**DEPARTMENT OF THE ARMY**
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
231 SOUTH LA SALLE STREET, SUITE 1500
CHICAGO IL 60604

1 8 JUN 2014

Technical Services Division
Hydraulic and Environmental Engineering Section

Mr. James Casey, P.E.
Illinois Department of Natural Resources
Office of Water Resources
160 North LaSalle Street, Suite S-703
Chicago, Illinois 60601

Dear Mr. Casey:

This letter is an addendum to our last correspondence dated May 30, 2014 regarding maintenance dredging activities in the Approach Channel and Advanced Maintenance Area at Waukegan Harbor in Waukegan, Illinois. The U.S. Army Corps of Engineers (USACE) Chicago District requests a federal consistency determination with Illinois' Coastal Management Program for the proposed dredging project. The proposed activities comply with Illinois' approved coastal management program and will be conducted in a manner consistent with such policies.

The proposed activities include mechanical dredging up to 125,000 cubic yards annually from the Waukegan Harbor Approach Channel and Advance Maintenance Area, and for in-water disposal in the littoral zone of Lake Michigan at a depth of less than 18 feet, over a period of ten years (2015 - 2025). A copy of the application for Clean Water Act Section 401 water quality certification was enclosed with the May 30 letter, as was a 404(b)1 Contaminant Determination for the proposed project.

Requests for additional information or questions about the proposed dredging or disposal activities may be directed to Lauren Fleer at (312) 846-5501, or to Jay Semmler, Chief, Hydraulic and Environmental Engineering Section at (312) 846-5500.

RECEIVED
JUN 19 2014
OFFICE OF WATER RESOURCES
DIVISION OF RESOURCE MANAGEMENT

Sincerely,

Christopher T. Drew
Colonel, U.S. Army
District Commander

CC: Diane Tecic, IDNR

# JOINT APPLICATION FORM FOR ILLINOIS

ITEMS 1 AND 2 FOR AGENCY USE

| 1. Application Number | 2. Date Received |
|---|---|
| | |

3. and 4. (SEE SPECIAL INSTRUCTIONS) NAME, MAILING ADDRESS AND TELEPHONE NUMBERS

| 3a. Applicant's Name: | 3b. Co-Applicant/Property Owner Name (if needed or if different from applicant): | 4. Authorized Agent (an agent is not required): |
|---|---|---|
| Lauren Fleer<br>Company Name (if any) :<br>US Army Corps of Engineers, Chicago<br>Address:<br>231 S. LaSalle Street, Suite 1500<br>Chicago, IL 60604<br>Email Address:<br>Lauren.A.Fleer@usace.army.mil | Company Name (if any):<br>Address:<br>Email Address: | Company Name (if any):<br>Address:<br>Email Address: |
| Applicant's Phone Nos. w/area code<br>Business: 312-846-5501<br>Residence:<br>Cell:<br>Fax: 312-353-5126 | Applicant's Phone Nos. w/area code<br>Business:<br>Residence:<br>Cell:<br>Fax: | Agent's Phone Nos. w/area code<br>Business:<br>Residence:<br>Cell:<br>Fax: |

***STATEMENT OF AUTHORIZATION***

I hereby authorize, _____ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

_____ Applicant's Signature

_____ Date

5. ADJOINING PROPERTY OWNERS (Upstream and Downstream of the water body and within Visual Reach of Project)

| Name | Mailing Address | Phone No. w/area code |
|---|---|---|
| a. See attached sheet. | | |
| b. | | |
| c. | | |
| d. | | |

6. PROJECT TITLE:
Waukegan Harbor Approach Channel Dredging

7. PROJECT LOCATION:

| | |
|---|---|
| LATITUDE: 42.36100 °N<br>LONGITUDE: 87.80908 °W | UTMs<br>Northing:<br>Easting: |

| STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION | LEGAL DESCRIPT | QUARTER | SECTION | TOWNSHIP NO. | RANGE |
|---|---|---|---|---|---|
| End of the Waukegan Harbor North Breakwater | | NW | 22 | 45N | 12E |

| ☒ IN OR ☐ NEAR CITY OF TOWN (check appropriate box)<br>Municipality Name | WATERWAY | RIVER MILE (if applicable) |
|---|---|---|
| Waukegan | Lake Michigan | |

| COUNTY | STATE | ZIP CODE |
|---|---|---|
| Lake | Illinois | |

Revised 2010

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8. PROJECT DESCRIPTION (Include all features):

The project includes placement of up to 125,000 cubic yards of material annually dredged from the Waukegan Harbor Approach Channel and Advance Maintenance Area. The proposed project includes mechanical dredging with disposal of the dredged sand in the littoral zone of Lake Michigan at a depth of less than 18 feet, at one of three potential locations used previously.

9. PURPOSE AND NEED OF PROJECT:

The purpose of the project is to maintain the federally authorized navigation channel.

**COMPLETE THE FOLLOWING FOUR BLOCKS IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED**

10. REASON(S) FOR DISCHARGE:

The enclosed 404(b)1 evaluation indicates that the proposed disposal of dredged material meets Illinois water quality standards for the open waters of Lake Michigan, with a mixing zone measuring 236 ft x 1059 ft, at a depth of 18 ft.

11. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS FOR WATERWAYS:

TYPE: Fine sand

AMOUNT IN CUBIC YARDS:

Up to 125,000 CY annually

12. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (See Instructions)

Disposal area is 2000 ft x 1000 ft = 46 ac

13. DESCRIPTION OF AVOIDANCE, MINIMIZATION AND COMPENSATION (See instructions)

14. Date activity is proposed to commence: Spring 2015 — Date activity is expected to be completed: Fall 2025

15. Is any portion of the activity for which authorization is sought now complete? Yes [ ] No [X] NOTE: If answer is "YES" give reasons in the Project Description and Remarks section. Indicate the existing work on drawings.
Month and Year the activity was completed

16. List all approvals or certification and denials received from other Federal, interstate, state, or local agencies for structures, construction, discharges or other activities described in this application.

| Issuing Agency | Type of Approval | Identification No. | Date of Application | Date of Approval | Date of Denial |
|---|---|---|---|---|---|
| | | | | | |

17. CONSENT TO ENTER PROPERTY LISTED IN PART 7 ABOVE IS HEREBY GRANTED. Yes No

18. APPLICATION VERIFICATION (SEE SPECIAL INSTRUCTIONS)

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

COL, EN — MAY 30 2014

Signature of Applicant or Authorized Agent — Date

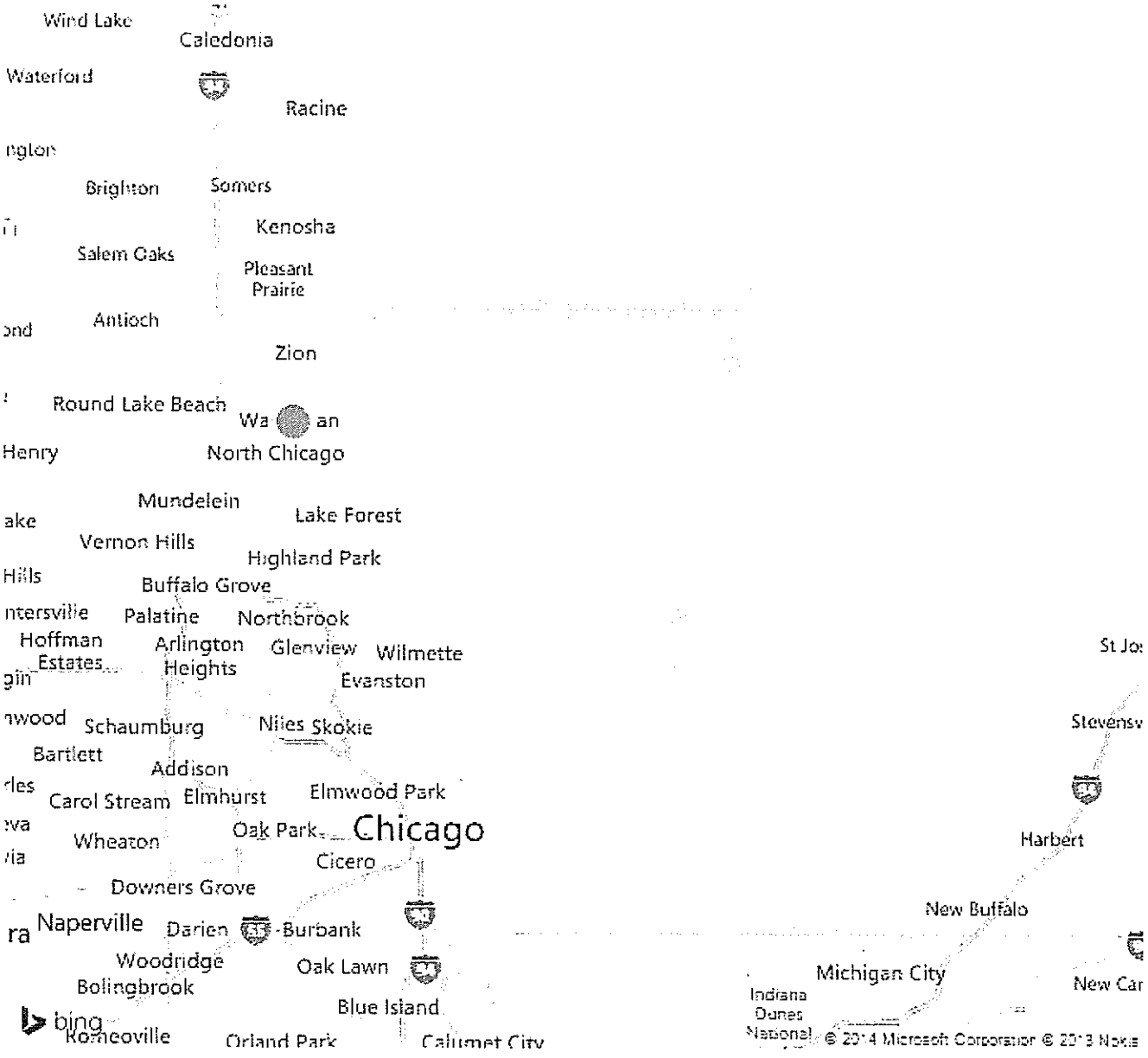
Signature of Applicant or Authorized Agent — Date

Signature of Applicant or Authorized Agent — Date

☐ Corps of Engineers Revised 2010 ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

SEE INSTRUCTIONS FOR ADDRESS

# LOCATION MAP




Revised 2010

☐ Corps of Engineers ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

# Clean Water Act Section 404(b)(1) Contaminant Determination

## Approach Channel and Advanced Maintenance Area
## Waukegan Harbor, Waukegan Illinois

Completed by:
U.S. Army Corps of Engineers, Chicago District
231 South LaSalle Street
Chicago, Illinois 60604

May 2014

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## Tables

# 1. Introduction

Recent maintenance dredging activities in the Approach Channel and Advanced Maintenance Area at Waukegan Harbor, Waukegan, Illinois, have been performed in accordance with Permit No. 2005-LM-2830, issued by IEPA on February 1, 2005 and revised on: June 28, 2005; April 1, 2008; and March 6, 2009. This certification under Section 401 of the Clean Water Act and final determination under Section 39 of the Illinois Environmental Protection Act expires December 31, 2014. The current Ten Year Maintenance Dredging Permit, No. LM2005003, was issued by IDNR and IEPA on February 22, 2005 and expires on December 31, 2015. The U. S. Army Corps of Engineers (USACE), Chicago District seeks Clean Water Act Section 401 Water Quality Certification and a new ten-year permit for mechanical dredging up to 125,000 cubic yards annually, from the Waukegan Harbor Approach Channel and Advance Maintenance Area, and for in-water disposal in Lake Michigan at a depth of less than 18 feet, over a period of ten years (2015 - 2025).

The following document was prepared by the U. S. Army Corps of Engineers (USACE) Chicago District, to state and evaluate information regarding the effects of the proposed discharge of dredged material into waters of the United States. The following evaluation was prepared in accordance with Section 404(b)(1) of the Clean Water Act (CWA), Public Law 92-500 and with the regional guidances, *Great Lakes Dredged Material Testing and Evaluation Manual* (USEPA and USACE 1998b) and *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (USEPA and USACE 1998a), also known as the "Inland Testing Manual." Tier I and Tier II evaluations, as defined by these regional guidances, were last completed for this project in October 1995 and April 1996, respectively, and were subsequently approved by the IEPA Division of Water Pollution Control. Since that time, nearby potential sources of contamination have been substantially addressed and extensive sediment and water quality monitoring has been completed.

