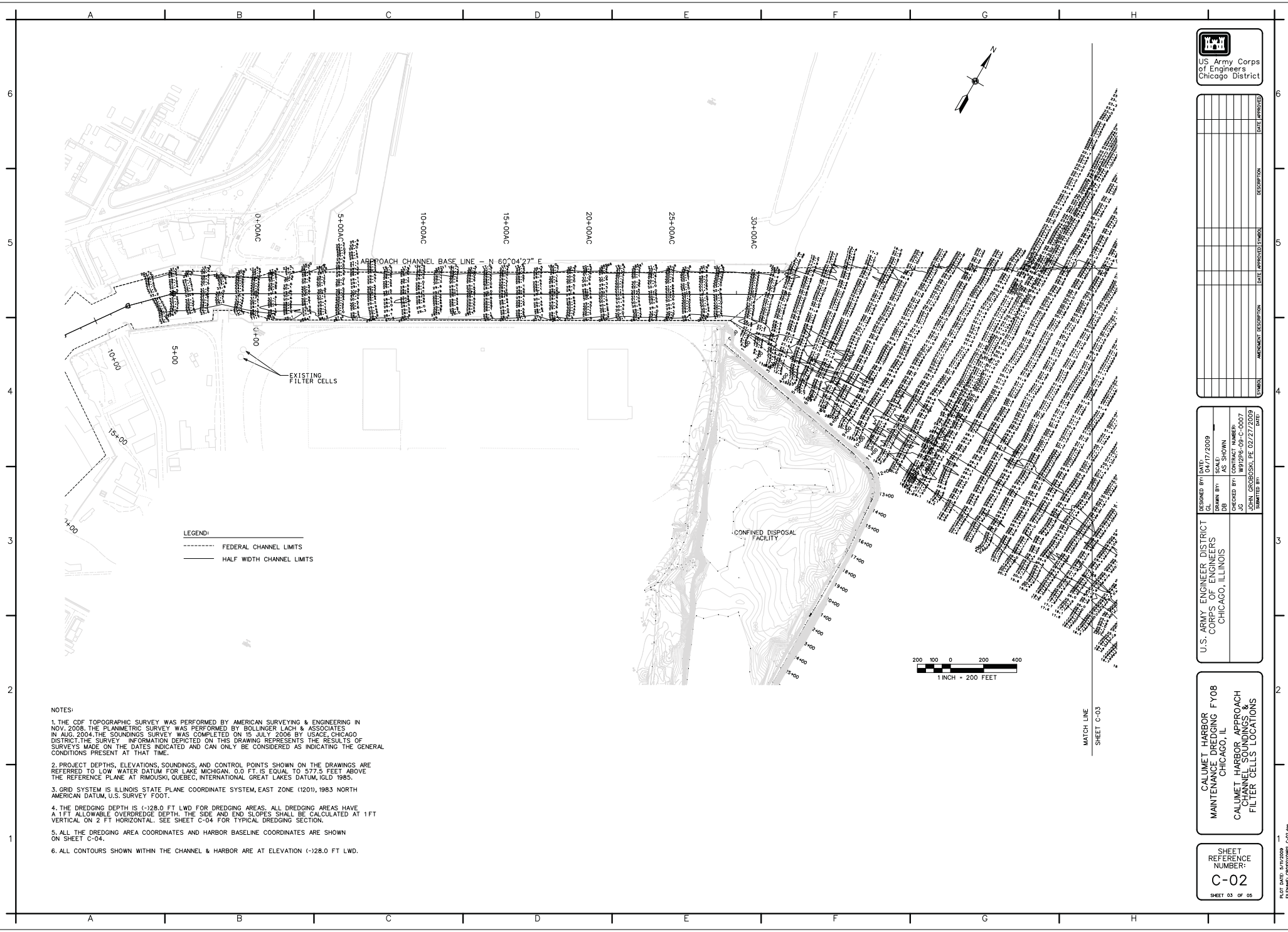
The purpose of this report is to address the maintenance dredging of the Calumet Harbor during the period October 20 through December 22, 2009. This shall also serve to fulfill the annual routine water quality monitoring requirement for 2010. The results and analysis of the monitoring done before, during, and after the dredging event are provided in Sections 4 and 5. The sample collection period was from October 20 through December 22, 2009.

2. Background

The Chicago Area CDF is a facility for the disposal and containment of polluted dredged materials from deep-draft federal navigation projects in Chicago, Illinois. The CDF was constructed by the Chicago District in 1982-1984 in Calumet Harbor, south of the Calumet River entrance channel and adjacent to the Chicago Port Authority-owned Iroquois Landing. The CDF is an in-water diked facility and triangular in shape. Dikes form two of the walls and Iroquois Landing forms the third. The facility is about 43 acres in area and has a capacity for approximately 1.3 million cubic yards of dredged materials. This facility was constructed and is operated and maintained by the Chicago District under authority of PL91-611, Section 123.

The Chicago Area CDF has been previously used for twelve dredged material disposal operations since its construction. The thirteenth dredging event, which is discussed in this report, was the maintenance dredging of the Calumet Harbor. The dredging occurred from October 20 through December 22, 2009. A total of 167,404 cubic yards were dredged by Luedtke Engineering from the locations shown in Figures 1a through 1c. Material was dredged mechanically using an enclosed bucket, transported in scows and disposed of in the CDF, as shown in Figure 1d. A summary of the thirteen dredging events which have been disposed of in the CDF is outlined in Table 1. All the dredging events except for the fifth, eleventh, and twelfth were conducted by the Corps; the fifth and eleventh events were conducted by KCBX Terminals Company, the twelfth was conducted by DTE Energy.

Figure 1a: Dredging locations for 2009 dredging event



NOTES:

1. THE CDF TOPOGRAPHIC SURVEY WAS PERFORMED BY AMERICAN SURVEYING & ENGINEERING IN NOV. 2008. THE PLANIMETRIC SURVEY WAS PERFORMED BY BOLLINGER LACH & ASSOCIATES IN AUG. 2004. THE SOUNDINGS SURVEY WAS COMPLETED ON 15 JULY 2006 BY USACE, CHICAGO DISTRICT. THE SURVEY INFORMATION DEPICTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS PRESENT AT THAT TIME.

2. PROJECT DEPTHS, ELEVATIONS, SOUNDINGS, AND CONTROL POINTS SHOWN ON THE DRAWINGS ARE REFERRED TO LOW WATER DATUM FOR LAKE MICHIGAN. 0.0 FT. IS EQUAL TO 577.5 FEET ABOVE THE REFERENCE PLANE AT RIMOUSKI, QUEBEC, INTERNATIONAL GREAT LAKES DATUM, IGLD 1985.

3. GRID SYSTEM IS ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE (1201), 1983 NORTH AMERICAN DATUM, U.S. SURVEY FOOT.

4. THE DREDGING DEPTH IS (-)28.0 FT LWD FOR DREDGING AREAS. ALL DREDGING AREAS HAVE A 1 FT ALLOWABLE OVERDREDGE DEPTH. THE SIDE AND END SLOPES SHALL BE CALCULATED AT 1 FT VERTICAL ON 2 FT HORIZONTAL. SEE SHEET C-04 FOR TYPICAL DREDGING SECTION.

5. ALL THE DREDGING AREA COORDINATES AND HARBOR BASELINE COORDINATES ARE SHOWN ON SHEET C-04.

6. ALL CONTOURS SHOWN WITHIN THE CHANNEL & HARBOR ARE AT ELEVATION (-)28.0 FT LWD.

Figure 1b: Dredging locations for 2009 dredging event

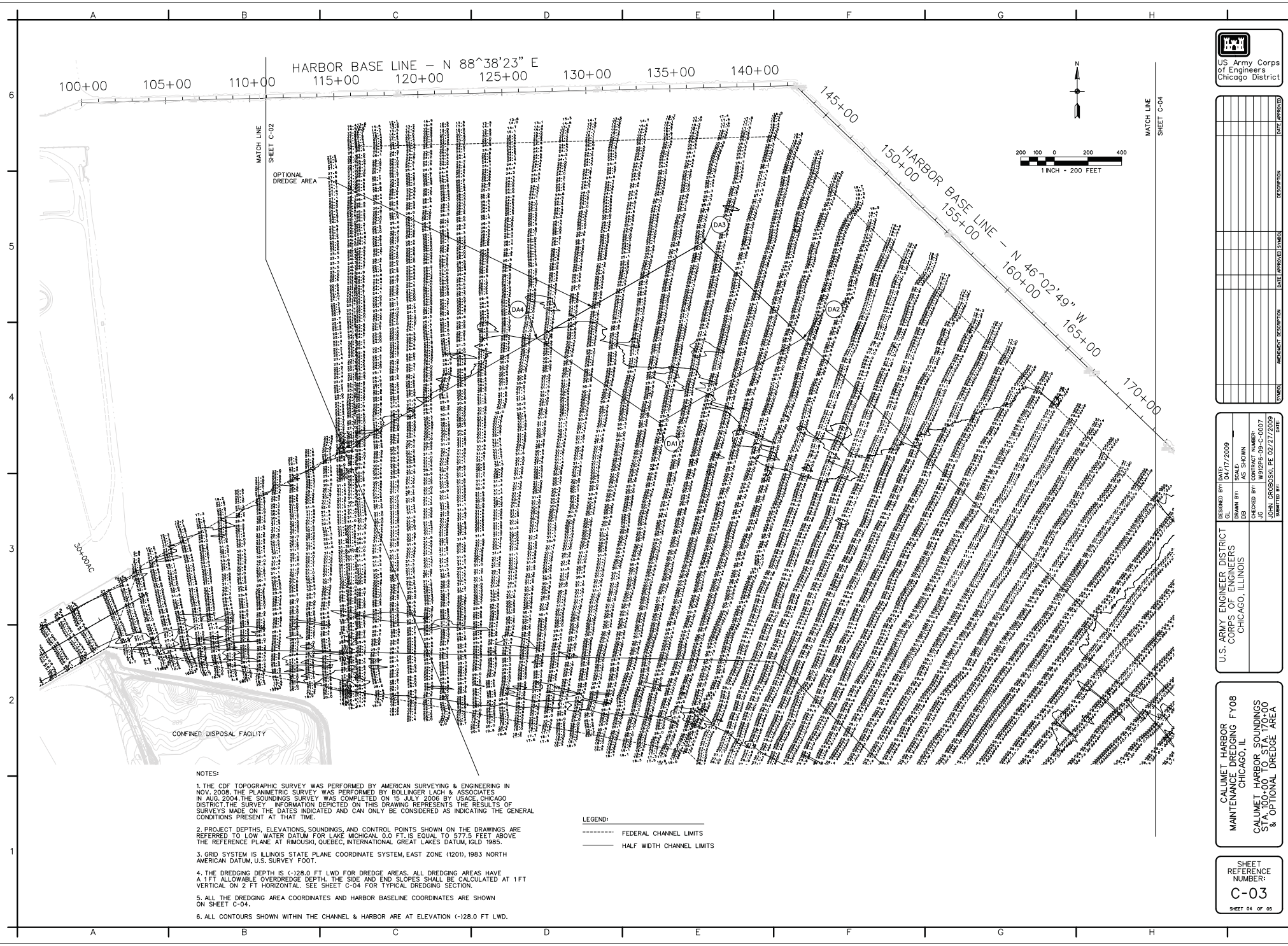
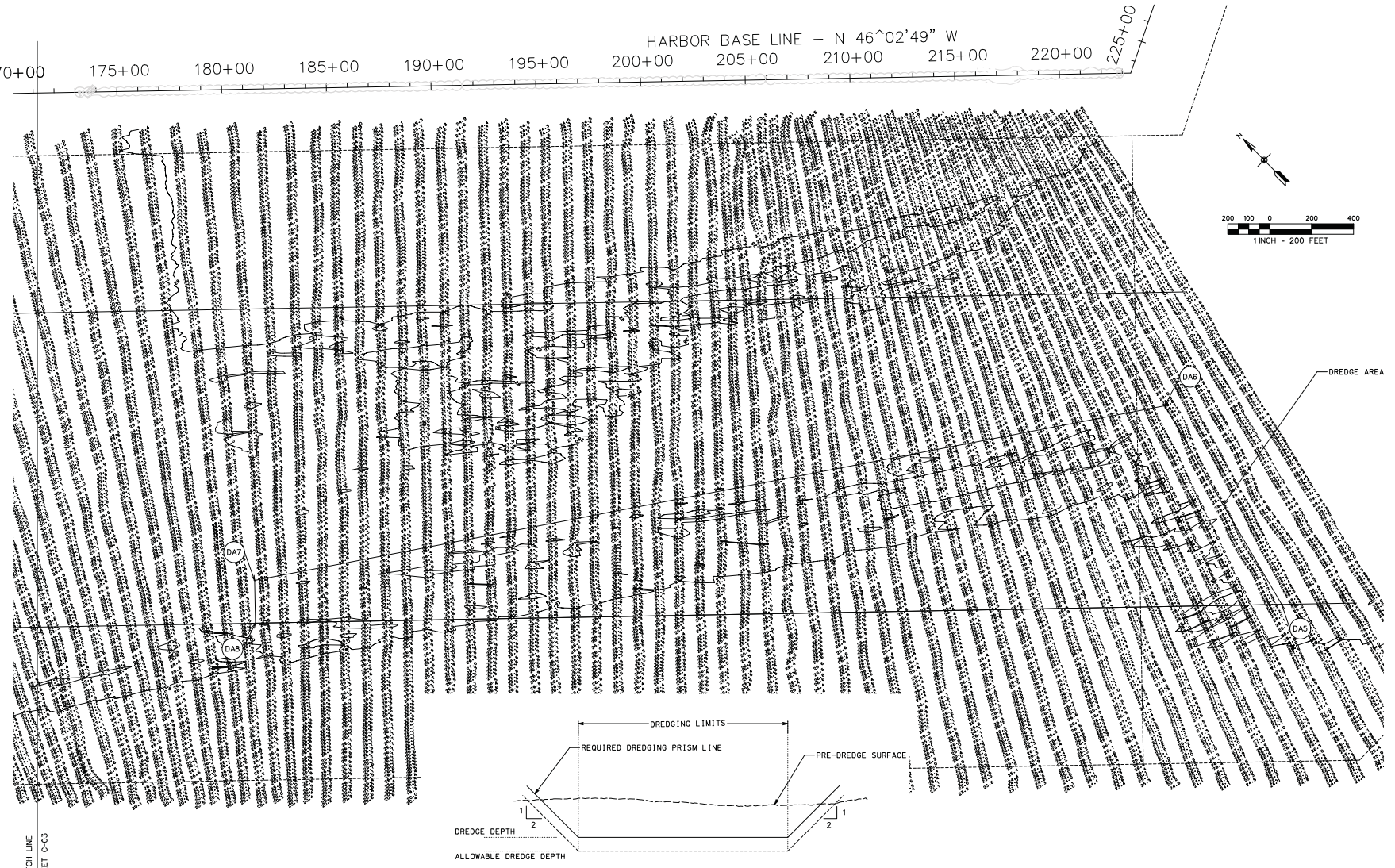


Figure 1c: Dredging locations for 2009 dredging event



TYPICAL DREDGING SECTION

NOT TO SCALE

NOTES:

1. THE SOUNDINGS SURVEY WAS COMPLETED ON 15 JULY 2006 BY USACE, CHICAGO DISTRICT. THE SURVEY INFORMATION DEPICTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS PRESENT AT THAT TIME.

