Clean Water Act 404(b)1 Contaminant Determination Report

For

Waukegan Outer Harbor

Waukegan, Illinois

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Introduction

The U.S. Army Corps of Engineers (USACE), Chicago District, is preparing to dredge Waukegan Outer Harbor, in Waukegan, Illinois. Waukegan Harbor is located along the shoreline of Lake Michigan, several miles south of the Illinois/Wisconsin border (Figure 1). The federally maintained navigational facility consists of an approach channel, an outer harbor, an entrance channel, and an inner harbor. There are also privately owned and maintained slips and an extension to the inner harbor which is federally authorized but not maintained. Waukegan Harbor is used for both recreational and industrial activities.

The harbor is shown in Figure 2, with the outer harbor area outlined. Although the USACE regularly dredges shoaled sediment in the approach channel, the outer harbor has not been dredged in a number of years. A superfund project removed the most heavily contaminated sediment from the inner harbor, although PCBs are still present in the sediment of the inner harbor. The lack of complete remediation of the inner harbor has controlled the extent of dredging in the outer harbor, and in past years there has been little routine maintenance in the outer harbor. However, the outer harbor is not part of the remediation area and the outer harbor sediment is of better quality than the inner harbor sediment.

The Waukegan Outer Harbor requires maintenance dredging to remove shoaled sediment to a depth of -22' Low Water Datum (LWD) + 1' allowable overdredge. Sediment sampling and elutriate (supernatant) testing were conducted to determine the appropriate disposal for both the dredged sediment and the entrained water. The proposed project plan is to dredge mechanically. Free water would be drawn off and placed into the sanitary sewer system of the North Shore Sanitary District (NSSD), for treatment and discharge, or would possibly be used by a Waukegan area industry as process water. The dewatered sediment would be hauled by trucks to the proposed location of a railroad embankment, for use by the City of Waukegan in building the embankment, or the dewatered sediment would be used as clean fill on an unspecified site in the Waukegan Harbor area.

Tier 1 Evaluation: History of the Waukegan Harbor Area

Waukegan Harbor is a man-made harbor on southern Lake Michigan. The harbor was constructed in 1880, and has been expanded and modified over the years. In the past there have been several privately owned and maintained slips: "Slip No. 2" was filled in the mid-twentieth century and industry was constructed in this area; "Slip No. 3" was filled in the 1990's with PCB contaminated sediment, and the "Larsen Marine" slip was constructed around this time. The current configuration, shown in Figure 2, has been the configuration for approximately 10 years.

Waukegan Harbor is currently used for recreational and industrial uses. Past land uses around the harbor have been substantially industrial in nature. Since the late 1800's, documented industry within a mile of Waukegan Harbor includes steel processing; paint and dye industry; foundry work; coking operation; manufacture of construction materials including wallboard,

insulation and concrete products; wastewater and water treatment; and marine motor and vessel construction. Past activities and discharges of industry into the harbor led to contamination of the inner harbor sediment, and the adjacent industry and the inner harbor were placed on the National Priority List in 1983. A large clean-up operation in the 1990's removed the most heavily contaminated sediment, however the inner harbor sediment still contains low concentrations of PCBs and metals, and the adjacent land still has soil and groundwater contamination. Other properties in the harbor area also have a history of contamination, due to more than 100 years of industrial activities. In general, due to elevated pollutant concentrations in the inner harbor, the inner harbor has not been dredged or federally maintained. Industrial and recreational uses of the harbor have continued regardless, but the shoaled sediment has been an impediment to full industrial use of the waterway since boats cannot enter the harbor fully loaded.

For the past 10 – 15 years, there have been numerous plans to complete the inner harbor remediation, so that routine harbor maintenance can resume. Various ideas have included dredging the inner harbor sediment and placing it in a dedicated disposal facility or disposing the material in connection with other contaminated materials from the Waukegan Harbor area. The current plan for the inner harbor involves dredging the inner harbor and placing sediment at the adjacent OMC site, as a Great Lakes Legacy Act project with the City of Waukegan and others as the local sponsor. With the potential dredging of the inner harbor, there is a need to dredge the outer harbor.

The Waukegan Outer Harbor has not been dredged for a number of years. The sediment has been sampled extensively in connection with dredging the inner harbor, and the most recent sediment data are presented in the following section. In general, the outer harbor is less impacted by the industrial activities than the inner harbor. In the west end of the outer harbor, near the entrance channel, the sediment is finer grained and is likely at least partly material from the inner harbor that is moved by ships (note that the harbor has no tributary and thus there is no current that moves sediment toward Lake Michigan). In the east end of the outer harbor, near the end of the breakwaters, the material is from littoral drift. East of the outer harbor is an approach channel that is routinely dredged; the approach channel sediment is clean fine sand and is used for beach nourishment or placed in open water.