# 2. Project Description

## 2.1. Location

Waukegan Harbor is located in Waukegan, Illinois, approximately 40 miles north of downtown Chicago, Illinois and 10 miles south of the Illinois-Wisconsin state line. The Federal navigation channel is comprised of three main areas: Inner Harbor, Outer Harbor, and Approach Channel. The area proposed for future dredging includes the Approach Channel and Advance Maintenance Area. This area extends approximately 1400 ft east from the east end of the north breakwater, and extends about 650 ft south toward the east-west line extension from the U.S. South Pier. The total area proposed for future dredging operations is approximately 910,000 $ft^2$ (1400 ft * 650 ft).

## 2.2. Background

The initial improvement of Waukegan Harbor began in the 1880's and the federal portion of the harbor developed into its present configuration in 1966. The harbor is protected by a 1,894-foot long outer breakwater and two parallel piers. The north pier is 998-feet in length and the south pier is 3,225-feet in length. The Inner Harbor consists of the area protected by the parallel piers; the Outer Harbor consists of the area protected by the breakwater; and the Approach Channel is

an unprotected area, which extends out into Lake Michigan. The Inner Harbor also includes privately owned slips which are not maintained by USACE.

The major portion of waterborne commerce in Waukegan Harbor is shipping of gypsum, cement and concrete. National Gypsum, Lafarge Cement, and St. Mary's Cement, Inc. are the major commercial users of the harbor. In 2011, shipments totaled 110,000 tons. Recreational boaters also utilize the Port of Waukegan and its hundreds of boat slips and moorings.

In 1975, polychlorinated biphenyls (PCBs) were discovered in discharge water from the nearby Outboard Marine Corporation (OMC) facility and later found in Waukegan Harbor sediments and fish tissue. Portions of the harbor and surrounding areas were subsequently placed on the National Priorities List (Superfund) and identified as an Area of Concern (AOC). While the Inner Harbor and private industrial grounds experienced significant contamination, there is little evidence to suggest that PCB contamination spread to the Outer Harbor, Approach Channel, or Lake Michigan. This has been confirmed by numerous sediment sampling events conducted over the past decade. The extent of contamination was limited in part due to the relatively stagnant flow conditions within the harbor, which has no natural tributary and produces minimal sediment transport. Since the vast majority of sediment that enters the harbor is littoral in nature, newer sediment tends to be consistent with Lake Michigan sediment quality and free of contamination.

USACE performs periodic dredging of deposited sediments to maintain authorized depths in the Federal channel for commercial navigation. The approach channel and outer harbor are maintained at a depth of -22 feet Low Water Datum (LWD) and the entrance channel and inner harbor are authorized for dredging to a depth of -18 feet LWD. The Corps has been conducting navigation dredging at the harbor since 1889 and currently dredges on an annual or biennial basis. Since the mid 1970s, the Corps has only dredged within the Approach Channel, averaging about 40,000 cubic yards per year. The Approach Channel contains clean littoral sands that have been shown to be suitable for open water disposal in Lake Michigan. Outer Harbor sediments are not suitable for open water disposal or beach placement due to the fine grained nature of the materials, but are approved for unconfined upland placement. In 2014, the US Army Corps of Engineers plans to dredge up to 100,000 cubic yards of clean sediment from the Outer Harbor area of Waukegan Harbor.

In addition to Corps' navigation dredging, USEPA has also conducted environmental dredging within the Inner Harbor. As part of a Superfund project, USEPA removed approximately 1 million pounds of sediment contaminated with polychlorinated biphenyls (PCBs) from the Inner Harbor and other privately owned areas in the early 90s. A second phase of the Superfund cleanup dredged an additional 150,000 cubic yards from the Inner Harbor in 2012 and 2013. The Outer Harbor and Approach Channel are not part of the Superfund project.

## 2.3. Disposal Areas

Dredging activities in the Waukegan Harbor Approach Channel and Advance Maintenance Area have taken place approximately biannually since 1961. Until 1982, sediment was disposed in the open water of Lake Michigan, approximately two miles east of Waukegan Harbor. From 1985 through 1998, sediment was placed in Disposal Area 1, near the shore of North Chicago, IL,

approximately one mile south of Waukegan Harbor, as shown on Figure 2. In 2003, this disposal location was moved further away from the shore, shifting the western-most edge of the site from 1,000 to 2,000 feet out from the shoreline. This new boundary for Disposal Location 1 has been used from 2003 to the present. From 1999 to 2002 and in 2005, 2008, 2009, 2012 and 2013, dredged material was utilized for beach nourishment along Illinois Beach State Park (IBSP). Disposal Locations 2 and 3 at IBSP are shown in Figure 3. Disposal Locations 1, 2, and 3 are all potential sediment disposal sites for future dredging events, with Disposal Location 2 being the preferred location consistent with the Illinois Lake Michigan Implementation Plan.

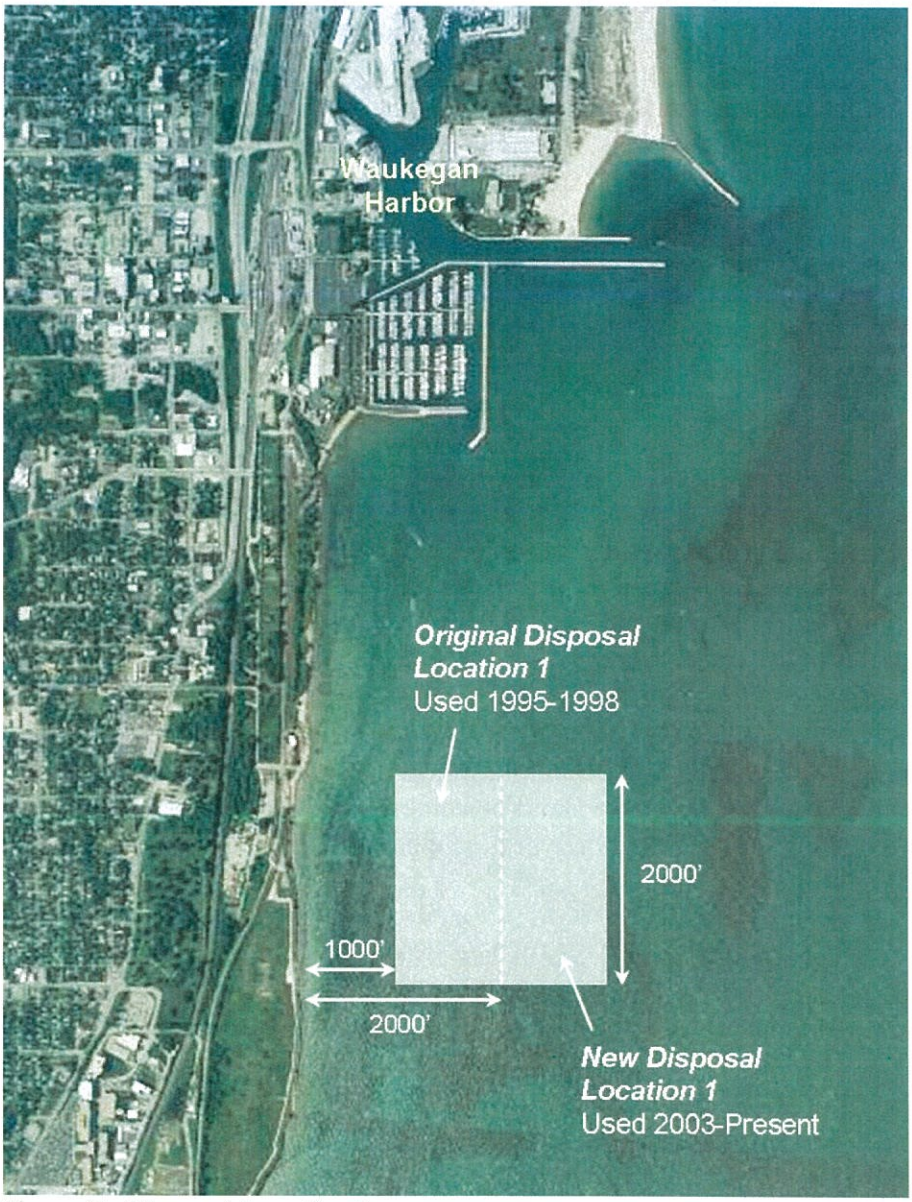


**Figure 2. Disposal Location 1**


**Figure 3. Disposal Locations 2 and 3 have been used for beach nourishment at Illinois Beach State Park (IBSP)**

# 3. Tier 1 Analysis

## 3.1. Approach

The U.S. Environmental Protection Agency (USEPA) and the U.S. Army Corps of Engineers (USACE) jointly developed the *Great Lakes Dredged Material Testing and Evaluation Manual* to establish procedures for evaluating potential environmental impacts associated with the discharge of dredged material in inland waters, near coastal waters, and surrounding environs. This document outlines a structured, sequential approach to sediment evaluation and testing to determine if dredged sediment from harbors and rivers tributary to the Great Lakes may be disposed in open-waters of the Great Lakes. The objective of the tiered testing approach is to make optimal use of resources in generating the required information for a factual determination of compliance with the Clean Water Act Section 404(b)(1), using an integrated chemical, physical, and biological evaluation approach.

## 3.2. Tier 1 Objectives

The purpose of the Tier 1 evaluation is to compile readily available, existing information in order to make a factual determination regarding compliance with the Clean Water Act (CWA) Section 404(b)(1), and to generate a list of "Contaminants of Concern". Disposal operations that are excluded from testing or have historic data sufficient for the factual determination may proceed without additional testing. If a factual determination of non-compliance can be made and it is determined that the dredged sediments will not be disposed in open water, additional testing is not required, except as necessary for consideration of other disposal options. If the information is insufficient for a factual determination, then it is deemed inconclusive and a Tier 2 evaluation is performed. If necessary, a Tier 3 evaluation is performed to determine toxic effects of sediment contaminants on biological life. The Tier 1 evaluation is not intended to provide a comprehensive investigation of all potential sources of sediment contamination, but rather is intended to indicate whether sediment bulk chemistry and elutriate testing is warranted based on existing data and potential sources of sediment contamination.

## 3.3. Sediment Sources

Sediment deposition in Waukegan Approach Channel is primarily the result of littoral transport of Lake Michigan sand from areas north of Waukegan Harbor. Littoral transport is the movement of sediments in the nearshore zone by waves and current. The littoral zone of Lake Michigan is generally within 5 to 10 miles of shore and the littoral transport travels parallel to the coast in either a clockwise or counterclockwise direction. The predominant direction of littoral transport outside Waukegan Harbor is from north to south.

## 3.4. Contaminant Transport and Pathways

### 3.4.1. Land Use

The land surrounding the harbor is used for industrial, commercial and recreational purposes. Environmental remediation of contaminated areas is facilitating a shift in land use from predominantly industrial manufacturing activities to commercial and residential uses. In 2003, the City of Waukegan adopted a redevelopment Master Plan, *A 21st Century Vision for Waukegan's Downtown and Lakefront.* This municipal planning document describes a

transformation of the North Harbor from a coke plant and Superfund site to a "residential, mixed-use district with marina-related businesses, neighborhood commercial and institutional uses" (City of Waukegan 2003). The Zoning District Map published by the City of Waukegan, Illinois, identifies four major categories of land use in 2013: Conservation/Recreation (CR); General Residence–Minimum lot size 6,000 sf (R8); Marine Commercial Recreation (M-CR); and General Industrial (I2).