2. PROJECT DEPTHS, ELEVATIONS, SOUNDINGS, AND CONTROL POINTS SHOWN ON THE DRAWINGS ARE REFERRED TO LOW WATER DATUM FOR LAKE MICHIGAN. 0.0 FT. IS EQUAL TO 577.5 FEET ABOVE THE REFERENCE PLANE AT RIMOUSKI, QUEBEC, INTERNATIONAL GREAT LAKES DATUM, IGLD 1985.

3. GRID SYSTEM IS ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE (1201), 1983 NORTH AMERICAN DATUM, U.S. SURVEY FOOT.

4. THE DREDGING DEPTH IS (-)28.0 FT LWD FOR DREDGING AREAS. ALL DREDGING AREAS HAVE A 1 FT ALLOWABLE OVERDREDGE DEPTH. THE SIDE AND END SLOPES SHALL BE CALCULATED AT 1 FT VERTICAL ON 2 FT HORIZONTAL. SEE SHEET C-04 FOR TYPICAL DREDGING SECTION.

5. ALL THE DREDGING AREA COORDINATES AND HARBOR BASELINE COORDINATES ARE SHOWN ON SHEET C-04.

6. ALL CONTOURS SHOWN WITHIN THE CHANNEL & HARBOR ARE AT ELEVATION (-)28.0 FT LWD.

DREDGE AREA AND OPTIONAL DREDGE AREA COORDINATES

POINT	NORTHING	EASTING
DA1	1847448.65	1206950.78
DA2	1847951.58	1207805.91
DA3	1848522.52	1207213.71
DA4	1847950.74	1206220.39
DA5	1841533.49	1212301.76
DA6	1842598.76	1212577.85
DA7	1845081.68	1208915.77
DA8	1844934.5	1208774.14

HARBOR BASELINE COORDINATES

POINT	STATION	NORTHING	EASTING
POB	100+00	1849353.06	1203513.02
PI	142+48.11	1849453.92	1207759.93
PI	223+40.74	1843837.07	1213585.88
POE	318+27.01	1848002.55	1222108.68

LEGEND:

FEDERAL CHANNEL LIMITS

HALF WIDTH CHANNEL LIMITS

US Army Corps of Engineers Chicago District

SYMBOL	AMENDMENT DESCRIPTION	DATE	APPROVED SYMBOL	DESCRIPTION	DATE APPROVED

DESIGNED BY: GL DATE: 04/17/2009
DRAWN BY: DB SCALE: AS SHOWN
CHECKED BY: JC CONTRACT NUMBER: W912P6-09-C-0007
SUBMITTED BY: JOHN GROBOSKI, PE DATE: 02/27/2009

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CHICAGO, ILLINOIS

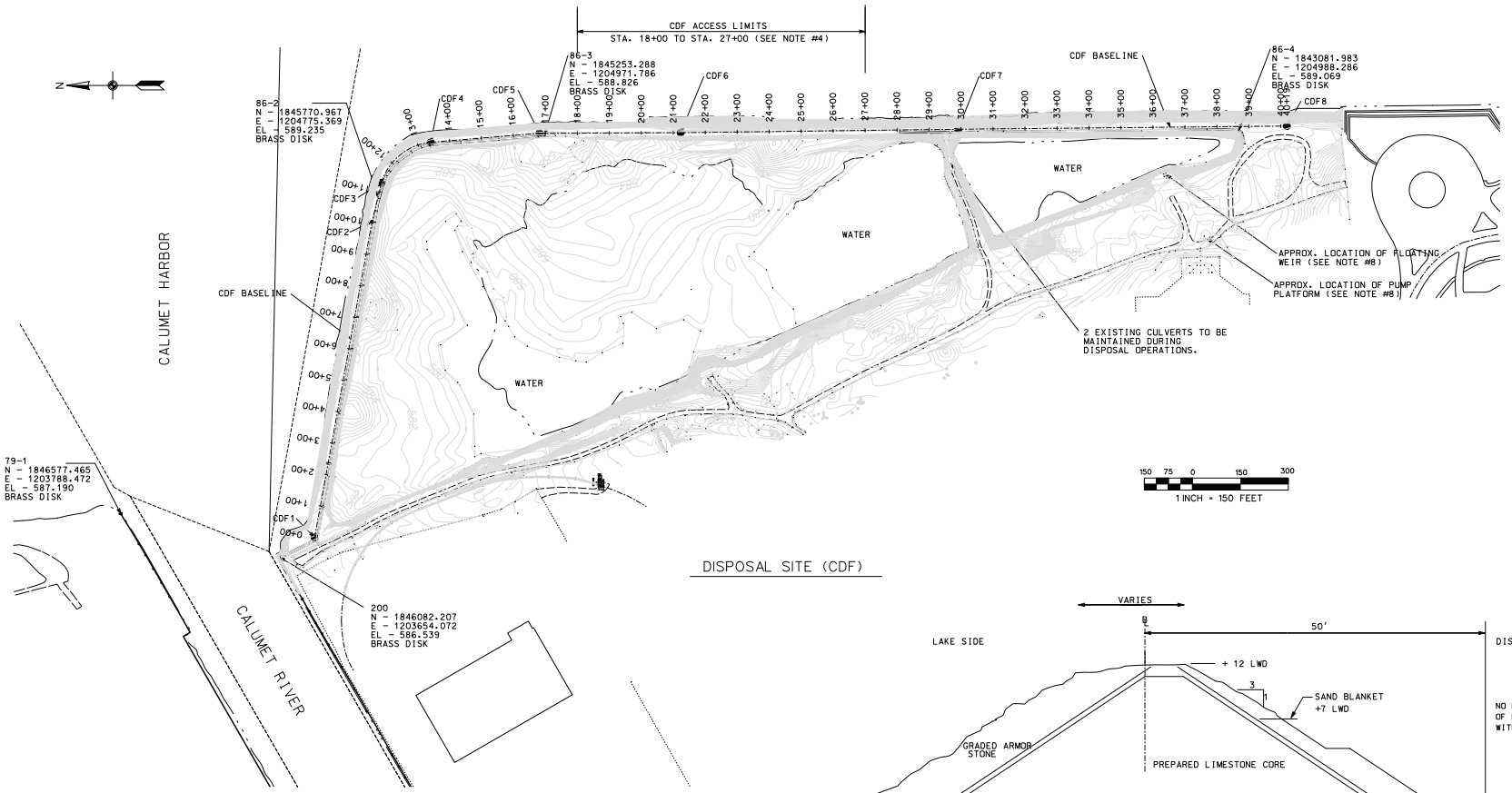
CALUMET HARBOR
MAINTENANCE DREDGING FY08
CHICAGO, IL

CALUMET HARBOR SOUNDINGS
STA. 170+00 TO STA. 225+00
& DREDGE AREA

SHEET REFERENCE NUMBER:
C-04
SHEET 05 OF 05

PLOT DATE: 27/FEB/2009
FILENAME: C:\PROJECTS\CAL...C-04.dgn

Figure 1d: CDF disposal locations for 2009 dredging event



DISPOSAL SITE (CDF)

EXISTING CDF REVETMENT – TYPICAL SECTION

NOTES:

1. THE CDF TOPOGRAPHIC SURVEY WAS PERFORMED BY AMERICAN SURVEYING & ENGINEERING IN NOV. 2008. THE PLANIMETRIC SURVEY WAS PERFORMED BY BOLLINGER LACH & ASSOCIATES IN AUG. 2004. THE SURVEY INFORMATION DEPICTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS PRESENT AT THAT TIME.

2. THERE ARE MONITORING WELLS LOCATED IN THE CDF AND IN THE AREAS ADJACENT TO THE CDF. THE CONTRACTOR SHALL AVOID CONTACTING OR DISTURBING THE MONITORING WELLS. THE CONTRACTOR SHALL CONDUCT A VISUAL SEARCH OF THE REVETMENT AND ALL OTHER WORK AREAS AND CLEARLY MARK THE WELL LOCATIONS PRIOR TO BEGINNING CONSTRUCTION. THE COST OF LOCATING AND MARKING THE WELL SHALL BE INCIDENTIAL TO THE DREDGING COST. SEE PLATE 1 ATTACHED TO SPECIFICATION SECTION 35 21 00.03, WATER QUALITY MONITORING, FOR THE CDF MONITORING LOCATIONS.

3. THE STABILITY OF THE EXISTING MATERIAL WITHIN THE CDF IS UNKNOWN.

4. NO ACCESS TO THE CDF FOR DREDGE MATERIAL PLACEMENT IS ALLOWED OUTSIDE OF THE ACCESS LIMITS SHOWN ON THIS DRAWING.

5. PROJECT DEPTHS, ELEVATIONS, SOUNDINGS, AND CONTROL POINTS SHOWN ON THE DRAWINGS ARE REFERRED TO LOW WATER DATUM FOR LAKE MICHIGAN. 0.0 FT. IS EQUAL TO 577.5 FEET ABOVE THE REFERENCE PLANE AT RIMOUSKI, QUEBEC, INTERNATIONAL GREAT LAKES DATUM, IGLD 1985.

6. GRID SYSTEM IS ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE (1201), 1983 NORTH AMERICAN DATUM, U.S. SURVEY FOOT.

7. DURING DISPOSAL OPERATIONS, CONTRACTOR SHALL ENSURE THAT WATER FLOWS FROM THE NORTH TO THE SOUTH CDF THROUGH THE EXISTING PIPE CULVERTS.

8. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL CONFIRM THE LOCATIONS OF THE FLOATING WEIR AND THE PUMPING FACILITIES.

CDF BASELINE COORDINATES		
POINT	NORTHING	EASTING
CDF1	1845971.64	1203715.28
CDF2	1845792.41	1204702.84
CDF3	1845762.83	1204824.59
PI	1845728.06	1204939.16
CC	1845590.59	1204772.32
RADIUS:	180	
CDF4	1845608.95	1204951.38
CDF5	1845268.43	1204979.48
CDF6	1844827.45	1204981.26
CDF7	1843959.74	1204992.15
CDF8	1842931.73	1205002.19

LEGEND:

---------- FEDERAL CHANNEL LIMITS

———— HALF WIDTH CHANNEL LIMITS

US Army Corps of Engineers
Chicago District

SYMBOL	AMENDMENT DESCRIPTION	DATE APPROVED	APPROVED SYMBOL	DESCRIPTION	DATE APPROVED

DESIGNED BY: GL | DATE: 04/17/2009
DRAWN BY: DB | SCALE: AS SHOWN
CHECKED BY: JG | CONTRACT NUMBER: W912P6-09-C-0007
SUBMITTED BY: JOHN GROBOSKI, PE | DATE: 02/27/2009

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CHICAGO, ILLINOIS

CALUMET HARBOR
MAINTENANCE DREDGING FY08
CHICAGO, IL

CONFINED DISPOSAL FACILITY

SHEET REFERENCE NUMBER:
C-01
SHEET 02 OF 05

PLOT DATE: 27/FEB/2009
FILENAME: C:\DGN\FY08_C-01.dgn

Table 1: Historical Dredging and Disposal Events for Chicago Area CDF

Event No.	Year of Disposal Operation	Volume of Dredged Material	Location of Dredging	Location of Rehandling
1	Oct. – Dec. 1984	100,000 yd^3	Calumet River	NW corner of CDF
2	July – Sept. 1985	108,000 yd^3	Calumet River	NE corner of CDF
3	May – June 1986	62,000 yd^3	Chicago Harbor & Calumet River	N dike of CDF
4	April – June 1989	70,100 yd^3	Calumet River	NE of crossdike in CDF
5	May 1991	3,100 yd^3	Calumet River	CDF
6	December 1994	62,000 yd^3	Calumet River	NE corner of CDF
7	Aug. 2000 – Apr. 2001	205,500 yd^3	Calumet River & Harbor Breakwater	N dike of CDF
8	Sept. – Dec. 2001	291,000 yd^3	Calumet Harbor & Calumet River	E dike wall
9	Sept. – Dec. 2003	135,000 yd^3	Calumet River	E dike wall
10	Sept. – Dec. 2007	131,020 yd^3	Calumet Harbor	E dike wall
11	April 2008	186 yd^3	Calumet River	CDF
12	June 2009	600 yd^3	Calumet River	CDF
13	**Oct. – Dec. 2009**	**167,404 yd^3**	**Calumet Harbor**	**E dike wall**
	Total Dredged	1,335,910 yd^3		

3. Introduction

During the period of October 20 through December 22, 2009 various locations within the Calumet Harbor were dredged and the dredged material was disposed in the CDF. During a dredging event, the CDF is routinely monitored as part of compliance with Illinois EPA Water Pollution Control Permit number 2006-EA-0864 and Section 401 certification requirements. A report summarizing the monitoring activities conducted for the dredging event is routinely submitted to the Illinois EPA.

Sections 4 and 5 present a summary of the 2009 dredging event. Section 4 discusses the sampling program used to document the water quality before, during, and after dredging. Section 5 contains the analytical results for the filter cell effluent (treated CDF discharge), turbidity and total suspended solids monitoring at the dredging and rehandling area, and analytical results for the dredged sediment. Also included in this section is a discussion relating to the potential for impact of the filter cell effluent on the Calumet River and an analysis of filter cell performance. The analytical data are presented in Appendix A. The report is summarized in Section 6.

3.1. Description of Dredging and Rehandling Operations

Dredged material was mechanically loaded into scows using an 8 cubic yard cable arm environmental clamshell bucket, and then transported by tug and scows to the rehandling area along the eastern dike wall of the CDF, where they were unloaded with the same type of bucket.

Dredged material was transferred from the bucket to the CDF using a hopper located on the dike wall and a sluice with a drop section. CDF access was between stations 15+00 and 26+00. The unloading station during the beginning of the operation was at approximately 26+00. The unloading station was then moved to station 19+00. The remainder of the material was placed in the CDF near station 15+00 to allow the dredged material to enter the CDF more easily and fill the remaining ponded water.

Water depths in the CDF have been diminishing in recent years and sampling of the CDF pond water has become more difficult. Beginning at the end of the 2007 dredging project, the water in the north end of the CDF became too shallow for collection and a sampling location was moved to the south basin of the CDF. For the 2009 dredging project, all three sampling locations were in the south basin of the CDF.

The water in the CDF is clarified by settling in the CDF pond, and then the water is pumped from the southern end of the CDF to filters located by the Calumet River approximately 3,000 feet west of the CDF. After filtration, the effluent is discharged to the Calumet River.

The hours of operation for a particular dredging event depends on the completion schedule, weather, and the pieces of equipment and crew members that the dredging company has available. The dredging operation in general ran on a 24 hour/day schedule when weather conditions allowed.

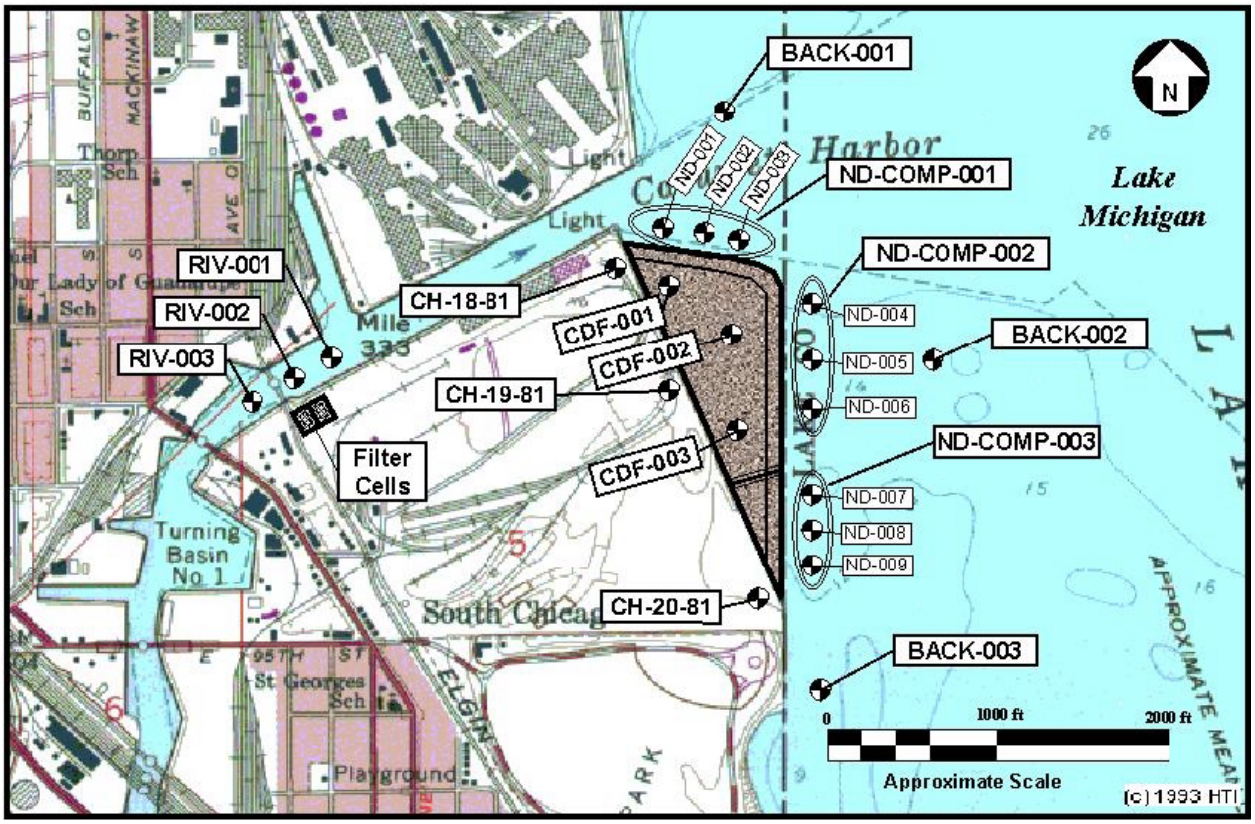
4. Sampling Program

A sampling program was established to document the water quality before, during, and after dredging. In addition, sediment samples were collected that characterized the material being dredged. Monitoring was conducted at the stations shown in Figure 2 to evaluate impacts to water quality. The following specific tasks were performed:

a. The water quality of the treated effluent from the CDF (Station 3 permit terminology, CH-00-03) was compared to applicable water quality standards.
b. The chemical characteristics of dredged material disposed in the CDF (Sediment sample CH-00-SED) were documented.
c. The localized effects of the dredging and rehandling operations on the water quality in Calumet Harbor were documented and reviewed (Turbidity and Total suspended solids monitoring around the dredge and rehandling operations, stations CH-00-09 to CH-00-14).
d. Upstream river background samples were compared to a downstream sample of the Calumet River to determine if there is an effect from the discharge of the filter cells (Stations RIV-001 through RIV-003).
e. The performance of the filter cells was checked by comparing influent to effluent and evaluating the retention of solids (Station 2, Filter cell influent and Station 3, Filter cell effluent).
f. The effect of the dredging event on the water quality of Calumet Harbor was assessed.

g. The short-term impact of the CDF operation on Calumet Harbor water quality was assessed.

Figure 2: Sampling Locations



The samples were collected over the period extending from October 20 through December 22, 2009 by TriMatrix Laboratories of Grand Rapids, Michigan. This included the before, during, and after dredging time periods. Samples were collected at two sampling frequencies. Samples were collected twice per week for one week prior to dredging and one week after dredging. During dredging, samples were collected once per week. Table 2 lists the sediment parameters used, Table 3 lists the water parameters used, and Table 4 outlines the sampling analysis and frequency. All parameters and reporting limits are in accordance with the Illinois EPA Water Pollution Control Permit, except were TriMatrix Laboratories found reporting limits to be unachievable, as noted.

Table 2: Parameters for chemical analysis of sediment samples

Parameter	Method	Reporting Limit (mg/kg)
Metals		
Arsenic	6020A	1.0
Barium	6020A	1.0
Cadmium	6020A	1.0
Chromium	6020A	1.0

Parameter	Method	Reporting Limit (mg/kg)
Copper	6020A	1.0
Lead	6020A	1.0
Manganese	6020A	1.0
Mercury	7471A	0.02
Nickel	6020A	1.0
Zinc	6020A	1.0
Physical		
Total Volatile Solids	SM 2540G	1.0%
Total Solids	SM 2540G	1.0%
Organics		
Chemical Oxygen Demand	SM 5220 D	100
Oil & Grease	9071B	87-200[1]
Total PCBs	8082	0.05
Nutrients & Others		
Ammonia-Nitrogen	4500-NH_3 G	0.5
Total Organic Carbon	MSA 29-3.5.2	0.1
Total Phosphorus	SM 4500P. F	0.88-8.7[2]
Total Cyanide	9010/9014	0.2

Note:
[1] Permit required RL of 10 mg/kg unachievable, as it is reflective of the old and currently banned Freon-113 extraction procedure 413.1
[2] Permit required RL of 1.0 mg/kg unachievable due to percent solids of sediment samples

Table 3: Parameters for chemical analysis of water samples

Parameter	Proposed Method	Reporting Limit (mg/L)
Chromium (Total)	6020A	0.0010
Manganese (Total)	6020A	0.0010
Zinc (Total)	6020A	0.0010
Ammonia, Nitrogen	SM 4500-NH_3 G	0.01
Phosphorus, Total	SM 4500-P F	0.005
Total Kjeldahl Nitrogen	351.2	0.2
pH	SM 4500-H B	+/- 0.01 pH Units
Total Suspended Solids	SM 2540 D	3.3[1]
Total Dissolved Solids	SM 2540 C	3.3[1]
Temperature	SM 2550 B	+/- 0.1 ^oC
Turbidity	180.1	1.0 NTV

Note:
[1] Permit required RL of 1.0 mg/L unachievable

Table 4: Sample collection analysis and frequency specifications

Sample ID Number	Sample Type	Sample Point Description	Sampling Method	Pre/Post-Dredging	During Dredging
CDF					
CDF-001, 002, 003	Grab	Inside CDF; 1/3 of Water Column	Kemmerer	Yes	Yes
Filter Cell					
CH-00-02	Grab	Filter Cell Influent	Water Grab	No	Yes
CH-00-03	Composite	Discharge Sample Well	Composite	No	Yes
River/Harbor					
RIV-001	Grab	200' Upstream of Filter Cell; 1/3 of Water Column	Kemmerer	Yes	Yes
RIV-002	Grab	At Filter Cell Effluent; 1/3 of Water Column	Kemmerer	Yes	Yes
RIV-003	Grab	200' Downstream of Filter Cell; 1/3 of Water Column	Kemmerer	Yes	Yes
ND-COMP-001	Composite	Comp. of ND-001, 002, 003; 1/3 of Water Column	Kemmerer	Yes	Yes
ND-COMP-002	Composite	Comp. of ND-004, 005, 006; 1/3 of Water Column	Kemmerer	Yes	Yes
ND-COMP-003	Composite	Comp. of ND-007, 008, 009; 1/3 of Water Column	Kemmerer	Yes	Yes
BACK-001	Grab	1000' from N. Dike Wall; 1/3 of Water Column	Kemmerer	Yes	Yes
BACK-002	Grab	1000' from E. Dike Wall; 1/3 of Water Column	Kemmerer	Yes	Yes
BACK-003	Grab	1000' S. of CDF & 50' E. of Dike Wall; 1/3 of Water Column	Kemmerer	Yes	Yes
Landing Wells					
CH-18-81, CH-19-81, CH-20-81	Grab	Monitoring Wells on CDF Landing	Well Bailers	Yes	Yes
Turbidity					
BACK-, RIV-, ND-COMP-001, 002, 003	Grab/ Composite	Background, River, and Near Dike Composite Turbidity; 1/3 of Water Column	Kemmerer	Pre-Dredging Only	1st Week Only
CH-00-09 TOP, CH-00-09 MID	Grab	100' Upstream from Dredging; Top, Mid Depth	Kemmerer	No	Yes
CH-00-10 TOP, CH-00-10 MID	Grab	100' Downstream from Dredging; Top, Mid Depth	Kemmerer	No	Yes
CH-00-11 TOP, CH-00-11 MID	Grab	500' Downstream from Dredging; Top, Mid Depth	Kemmerer	No	Yes
CH-00-12 TOP,	Grab	100' S. of Rehandling	Kemmerer	No	Yes

Sample ID Number	Sample Type	Sample Point Description	Sampling Method	Pre/Post-Dredging	During Dredging
CH-00-12 MID		Operation; Top, Mid Depth			
CH-00-13 TOP, CH-00-13 MID	Grab	100' E. of Rehandling Operation; Top, Mid Depth	Kemmerer	No	Yes
CH-00-14 TOP, CH-00-14 MID	Grab	100' N. of Rehandling Operation; Top, Mid Depth	Kemmerer	No	Yes
Suspended Solids					
CH-00-09, 10, 11, 12, 13, 14 TOP, MID	Grab	Dredging Area, Disposal Area Suspended Solids; Top, Mid Depth	Kemmerer	No	1st Week Only
Dredged Sediment					
CH-00-SED	Grab	Dredging Barge	Grab	No	Yes

The sampling dates are shown on the calendar in Table 5. The "before" dredging samples were collected twice in one week, on 20 October and 26 October 2009. The "during" dredging samples were collected once per week from 03 November 2009 through 16 December 2009. The "after" dredging samples were collected twice in one week, on 21 December and 22 December 2009. Laboratory analyses, submitted by TriMatrix, are included as Appendix C and contain the analytical results, field sampling and laboratory analysis quality control measures, and field sampling logs.

Table 5: Sampling schedule

	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.
Oct			20 sample	21	22	23	24
	25	26 sample	27	28	29	30	31
Nov	1	2	3 sample	4	5	6	7
	8	9	10	11	12 sample	13	14
	15	16	17	18	19 sample	20	21
	22	23	24 sample	25	26	27	28
Dec	29	30	1 sample	2	3	4	5
	6	7	8 sample	9	10	11	12
	13	14	15	16 sample	17	18	19
	20	21 sample	22 sample				

The water quality samples collected before, during, and after dredging from within and around the CDF were as follows: CDF-001, CDF-002, and CDF-003 were collected from the CDF pond at 3 sample locations, taken at one third of the depth at each location; samples CH-18-81 and CH-19-81 were collected from the two shallow wells installed in the landing adjacent to the CDF; RIV-001, RIV-002, and RIV-003 were samples collected in the Calumet River around the effluent discharge of the filter cell, at one third the depth; ND-COMP-001, ND-COMP-002, and

ND-COMP-003 were each composite samples collected in Calumet Harbor near the CDF dike, at one third of each depth; and Stations BACK-001, BACK-002, and BACK-003 were samples collected in Calumet Harbor at one third each depth, which served as background samples for the harbor. CH-00-02 and CH-00-03 were collected from the filter cell influent and effluent, respectively, and were collected only during dredging. To monitor the dredging and rehandling operations, samples were collected at top and mid-depth at three locations around the dredge (CH-00-09, 10, 11) and at top and mid-depth at three locations around the rehandling area (CH-00-12, 13, 14). These samples were tested for both total suspended solids (TSS) and turbidity on the first week of dredging, and from then on were only field tested for turbidity. To provide a correlation between turbidity meter results and laboratory TSS results, concurrent nephelometric measurements and grab samples for laboratory TSS were taken during the week of pre-dredging at the river (RIV-XXX), near CDF dike (ND-COMP-XXX), and background (BACK-XXX) locations. Lastly, a weekly sample of the dredged sediment was collected from the scow during dredging.

The Quality Assurance/Quality Control (QA/QC) measures for this project applied to both sample collection and laboratory analytical testing. The field sample QA consisted of field logs, chain of custody sheets, collecting a weekly field duplicate sample, and laboratory sample log-in checklists. The laboratory QC samples consisted of continuing calibration verification samples, matrix spikes, matrix spike duplicates, method blanks, surrogate spikes, and laboratory control samples. Appendix C includes this data on compact disk as part of the analytical results event files. Appendix B contains a quality assurance/control memorandum briefly reviewing five random data events from the eleven project sampling events.

5. Discussion of Analytical Results

This report was written to document and analyze the 2009 maintenance dredging of the Calumet Harbor. The seven objectives (a through g) of the sample program listed in Section 4 will be discussed in this section. The discussion includes a comparison of the analytical results to water quality standards, background levels, and previous dredging operations. The laboratory analysis was performed by TriMatrix of Grand Rapids, Michigan. The analytical results and the laboratory QC sample results are included in the TriMatrix report provided in Appendix C of this report. Summary tables of the laboratory results are included in Appendix A, and some quality control review is included in Appendix B.

5.1. Treated Effluent from the CDF (Filter Cell Effluent)

When dredged material is placed in the CDF, water is pumped from the CDF pond through one of two redundant filter cells. The treated effluent is then discharged into the Calumet River at a point approximately 3,000 feet downstream from the harbor mouth. Weekly effluent samples (CH-00-03) were collected during dredging, whenever pumping operations from the CDF were conducted. In general pumping operations were conducted only during unloading operations into the CDF. Collection of a composite sample was accomplished using a battery operated automatic-timed sampler. Sampling frequency was initially set at 400 mL every four hours such that a 5 gallon jar was filled in the course of a week. Ice and a backflow cycle capability were

included. The effluent sample composited in the container as it was collected. The automatic device did not take a sample unless the filter cell pump was running and liquid was in the outfall pipe. Field testing for pH and temperature was completed before samples were transferred to smaller containers for shipment to the laboratory. A filter cell effluent sample was collected for seven weeks.

Mean filter cell effluent sample values are presented in column two of Table 6. The general use water quality criteria and means of the CDF pond samples (CDF-001, CDF-002, and CDF-003) are presented for purposes of discussion. The treated effluent is compared to Illinois (August 2006) general use water quality standards solely for reference. The CDF pond samples are shown to compare the water quality of the untreated pond to the treated effluent. The treated effluent concentrations are all lower than both the pond concentrations (except for chromium, which was not detected in either the pond or effluent) and water quality standards. The filter cell effluent is discharged into the Calumet River. A mixing zone was not applied because the effluent concentrations were less than the water quality standards.

Section 302.208 of Subpart B establishes an acute and chronic water quality standard for chromium and zinc, and section 302.212 establishes both acute and chronic standards for total ammonia nitrogen. Because dredging has a short-term impact on water quality, it was decided that the acute standards are more applicable than the chronic ones. All the tables in this report will present the acute standards, as presented in column 3, for comparison to the water quality sample results.