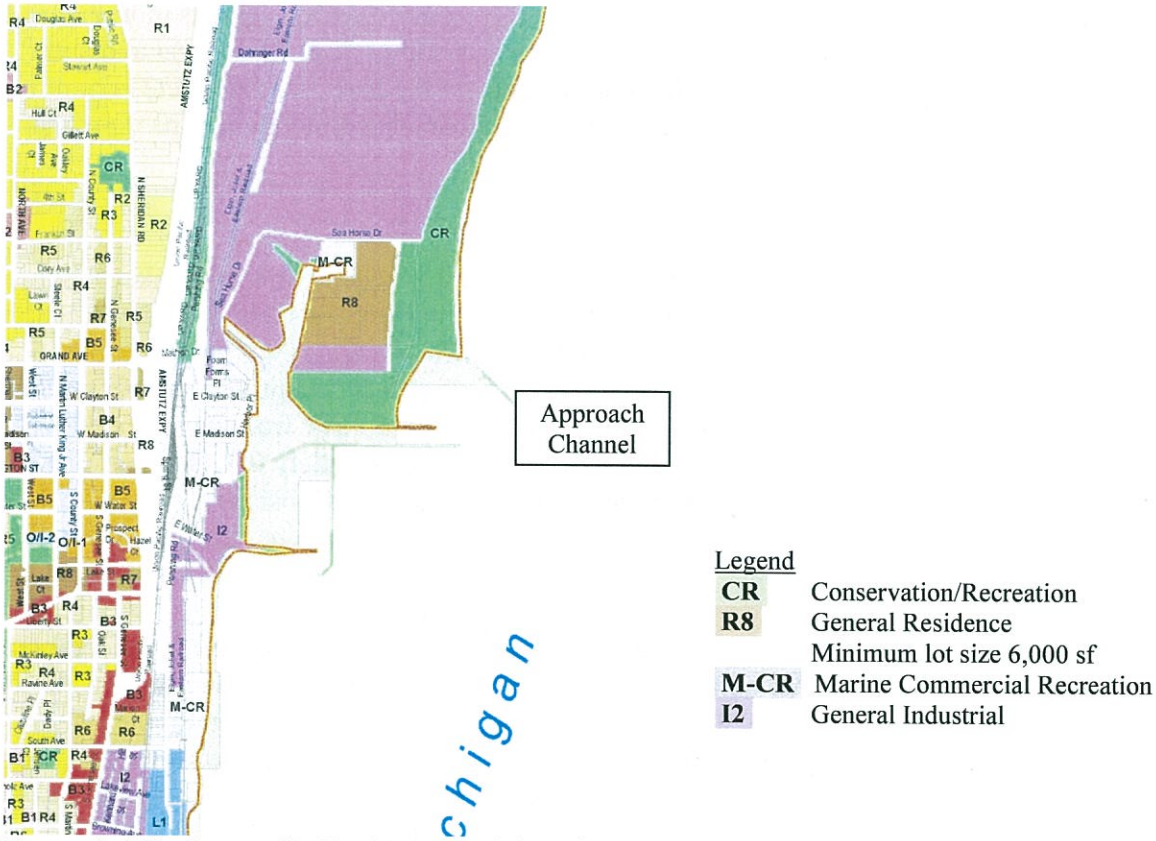


**Figure 4. Waukegan, IL Zoning Map** (City of Waukegan 2013)

### 3.4.2. Soil Type

The area surrounding Waukegan Harbor is located along Lake Michigan's coastal perimeter and lays in what is defined by the Illinois State Geologic Survey (ISGS) as the Lake Plain region. The current topography was formed through repeated glacial processes during the Pleistocene period and subsequently by erosion and man-made alterations. During the Wisconsinian Age (the last major advance of ice), several glaciation events spread over the region forming four types of topographic features: the Morainic Uplands, the Lake Plain, the Shore Deposits, and the Stream-Occupied Valleys. As the glaciers advanced and retreated, a landscape was carved out of overlying glacial till that was similar in relief and roughness present in the area today. Major depositional features of the area include moraines, outwash plains, valley trains, filled lake basins, river floodplains, and sand dunes. Erosional features of the area include sluiceways produced by glacial floodwaters, cliffs along the shore-lines of the lakes, and numerous small valleys that streams have eroded in the glacial deposits.

The Lake Plain area along the coast of Lake Michigan has been relatively flattened over time by wave erosion and minor depositions in the low areas, and has remained relatively uneroded by modern streams and rivers that flow above. The Lake Plain region consists of silt, sand, gravel, and clay deposits that accumulated in the glacial lake over time.

The area surrounding Waukegan Harbor is heavily urbanized, industrial, and highly disturbed. Soils found within this area are primarily comprised of Orthents. Orthents are loamy and undulating soils, which are commonly found in steep erodible terrain such as moraines in the case of Waukegan. Sediment within the harbor itself is comprised of fine sand and silt. Sediment texture tends to be finer in the inner reaches of the harbor where there is minimal influence by the littoral drift. On average, approach channel sediment contains more than 90% fine sand.

### 3.4.3. Hydrology and Tributary Flows

Waukegan Harbor is a man-made harbor positioned on the western shore of Lake Michigan and is not connected to any inland waterways or upland tributaries. As such, Waukegan Harbor does not receive any perennial or intermittent upland stream flow. Water within the harbor is relatively stagnant and experiences minimal flow. During storm events, the harbor does receive stormwater inflow from several discharge points and overland flow from its surrounding drainage area. The Waukegan Harbor drainage area is approximately 0.47 square miles and consists of industrial, commercial, municipal, and vacant lands. Consistent with typical urban stormwater runoff, stormwater flows into Waukegan Harbor tend to be flashy and poor in water quality.

The natural hydrology and littoral hydraulic processes of the lakeshore have been completely altered from their natural state. Artificial armoring of the shoreline and the implementation of numerous in-lake structures have impeded the natural littoral and altered natural erosion processes. While the harbor can be subjected to large waves during storms event, the man-made harbor structures dissipates wave energy resulting in much calmer conditions within the confines of the harbor as compared to exposed portions of the shoreline.

## 3.5. Sources of Information Investigated

### 3.5.1. Database Search

Federal databases were searched using the USEPA Envirofacts system to identify potential sources of sediment contamination. The databases investigated include: Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS); Resource Conservation and Recovery Act Information (RCRAInfo); and Toxics Release Inventory (TRI). The National Response Center, formerly the Emergency Response Notification System (ERNS), was searched for spill information.

Table 1 outlines the recommended search radii for Federal and State database listings, as provided in "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" (ASTM Standard E1527, 2013).

**Table 1. Recommended Search Radii for Federal and State Database Searches**

| Database Listing | Approximate Minimum Search Distance (Miles) | Search Distance used for this study (miles) |
|---|---|---|
| Federal NPL Site List | 1.0 | 1.5 |
| Federal CERCLIS List | 0.5 | 1.0 |
| Federal RCRA CORRACTS | no minimum | 1.5 |
| Federal RCRA TSD Facility | 1.0 | 1.0 |
| Federal RCRA Generators List | Property and Adjoining Properties | 0.75 |
| Federal ERNS List | Property Only | 0.5 |
| State Hazardous Waste Sites | 1.0 | 1.5 |
| State Landfill and Solid Waste Disposal Site Lists | 0.5 | 1.0 |
| State Leaking UST List | 0.5 | 1.0 |

#### *3.5.1.1. CERCLIS*

The Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS) database was consulted using the US EPA Envirofacts web service, to identify any sites regulated under CERCLA in the project area. The CERCLIS Search web feature identified seven sites in Waukegan, IL. Three of the seven are within a mile of Waukegan Harbor: Outboard Marine Corporation; North Shore Gas South Plant; and Johns Manville International. The Greiss Pfleger tannery site was not identified in the database search, though it was discussed in the 1995 Tier I Sediment Evaluation.

**The Outboard Marine Corporation (OMC)** facility is located at 200 Seahorse Drive, adjacent to the Waukegan Inner Harbor. From 1959 to 1971, OMC purchased 8 million gallons of hydraulic fluid containing polychlorinated biphenyls (PCBs) for use in various machines. In 1976, the company was found to be discharging PCBs through a floor drain into the Waukegan Harbor and the North Ditch. It was estimated that 700,000 pounds of PCBs were present in the soil on the OMC Plant 2 site and that 300,000 pounds of PCBs were present in the sediment in Waukegan Harbor (USEPA 1981; USEPA 2014a).

The OMC site was placed on the first Superfund National Priorities List in October 1981. EPA issued a record of decision (ROD) in 1984 that selected the first harbor cleanup action. From 1990-1993, OMC spent about $21 million to remove PCB-contaminated sediment and soil from the north harbor and the OMC Plant 2 site. Containment cells were built in the former Boat Slip #3 and on the north side of Plant 2, to accept the contaminated material. The 1984 ROD designated a remediation objective of 50 parts per million (ppm), which was later judged to be insufficiently protective of human health. A subsequent ROD issued in 1999 proposed dredging the harbor again to a target cleanup level of 1 ppm. The final dredging season concluded on July 17, 2013.

During the 1990-1993 cleanup, Boat Slip #4 was built to replace Boat Slip #3. Contaminated soils were identified during the excavation of Boat Slip #4, which led to the discovery of the adjacent Waukegan Coke Plant (WCP) site. EPA issued another record of decision in 1999 to reduce concentrations of ammonia, arsenic, benzene, phenol and PAHs in soil and groundwater.

The soil cleanup action was completed during 2004-05 and the groundwater cleanup was conducted from 2007-2011. Groundwater monitoring is still underway at the WCP site but the active cleanup activities have concluded.

A 2006 EPA site investigation found: PCB contamination at the Plant 2 building; PCB and PAH contamination in soil and sediment; groundwater contaminated with trichloroethene (TCE); and an underground pool of free TCE dense non-aqueous phase liquits (DNAPL). EPA issued a ROD in September 2007 that called for the PCB-contaminated OMC Plant 2 building to be demolished and the debris disposed of off site. The ROD also called for the excavation and offsite disposal of soil and sediment at contaminant levels above 1 ppm PCB and 2 ppm PAHs. The building was demolished and the soil was excavated and hauled off in 2010.

Extensive cleanup activities have controlled the exposure of contaminants to the environment at OMC. Waukegan Harbor (OU1) dredging was completed in July 2013 and the residual PCB concentrations measures were sufficiently low so that placement of a sand layer was deemed unnecessary. Soil cleanup at the WCP site (OU2) was completed in 2005. The PCB Containment Cells (OU 3) are routinely maintained and no leaks have been detected. Most of the contaminated soil and sediment has been removed from the OMC Plant 2 site (OU 4), and the consolidation facility will receive a cap in 2014 (USEPA 2014a). Due to the extensive cleanup efforts at the OMC site, it is unlikely that PCBs and other contaminants will impact sediments in the Approach Channel.

From the 1920s through the mid-1980s **Johns Manville (JM)** owned and operated an asbestos manufacturing and landfill facility located at 1871 North Pershing Road in Waukegan, Illinois. This land abuts Lake Michigan north of Waukegan Harbor. Since about 1928, Johns Manville deposited wastes in pits on site; the wastes contained asbestos, and to a lesser extent, lead, chrome, thiram and xylene. U.S. EPA listed the site on the National Priorities List in 1982. The JM Waste Disposal Area covers approximately 120 acres of the nearly 300 acres of land owned by Johns Manville International. Johns Manville (JM) stopped using asbestos in its manufacturing processes in the mid-1980s and shut down manufacturing altogether in 1998. From 1988 through 1991, a 24-inch barrier of vegetated, clean soil was placed over all dry-waste areas and a stone barrier was placed to line the wastewater treatment ponds.

Since 1998, asbestos-containing material (ACM) has been detected in seven additional areas outside of the Johns-Manville fence line. Site 1 is located just north of the JM property along an access road in the Illinois Beach State Park; it now is being monitored by the Illinois Department of Natural Resources. At JM Site 2, all ACM was removed to a depth of 2 to 3 feet below ground surface. At the Former Building Manufacturing Area, all buildings were demolished and the area was enrolled in the Illinois EPA's voluntary cleanup program (USEPA 2013). In November 2012, EPA selected response actions at the four remaining sites, including the removal of asbestos, containment of asbestos and environmental covenants for the sites. Construction activities are expected to be completed by early 2016 (USEPA 2013). Until the site is fully stabilized, it has potential to contribute contamination to the surrounding environment. However it is not likely that any releases from the unremediated portions of the site would impact sediment in the Approach Channel, because the areas still undergoing cleanup are located on the west half of the site, away from Lake Michigan or other migration pathways.