Table 6: Filter Cell Effluent during 2009 dredging

Parameter	**CDF Pond** (mg/L)	**Filter Cell Effluent** (mg/L)	**IL WQ General Use Standard[2] Total** (mg/L)
Chromium	<0.005	<0.005	0.714 [3, 4]
Manganese	0.044	<0.007	1.0
Zinc	0.018	0.009	0.157 [3]
Ammonia (as N)	<0.348	<0.087	6.95 [5]
TKN	0.854	0.44	--
Phosphorus	0.038	0.027	0.05
TDS	464	455	1000
TSS	<9.19	<9.57	15 [6]
pH, S.U.	8.63	7.69	6.5 – 9.0

Notes:

1. Mean concentrations are calculated using the detection limit where no concentrations were detected. Inclusion of the "<" symbol indicates that at least one non-detect was included in calculating the mean.
2. IL Pollution Control Board, Title 35, Subtitle C, Chapter I, Subpart B: General Use Water Quality Standards, effective Aug 9, 2006.
3. Acute standard based on hardness of Calumet River (H) = 138 mg/L $CaCO_3$
4. Standard for trivalent dissolved chromium
5. Acute standard based on pH of Calumet River = 8.1
6. Standard from Chicago Area Confined Disposal Facility 1982 Environmental Impact Statement

5.2. Sediment Quality

For the entire dredging event, sediment samples were collected from the scow near where the dredge was located. The analytical results for the seven sediment samples are summarized in Table 7.

Table 7: Sediment Quality of 2009 maintenance dredging of Calumet Harbor

	Units	3-Nov	12-Nov	19-Nov	24-Nov	1-Dec	8-Dec	16-Dec
Metals:								
Arsenic (Total)	mg/kg dry	10	8.7	7.1	7.5	10	9.1	8.9
Barium (Total)	mg/kg dry	33	33	27	27	37	35	33
Cadmium (Total)	mg/kg dry	1.1	<1.0	<1.0	<1.0	1.3	<1.0	<0.94
Chromium (Total)	mg/kg dry	43	32	30	30	46	31	35
Copper (Total)	mg/kg dry	39	33	27	27	36	34	38
Lead (Total)	mg/kg dry	83	66	57	56	93	68	75
Manganese (Total)	mg/kg dry	590	670	510	500	660	710	690
Mercury (Total)	mg/kg dry	0.099	0.090	0.083	0.077	0.14	0.12	0.097
Nickel (Total)	mg/kg dry	24	22	19	18	23	23	23
Zinc (Total)	mg/kg dry	240	190	170	150	290	180	200
Physical:								
Volatile Solids	%	4.0	3.6	2.9	2.8	2.6	3.5	4.1
Percent Solids	%	56	55	52	61	68	76	57
Organics:								
Chemical Oxygen Demand	mg/kg dry	110,000	110,000	88,000	65,000	62,000	82,000	66,000
HEM: Oil & Grease	mg/kg dry	570	360	430	480	800	440	320
Nutrients & Others:								
Nitrogen, Ammonia	mg/kg dry	160	200	190	130	130	160	220
Carbon, Total Organic	%	1.8	1.7	1.4	1.8	1.4	1.6	1.4
Phosphorus, Total	mg/kg dry	4.0	3.4	9.9	<8.3	<7.3	9.4	<8.7
Cyanide, Total	mg/kg dry	0.27	0.27	0.54	0.24	0.32	0.17	0.22
PCBs:								
PCB-1016	mg/kg dry	<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	<0.030
PCB-1221	mg/kg dry	<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	<0.030
PCB-1232	mg/kg dry	<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	<0.030
PCB-1242	mg/kg dry	<0.031	0.058	<0.033	<0.028	<0.025	<0.022	<0.030
PCB-1248	mg/kg dry	0.048	<0.031	0.074	0.056	0.033	0.039	0.083
PCB-1254	mg/kg dry	0.071	0.13	0.15	<0.028	0.039	0.066	0.11
PCB-1260	mg/kg dry	<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	0.037

An average for each parameter was calculated for the seven sediment samples and is shown in Tables 8 and 9. Also included in Tables 8 and 9 is the minimum, mean, and maximum results of the sediment analysis for the recent dredging event and all the past dredging events except the KCBX May 1991 event. In the last column, the table displays the overall maximum, mean, and minimum from all the combined sampling events. The overall mean value is calculated from the means of each of the twelve sampling events. The number of sediment samples collected for each dredging event varied from 1 to 18 as shown in the last row of each of the two tables. The number of samples was dependent on the length of the dredging operation.

Table 8: Metals in sediment characteristics for past and recent dredging events

Sediment Parameters	Units		Year of Dredging Operation												
			1984	1985	1986	1989	1994	2000-01	2001	2003	2007	2008	June 2009	Dec 2009	Overall
Arsenic	mg/kg	Max	12	74	4.3	124	27	57.9	12.7	124	11	--	--	10	124
		Mean	5.2	19.1	2.2	54.4	20	17.4	8.8	46.9	7.4	8.8	44	8.8	20.3
		Min	0.4	<0.3	0.66	6.84	11	6.7	4.4	<10	4.6	--	--	7.1	<0.3
Barium	mg/kg	Max	110	52	190	124	75	86	77	74	47	--	--	37	190
		Mean	46.3	27.8	66	71	65	<57	64	48.2	29.5	52	110	32	55.8
		Min	23	8.4	28	30	57	32	51	30	19	--	--	27	8.4
Cadmium	mg/kg	Max	5	2	5.1	15.8	4.8	6.2	15.5	2.7	1.3	--	--	1.3	15.8
		Mean	2.9	1.3	2.7	8.23	3.5	2.5	8.2	1.7	<1.03	<1.0	9.2	<1.05	3.61
		Min	0.88	0.82	0.82	<0.50	2.7	0.2	0.9	0.88	<1.0	--	--	<1.0	0.2
Chromium	mg/kg	Max	60	27	62	86.9	101	347	35	162	55	--	--	46	347
		Mean	34.7	19.2	24	62.3	61	68	18	52.4	25.6	20	110	35	44.2
		Min	23	12	3	20.9	31	19	2	24	14	--	--	30	2
Copper	mg/kg	Max	100	44	82	87.4	131	118	68	502	49	--	--	39	502
		Mean	57.6	29.9	42	67.4	86	64	56	103.8	27.5	24	140	33	60.9
		Min	34	24	4.4	26.4	47	14	44	43	16	--	--	27	4.4
Iron	mg/kg	Max	54,000	30,000	12,000	151,000	120,000	82,800	127,000	96,300	No Data	No Data	No Data	No Data	151,000
		Mean	40,323	18,909	8,100	54,043	76,475	38,388	38,044	49,582	No Data	No Data	No Data	No Data	40,483
		Min	22,350	13,000	5,400	16,100	37,400	14,800	12,700	27,900	No Data	No Data	No Data	No Data	5,400
Mercury	mg/kg	Max	0.66	0.12	0.9	0.169	0.57	0.62	0.2	0.19	0.13	--	--	0.12	0.9
		Mean	0.157	0.07	0.57	0.09	0.39	<0.19	<0.15	0.15	0.097	0.027	0.32	0.10	0.192
		Min	<0.01	0.04	0.11	0.022	0.23	<0.1	<0.1	<0.10	0.051	--	--	0.077	0.022
Manganese	mg/kg	Max	2,100	700	160	2,910	2,080	3,980	1,820	5,050	890	--	--	710	5,050
		Mean	1,069	451.8	140	1,691	1,440	1,257	780	1,515	625	760	2,900	619	1,104
		Min	600	390	130	344	881	394	476	717	530	--	--	500	130
Nickel	mg/kg	Max	50	32	19	73.7	63	61	35	100	31	--	--	24	100
		Mean	27	24.3	14	56.8	41	43.4	23	40.5	19.7	46	68	22	35.5
		Min	15	19	8.6	33.6	23	28.4	12	25	13	--	--	18	8.6
Lead	mg/kg	Max	520	130	250	276	639	367	161	393	140	--	--	93	639
		Mean	297.3	88	140	179.4	350	179.7	77	178	59.2	56	1,200	71	239
		Min	50	50	18	35	119	8.8	33	84	29	--	--	56	8.8
Zinc	mg/kg	Max	2,300	440	280	849	1,920	1,060	481	4,690	400	--	--	290	4,690
		Mean	1,108	270.5	170	423.5	1,051	511.9	221	942	172	180	4,000	203	770
		Min	280	180	61	80	282	54.3	82	283	95	--	--	150	54.3
Number of Samples Collected			11	11	7	7	4	18	9	11	13	1	1	7	100

Table 9: Wet chemistry sediment characteristics for past and recent dredging events

Sediment Parameters		Year of Dredging Operation												
		1984	1985	1986	1989	1994	2000-01	2001	2003	2007	2008	June 2009	Dec. 2009	Overall
Total Solids (%)	Max	63.2	73	74	66.8	65	86	49	No Data	66	--	--	76	86
	Mean	52	54.6	54	54.1	57	63.7	48.5	No Data	57.1	72	57	61	57.3
	Min	45.5	43	37	39.9	50.7	40	48	No Data	47	--	--	52	37
Total Volatile Solids (%)	Max	17	8.3	19	10.9	8.3	15.4	3.7	No Data	5.6	--	--	4.1	19
	Mean	11.1	7.2	9.3	6.34	7.2	5.4	3.6	No Data	3.85	13	7.1	3.4	6.99
	Min	5.1	2.7	2.4	3.8	6.2	2.8	3.5	No Data	2.6	--	--	2.6	2.4
Cyanide (mg/kg)	Max	5.1	0.56	0.54	2.8	1.4	2.1	1	5.8	2.3	--	--	0.54	5.8
	Mean	1.2	0.2	0.23	1.24	1.3	<0.79	<0.64	1.9	<0.47	<0.23	<0.36	0.29	0.74
	Min	<0.14	0.08	<0.01	<0.15	1.2	<0.5	<0.5	<0.20	<0.22	--	--	0.17	0.08
Chemical Oxygen Demand (mg/kg)	Max	290,000	73,000	52,000	962,000	200,000	134,000	107,000	282,000	240,000	--	--	110,000	962,000
	Mean	135,309	55,046	39,000	172,500	136,000	81,170	76,689	176,936	112,000	180,000	100,000	83,286	112,328
	Min	65,000	27,000	21,000	11,500	94,000	6,130	39,500	99,300	53,000	--	--	62,000	6,130
Ammonia (as N) (mg/kg)	Max	240	110	240	141	293	255	244	253	470	--	--	220	470
	Mean	137.45	72.9	80	59.97	216	134	166	210	152	32	140	170	131
	Min	80	2.4	15	26.8	142	20	81	138	67	--	--	130	2.4
TKN (mg/kg)	Max	4,900	890	1500	1,220	9,850	2,970	1,310	1,430	No Data	No Data	No Data	No Data	9,850
	Mean	1,624	721.9	910	514.3	7,328	1,224	932	1,212	No Data	No Data	No Data	No Data	1,808
	Min	670	81	360	156	4,200	541	627	713	No Data	No Data	No Data	No Data	81
Oil & Grease (mg/kg)	Max	15,000	4,400	6,500	99,500	1,640	5,780	3,350	6,580	790	--	--	800	99,500
	Mean	7,445	1,888	3,360	19,059	1,423	<1,394	1405	2714	338	2,200	13,000	486	4,559
	Min	1,000	970	650	326	1,080	20	258	1120	100	--	--	320	20
Phosphorus (total) (mg/kg)	Max	1,000	500	540	11.3	3,300	492	465	778	430	--	--	9.9	3,300
	Mean	513.6	307	360	15.8	1,118	252	295	511	290	160	730	<6.9	380
	Min	300	300	180	<0.10	227	8.9	208	350	190	--	--	3.4	<0.10
PCBs (mg/kg)	Max	19	1.2	12	11	7.3	4.1	<0.33	13	0.39	--	--	0.15	19
	Mean	4.4	0.7	5.4	5.04	3.8	<0.79	<0.33	2	<0.155	0.179	4.8	<0.041	2.31
	Min	0.69	0.3	0.41	<0.25	0.8	<0.33	<0.33	<0.33	<0.075	--	--	<0.022	<0.022
Total Organic Carbon (%)	Max	No Data	No Data	0.0965	0.198	No Data	No Data	No Data	No Data	2.1	--	--	1.8	2.1
	Mean	No Data	No Data	0.0576	0.098	No Data	No Data	No Data	No Data	1.23	1.7	7.1	1.6	1.36
	Min	No Data	No Data	0.009	0.024	No Data	No Data	No Data	No Data	0.83	--	--	1.4	0.009
# Samples Collected		11	11	7	7	4	18	9	11	13	1	1	7	100

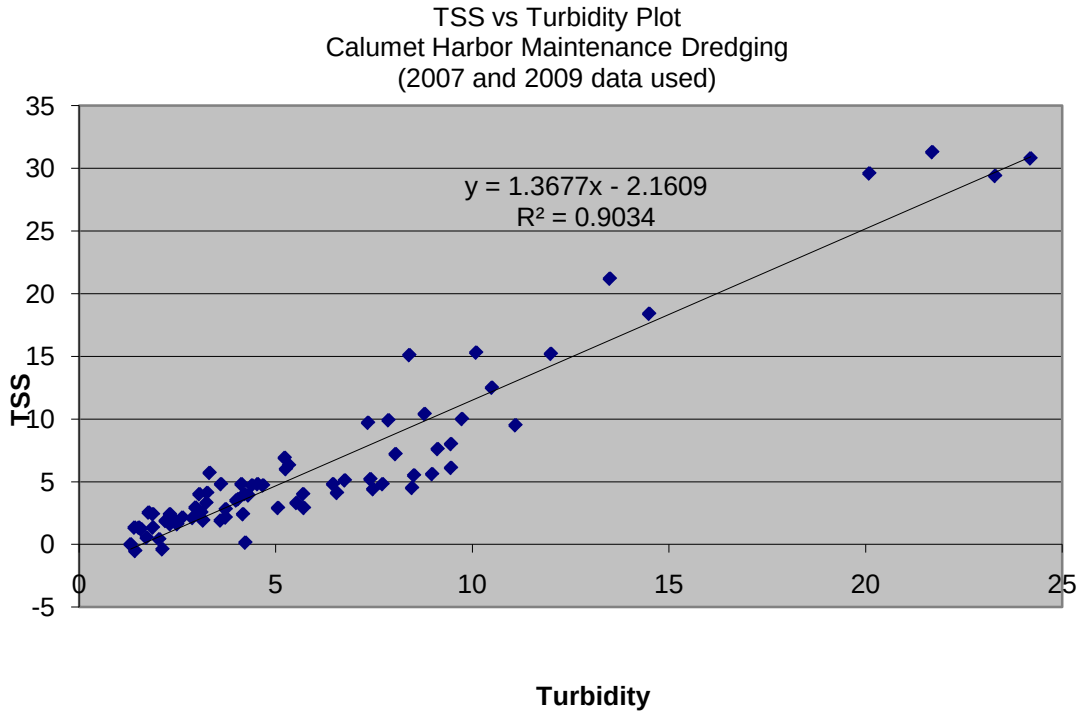
The sediment chemistry in Tables 8 and 9 characterizes the sediment that was placed in the Chicago Area CDF during the last thirteen dredging operations. Maintenance dredging of the Calumet River and Harbor occurred in the shoaled areas so the sediment characteristics shown in Tables 8 and 9 would have been from various locations along the river and in the harbor. Some variation in the data is introduced due to using multiple laboratories, analytical methods, and sample collection techniques.

This was the third dredging event in which only the harbor was dredged. The sediment testing results show significantly lower concentrations of metals, PCBs, and oil and grease compared to previous events when the dredged material was entirely from the river.