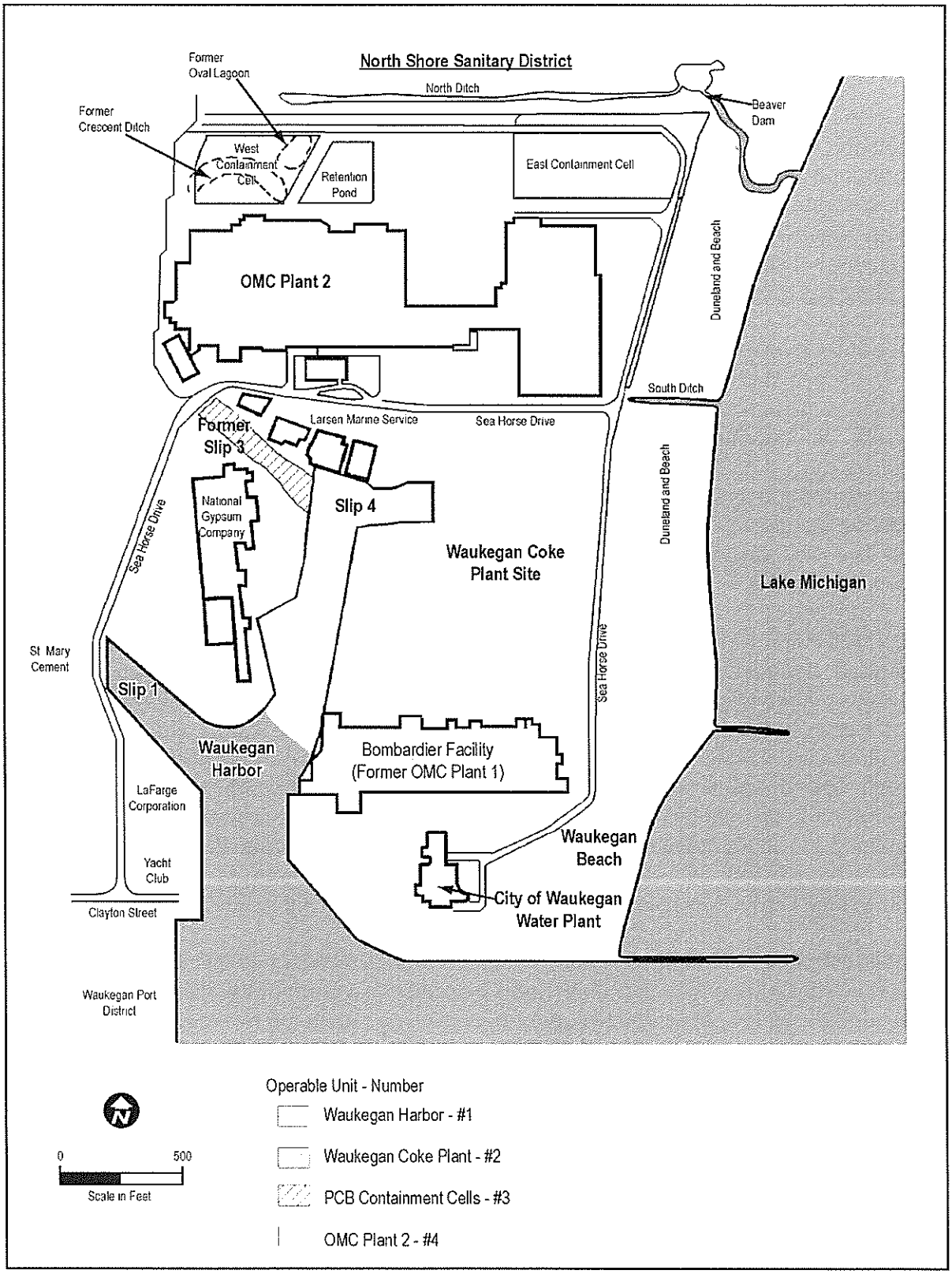


**Figure 5. Outboard Marine Corporation cleanup parcels, or "operable units" (OUs).**

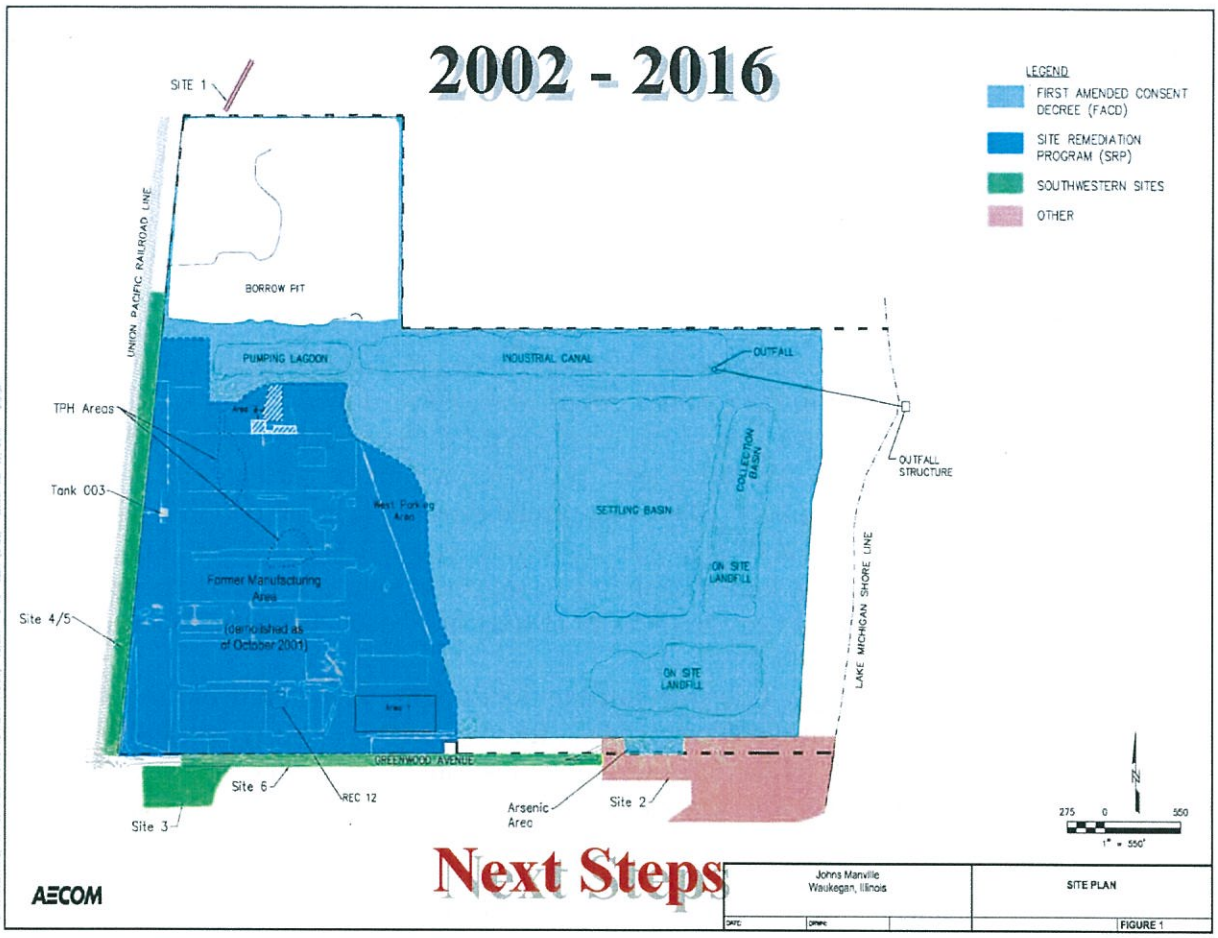


**Figure 6. Johns Manville CERCLA Site**

The **North Shore Gas (NSG) North Plant** is located north of Waukegan Harbor, at the corner of Pershing and Dehringer Roads. The North Plant site MGP was constructed in 1912 as a gas production and storage facility and was operated as such until 1953. Prior to its excavation in 1992, a tar pond called the "Waukegan Tar Pit" was located to the northeast of the site. Underground MGP structures included a tar well and tar separator below the 200,000-cubic foot gas holder. Aboveground MGP structures included: propane, oil, tar, and other storage tanks; coke bins; and a coke pile. The aboveground MGP structures were dismantled and removed in 1966 and 1968. Historical records indicate the potential for contamination and migration of contaminants during plant demolition activities, including the rupture of a relief holder unit which released 400,000 gallons of water, tar emulsion, and tar to the soil. The North Plant site is not listed on the National Priorities List; however, EPA is addressing the site under the Superfund Alternative Site approach. Soil removal is ongoing and a Remedial Investigation and Feasibility Study is currently being developed and is expected to be complete in 2015. Soil removal work is scheduled to continue through 2014 (USEPA 2014b). It is not likely that the soil contamination has impacted the Approach Channel or Advanced Maintenance Areas because the site is not adjacent to Lake Michigan.

The 1995 Tier I Sediment Evaluation for Waukegan Harbor identified the **Pfleger Greiss** property, a former tannery, as a CERCLA regulated site. The site is not listed on the NPL and has been referred to the State of Illinois Site Remediation Program. The Preliminary Assessment and Site Inspection conducted in the late 1980s assigned a "low" priority ranking to the site, indicating limited potential for impact to human health and the environment. Since the property is located approximately one mile north of the harbor itself, with no apparent contaminant pathways, it seems unlikely that the Pfleger Greiss property could have a negative impact on sediment quality.

#### *3.5.1.2. RCRIS*

The Resource Conservation and Recovery Information System (RCRIS) lists sites which generate, transport, store, and/or dispose of hazardous waste defined by the RCRA. The RCRIS database includes RCRA Corrective Action Report (CORRACTS), which identify hazardous waste handlers with RCRA corrective action activity; RCRA treatment, storage, and disposal facilities (TSDFs), and RCRA conditionally exempt small quantity generators (CESQGs), RCRA small quantity generators (SQGs), and large quantity generators (LQGs) facilities. SQGs generate between 100 kg and 1,000 kg of hazardous waste per month. CESQGs generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

The database search revealed 15 facilities regulated under RCRA within a mile of the project location. Of the identified facilities, one was a LQG, four were SQGs, four were CESQGs, and six were inactive. No CORRACTS facilities were found within the recommended search distance. Violations under RCRA were not recorded for any of the properties identified.

#### *3.5.1.3. ERNS*

The Emergency Response Notification System (ERNS) database listing for Illinois contains information on release of oil or hazardous substances that have occurred throughout Illinois and have been reported to the National Response Center (NRC), the USEPA Regional Office, or the Coast Guard. The ERNS Report contains initial notification data made immediately after an incident, when exact details are often not known. The ERNS Report incidence description may have been updated with more accurate response action information from various Federal, State, and local response authorities if they were involved in the response. The NRC database is currently unavailable due to maintenance. Therefore, the following information is provided from the 2005 Contaminant Determination document.

A review of the Illinois ERNS listing identifies four releases in the Waukegan area. Of these two releases, for hydrochloric acid and an unknown oil, list no quantity released and no responsible party. Another listing identifies a release of chromic acid by the Frederick Gumm Chemical Company, however no quantity was indicated. The Frederick Gumm Chemical Company is located outside the harbor area, on Greenfield Avenue, and is not considered to have any potential impact on sediment quality in the Approach Channel or Outer Harbor.

Finally, the ERNS listing indicates a release of 175 gallons of miscellaneous transformer oil by Commonwealth Edison on May 9, 1995. A review of a map of Waukegan shows a Commonwealth Edison substation located approximately one mile north of Waukegan Harbor, approximately 1,300 feet west of a small boat harbor.

**Table 2. Database Search Results**

| Database | Site Name | Proximity to Site | Status |
|---|---|---|---|
| RCRAInfo, AIRS/AFS, PCS/ICIS, TRI | Akzo Nobel Aerospace Coatings | 0.75 mi. WSW | RCRA-LQG: no violations |
| RCRAInfo, PCS/ICIS | Al Hanson Mfg. | 0.90 mi. NW | RCRA-SQG: no violations. CWA Non-compliance 7 out of the last 12 quarters. |
| RCRAInfo | ATM Labs Inc. | 1.08 mi. WSW | RCRA-CESQG: no violations. Monetary penalties under the CAA |
| RCRAInfo, PCS/ICIS | BRP US Inc. | 0.67 mi. NW | RCRA-SQG: no violations. |
| RCRAInfo | City of Waukegan Water Treatment Plant | 0.82 mi. NW | RCRA-CESQG: no violations. Monetary penalties in 2009 and 2010 under the CAA for "Failure to file a 5-year update to the facility's Risk Management Plan" |
| RCRAInfo, TRI | Duphar Nutrition, Inc. | 0.77 mi. W | Inactive RCRA handler, no violations. TRI releases were all transferred off-site to disposal. |
| RCRAInfo, AIRS/AFS, PCS/ICIS, TRI | New NGC Inc. / National Gypsum Co. | 0.80 mi. NW | RCRA-SQG: no violations. TRI: Chemicals released to the environment < 1lb. per year. |
| RCRAInfo | News-Sun | 0.72 mi. W | RCRA-SQG: no violations. |
| CERCLIS, RCRAInfo, PCS/ICIS, TRI | Outboard Marine Corporation | 0.5 mi. W | CERCLA: Cleanup substantially complete in 2013-14. RCRA: Inactive, no violations. |
| RCRAInfo | The Valspar Corporation | 0.92 mi. WSW | RCRA: Inactive, no violations. |
| RCRAInfo | City of Waukegan | 1.00 mi. W | RCRA: Inactive, no violations. |
| RCRAInfo, PCS/ICIS | Waukegan Port District | 0.73 mi. WSW | RCRA-CESQG: no violations. |
| CERCLIS, RCRAInfo, TRI | Johns Manville | 1.5 mi. N | CERCLA: Cleanup ongoing through 2016. RCRA: Inactive: no violations. |
| RCRAInfo | NSSD Waukegan STP | 1.1 mi. NNW | RCRA-CESQG: no violations. CWA violations 11 out of the last 12 quarters. |
| CERCLIS, RCRAInfo | North Shore Gas Plant Waukegan Tar Pits | 1.0 mi. NW | CERCLA: Soil removal work planned to continue through 2014. RCRA: Inactive, no violations. |

### 3.5.2. Historic Sediment Data

Sediment samples were collected from the approach channel in 1969, 1979, 1981, 1984, 1986, 1987, 1990, 1991, 1993, 1996, 1997, 2003, 2004, 2005, 2007, 2008, 2009, 2010, 2012 and 2013. Analyses have consisted primarily of grain size, asbestos, and PCBs. USACE began to analyze samples for asbestos in 1997 due to asbestos findings by others near Illinois Beach State Park. Asbestos was also investigated by the Illinois Attorney General in 2005. Investigations conducted in 1967, 1993 and 2003 included a wider range of parameters. Historic sediment data is tabulated in Appendix A and shown graphically below.

#### *3.5.2.1. Polychlorinated Biphenyls (PCBs)*

Sampling results indicate no PCB detections in the Waukegan Approach since 1997, as shown in Figure 7.

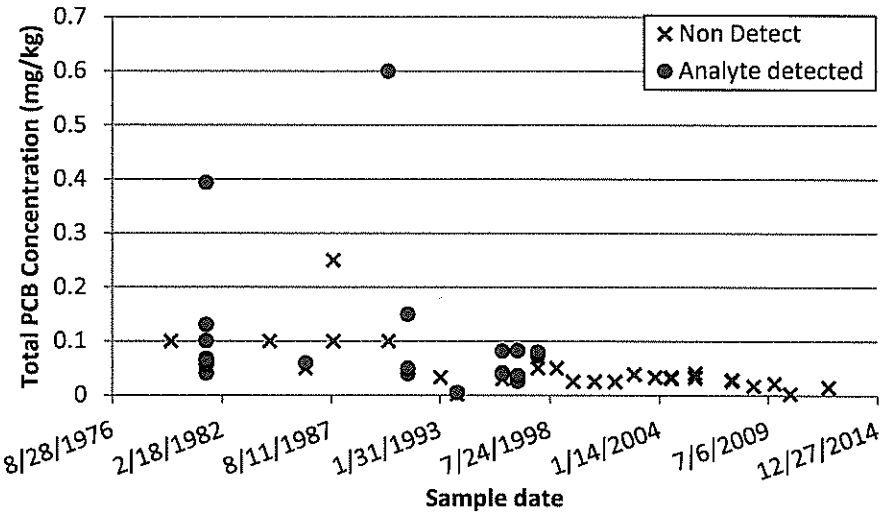


**Figure 7. Sediment Total PCB results, 1979-2012**

#### *3.5.2.2. Asbestos*

Due to asbestos findings around the Illinois Beach State Park (IBSP), USACE began to analyze samples for asbestos in 1997. Results from the sampling events in 1997-1998 and 2001-2013 have shown no evidence of asbestos. One sample from both the 1999 and 2000 events detected a trace amount of asbestos, but not at a concentration high enough to classify it as asbestos containing material (ACM). Material with 1% asbestos content or greater is defined as ACM. Sediment samples have been analyzed using two asbestos analytical methods: Polarized Light Microscopy (PLM) and Transmission Electron Microscopy (TEM). The PLM method evaluates the sediment for asbestos containing building material and asbestos fibers/bundles/matrices, and has the ability to detect fibers greater than or equal to 5 microns. The TEM method uses a more sophisticated technology that can analyze fibers less than 0.01 microns in diameter.

In 2005, members of the Illinois Attorney General's Asbestos Task Force conducted a study of asbestos contamination at IBSP, where asbestos-containing materials (ACM) had been found since 1997. Twelve sediment samples were collected from each of seven locations: five beach locations and two sand sources used for beach nourishment at IBSP. Sediment from the

Waukegan Harbor Approach Channel was among the potential sources evaluated. A sensitive analytical method with a very low detection limit, known as "Superfund/Elutriator," was used for the study. While asbestos fibers were detected in each of the twelve samples collected from the Waukegan Harbor Approach Channel, the detections indicated risk levels less than the USEPA benchmark risk level of one in one million. The study concluded, "the results of this study indicate that there is no reason to exclude the use of the lake-bottom sand sources for offshore beach nourishment, as is the current practice" (Cali, Scheff, and Sokas 2006).

#### *3.5.2.3. Grain Size*

According to Title 35 of the Illinois Administrative Code (Subtitle C, Chapter 2, Part 395), a particle size analysis is required to evaluate the potential for water pollution due to the discharge of dredge and fill. According to Special Condition #6, particle size tests that show 20% or more material passing through a #230 U.S. Standard sieve require notice to IEPA. The large majority of sediment samples collected from the Waukegan Approach Channel since 1981 meet have less than 20% passing a #230 sieve, as shown in Figure 8. Three samples collected in August of 2010 were found to contain 25, 33 and 30 percent fines, respectively. Since the grain size characteristics proved to be similar for both the dredged material and the disposal site, no environmental impacts were anticipated during disposal of the dredged material (USACE 2011). Water Quality Monitoring was conducted when this material was placed in 2012. Statistical comparisons between background and monitoring sample results did not indicate any difference between the data sets and it was concluded that sediment disposal operations are not having an impact on water quality in Lake Michigan.

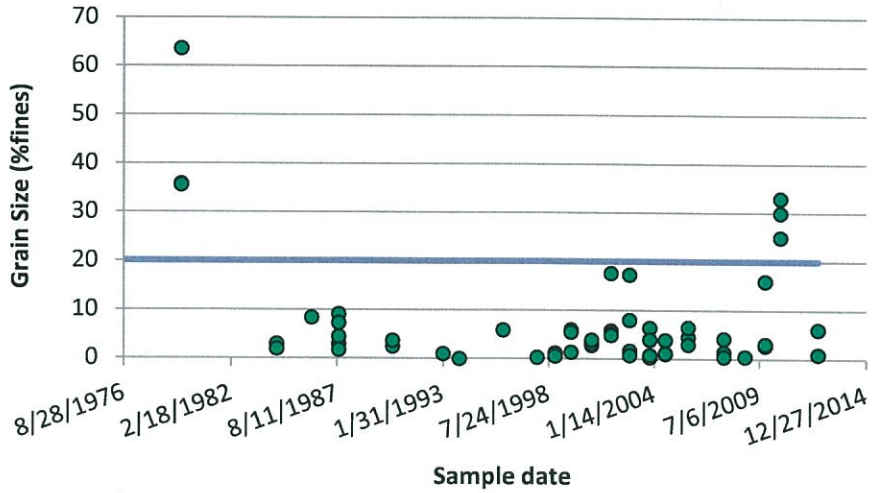


**Figure 8. Sediment Grain Size results, 1979-2012**

## 3.6. Potential Sources of Sediment Contamination

### 3.6.1. Agricultural Sources

There are no tributary flows to Waukegan Harbor and no adjacent agricultural areas. Therefore, there appear to be no agricultural sources of sediment contamination.

### 3.6.2. Industrial and Municipal Discharges, Overflows, and Bypasses

Several storm sewers discharge into Waukegan Harbor and Lake Michigan near Waukegan Harbor, including Dexter Packaging Products, National Gypsum Co., Larsen Marine Services, and Union Pacific Railroad. These facilities are minor dischargers covered under the general permit. Runoff from these areas is expected to be typical of industrialized, urban sites. The Waukegan Port District also is a minor discharger covered by a general permit, with no violations.

The Bombardier Motor Corporation of America (BRP), formerly Outboard Marine Corporation, develops and tests outboard motors and marine recreational products. The Bombardier plant discharges 0.735 MGD of non-contact cooling water from Outfall 001. NPDES Permit No. IL0076457 requires Bombardier to report monthly average and daily maximum flow, as well as temperature.

Outfall 2 of the North Shore Sanitary District (NSSD) Waukegan Sewage Treatment Plant (STP) discharges to Lake Michigan just north of Waukegan Harbor. Plant effluent is subject to permit limits on $CBOD_5$, suspended solids, dissolved oxygen, pH, fecal coliform, ammonia-nitrogen, phosphorus, and chlorine residual. USEPA Enforcement and Compliance History Online (ECHO) shows that the facility has been out of compliance every quarter of the last three years. Violations include exceedances of the fecal coliform effluent limit, as well as late and missing biosolids program reports.

### 3.6.3. Previous Dredging or Fill Discharges

There are no known dredging or filling activities which discharged into the approach channel or advance maintenance areas. Previous dredging activities conducted by USACE and their corresponding disposal locations are described in paragraph 2.3.

### 3.6.4. Landfill Leachate/Ground Water Discharge

There are no landfills in the immediate vicinity of Waukegan Harbor. However there is a PCB containment cell at the north end of the Inner Harbor. Former Slip 3, shown on Figure 5. Outboard Marine Corporation cleanup parcels, or "operable units" (OUs). was filled in 1993 and used as a containment cell for PCB-contaminated sediment and soil removed from the north harbor and the OMC Plant 2 site. It is possible yet unlikely that this containment cell is a source of PCBs to the Inner Harbor or Approach Channel.


**Figure 9. Industrial and Municipal Dischargers**

**Table 3. Industrial and Municipal Discharges**

| Facility Name | NPDES # | CWA Permit Type | Areas | Status | Notes |
|---|---|---|---|---|---|
| Akzonobel Aerospace Coatings/ Dexter Packaging Products | ILR000490 | Minor: General Permit Covered Facility | Storm Water Industrial | Effective, expires 4/30/2014 | No violations |
| Bombardier; formerly Outboard Marine | IL0002267 | Major: NPDES Individual Permit | -- | Terminated 6/1/1992 | Internal Combustion Engines; non-contact cooling water. Receiving waters: Waukegan Harbor |
| Bombardier Motor Corporation of America | IL0076457 | Minor: NPDES Individual Permit | -- | Effective, expires 4/30/2018 | No violations |
| National Gypsum Co. | ILR000113 | Minor: General Permit Covered Facility | Storm Water Industrial | Effective, expires4/30 /2014 | No violations; Receiving waters: Lake Michigan |
| NSSD Waukegan STP | IL0030244 | Major: NPDES Individual Permit | Biosolids, POTW, Pretreatment | Admin Continued 4/30/2012 | See next. |
| NSSD Waukegan STP | ILL030244 | Minor: Associated Permit Record | Biosolids | Effective | 12 of the last 12 quarters in non-compliance: fecal coliform exceedance, biosolids program report submitted late. Receiving Waters: Lake Michigan. |
| Larsen Marine Services | ILR001924 | Minor: General Permit Covered Facility | Storm Water Industrial | Effective, expires 12/31/2015 | No violations. Receiving waters: Lake Michigan |
| Union Pacific Railroad - Waukegan | ILR003068 | Minor: General Permit Covered Facility | Storm Water Industrial | Effective, expires 4/30/2014 | 9 of the last 12 quarters in non-compliance: Failure to develop stormwater control program. |
| Waukegan Sheridan Road | ILR10J385 | Minor: General Permit Covered Facility | Storm Water Construction | Terminated 7/31/2013 | No violations |
| Waukegan Port District | ILG870002 | Minor: General Permit Covered Facility | -- | Effective, expires 10/30/2016 | No violations |

### 3.6.5. Spills of Oil or Chemicals

#### *3.6.5.1. Outboard Marine Corp*

The OMC site contains four cleanup parcels, called "operable units" (OUs), which are shown below in **Error! Reference source not found.**. The Waukegan Harbor (WH) site is OU 1, the Waukegan Manufactured Gas and Coke Plant (WCP) site is OU 2, the PCB Containment Cells, which were created when the harbor was first cleaned up in 1990-1993, comprise OU 3, and the OMC Plant 2 site is OU 4.