5.3. Total Suspended Solids Monitoring During Dredging

To assess the contractor's operating performance during dredging and rehandling, water samples were collected and analyzed for total suspended solids (TSS) around the dredging area and rehandling area. On the first week of dredging, concurrent nephelometric turbidity measurements and grab samples for laboratory TSS were taken. These results provided a correlation between turbidity meter results and laboratory TSS results for all subsequent analysis (see Figure 3 below). The plot was created using results from 2009 and 2007 dredging events to provide a better correlation. Field turbidity measurements were performed once a week for seven weeks during the 2009 dredging and were analyzed for TSS using Method SM 2540D. Three sampling locations were specified each at the dredging and rehandling areas, and samples were taken at two depths (at a few feet below the water surface and at mid-depth). The sampling locations for the dredging and rehandling areas are shown in Figures 4 and 6.

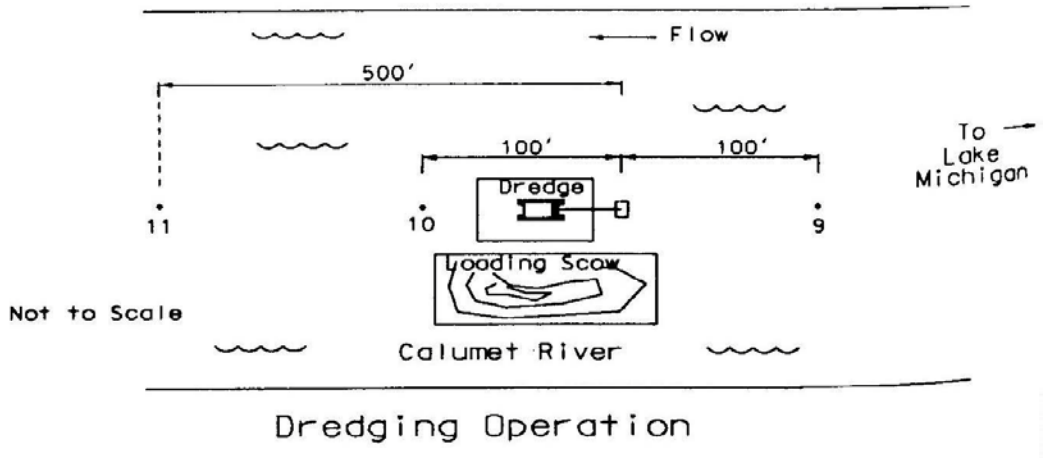
Figure 3: Total Suspended Solids vs. Turbidity Data Correlation Plot



5.3.1. Dredging Area TSS Monitoring

The three sampling stations around the dredging operation were 100 feet upstream, 100 feet downstream, and 500 feet downstream of the centerline of the dredge (see Figure 4). The upstream samples were collected to establish background suspended solids concentrations in the harbor. As the dredge was relocated to different stations in the harbor, the sampling locations remained the same in relation to the dredge and the flow of the river. Generally, all three samples were collected one after the other within one-half hour of each other and after the harbor and river water quality samples were collected.

Figure 4: Turbidity monitoring around dredging operations



As reported by the Metropolitan Water Reclamation District, the annual average flow through the O'Brian Lock and Dam for the period of record from 1983 to 1992 was 250 cubic feet per second. The lock is at the downstream end of the Calumet River and is an indication of the current in the river, because the lock controls the flow. Based on the channel cross-section 300 feet wide by 30 feet deep, the average current would be 0.03 ft/sec. However, because dredging occurred only in the harbor, and not in the river, this current is not likely to reflect the actual current around the dredge area.

The analytical results from the dredging locations are summarized in Table 10. Means were calculated for each depth for the three samples collected around the dredge. Figure 5 depicts the means at each sampling location. At 100 feet upstream, the mean mid-depth and surface suspended solids concentrations were slightly higher than that of the downstream samples. At 500 feet downstream, the mean suspended solids concentration of mid-depth samples was similar to 100 feet downstream. This result indicates that the "upstream" and "downstream" do not realistically describe sampling locations in the harbor. It is likely that migration patterns of suspended solids in the harbor were determined more by wave action than by water flowing out of the harbor.

Considering this monitoring issue, background suspended solids results are also shown in Tables 10 and 11 for a comparison. TSS was monitored at background locations 1000 feet north, east, and south of the CDF, as shown in Figure 2. However, these measurements were not produced by correlating top and mid-depth field turbidity results to laboratory TSS results, as the dredging and rehandling area samples were. Rather, background samples were collected at 1/3 the height of the water column using a Kemmerer water sampler and analyzed for TSS at the lab.

The nature of the dredging operation creates resuspension of solids in the water column which causes increased suspended solids. The resuspension is a localized, short-term impact which decreases as the distance from the operation increases. The data show that the dredging operation had only a small impact on any increase in suspended solids outside a distance of 100 feet from the dredge, as suspended solids concentrations 500 feet from the dredge were only slightly above background, if at all. Table 11 also shows that TSS concentrations in the harbor increased over the course of the dredging event, but because the elevated TSS levels remained for more than a week after dredging ended, this increase is likely unrelated to dredging activities. It is likely that the increased suspended solids are due to weather related factors, since the lake generally has more waves and mixing during late fall and winter.

Table 10: Suspended Solids (mg/L) monitoring results around dredge area and background

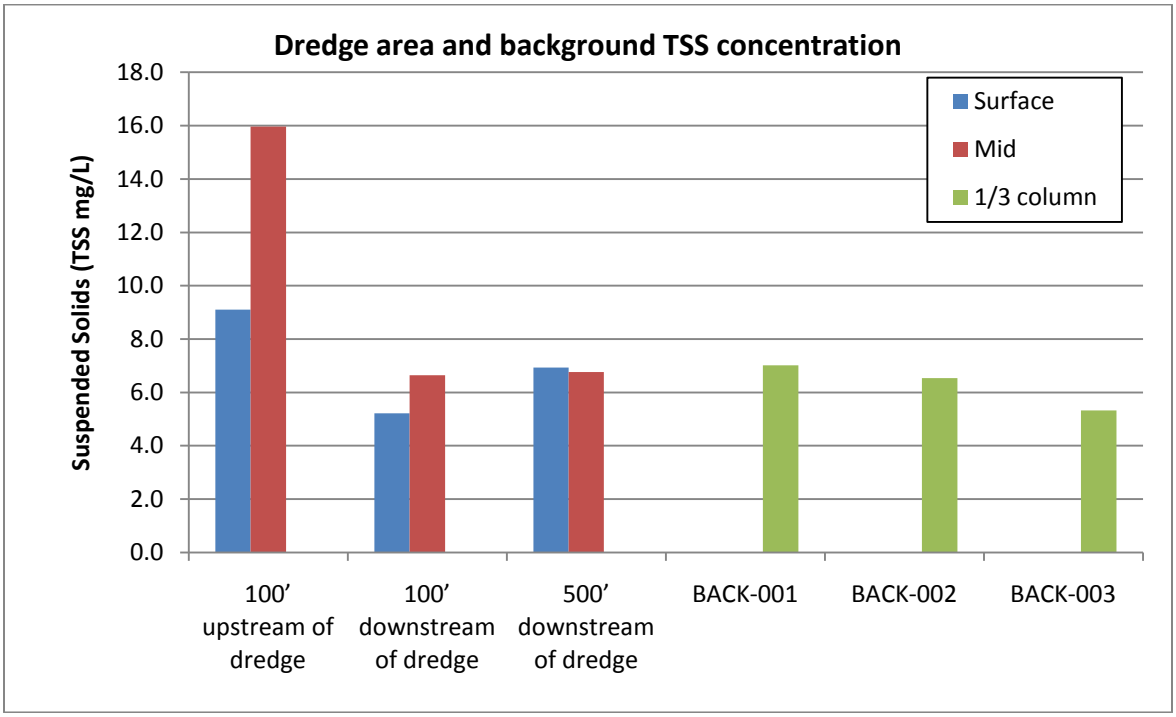
		3-Nov	12-Nov	19-Nov	24-Nov	1-Dec	8-Dec	16-Dec	Avg.
CH-00-09: 100' upstream	Surface	6.3	<3.3	14.1	4.03	4.24	14.4	18.8	9.1
	Mid	31.3	5.57	14.8	5.98	7.71	20.4	26	16.0
CH-00-10: 100' downstream	Surface	3.3	<3.3	5.55	<3.3	4.02	8.51	13.3	5.2
	Mid	4.7	5.06	8.22	<3.3	7.84	6	14	6.6
CH-00-11: 500' downstream	Surface	10	<3.3	8.02	<3.3	4.43	4.62	12.1	6.9
	Mid	7.6	3.73	9.6	<3.3	4.36	4.13	17	6.8
BACK-001	1/3 water column	8.0	7.6	6.9	8.4	4.3	6.3	7.6	7.0
BACK-002		9.5	4.0	5.1	<3.3	<3.3	6.8	7.3	6.5
BACK-003		4.0	4.5	<3.3	<3.3	3.7	7.8	6.6	5.3

Note: All dredge area TSS results except for 11/3 calculated from correlation to turbidity measurements

Table 11: Background Suspended Solids before, during, and after dredging

	Before		During	After	
	20-Oct	26-Oct	Avg.	21-Dec	22-Dec
BACK-001	<3.3	4.0	7.0	5.6	6
BACK-002	<3.3	<3.3	6.5	5.1	5.7
BACK-003	<3.3	<3.3	5.3	5.3	3.7

Figure 5: Average Suspended Solids concentration around dredge area and background



5.3.2. Rehandling Area TSS Monitoring

At different times during the operation the rehandling area was located along the CDF dike wall between stations 15+00 and 26+00. Water samples were collected at three sampling points within approximately 100 feet of the scow being unloaded (see Figure 6). The three samples were collected one after the other within one-half hour and along with the harbor water quality samples. Table 12 is a list of the means of the rehandling area suspended solids samples. The total suspended solids concentrations around the rehandling area averaged between 8.0 to 16.0 mg/L including non-detectable samples set equal to the detection limit.

Figure 6: Turbidity monitoring around rehandling area

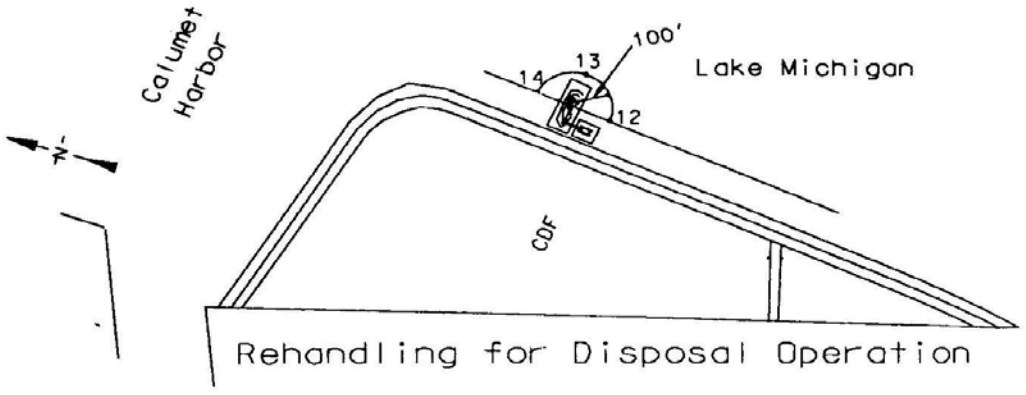


Table 12: Suspended Solids (mg/L) monitoring results around the rehandling area

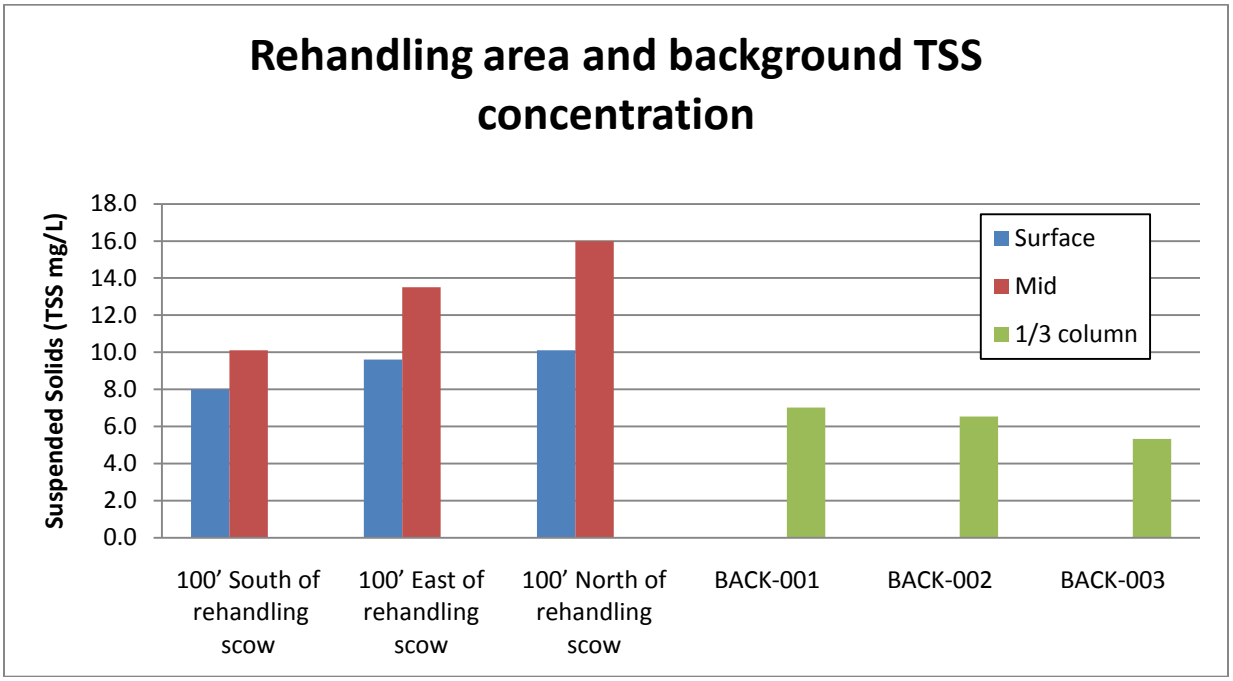
		3-Nov	12-Nov	19-Nov	24-Nov	1-Dec	8-Dec	16-Dec	Avg.
CH-00-12: 100' South	Surface	4.5	5.66	13.7	5.87	<3.3	12.6	11.9	<8.0
	Mid	6.1	7.67	15.8	6.95	<3.3	13.3	18.6	<10.1
CH-00-13: 100' East	Surface	4.8	14.5	11.7	8.62	<3.3	14.5	11.7	<9.6
	Mid	4.8	32.9	11.9	12.2	<3.3	13	17.7	<13.5
CH-00-14: 100' North	Surface	5.6	10.4	13.6	<3.3	3.9	19	16.2	<10.1
	Mid	5.5	19.2	16.9	22.2	3.83	30.4	14.3	16.0

Note: All rehandling area TSS results except for 11/3 calculated from correlation to turbidity measurements

Figure 7 shows the means of the TSS concentrations around the rehandling area on a bar graph. TSS concentrations around the rehandling area were lower south of the scow. Average TSS concentrations were slightly higher around the rehandling area than around the dredge area. Still, as with the dredging operations, the rehandling operations do not appear to have affected the overall water quality in the harbor.

Some spillage occurred at the rehandling area as the sediment was removed from the barge and placed in the hopper on the dike wall. A filter mat was placed on the rocks of the dike wall around the hopper as spillage protection. In addition, the crane operators were instructed to minimize spillage when transporting the sediment to the hopper. The operation was monitored to ensure spills were minimized.

Figure 7: Average Suspended Solids concentration around rehandling area and background



5.4. Calumet River Sampling

The Calumet River was sampled at three points around the filter cell effluent discharge point to determine if the effluent had an impact on the river. RIV-001 was collected 200 feet upstream of the discharge point, RIV-002 was collected at the discharge point, and RIV-003 was collected 200 feet downstream of the discharge point.