Potential sources of sediment contamination are largely controlled due to extensive cleanup actions. Waukegan Harbor (OU1) dredging was completed in July 2013 and the residual PCB concentrations measures were sufficiently low so that placement of a sand layer was deemed unnecessary. Soil cleanup at the WCP site (OU2) was completed in 2005. The PCB Containment Cells (OU 3) are routinely maintained and no leaks have been detected. Most of the contaminated soil and sediment has been removed from the OMC Plant 2 site (OU 4), and the consolidation facility will receive a cap in 2014 (USEPA 2014a). Much of the surface of the property is now available for redevelopment, however the City of Waukegan plans to wait until the entire property is ready for re-use before commencing redevelopment work. In 2014, the US Army Corps of Engineers plans to dredge up to 100,000 cubic yards of clean sediment from the Outer Harbor area of Waukegan Harbor and place the sediment in the Waukegan Coke Plant portion of the OMC Site. Work is scheduled to begin in late spring 2014.

#### *3.6.5.2. Johns Manville International*

The Johns Manville property, a former asbestos manufacturing and landfill facility, was enrolled in CERCLA in 1982 and has since undergone substantial remedial action. Cleanup was complete at the JM Waste Disposal Area in 2002. As shown below in **Error! Reference source not found.**, this is the eastern portion of the site, closest to Lake Michigan, with the greatest proximity to the proposed dredging area in the Approach Channel. However, remedial action is not yet complete in the Former Manufacturing Area, the Southwestern Site Area, in the Industrial Canal/Pumping Lagoon, and at the Borrow Pit. Construction is expected to continue through 2016. Until the site is fully stabilized, this site will have some potential to release contamination to the surrounding environment. However the unremediated portions of the site are located to the west, away from Lake Michigan, which reduces the likelihood of impacts to Approach Channel sediments.

#### *3.6.5.3. North Shore Gas (NSG) North Plant*

Integrys has conducted some cleanup actions at the North Shore Gas (NSG) North Plant site in the past, but soil still contains residual levels of polynuclear aromatic hydrocarbons (PAHs), the BTEX group (benzene, toluene, ethylbenzene, and xylene) of volatile organic compounds (VOCs), and heavy metals. The Waukegan Tar Pit was excavated in 1992; however, tar was observed well beyond the limits of the excavation, with tarry residues contaminating an estimated 67,400 cubic yards of soil. Evidence of chlorinated solvents, free phase coal tar, and oily hydrocarbons has been observed in soil samples collected at the site. Chemicals detected in groundwater samples from the site include VOCs (primarily BTEX and chlorinated solvents), SVOCs (primarily PAHs and phenols), heavy metals, and cyanide. Soil removal is ongoing and a Remedial Investigation and Feasibility Study is currently being developed and is expected to be complete in 2015. Soil removal work is scheduled to continue through 2014 (USEPA 2014b). Because this site is not adjacent to the harbor or Lake Michigan, it is not likely that the soil contamination has impacted the Approach Channel or Advanced Maintenance areas.

### 3.6.6. Air Deposition

There are no apparent air depositional sources which would be likely to contribute significantly to sediment volume or content.

### 3.6.7. Biological Deposition (detritus)

Biological detritus is unlikely to contribute significantly to sediment volume or content.

### 3.6.8. Mineral Deposits

None of the database sources or previous sediment studies indicate that mineral deposits would contribute significantly to sediment volume or content.

## 3.7. Tier 1 Conclusion

The southward littoral drift pattern and historic sediment data at the Waukegan Harbor Approach Channel suggest that the sediment in the project area are littoral sands and are likely suitable for open-lake disposal. However, based on an overall evaluation of the historic sediment data from The Waukegan Harbor Approach, and the potential sources of sediment contamination identified in this report, the Chicago District, U.S. Army Corps of Engineers concludes that the existing information is insufficient to make a factual determination regarding compliance with the Clean Water Act, Section 404(b)(1). As such, a Tier 2 evaluation is required, which will involve the analysis of representative sediment and elutriate samples.

### 3.7.1. Sediment Contaminant List

Based on the information obtained from the Tier I sediment evaluation, a list of potential Contaminants of Concern has been compiled, as shown in Table 4. The constituents indicated on this list should be evaluated through analytical testing during the Tier 2 evaluation.

**Table 4. Waukegan Harbor Approach Contaminants of Concern**

| Parameter | Matrix |
|---|---|
| Total PCBs | Sediment and Elutriate |
| Asbestos | Sediment |
| Grain size | Sediment |
| Total Suspended Solids (TSS) | Water and Elutriate |
| Total Volatile Solids (TVS) | Water and Elutriate |
| Total Dissolved Solids (TDS) | Water and Elutriate |
| Phosphorus (as P) | Water and Elutriate |
| Ammonia-nitrogen (as N) | Water and Elutriate |
| Sulfate | Water and Elutriate |
| Chloride | Water and Elutriate |
| Lead (total) | Water and Elutriate |
| Zinc (total) | Water and Elutriate |

# 4. Tier II Evaluation

## 4.1. Tier II Objectives

The Tier II evaluation identifies potential water-column impacts that may result from disposal of dredged sediment into Lake Michigan, in order to make a factual determination regarding project compliance with the Clean Water Act Section 404(b)(1). The Tier II consists of evaluation of state water quality standard (WQS) compliance using a numerical mixing model of the disposal site conditions. The STFATE numerical mixing model was run with chemical data obtained from elutriate tests performed on dredged material from Waukegan Harbor Approach Channel. According to the *Inland Testing Manual*, "If the numerical model predicts that the concentration of all contaminants of concern at the edge of the mixing zone is less than the applicable WQS, the dredged material complies with WQS. Otherwise, it does not" (USEPA and USACE 1998a).

The STFATE (Short-Term FATE of dredged material disposal in open water) model is used for discrete discharges from barge and hopper dredges. STFATE is a module of the Automated Dredging and Disposal Alternatives Management System (ADDAMS) is a design, analysis, and evaluation system for dredged material disposal and management supported by the Environmental Laboratory of the U.S. Army Corps of Engineers Engineer Research and Design Center. STFATE represents the disposal of dredged material as a sequence of convecting clouds released at a constant time interval. The equations governing the motion are those for conservation of mass, momentum, buoyancy, solid particles, and vorticity.

## 4.2. Water column impact

### 4.2.1. Elutriate test history

Section 401 Water Quality compliance is determined using elutriate test results. The elutriate is the supernatant resulting from vigorous 30 minute mixing of sediment and water, followed by settling and centrifugation. The elutriate test is a conservative estimate of contaminant partitioning into the water column. Elutriate test results for sediment samples collected in 1995, 2009, 2010, 2012 and 2013 are tabulated in Appendix B. Test results showed exceedances of the state water quality standards for Total Dissolved Solids (TDS), Phosphorus (as P), Ammonia-nitrogen (as N), Sulfate, Chloride, Lead (total), and Zinc (total) based only on the measured elutriate results. Background aqueous concentrations of Phosphorus (as P), Sulfate, and Chloride also exceeded state water quality standards. This implies that it will not be possible for the elutriate results to meet water quality standards for those constituents. Elutriate data are tabulated in Appendix B. The maximum concentration detected for each of the contaminants of concern from 2009 through 2013 is shown below in Table 5 ($C_e$). State water quality standards for each parameter and average measured background concentrations for each constituent are also shown. Water quality standards for the open waters of Lake Michigan are defined by 35 Ill. Adm. Code 302.

The *Inland Testing Manual* offers the following equation to determine which contaminant requires the greatest dilution, since the model need only be run for the contaminant that requires the greatest dilution to make a determination. In cases when the background concentrations exceed the water quality standards, it is assumed that the dilution endpoint would be the background concentration, and not the WQS. In this scenario, the dilution factor will always

equal 1. Based on the calculations summarized below in Table 5, Ammonia-nitrogen was selected as the critical parameter for the STFATE mixing zone analysis.

$$D = (C_e - C_{wq})/(C_e - C_{ds})$$

Where:

$D$ = dilution

$C_e$ = concentration of the dissolved contaminant in the standard elutriate in micrograms per liter (µg/L)

$C_{wq}$ = WQS in micrograms per liter (µg/L)

$C_{ds}$ = background concentration of the contaminant at the disposal site in micrograms per liter (µg/L)

**Table 5. Dilution required to meet WQS**

| | Units | $C_e$ | $C_{wq}$ | $C_{ds}$ | D |
|---|---|---|---|---|---|
| Total Suspended Solids (TSS) | ug/L | 128,000,000 | NA | 42,400 | NA |
| Total Volatile Solids (TVS) | ug/L | 164,000,000 | NA | 106,000 | NA |
| Total Dissolved Solids (TDS) | ug/L | 853,000 | 180,000 | 136,000 | 0.94 |
| Phosphorus (as P) | ug/L | 849 | 7 | 69.8 | 1.00 |
| **Ammonia-nitrogen (as N)** | **ug/L** | **3,600** | **20** | **12.7** | **1.00** |
| Sulfate | ug/L | 36,000 | 24,000 | 24,700 | 1.00 |
| Chloride | ug/L | 19,600 | 12,000 | 14,700 | 1.00 |
| Lead (total) | ug/L | 258 | 50 | 0 | 0.81 |
| Zinc (total) | ug/L | 716 | 195.5 | 3.23 | 0.73 |
| Total PCBs | ug/L | 0 | NA | NA | NA |

### 4.2.2. Sediment data

As discussed in Paragraph 3.5.2.3, Illinois regulations require reporting to IEPA when particle size tests for dredged material show 20% or more material passing through a #230 U.S. Standard sieve. Prior to each dredging event at Waukegan Harbor Approach, sediment samples have been collected and analyzed for grain size. Percent fines and water content were measured in the laboratory and reported in annual dredging reports. Historically, sediment from the Waukegan Harbor Approach Channel has contained less than 7% fines, as shown in Appendix A. However, samples collected in 2010 contained 25, 33, and 30 percent fines. The STFATE model was run for four grain size scenarios: Scenario 1 utilized the 2013 grain size results, which were typical compared to the historical results; and Scenario 2 utilized the 2010 grain size data, which contained a much higher fraction of fines. In 2010, no effort was made to distinguish between the silt and clay fractions of the fine-grained material. Therefore, for the STFATE model input it was assumed that the fines consisted of equal parts silt and clay. Scenarios 3 and 4 also used the 2010 grain size data with the higher fraction of fines, but assumed higher plasticity for the clay fraction. A default value of 20% entrained water in the placement barge was used for all calculations. The following values were also assumed: $\rho_w = 1$ g/cm$^3$; SG sediment = 2.65. The sediment data selected for use in the STFATE model and the calculated volumetric fractions (VF) of the dredged material in the disposal barge are given below in Table 6. The other STFATE model input parameters describing the dredged material is shown in Table 7.

**Table 6. Sediment data selected for STFATE**

| | Scenario 1 2013 data | Scenario 2 2010 data | Scenario 3 2010 data | Scenario 4 2010 data |
|---|---|---|---|---|
| % Coarse | 96.6 | 67 | 67 | 67 |
| %Silt | 3.3 | 16.5 | 16.5 | 16.5 |
| %Clay | 0.1 | 16.5 | 16.5 | 16.5 |
| w, % | 22.32 | 26 | 26 | 26 |
| Liquid Limit | - | - | 20 | 50 |
| $F_v$clumps | 0.000 | 0.000 | 0.500 | 0.800 |
| $F_v$coarse | 0.480 | 0.317 | 0.119 | 0.000 |
| $F_v$silt | 0.016 | 0.078 | 0.029 | 0.000 |
| $F_v$clay | 0.000 | 0.078 | 0.029 | 0.000 |
| $F_v$water | 0.504 | 0.526 | 0.322 | 0.200 |

**Table 7. STFATE Model Input Parameters - Material Description**

| | Units | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|---|---|
| Number of solids fraction | | 2 | 3 | 4 | 4 |
| Solid fraction descriptions | | Fine Sand, Silt | Fine Sand, Silt, Clay | Clumps, Fine Sand, Silt, Clay | Clumps, Fine Sand, Silt, Clay |
| Solid fraction specific gravity | | 2.7, 2.65 | 2.7, 2.65, 2.65 | 1.6, 2.7, 2.65, 2.65 | 1.6, 2.7, 2.65, 2.65 |
| Solid fraction volume concentration | $yd^3/yd^3$ | 0.480, 0.016 | 0.317, 0.078, 0.078 | 0.5, 0.119, 0.029, 0.029 | 0.8, 0.01, 0.01, 0.01 |
| Solid fraction fall velocity | ft/s | 0.02, 0.01 | 0.02, 0.01, 0.002 | 3.0, 0.02, 0.01, 0.002 | 3.0, 0.02, 0.01, 0.002 |
| Solid fraction depositional void ratio | | 0.7, 405 | 0.7, 4.5, 7.5 | 0.4, 0.7, 4.5, 7.5 | 0.4, 0.7, 4.5, 7.5 |
| Solid fraction critical shear stress | $lb/ft^2$ | 0.015, 0.0085 | 0.015, 0.0085, 0.0038 | 99.0, 0.015, 0.0085, 0.0038 | 99.0, 0.015, 0.0085, 0.0038 |
| Cohesive (Y /N) | | N, N | N, Y, Y | N, N, Y, Y | N, N, Y, Y |
| Stripped during descent(Y /N) | | Y, Y | Y, Y, Y | N, Y, Y, Y | N, Y, Y, Y |
| Dredge site water density | g/cc | 1 | 1 | 1 | 1 |
| Number of layers | | 1 | 1 | 1 | 1 |
| Volume of each layer | $yd^3$ | 200 | 200 | 200 | 200 |
| Vessel velocity in x-direction | ft/s | 0 | 0 | 0 | 0 |
| Vessel velocity in z-direction | ft/s | 0 | 0 | 0 | 0 |

### 4.2.3. Site Data

STFATE was run for Disposal Location 1 shown in Figure 2, which measures 1000 ft in the east-west direction and 2000 ft north-south. A water depth of 18 feet was selected because permit conditions have stipulated that disposal must be conducted in less than 18 feet of water. Average current velocity at the disposal site was approximated from the NOAA/GLERL Great Lakes Monthly Depth-Averaged Currents Map (National Oceanic and Atmospheric Association and Great Lakes Coastal Forecasting System). The monthly depth-averaged velocity at the project site during 2013 does not appear to exceed 0.4 ft/s. Therefore the maximum depth-averaged value was used in the STFATE modeling and was given a logarithmic profile. The currents are predominantly in the southerly direction, parallel to the shoreline.

**Table 8. STFATE Model Input Parameters - Site Data**

| | | |
|---|---|---|
| Number of grid points (L-R, +z dir) | | 30 |
| Number of grid points (T-B, +x dir) | | 30 |
| Grid spacing (L-R), f(V) | ft | 50 |
| Grid spacing (T-B), f(V) | ft | 100 |
| Constant water depth | ft | 18 |
| Bottom roughness | ft | 0.005 |
| Bottom slope (x-dir) | deg | 0 |
| Bottom slope (z-dir) | deg | 0 |
| Number of points in density profile | | 2 |
| Density at point one (surface) | g/cc | 1 |
| Density at point two (bottom) | g/cc | 1.0002 |
| Type of velocity profile | | depth-averaged |
| Vel for z-direction | ft/s | 0.4 |

### 4.2.4. Operations data

The split-hull barge utilized for dredging at the Waukegan Harbor Approach in 2013 measures 151 feet long x 34.5 foot wide x 15 foot deep. It drafts 4 feet when empty and 14 feet when fully loaded. The capacity of the barge is 1,000 cubic yards and emptying time averages 15 minutes (Luedtke 2014). Disposal from a split-hull barge occurs as a series of discrete discharges. Therefore the model input parameters represent 5 disposals of 200 cubic yards each.

**Table 9. STFATE Model Input Parameters – Operations data**

| | | |
|---|---|---|
| Disposal point top of grid | ft | 750 |
| Disposal point left edge of grid | ft | 1000 |
| Length of vessel bin | ft | 151 |
| Width of vessel bin | ft | 35 |
| Bottom depression length x-direction | ft | 0 |
| Bottom depression length z-direction | ft | 0 |
| Bottom depression average depth | ft | 0 |
| Predisposal draft | ft | 14 |
| Postdisposal draft | ft | 4 |
| Time to empty vessel | s | 180 |

### 4.2.5. STFATE Results

Model results show that water quality criteria for ammonia was met at the boundaries of a mixing zone measuring 209 ft east-west by 934 ft north-south. Similar conclusions were reached for the two different grain size distributions considered, indicating that the one odd year of finer grained material has no bearing on the water quality impacts of dredging/disposal operations. In fact, model results show that smaller mixing zones are needed when a larger fraction of the dredged material has cohesive properties, as shown in Table 10. Figure 9 shows a concentration contour plot of the maximum mixing zone required for ammonia compliance. As ammonia was one of the parameters requiring the greatest dilution, water quality standards for all other constituents should be met within this zone as well. The required mixing zone is much smaller than the 1000 ft x 2000 ft material disposal area. Therefore, the proposed disposal is understood to comply with the applicable water quality standards for the open waters of Lake Michigan in Illinois.

**Table 10. STFATE Results - Mixing Zone Dimensions**

| | L (ft) | W (ft) |
|---|---|---|
| Scenario 1 | 1059 | 236 |
| Scenario 2 | 934 | 209 |
| Scenario 3 | 814 | 147 |
| Scenario 4 | 618 | 113 |

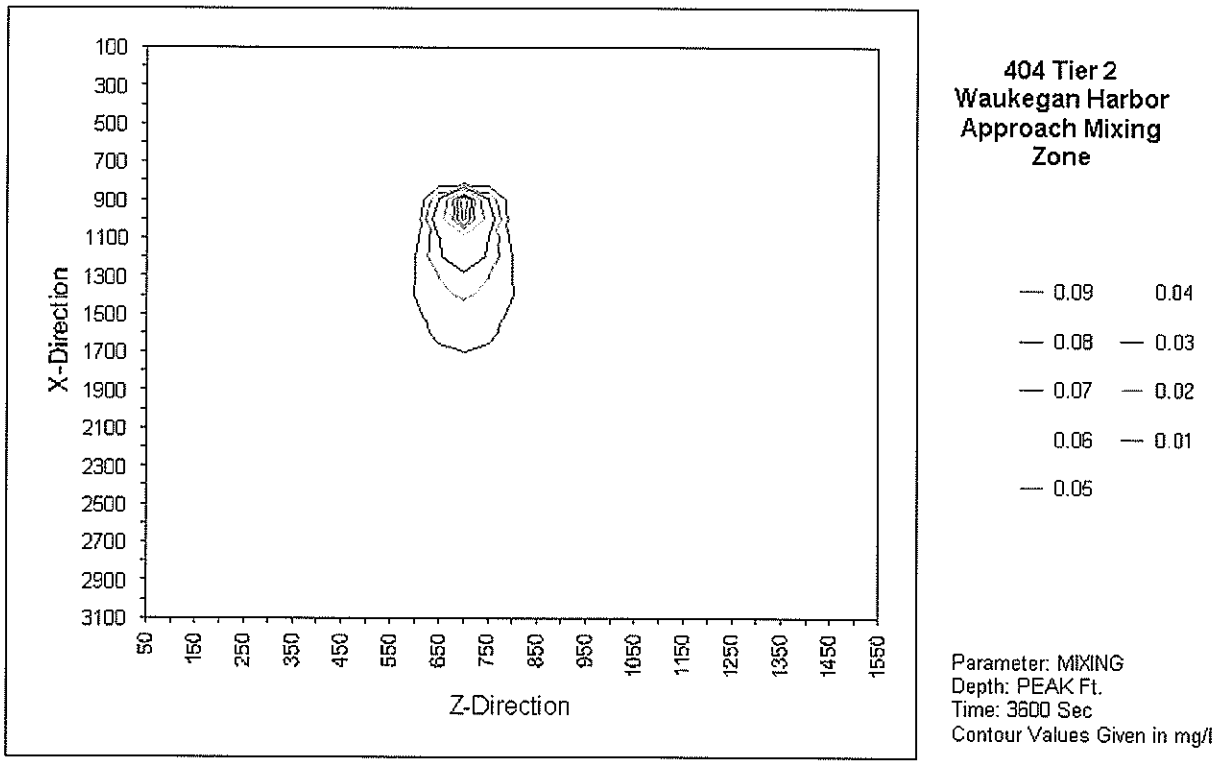


**Figure 10. Concentration contour plot ($NH_3$) for Scenario 2**

## 4.3.Water Quality Monitoring During Disposal

Water samples have been taken in Lake Michigan during sediment disposal operations for the purpose of monitoring water quality, as required by Special Condition #7 of Permit # 2005-LM-2830 dated February 1, 2005 and its three revisions dated June 28, 2005; April 1, 2008; and March 6, 2009. Samples are routinely taken on a weekly basis for the duration of dredging, at locations downstream of the disposal point. Background samples are also collected upstream of the disposal point to provide a basis for comparison. Statistical comparisons between background and monitoring sample results typically do not indicate any significant difference between upstream and downstream water quality (USACE 2014, USACE 2012, USACE 2010, USACE 2009). Water quality monitoring during dredging and disposal of Waukegan Harbor Approach Channel sediment is not recommended for annual maintenance dredging events in the future, owing to the absence of observed exceedances of state water quality standards during the dredging events covered by the existing permit.

## 4.4. Tier II Conclusions

In summary, the Chicago District has completed a contaminant determination for sediments to be dredged from Waukegan Harbor Approach Channel in Waukegan, Illinois, as required by Section 404(b)(1) of the Clean Water Act (CWA). The determination used a tiered approach that included physical and chemical tests. Our evaluations indicate that the proposed dredged material is acceptable for open water disposal. The Illinois water quality standards for the open waters of Lake Michigan are met, with a mixing zone of 236 ft x 1059 ft.

USACE Chicago District has conducted extensive sediment collection and analysis prior to dredging at the Waukegan Harbor Approach Channel. There have been no PCB detections at the project site since 1997, when the total PCB concentration measured was less than 0.1 mg/kg. The sources of PCBs to the Waukegan Harbor area have also been substantially remediated over the last two decades. Future annual sediment sampling and elutriate analysis is not recommended for detection of PCBs, owing to the absence of historical detections and the elimination of sources.

USACE Chicago District has also conducted sediment sampling and analysis for asbestos contamination since 1997, when asbestos-containing material (ACM) was found at Illinois Beach State Park. Since 1997, USACE has observed no asbestos containing material in the Waukegan Approach Channel sediment. Additionally, the Illinois Attorney General sponsored an asbestos investigation in 2005 that analyzed health risk from asbestos concentrations in Waukegan Approach sediment. This study used a very sensitive laboratory method and did detect asbestos structures in the lake-bottom sand in the Waukegan Approach. However, the concentrations were sufficiently low that the assessment concluded the sand represented a "minimal risk" to beach users, and recommended that beach nourishment using lake-bottom sand from the Waukegan Harbor Approach Channel continue. Therefore, annual sediment sampling and analysis for asbestos is not recommended for future maintenance dredging at the Waukegan Approach Channel, owing to the absence of historical detections and lack of human health risk posed by trace concentrations.

Grain size analyses of the lake-bottom sand at the Waukegan Harbor Approach Channel consistently show that the material consists of more than 90% fine sand. The data shows one notable aberration in 2010, when a higher percentage of fine-grained material was observed. Dredged material disposal simulations using the STFATE model show that a higher percentage of fines does not increase the area of expected water quality impacts, and that the area of expected impacts decreases in size as the plasticity of the fine-grained fraction increases. Annual grain size analysis is not recommended for future maintenance dredging at the Waukegan Approach Channel. Historical grain size distributions have consistently shown the composition of the material to be nearly totally fine sand; and exceptions to this trend have no bearing on water quality impacts during disposal.

Future sediment sampling and elutriate analysis is recommended one year prior to the next ten-year water quality certification request to document any potential change in environmental conditions. This is a sampling frequency that is consistent with other Great Lakes harbors in the littoral zone, and is consistent with the Federal Standard.