5.4.1. Calumet River Sampling During Dredging

The only time that water is pumped from the CDF and discharged through the filter cells is when dredged material is placed in the CDF. A total of seven samples were collected from each river location during dredging. The mean concentrations during dredging were calculated for each of the three river locations and are presented in Table 13. The general use water quality standards and means of the filter cell effluent have been included in Table 13 for discussion.

During dredging, all filter cell parameters were well below the reference concentrations. The river concentrations of Ammonia (as N), TKN, Phosphorous, TDS, and TSS were below the corresponding filter cell effluent concentrations. Manganese and Zinc concentrations in the river were above the effluent concentrations. Chromium concentrations of the effluent were the same as those of the river. The pH of the effluent was more neutral than that of the river. Overall, there was no negative effect in the Calumet River from the discharge of the filter cells.

Table 13: Calumet River samples collected during dredging

Parameter	Dredging			Filter Cell Effluent (mg/L)	General Use Water Quality Standard (mg/L)
	RIV-001 (mg/L)	RIV-002 (mg/L)	RIV-003 (mg/L)		
Chromium	<0.0050	<0.0050	<0.0050	<0.005	0.714 [3, 4]
Manganese	0.0159	0.0109	0.0099	<0.007	1
Zinc	<0.0105	0.0183	0.0167	0.009	0.157 [3]
Ammonia (as N)	<0.0310	0.0324	0.0296	<0.087	6.95 [5]
TKN	<0.24	<0.25	<0.25	0.44	--
Phosphorus	0.016	0.012	0.014	0.027	0.05
TDS	233	232	242	455	1000
TSS	<6.4	<6.5	5.9	<9.57	15 [6]
pH, S.U.	8.03	8.03	8.05	7.69	6.5 – 9.0

Notes:

1. Mean concentrations are calculated using the detection limit where no concentrations were detected. Inclusion of the "<" symbol indicates that at least one non-detect was included in calculating the mean.
2. IL Pollution Control Board, Title 35, Subtitle C, Chapter I, Subpart B: General Use Water Quality Standards, effective Aug 9, 2006.
3. Acute standard based on hardness of Calumet River (H) = 138 mg/L $CaCO_3$
4. Standard for trivalent dissolved chromium
5. Acute standard based on pH of Calumet River = 8.1
6. Standard from Chicago Area Confined Disposal Facility 1982 Environmental Impact Statement

5.4.2. Calumet River Sampling Before, During, and After Dredging

Samples were collected at RIV-001, RIV-002, and RIV-003 on two days about a week before dredging, seven weeks during dredging, and on two days the week after dredging. These samples were collected to compare the background water quality of the river previous to dredging 2009, during dredging, and after dredging. Table 14 displays the means of the river samples collected before, during, and after dredging. Concentrations of Ammonia and TDS were slightly higher after dredging.

Table 14: Calumet River samples collected before, during, and after dredging

	Before Dredging			During Dredging			After Dredging		
Parameter	RIV-001 (mg/L)	RIV-002 (mg/L)	RIV-003 (mg/L)	RIV-001 (mg/L)	RIV-002 (mg/L)	RIV-003 (mg/L)	RIV-001 (mg/L)	RIV-002 (mg/L)	RIV-003 (mg/L)
Chromium	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0050	<0.005	<0.005	<0.005
Manganese	0.0085	0.0115	0.0084	0.0159	0.0109	0.0099	0.007	0.0064	0.0064
Zinc	0.01	0.014	<0.009	<0.0105	0.0183	0.0167	0.0066	0.0076	<0.0085
Ammonia (as N)	0.0255	0.0325	0.0245	<0.0310	0.0324	0.0296	0.0435	0.0415	0.037
TKN	<0.2	<0.21	<0.2	<0.24	<0.25	<0.25	<0.2	<0.2	<0.2
Phosphorus	0.007	0.009	0.009	0.016	0.012	0.014	<0.005	<0.005	<0.005
TDS	175	186	189	233	232	242	280	246	254
TSS	7.4	10.9	5.7	<6.4	<6.5	5.9	4.2	<3.7	<3.7
Temperature, ^{o}F	52.5	52.5	53.6	46.5	46.5	46.7	35.4	35.5	35.8
pH, S.U.	8.04	8.06	8.09	8.03	8.03	8.05	8.0	8.0	8.04

Notes: Mean concentrations are calculated using the detection limit where no concentrations were detected. Inclusion of the "<" symbol indicates that at least one non-detect was included in calculating the mean.

These data were also analyzed using a statistical analysis software package, Analyze-it for Microsoft Excel. Manganese, ammonia, phosphorus, TSS, TDS, and zinc were analyzed, but chromium and TKN were not because over 30% of the results were below the reporting limit for these parameters so any analysis would not yield significant results. Results for RIV-001 and RIV-003 (200 feet upstream and 200 feet downstream of the filter cell point of influent) were compared using the Mann-Whitney test and the Kruskal-Wallis test. Neither test showed a statistically significant difference (within a 95% confidence interval) between upstream and downstream concentrations of any of the parameters. Therefore, there is no indication of any impact on the Calumet River due to filter cell effluent for the dredging operations.

5.5. Filter Cell Performance as Measured by Solids Removal

The ability of the filter cells to reduce the total suspended solids in the effluent is a measure of their performance. According to the Final Environmental Impact Statement issued for the construction of the CDF, the filter cells were designed to reduce the suspended solids in the discharge to at least 15 mg/L (USACE, 1982). The Illinois Environmental Protection Agency's water quality standard for total suspended solids in the Lake Michigan Basin is also 15 mg/L.

Table 15 summarizes the suspended solids concentration in the filter cell influent and effluent during the dredging period. The effluent did not exceed the 15 mg/L design concentration in any of the samples.

Table 15: Total Suspended Solids concentrations and filter cell efficiency

Sampling Date	CH-00-02 Filter Cell Influent (mg/L)	CH-00-03 Filter Cell Effluent (mg/L)	Efficiency (%)
11/3/2009	6.5	Not Sampled	--
11/12/2009	10.8	7.1	34.3
11/19/2009	5.3	<3.3	>37.7
11/24/2009	5.0	<3.3	>34
12/1/2009	<5.0	<3.3	>34
12/8/2009	<5.0	3.3	>34
12/16/2009	7.6	Frozen	--

The filter cell efficiency is a function of the influent and effluent concentrations. Efficiency was calculated for 12 November 2009. On that date both the influent and effluent samples contained measured TSS concentrations. Because the samples were below the detection limit on the other four days, the calculated efficiencies were between >34% and >37.7%. The filter cell effluent was not sampled on 03 November 2009. The filter cell effluent was frozen on 16 December 2009.

5.6. Calumet Harbor Background Water Quality

To assess impacts of the CDF pond on Calumet Harbor, the Analyze-it statistical software was also used for analysis of water sample results around the CDF. Near-dike (ND-COMP-001, -002, -003) and background (BACK-001, -002, -003) sample results were compared using the Mann-Whitney test and Kruskal-Wallis test. Ammonia, phosphorus, TDS, TSS, and zinc were analyzed, but chromium, manganese, and TKN were not because over 30% of the results were below the reporting limit for these parameters so any analysis would not yield significant results. Neither test showed a statistically significant difference (within a 95% confidence interval) between near-dike and background concentrations of any of the parameters. Therefore, there is no indication water quality in Calumet Harbor is being impacted by the CDF.

6. Report Summary

During the period of 20 October through 22 December 2009, various locations within the Calumet Harbor were dredged and the dredge material was disposed in the Chicago Area CDF located adjacent to Iroquois Landing, Calumet Harbor, Illinois. As part of compliance with

Illinois EPA Water Pollution Control Permit number 2006-EA-0864 and Section 401 certification requirements, this report summarizes the monitoring activities conducted for the dredging event. The following conclusions were reached upon review of the analytical data:

1) The treated effluent was below water quality standards and the discharge did not indicate a long term adverse impact on Calumet River water quality.

2) Total suspended solids concentrations were not significantly impacted by the dredging operations outside a distance of 100 feet from the dredge.

3) TSS concentrations around the rehandling area were higher North and East of the scow. The rehandling TSS concentrations were slightly higher than the TSS concentrations the same distance from the dredge.

4) The filter cells effectively removed the suspended solids from water entering the Calumet River from the CDF.

5) Calumet Harbor water quality was not negatively impacted.

Appendix A:

Water Quality Summary Data

SAMPLENAME	PARAMETER	10-20	10-26	11-3	11-12	11-19	11-24	12-1	12-8	12-16	12-21	12-22	UNIT
CH-00-02	Nitrogen, Ammonia			<0.010	0.050	0.053	0.12	0.25	0.38	1.8			mg/L
CH-00-02	Residue, Suspended			6.5	10.8	5.3	5.0	<5.0	<5.0	7.6			mg/L
CH-00-09 TOP	Turbidity (Field)			5.34	2.93	11.9	4.53	4.68	14.3	15.3			NTU
CH-00-09 TOP	Residue, Suspended			6.3									mg/L
CH-00-09 MID	Turbidity (Field)			21.7	5.65	12.4	5.95	7.22	16.5	20.6			NTU
CH-00-09 MID	Residue, Suspended			31.3									mg/L
CH-00-10 TOP	Turbidity (Field)			5.53	2.55	5.64	1.95	4.52	7.80	11.3			NTU
CH-00-10 TOP	Residue, Suspended			3.3									mg/L
CH-00-10 MID	Turbidity (Field)			4.68	5.28	7.59	2.07	7.31	5.97	11.8			NTU
CH-00-10 MID	Residue, Suspended			4.7									mg/L
CH-00-11 TOP	Turbidity (Field)			9.74	3.34	7.44	1.43	4.82	4.96	10.4			NTU
CH-00-11 TOP	Residue, Suspended			10.0									mg/L
CH-00-11 MID	Turbidity (Field)			9.12	4.31	8.60	2.23	4.77	4.60	14.0			NTU
CH-00-11 MID	Residue, Suspended			7.6									mg/L
CH-00-12 TOP	Turbidity (Field)			8.47	5.72	11.6	5.87	2.83	10.8	10.3			NTU
CH-00-12 TOP	Residue, Suspended			4.5									mg/L
CH-00-12 MID	Turbidity (Field)			9.46	7.19	13.1	6.66	3.09	11.3	15.2			NTU
CH-00-12 MID	Residue, Suspended			6.1									mg/L
CH-00-13 TOP	Turbidity (Field)			7.72	12.2	10.1	7.88	2.41	12.2	10.1			NTU
CH-00-13 TOP	Residue, Suspended			4.8									mg/L
CH-00-13 MID	Turbidity (Field)			6.46	25.6	10.3	10.5	2.99	11.1	14.5			NTU
CH-00-13 MID	Residue, Suspended			4.8									mg/L
CH-00-14 TOP	Turbidity (Field)			8.98	9.17	11.5	3.14	4.43	15.5	13.4			NTU
CH-00-14 TOP	Residue, Suspended			5.6									mg/L
CH-00-14 MID	Turbidity (Field)			8.52	15.6	13.9	17.8	4.38	23.8	12.0			NTU
CH-00-14 MID	Residue, Suspended			5.5									mg/L
BACK-001	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
BACK-001	Manganese (Total)	<0.0050	<0.0050	0.0083	0.010	0.0085	0.011	0.0054	<0.0050	0.0068	<0.0050	<0.0050	mg/L
BACK-001	Nitrogen, Ammonia	0.017	0.025	0.015	0.016	0.011	<0.010	0.011	<0.010	0.017	0.027	0.017	mg/L
BACK-001	Nitrogen, Total Kjeldahl	<0.20	<0.20	0.31	<0.20	<0.20	<0.20	<0.20	0.21	<0.20	<0.20	<0.20	mg/L
BACK-001	pH (Field)	8.06	8.06	8.09	8.20	8.10	8.08	8.08	8.06	8.08	7.98	7.95	pH Units
BACK-001	Phosphorus, Total	<0.005	0.017	0.009	0.008	0.015	0.016	0.045	0.009	0.009	<0.005	<0.005	mg/L
BACK-001	Residue, Dissolved @ 180° C	150	172	210	88.0	146	188	156	162	188	180	156	mg/L
BACK-001	Residue, Suspended	<3.3	4.0	8.0	7.6	6.9	8.4	4.3	6.3	7.6	5.6	6.0	mg/L
BACK-001	Temperature °C (Field)	11.2	11.6	10.4	10.8	9.6	9.9	7.7	4.6	1.6	1.7	1.6	°C
BACK-001	Turbidity (Field)	4.17	5.70	9.46									NTU
BACK-001	Zinc (Total)	0.0059	0.0050	0.022	<0.0050	0.0062	0.016	0.013	0.0097	0.0061	0.0068	0.0088	mg/L