The proposed sampling frequency is also consistent with 40 CFR § 230.60, which defines testing requirements for dredged or fill material. Sections 230.60 (a) and (b) state that if an evaluation of the dredging site indicates that the dredged material is not a "carrier of contaminants," the determination of the presence or effects of contaminants can be made without testing. The regulation further states that, "Dredged or fill material is most likely to be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel and other inert materials." The extensive sediment and water sampling conducted at the Waukegan Harbor Approach Channel, summarized in this report, appears to satisfy these criteria. Furthermore, Section 230.60 (c) states, "Where the results of prior evaluations, chemical and biological tests, scientific research, and experience can provide information helpful in making a determination, these should be used. Such prior results may make new testing unnecessary." The compilation of existing information provided in this Contaminant Determination supports each of these exclusions and the testing frequency proposed for future discharges of dredged material from the Waukegan Harbor Approach Channel and Advance Maintenance Area.

## 5. References


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# PLAN VIEW

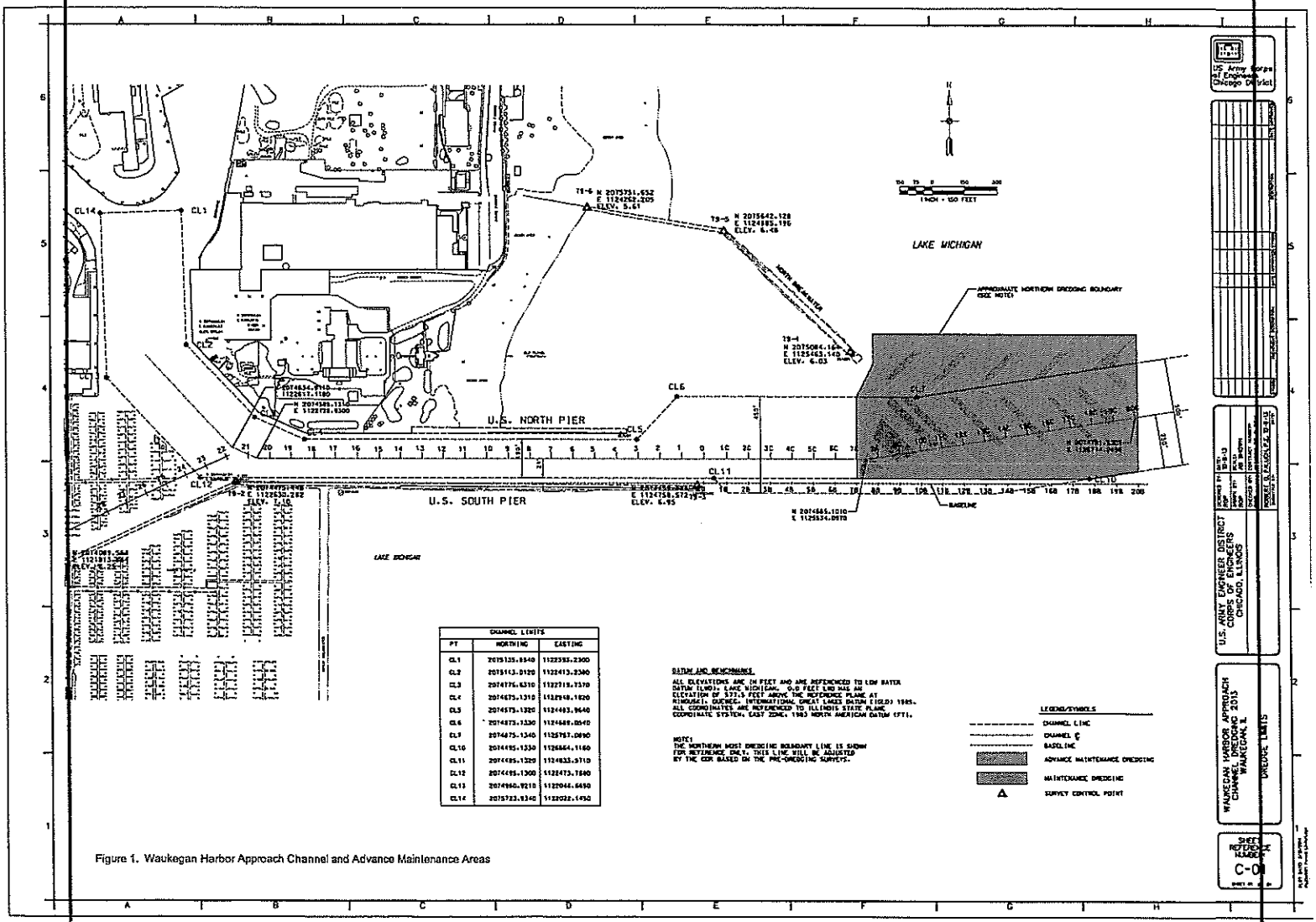


Figure 1. Waukegan Harbor Approach Channel and Advance Maintenance Areas

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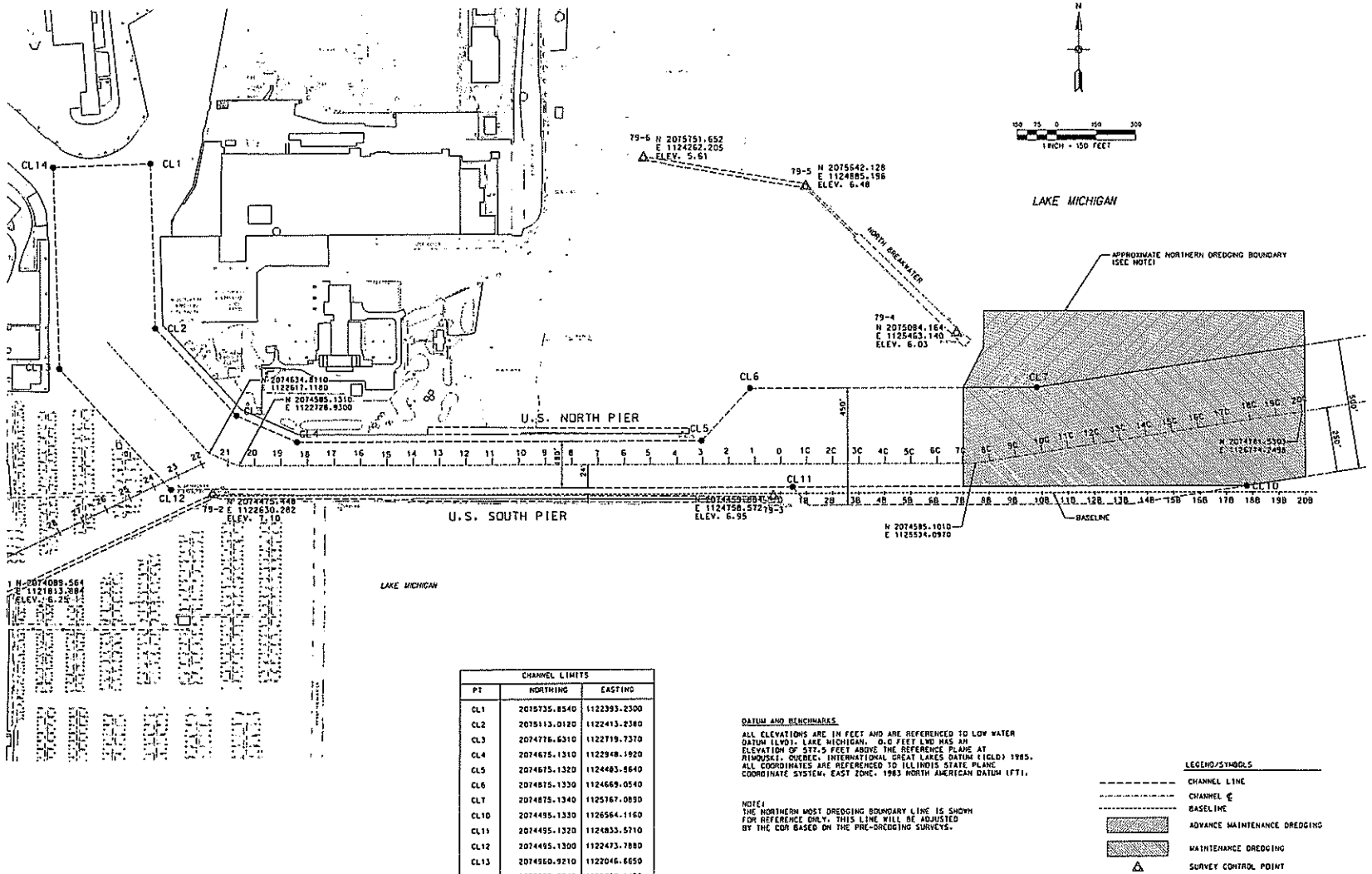


| CHANNEL LIMITS | | |
|---|---|---|
| PT | NORTHING | EASTING |
| CL1 | 2075735.8540 | 1122393.2300 |
| CL2 | 2075113.0120 | 1122413.2380 |
| CL3 | 2074776.6310 | 1122719.7370 |
| CL4 | 2074675.1310 | 1122948.1920 |
| CL5 | 2074675.1320 | 1124483.8640 |
| CL6 | 2074875.1330 | 1124669.0540 |
| CL7 | 2074875.1340 | 1125367.0850 |
| CL10 | 2074495.1330 | 1126564.1160 |
| CL11 | 2074495.1320 | 1124833.5710 |
| CL12 | 2074495.1300 | 1122473.7880 |
| CL13 | 2074950.9210 | 1122046.6650 |
| CL14 | 2075723.9340 | 1122022.1450 |

DATUM AND BENCHMARKS

ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO LOW WATER DATUM (LWD). LAKE MICHIGAN, 0.0 FEET LWD HAS AN ELEVATION OF 577.5 FEET ABOVE THE REFERENCE PLANE AT RIMOUSKI, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (IGLD) 1985. ALL COORDINATES ARE REFERENCED TO ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE, 1983 NORTH AMERICAN DATUM (FT).

NOTE:
THE NORTHERN MOST DREDGING BOUNDARY LINE IS SHOWN FOR REFERENCE ONLY. THIS LINE WILL BE ADJUSTED BY THE COR BASED ON THE PRE-DREDGING SURVEYS.

LEGEND/SYMBOLS

- CHANNEL LINE
- CHANNEL ℄
- BASELINE
- ADVANCE MAINTENANCE DREDGING
- MAINTENANCE DREDGING
- SURVEY CONTROL POINT

US Army Corps of Engineers Chicago District

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

DESIGNED BY/DATE: 10-5-13
DRAWN BY: RDP
SCALE: AS SHOWN
CHECKED BY: RDP
CONTRACT NUMBER:
SUBMITTED BY: ROBERT C. PALUCH, P.E. 10-8-13

WAUKEGAN HARBOR APPROACH CHANNEL DREDGING 2013
WAUKEGAN, IL
DREDGE LIMITS

SHEET REFERENCE NUMBER: C-01

Figure 1. Waukegan Harbor Approach Channel and Advance Maintenance Areas

Approach Channel and Advance Maintenance Area Dredging
Waukegan Harbor, Waukegan, Illinois
Paragraph 5. Adjacent Property Owners and Interested Parties

LaFarge Corporation
315 E. Sea Horse Drive
Waukegan, Illinois 60085

National Gypsum Co.
c/o C/P Property Tax Manager
2001 Rexford Rd
Charlotte, North Carolina 28211-3415

St. Mary's Cement Inc. US
9333 Dearborn St.
Detroit, Michigan 48209-2624

Waukegan Yacht Club
P.O. Box 75
Waukegan, Illinois 60079

Bombardier Motor Corp of America
200-300 Sea Horse Drive
Waukegan, Illinois 60085

City of Waukegan
Waukegan City Hall
106 N. Martin Luther King Jr. Ave.
Waukegan, Illinois 60085

Larsen Marine Service Incorporated
625 Sea Horse Drive
Waukegan, Illinois 60085-2163

Waukegan Port District
P.O. Box 620
Waukegan, Illinois 60079

U.S. Coast Guard Auxiliary Waukegan
Flotilla 3-5 9WR
9 Harbor Place
Waukegan, Illinois 60085

Tim Drexler
U.S. EPA Region 5
77 West Jackson Blvd.
Mail Code: SR-6J
Chicago, Illinois 60604-3507

Suzie Schreiber
Waukegan Harbor Citizen's Advisory Group
152 Glenwood Ave.
Winnetka, IL 60093

Waukegan Park District
412 S. Lewis Ave.
Waukegan, Illinois 60085

AKZO Nobel Aerospace Coatings
1 E. Water Street
Waukegan, Illinois 60085