SAMPLENAME	PARAMETER	10-20	10-26	11-3	11-12	11-19	11-24	12-1	12-8	12-16	12-21	12-22	UNIT
BACK-002	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
BACK-002	Manganese (Total)	<0.0050	<0.0050	0.0074	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	<0.0050	<0.0050	mg/L
BACK-002	Nitrogen, Ammonia	0.019	0.023	0.020	0.017	0.010	<0.010	<0.010	0.016	0.015	0.020	0.013	mg/L
BACK-002	Nitrogen, Total Kjeldahl	0.20	<0.20	0.35	<0.20	<0.20	<0.20	<0.20	0.23	<0.20	<0.20	<0.20	mg/L
BACK-002	pH (Field)	8.09	8.00	8.22	8.22	8.05	8.13	8.10	8.06	8.09	7.98	7.99	pH Units
BACK-002	Phosphorus, Total	<0.005	0.011	0.010	0.014	0.011	0.009	0.010	0.061	0.009	<0.005	<0.005	mg/L
BACK-002	Residue, Dissolved @ 180° C	186	172	52.0	138	168	192	192	154	148	172	174	mg/L
BACK-002	Residue, Suspended	<3.3	<3.3	9.5	4.0	5.1	<3.3	<3.3	6.8	7.3	5.1	5.7	mg/L
BACK-002	Temperature °C (Field)	11.3	12.1	10.5	11.7	10.0	10.2	7.5	4.8	1.7	1.6	1.4	°C
BACK-002	Turbidity (Field)	3.07	3.16	11.1									NTU
BACK-002	Zinc (Total)	0.0068	0.0088	0.010	0.0052	0.0051	0.0085	0.0089	0.0057	0.011	0.0088	<0.0050	mg/L
BACK-003	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
BACK-003	Manganese (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.0077	<0.0050	<0.0050	mg/L
BACK-003	Nitrogen, Ammonia	0.021	0.021	<0.010	0.017	0.018	0.010	0.013	<0.010	0.023	0.032	0.025	mg/L
BACK-003	Nitrogen, Total Kjeldahl	0.22	0.26	0.31	0.23	0.22	<0.20	<0.20	0.25	<0.20	<0.20	<0.20	mg/L
BACK-003	pH (Field)	8.07	7.99	8.16	8.22	8.08	8.21	8.10	8.05	8.09	7.97	7.94	pH Units
BACK-003	Phosphorus, Total	0.015	<0.005	0.008	0.006	0.007	0.006	0.013	0.039	0.011	0.031	<0.005	mg/L
BACK-003	Residue, Dissolved @ 180° C	170	152	116	518	144	186	206	136	162	228	206	mg/L
BACK-003	Residue, Suspended	<3.3	<3.3	4.0	4.5	<3.3	<3.3	3.7	7.8	6.6	5.3	3.7	mg/L
BACK-003	Temperature °C (Field)	11.1	11.6	10.4	11.8	9.8	10.5	7.7	4.4	1.9	1.8	1.3	°C
BACK-003	Turbidity (Field)	3.73	3.60	3.06									NTU
BACK-003	Zinc (Total)	0.0061	0.011	0.018	0.0079	<0.0050	0.0074	0.013	0.010	0.0067	<0.0050	<0.0050	mg/L
CDF-001	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
CDF-001	Manganese (Total)	0.028	0.050	0.052	0.052	0.034	0.049	0.033	0.024	0.10	0.074	0.067	mg/L
CDF-001	Nitrogen, Ammonia	<0.010	<0.010	<0.010	0.043	0.058	0.14	0.31	0.43	1.9	1.4	1.4	mg/L
CDF-001	Nitrogen, Total Kjeldahl	0.73	0.71	0.89	0.37	0.73	0.61	0.70	1.1	2.5	1.7	1.7	mg/L
CDF-001	pH (Field)	7.97	7.93	8.28	8.68	7.83	7.93	7.97	7.93	7.85	7.76	7.65	pH Units
CDF-001	Phosphorus, Total	0.036	0.040	0.044	0.027	0.035	0.038	0.028	0.033	0.032	0.016	0.020	mg/L
CDF-001	Residue, Dissolved @ 180° C	402	390	424	414	424	462	496	494	538	336	460	mg/L
CDF-001	Residue, Suspended	9.6	14.0	7.7	10.5	8.7	9.6	5.8	<5.0	7.2	<3.3	<3.3	mg/L
CDF-001	Temperature °C (Field)	10.7	11.4	10.1	10.2	8.0	8.1	5.0	1.5	2.5	1.0	1.0	°C
CDF-001	Zinc (Total)	0.013	0.016	0.014	0.0083	0.0089	0.014	0.017	0.012	0.013	0.012	0.019	mg/L
CDF-002	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
CDF-002	Manganese (Total)	0.032	0.044	0.051	0.050	0.041	0.046	0.030	0.025	0.024	0.055	0.074	mg/L
CDF-002	Nitrogen, Ammonia	0.015	<0.010	<0.010	0.090	0.097	0.14	0.30	0.40	0.74	1.2	1.2	mg/L
CDF-002	Nitrogen, Total Kjeldahl	0.66	0.62	0.79	0.35	0.56	0.62	0.69	0.97	0.98	1.6	1.5	mg/L
CDF-002	pH (Field)	8.01	7.89	8.27	8.11	7.90	7.94	8.04	7.91	9.89	9.01	8.94	pH Units
CDF-002	Phosphorus, Total	0.040	0.033	0.040	0.036	0.044	0.053	0.047	0.035	0.036	0.015	0.023	mg/L
CDF-002	Residue, Dissolved @ 180° C	404	408	406	396	422	480	560	418	504	436	446	mg/L
CDF-002	Residue, Suspended	10.9	17.3	11.5	14.1	9.3	10.0	<5.0	<5.0	25.2	7.5	14.6	mg/L
CDF-002	Temperature °C (Field)	10.6	11.4	10.1	10.2	8.1	8.2	5.0	1.9	3.9	2.4	2.6	°C
CDF-002	Zinc (Total)	0.0080	0.019	0.010	0.0092	0.0092	0.012	0.011	0.0088	0.012	0.0072	0.016	mg/L

SAMPLENAME	PARAMETER	10-20	10-26	11-3	11-12	11-19	11-24	12-1	12-8	12-16	12-21	12-22	UNIT
CDF-003	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
CDF-003	Manganese (Total)	0.029	0.045	0.049	0.055	0.035	0.049	0.030	0.021	0.082	0.047	0.047	mg/L
CDF-003	Nitrogen, Ammonia	0.011	<0.010	<0.010	0.044	0.059	0.18	0.28	0.36	1.7	1.3	1.3	mg/L
CDF-003	Nitrogen, Total Kjeldahl	0.95	0.82	0.79	0.42	0.44	0.64	0.61	0.88	2.3	1.5	1.5	mg/L
CDF-003	pH (Field)	8.06	7.83	8.13	8.44	8.02	7.99	8.32	7.96	7.85	8.12	7.90	pH Units
CDF-003	Phosphorus, Total	0.052	0.039	0.034	0.041	0.041	0.042	0.031	0.041	0.039	0.017	0.027	mg/L
CDF-003	Residue, Dissolved @ 180° C	432	404	406	400	422	456	538	494	596	448	454	mg/L
CDF-003	Residue, Suspended	13.3	15.6	7.9	10.7	10.1	12.4	6.0	<5.0	<6.2	<4.5	<3.3	mg/L
CDF-003	Temperature °C (Field)	10.7	11.3	10.4	10.7	8.2	8.2	5.7	1.7	2.7	0.9	1.5	°C
CDF-003	Zinc (Total)	0.012	0.017	0.017	0.14	0.0098	0.012	0.012	0.0085	0.023	0.11	0.059	mg/L
CH-00-03	Chromium (Total)				<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050			mg/L
CH-00-03	Manganese (Total)				0.011	0.011	0.0054	<0.0050	<0.0050	<0.0050			mg/L
CH-00-03	Nitrogen, Ammonia				0.11	<0.010	0.016	0.014	0.10	0.27			mg/L
CH-00-03	Nitrogen, Total Kjeldahl				0.41	0.43	0.29	0.28	0.68	0.55			mg/L
CH-00-03	pH (Field)				7.82	7.65	7.61	7.90	7.86	8.01			pH Units
CH-00-03	Phosphorus, Total				0.028	0.027	0.040	0.019	0.025	0.024			mg/L
CH-00-03	Residue, Dissolved @ 180° C				336	428	456	482	516	514			mg/L
CH-00-03	Residue, Suspended				7.1	<3.3	<3.3	<3.3	3.3	37.1			mg/L
CH-00-03	Temperature °C (Field)				9.4	7.9	7.8	5.2	0.3	5.0			°C
CH-00-03	Zinc (Total)				0.0065	0.0055	0.0083	0.022	0.0063	0.0064			mg/L
CH-00-SED	Arsenic (Total)			10	8.7	7.1	7.5	10	9.1	8.9			mg/kg dry
CH-00-SED	Barium (Total)			33	33	27	27	37	35	33			mg/kg dry
CH-00-SED	Cadmium (Total)			1.1	<1.0	<1.0	<1.0	1.3	<1.0	<0.94			mg/kg dry
CH-00-SED	Carbon, Total Organic			1.8	1.7	1.4	1.8	1.4	1.6	1.4			%
CH-00-SED	Chemical Oxygen Demand			110000	110000	88000	65000	62000	82000	66000			mg/kg dry
CH-00-SED	Chromium (Total)			43	32	30	30	46	31	35			mg/kg dry
CH-00-SED	Copper (Total)			39	33	27	27	36	34	38			mg/kg dry
CH-00-SED	Cyanide, Total			0.27	0.27	0.54	0.24	0.32	0.17	0.22			mg/kg dry
CH-00-SED	HEM: Oil & Grease			570	360	430	480	800	440	320			mg/kg dry
CH-00-SED	Lead (Total)			83	66	57	56	93	68	75			mg/kg dry
CH-00-SED	Manganese (Total)			590	670	510	500	660	710	690			mg/kg dry
CH-00-SED	Mercury (Total)			0.099	0.090	0.083	0.077	0.14	0.12	0.097			mg/kg dry
CH-00-SED	Nickel (Total)			24	22	19	18	23	23	23			mg/kg dry
CH-00-SED	Nitrogen, Ammonia			160	200	190	130	130	160	220			mg/kg dry

SAMPLENAME	PARAMETER	10-20	10-26	11-3	11-12	11-19	11-24	12-1	12-8	12-16	12-21	12-22	UNIT
CH-00-SED	PCB-1016			<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	<0.030			mg/kg dry
CH-00-SED	PCB-1221			<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	<0.030			mg/kg dry
CH-00-SED	PCB-1232			<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	<0.030			mg/kg dry
CH-00-SED	PCB-1242			<0.031	0.058	<0.033	<0.028	<0.025	<0.022	<0.030			mg/kg dry
CH-00-SED	PCB-1248			0.048	<0.031	0.074	0.056	0.033	0.039	0.083			mg/kg dry
CH-00-SED	PCB-1254			0.071	0.13	0.15	<0.028	0.039	0.066	0.11			mg/kg dry
CH-00-SED	PCB-1260			<0.031	<0.031	<0.033	<0.028	<0.025	<0.022	0.037			mg/kg dry
CH-00-SED	Percent Solids			57	56	52	61	68	76	57			%
CH-00-SED	Percent Solids			55	54	52	61	68	76	57			%
CH-00-SED	Phosphorus, Total			4.0	3.4	9.9	<8.3	<7.3	9.4	<8.7			mg/kg dry
CH-00-SED	Volatile Solids			4.0	3.6	2.9	2.8	2.6	3.5	4.1			%
CH-00-SED	Zinc (Total)			240	190	170	150	290	180	200			mg/kg dry
CH-18-81	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
CH-18-81	Manganese (Total)	0.019	0.028	0.034	0.028	0.021	0.019	0.061	0.017	0.029	0.019	0.018	mg/L
CH-18-81	Nitrogen, Ammonia	1.1	0.21	0.15	0.97	1.2	1.3	1.3	1.3	1.1	1.1	1.1	mg/L
CH-18-81	Nitrogen, Total Kjeldahl	1.3	0.40	0.45	0.89	1.4	1.3	1.1	1.3	1.0	1.0	1.1	mg/L
CH-18-81	pH (Field)	9.17	7.73	7.77	8.25	8.75	8.79	8.95	9.04	9.00	9.04	9.04	pH Units
CH-18-81	Phosphorus, Total	0.030	0.026	0.027	0.030	0.032	0.033	0.044	0.032	0.030	0.023	0.023	mg/L
CH-18-81	Residue, Dissolved @ 180° C	512	476	516	402	498	496	528	522	536	520	488	mg/L
CH-18-81	Residue, Suspended	5.1	<3.3	<3.3	<3.3	4.8	<3.3	6.1	<3.3	<3.3	7.7	<3.3	mg/L
CH-18-81	Temperature °C (Field)	17.0	16.4	15.4	15.6	14.4	14.5	13.9	12.6	12.3	12.2	12.2	°C
CH-18-81	Turbidity (Field)	3.00	<1.00	<1.00									NTU
CH-18-81	Zinc (Total)	0.0090	0.012	0.012	0.0064	0.0089	0.0079	0.030	0.0089	0.0095	0.014	0.012	mg/L
CH-19-81	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
CH-19-81	Manganese (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
CH-19-81	Nitrogen, Ammonia	1.6	1.7	1.3	0.87	1.0	1.1	1.5	1.6	1.9	3.3	3.3	mg/L
CH-19-81	Nitrogen, Total Kjeldahl	1.8	1.9	1.6	0.88	1.0	1.1	1.3	1.7	1.6	3.3	3.2	mg/L
CH-19-81	pH (Field)	11.1	11.2	11.2	11.3	11.2	11.3	11.3	11.3	11.2	11.5	11.5	pH Units
CH-19-81	Phosphorus, Total	0.005	0.007	0.007	0.006	0.015	0.078	0.009	0.022	0.007	<0.005	0.012	mg/L
CH-19-81	Residue, Dissolved @ 180° C	452	358	366	234	420	466	484	456	438	384	402	mg/L
CH-19-81	Residue, Suspended	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	mg/L
CH-19-81	Temperature °C (Field)	12.4	12.1	11.3	12.6	12.2	12.4	12.1	10.7	11.1	11.1	11.1	°C
CH-19-81	Turbidity (Field)	<1.00	<1.00	<1.00									NTU
CH-19-81	Zinc (Total)	<0.0050	0.0083	<0.0050	0.012	<0.0050	<0.0050	0.025	0.0063	<0.0050	0.0050	0.0087	mg/L
Duplicate	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
Duplicate	Manganese (Total)	0.0060	<0.0050	0.0066	<0.0050	0.0072	0.0097	0.0071	0.0074	0.0066	<0.0050	0.0066	mg/L
Duplicate	Nitrogen, Ammonia	0.033	0.026	0.032	0.015	0.016	0.026	0.024	0.014	0.037	0.021	0.047	mg/L
Duplicate	Nitrogen, Total Kjeldahl	0.24	<0.20	0.38	<0.20	0.21	0.26	<0.20	0.26	<0.20	<0.20	<0.20	mg/L
Duplicate	pH (Field)	8.22	7.99	7.94	8.22	8.10	8.10	7.92	8.04	8.05	7.98	7.95	pH Units
Duplicate	Phosphorus, Total	0.005	0.005	0.009	0.007	0.010	0.011	0.010	0.009	0.008	<0.005	0.005	mg/L
Duplicate	Residue, Dissolved @ 180° C	162	188	240	178	186	274	290	226	258	164	244	mg/L
Duplicate	Residue, Suspended	4.5	<3.3	3.7	4.7	7.6	5.5	5.1	6.0	<3.3	5.2	3.3	mg/L
Duplicate	Temperature °C (Field)	12.2	11.6	11.0	11.7	9.6	9.6	8.1	5.2	2.5	1.7	1.8	°C
Duplicate	Turbidity (Field)	6.56	3.60	3.61									NTU
Duplicate	Zinc (Total)	0.0060	0.0061	0.0085	0.017	0.0099	0.012	0.0060	0.0060	0.0062	0.0094	0.0062	mg/L

SAMPLENAME	PARAMETER	10-20	10-26	11-3	11-12	11-19	11-24	12-1	12-8	12-16	12-21	12-22	UNIT
ND-COMP-001	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
ND-COMP-001	Manganese (Total)	<0.0050	0.0053	0.010	0.010	0.025	0.0078	0.0050	0.0063	0.0061	0.0057	<0.0050	mg/L
ND-COMP-001	Nitrogen, Ammonia	0.016	0.032	0.017	0.042	0.012	0.015	<0.010	<0.010	0.017	0.028	0.016	mg/L
ND-COMP-001	Nitrogen, Total Kjeldahl	0.24	0.22	0.31	<0.20	0.33	0.25	0.20	0.26	<0.20	<0.20	<0.20	mg/L
ND-COMP-001	pH (Field)	7.83	7.98	8.12	8.19	8.14	8.14	8.10	8.04	8.07	7.99	7.96	pH Units
ND-COMP-001	Phosphorus, Total	0.018	0.013	0.011	0.009	0.020	0.014	0.005	0.008	0.007	<0.005	<0.005	mg/L
ND-COMP-001	Residue, Dissolved @ 180° C	184	170	216	142	192	202	246	184	174	160	156	mg/L
ND-COMP-001	Residue, Suspended	3.5	5.2	12.5	10.5	14.0	3.5	4.1	6.5	5.3	4.9	4.4	mg/L
ND-COMP-001	Temperature °C (Field)	11.8	11.8	10.8	11.4	9.6	10.0	7.9	4.6	1.5	1.6	1.4	°C
ND-COMP-001	Turbidity (Field)	4.00	7.41	10.5									NTU
ND-COMP-001	Zinc (Total)	0.011	0.0076	0.010	0.0067	0.020	0.0078	0.0072	0.054	0.0066	0.012	0.011	mg/L
ND-COMP-002	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
ND-COMP-002	Manganese (Total)	<0.0050	<0.0050	<0.0050	<0.0050	0.012	0.013	0.0053	0.011	0.012	<0.0050	<0.0050	mg/L
ND-COMP-002	Nitrogen, Ammonia	0.017	0.020	0.029	0.018	0.069	0.012	0.017	<0.010	0.020	0.023	0.015	mg/L
ND-COMP-002	Nitrogen, Total Kjeldahl	<0.20	<0.20	0.33	<0.20	0.22	0.26	<0.20	0.23	<0.20	<0.20	<0.20	mg/L
ND-COMP-002	pH (Field)	8.08	8.01	8.15	8.18	8.07	8.16	8.11	8.07	8.06	7.95	7.92	pH Units
ND-COMP-002	Phosphorus, Total	<0.005	<0.005	0.010	0.006	0.017	0.026	0.007	0.025	0.013	<0.005	0.013	mg/L
ND-COMP-002	Residue, Dissolved @ 180° C	160	170	116	128	162	170	218	168	176	174	170	mg/L
ND-COMP-002	Residue, Suspended	<3.3	<3.3	4.8	5.3	12.4	5.2	5.5	15.6	11.0	4.3	3.9	mg/L
ND-COMP-002	Temperature °C (Field)	11.8	11.6	10.7	11.5	9.4	10.2	8.1	4.3	1.7	1.6	1.1	°C
ND-COMP-002	Turbidity (Field)	2.89	5.72	4.54									NTU
ND-COMP-002	Zinc (Total)	0.011	0.0085	0.0077	0.0050	0.013	0.017	0.015	0.0097	0.0076	0.0078	<0.0050	mg/L
ND-COMP-003	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
ND-COMP-003	Manganese (Total)	<0.0050	<0.0050	<0.0050	<0.0050	0.0099	<0.0050	0.0062	0.0072	0.0064	<0.0050	<0.0050	mg/L
ND-COMP-003	Nitrogen, Ammonia	0.016	0.019	0.023	0.016	0.017	0.014	<0.010	<0.010	0.018	0.022	0.013	mg/L
ND-COMP-003	Nitrogen, Total Kjeldahl	0.21	<0.20	0.38	<0.20	0.20	0.27	<0.20	0.23	<0.20	<0.20	<0.20	mg/L
ND-COMP-003	pH (Field)	8.19	8.00	8.16	8.20	8.08	8.18	8.10	8.04	8.08	7.95	7.88	pH Units
ND-COMP-003	Phosphorus, Total	0.010	<0.005	0.008	0.007	0.011	0.009	0.026	0.010	0.008	<0.005	<0.005	mg/L
ND-COMP-003	Residue, Dissolved @ 180° C	204	166	140	220	136	188	202	170	182	174	160	mg/L
ND-COMP-003	Residue, Suspended	<3.3	<3.3	4.4	4.8	8.1	<3.3	4.7	10.3	7.1	4.0	4.1	mg/L
ND-COMP-003	Temperature °C (Field)	11.5	11.6	10.4	10.8	9.5	10.4	8.0	4.3	1.7	1.6	1.0	°C
ND-COMP-003	Turbidity (Field)	2.41	5.06	7.48									NTU
ND-COMP-003	Zinc (Total)	<0.0050	<0.0050	0.0075	0.0084	0.015	0.0078	0.025	0.036	0.0064	0.0056	0.0093	mg/L

SAMPLENAME	PARAMETER	10-20	10-26	11-3	11-12	11-19	11-24	12-1	12-8	12-16	12-21	12-22	UNIT
RIV-001	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
RIV-001	Manganese (Total)	0.0060	0.011	0.0072	0.060	0.014	0.011	0.0058	0.0073	0.0061	0.0074	0.0065	mg/L
RIV-001	Nitrogen, Ammonia	0.024	0.027	0.036	0.037	0.048	0.027	0.023	<0.010	0.036	0.047	0.040	mg/L
RIV-001	Nitrogen, Total Kjeldahl	<0.20	<0.20	0.41	<0.20	<0.20	0.24	0.20	0.23	<0.20	0.20	<0.20	mg/L
RIV-001	pH (Field)	8.12	7.96	7.94	8.10	8.03	8.05	7.97	8.04	8.05	7.98	7.95	pH Units
RIV-001	Phosphorus, Total	0.005	0.009	0.008	0.025	0.017	0.027	0.011	0.013	0.008	0.005	<0.005	mg/L
RIV-001	Residue, Dissolved @ 180° C	168	182	266	242	212	250	304	190	170	286	274	mg/L
RIV-001	Residue, Suspended	5.1	9.7	4.8	4.7	16.1	5.1	4.1	6.4	<3.3	3.9	4.5	mg/L
RIV-001	Temperature °C (Field)	11.2	11.6	11.0	10.7	9.6	9.7	8.1	5.2	2.2	1.9	1.8	°C
RIV-001	Turbidity (Field)	6.76	7.35	3.61									NTU
RIV-001	Zinc (Total)	0.010	0.010	0.0074	0.017	0.0067	0.0089	0.021	0.0077	<0.0050	0.0060	0.0071	mg/L
RIV-002	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
RIV-002	Manganese (Total)	0.011	0.012	0.0081	0.017	0.015	0.011	0.0064	0.012	0.0065	0.0070	0.0057	mg/L
RIV-002	Nitrogen, Ammonia	0.033	0.032	0.038	0.043	0.026	0.024	0.022	0.013	0.061	0.046	0.037	mg/L
RIV-002	Nitrogen, Total Kjeldahl	0.21	<0.20	0.39	<0.20	<0.20	0.28	<0.20	0.29	<0.20	<0.20	<0.20	mg/L
RIV-002	pH (Field)	8.17	7.94	8.00	8.06	8.07	8.06	7.92	8.00	8.09	8.02	7.95	pH Units
RIV-002	Phosphorus, Total	0.006	0.012	0.011	0.010	0.017	0.010	0.009	0.013	0.011	<0.005	<0.005	mg/L
RIV-002	Residue, Dissolved @ 180° C	172	200	276	288	166	260	296	172	164	262	230	mg/L
RIV-002	Residue, Suspended	12.0	9.9	4.0	3.9	13.2	5.5	4.0	11.8	<3.3	4.1	<3.3	mg/L
RIV-002	Temperature °C (Field)	11.2	11.5	11.1	10.8	9.1	9.6	8.1	5.3	2.3	2.0	1.9	°C
RIV-002	Turbidity (Field)	18.6	7.87	4.21									NTU
RIV-002	Zinc (Total)	0.014	0.014	0.012	0.010	0.069	0.012	0.011	0.0082	0.0058	0.0077	0.0075	mg/L
RIV-003	Chromium (Total)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	mg/L
RIV-003	Manganese (Total)	0.0058	0.011	0.0075	0.017	0.018	0.0090	0.0063	0.0053	0.0061	0.0077	0.0051	mg/L
RIV-003	Nitrogen, Ammonia	0.020	0.029	0.037	0.045	0.026	0.027	0.020	0.018	0.034	0.038	0.036	mg/L
RIV-003	Nitrogen, Total Kjeldahl	0.20	<0.20	0.37	<0.20	0.29	0.21	0.25	0.23	<0.20	<0.20	<0.20	mg/L
RIV-003	pH (Field)	8.22	7.95	8.05	7.90	8.12	8.10	8.09	8.01	8.05	8.07	8.00	pH Units
RIV-003	Phosphorus, Total	0.009	0.009	0.008	0.010	0.016	0.017	0.029	0.009	0.008	<0.005	<0.005	mg/L
RIV-003	Residue, Dissolved @ 180° C	168	210	284	208	286	220	212	226	260	248	260	mg/L
RIV-003	Residue, Suspended	4.1	7.2	4.1	3.7	16.4	5.6	4.1	3.6	3.7	4.1	<3.3	mg/L
RIV-003	Temperature °C (Field)	12.2	11.8	11.0	10.9	9.7	9.6	8.3	5.3	2.5	2.3	1.9	°C
RIV-003	Turbidity (Field)	6.56	8.05	3.26									NTU
RIV-003	Zinc (Total)	<0.0050	0.013	0.016	0.016	0.018	0.040	0.014	0.0055	0.0074	0.012	<0.0050	mg/L

Appendix B:

Data Quality Analysis

CELRC-TS-D-HE 03 May 2010

MEMORANDUM FOR RECORD

SUBJECT: DATA QUALITY ASSESSMENT FOR TRIMATRIX LABORATORIES, INC. FOR LUEDTKE ENGINEERING CO. CALUMET HARBOR DREDGING AND DISPOSAL FALL 2009 WATER AND SEDIMENT QUALITY MONITORING EVENTS

1. TriMatrix Laboratories, Inc under subcontract to the dredging contractor Luedtke Engineering Co collected samples from the Chicago Area CDF and Calumet River, Illinois in the period 20 October 2009 through 22 December 2009 for the Chicago District, Environmental Engineering Section. The parameters discussed in this assessment are those collected during dredging monitoring events. The objective for collection of these data is to verify the performance of the dredging operation and the confined disposal facility for the dredged material located in Calumet Harbor, Illinois under dredged material disposal conditions.

2. Items reviewed for all 11 sampling events were number and type of samples collected, chain of custody record, field duplicate frequency, holding and extraction time records, and water and sediment detection limit compliance required by the scope of work. Items reviewed for five randomly chosen events were method blank frequency and analyte concentration. Matrix spike and matrix spike duplicate concentrations were checked for water and sediment control limit compliance. Laboratory duplicates were checked against relative percent difference (RPD) requirements. Laboratory control samples were checked against percent recovery and RPD requirements. Laboratory surrogate concentrations were checked against control limits for PCB analysis. Data qualification case narratives were also reviewed for the five randomly chosen events.

3. TriMatrix personnel delivered the samples to TriMatrix Laboratories, Inc in Grand Rapids, Michigan. TriMatrix Laboratories, Inc filled out the Chain of Custody worksheets for the 15 to 30 water and sediment samples per sampling event. A blind duplicate per water quality monitoring event was included. All required samples appear to have been collected. All parameters requested appear to be present. All temperatures of received samples were checked. The average temperature in the coolers ranged from 2.2^{o}C to 6 ^{o}C. The maximum received cooler temperature was 9.5 ^{o}C. Temperatures above 6 ^{o}C were addressed by the laboratory. Because samples were delivered on the same day that they were collected, NELAC considers samples acceptable if there is evidence that the chilling process has begun such as arrival on ice. All samples in coolers received above 6 ^{o}C were received on ice at the TriMatrix laboratory. All holding times were met for water quality monitoring events one through four and six through eleven. For event number five, TSS for all 16 water samples and the duplicate was analyzed past holding time. Reporting limits for all parameters were met except for TSS. TriMatrix used a TSS reporting limit of 3.3 mg/L while a reporting limit of 1.0 mg/L was required. However, most TSS results were above the employed reporting limit. Reporting limits for all events were acceptable except event #9 TSS sample CDF-003. The reporting limit

for this sample was elevated to 6.2 mg/L due to sample matrix clogging the filter, causing less sample volume to be analyzed. All the laboratory methods used were current and acceptable.

4. Five random events were reviewed in detail. The event numbers were generated using the Excel RAND function. The five numbers from the 5th iteration of the function were recorded. The event numbers are 2, 3, 5, 9, and 11. Event 2 is a pre-dredging event conducted on 10/26/09; numbers 3, 5, and 9 are during dredging events conducted on 11/3/09, 11/19/09, and 12/16/09 respectively; and number 11 is a post-dredging event conducted on 12/22/09.

5. Field duplicates were required by the scope of work. They were run at an acceptable frequency of one per water quality monitoring event. Field duplicate results were close to the corresponding original samples. The parameter with the most noticeable differences between sample and field duplicate was zinc, however field duplicate results were acceptable. Method preparation blanks were run at an acceptable frequency of one per parameter for events 2, 3, 5, 9, and 11. All checked method blank concentrations were below reporting limits.

6. Matrix spike samples and matrix spike duplicate samples were required by the scope of work to determine precision and accuracy. Matrix spiked sample recoveries were reported within the following limits: for Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Nickel, and Zinc (75-125%), for Mercury (80-120%), for COD (47-170%), for Cyanide (51-126%), for Ammonia Nitrogen, TKN, and Phosphorus (90-110%). Surrogates decachlorobiphenyl and tetrachloro-m-xylene were run for PCB comparisons. Matrix spike samples were within percent recovery limits listed, except as noted below. Matrix spike duplicates were within the percent recovery and relative percent difference (RPD), except as noted below. For event 2, the Phosphorus matrix spike duplicate recovery was outside the laboratory control limits for sample CDF-001. For event 3, the Phosphorus matrix spike recovery was outside the laboratory control limits for sample CH-00-SED. For event 5, the Ammonia Nitrogen matrix spike and matrix spike duplicate recoveries were outside the laboratory control limits for sample RIV-001. The Ammonia Nitrogen matrix spike recovery was also outside the laboratory control limits for sample CH-18-81. The Phosphorus matrix spike recovery was outside the laboratory control limits for sample CH-00-SED. The TKN matrix spike and matrix spike duplicate recoveries were outside the laboratory control limits for sample CDF-003. For event 9, the Phosphorus matrix spike recovery was outside the laboratory control limits for sample RIV-001. The Ammonia Nitrogen matrix spike recovery was outside the laboratory control limit for sample CDF-001. For event 11, the TKN matrix spike duplicate recovery was outside the laboratory control limits for sample CH-19-81.

7. Laboratory control samples were run at an acceptable frequency for events 2, 3, 5, 9, and 11. Laboratory control samples percent recoveries were reported within the following limits: for PCBs (73-118%), for Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Zinc, and TSS (80-120%), for TOC (92-138%), for COD, Cyanide, Ammonia Nitrogen, TKN, and Phosphorus (90-110%), for oil & grease (76-

120%), for TDS (87-115%). All parameters were run within control limits. Laboratory duplicates, when completed, had a RPD below the RPD limit except for events 5 and 9. For event 5, the laboratory duplicate RPD exceeded the control limit for Phosphorus on sample CH-00-SED. For event 9, the laboratory duplicate RPD exceeded the control limit for TDS on sample ND-COMP-003.

8. Data qualification statements were prepared for the five spot checked events as needed by the laboratory. Each sample identification number and parameter so qualified was recorded. Corrective action as needed for the five events consisted of reporting the result as considered estimated.

Event Number	**Test Type**	**Sample ID**	**Data Qualification**
Event #2	MSD Phosphorus	CDF-001	Not estimated
Event #3	MS Phosphorus	CH-00-SED	Estimated
Event #5	Lab duplicate RPD Phosphorus	CH-00-SED	Estimated
	MS & MSD Ammonia Nitrogen	RIV-001	Estimated
	MS Ammonia Nitrogen	CH-18-81	Not estimated
	MS Phosphorus	CH-00-SED	Estimated
	MS & MSD TKN	CDF-003	Estimated
Event #9	Lab duplicate RPD TDS	ND-COMP-003	Not estimated
	MS Phosphorus	RIV-001	Not estimated
	MS Ammonia Nitrogen	CDF-001	Not estimated
Event #11	MSD TKN	CH-19-81	Not estimated

9. All related laboratory parameters were logical and reasonable.

10. In accordance with the level of review detailed in paragraph two, a general review that included holding times was performed for all events. Five of eleven events were randomly reviewed in more detail. The data are intended for use in verifying the performance of the dredging operation and the confined disposal facility for the dredged material located in Calumet Harbor, Illinois under dredged material disposal conditions. The data are suitable and acceptable for the intended purpose. Acceptance of this data package is recommended noting that QC qualified data should be used with caution.

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Environmental Engineering

Appendix C:

TriMatrix Analytical Data

(See enclosed CD)