Past Sampling Events

There have been numerous sampling events over the recent past for Waukegan Harbor. These sampling events had various objectives, but included bulk sediment chemistry for various parameters. USACE sampling events at the inner and outer harbors occurred in 1995, 1998, and 2003 (USACE, 1998; QST, 1998). In addition, the USEPA conducted additional sampling in 2005 (CH2M Hill, 2005; Bishop and Stanca, 2005). Data from these sampling events indicate that the sediment in the outer harbor is fine sand and silt. The sediment contains low levels (< 1 mg/kg) of PCBs, and low levels of metals, pesticides, VOCs, and SVOCs. Ammonia and nutrient concentrations are somewhat elevated. Asbestos fibers have not been detected in the outer harbor within proposed dredging depths (-23 LWD) using PLM and TEM analysis

techniques. Although the sediment contains low levels of some constituents, the levels are all below TACO residential levels, indicating that the material would be suitable for land application or beneficial re-use. Table 1 is a summary of recent past sediment data from the outer harbor. Table 1 lists only past detectable results within the outer harbor dredging limits (above -23 LWD). Table 2 is a summary of the past asbestos sample data from the outer harbor.

Table 1: Summary of Waukegan Outer Harbor Sediment Results, 1995 - 2005

Constituent[1] (mg/kg unless otherwise noted)	1995	1998	2003	2005	TACO Residential level[2]
Total PCBs	0.247	0.726	0.048 0.152 0.165	0.12 0.13 0.1 0.088 0.09 0.12 0.092 0.06 0.12 0.79 0.72 0.21 0.15 0.076 0.058 0.087 0.076 0.14 0.075 0.12 0.28 0.096 0.074 0.085 0.11 0.076 0.12 0.099 0.14 0.069 0.172 0.075 0.091 0.145 0.086 0.05 0.04 0.037 0.054 0.44 0.1	1
Aluminum		1920			(background within the Metropolitan

Constituent[1] (mg/kg unless otherwise noted)	1995	1998	2003	2005	TACO Residential level[2]
					Statistical Area = 9500)
Arsenic		3.32	1.7 1.8 6.6 3.7 4.1 7.4		750 (background within the Metropolitan Statistical Area = 213)
Barium		18.2	4.6 4.8 34 15 18 29		5500 (background within the Metropolitan Statistical Area = 110)
Calcium		84,400			background within the Metropolitan Statistical Area = 9300
Chromium		16.4	1.9 9.7 4.5 6.5 7.0		270 (background within the Metropolitan Statistical Area = 16.2)
Cobalt		2.78			4700 (background within the Metropolitan Statistical Area = 8.9)
Copper		17.8	17 8.1 12 15		2900 (background within the Metropolitan Statistical Area = 19.6)
Iron		7,860	3500 3500 19000 9000 10000 19000		background within the Metropolitan Statistical Area = 15,900
Lead		18.5	3.4 4.1 11 13 19 10		400 (background within the Metropolitan Statistical Area = 3.6)
Magnesium		43,700			background within the Metropolitan Statistical Area = 4820
Manganese		407			3700 (background within the Metropolitan Statistical Area = 636)
Mercury		0.047	0.04		10 (background within the Metropolitan Statistical Area = 0.06)
Nickel		7.2	3 3.1 21 8.3 9.8 21		1600 (background within the Metropolitan Statistical Area = 18.0)
Potassium		239			background within the Metropolitan

Constituent[1] (mg/kg unless otherwise noted)	1995	1998	2003	2005	TACO Residential level[2]
					Statistical Area = 1268
Sodium		165			background within the Metropolitan Statistical Area = 130
Vanadium		7.85			550 (background within the Metropolitan Statistical Area = 25.2)
Zinc		70	29 28 57 71 85 95		23,000 (background within the Metropolitan Statistical Area = 95)
Ammonia as N		160	26.4 8.92 63 35.1		
Total Kjeldahl Nitrogen		300			
pH		8.13			
Total Phosphorus		165			
Total Solids (%)	79.6 71.8		78.9 79.8 89.5 79.8 80.5 84.1		
Total Volatile Solids (%)			1.74 1.18 1.26 1.06		
Chemical Oxygen Demand		1870			
Total Organic Carbon		55,900	2.1% wet 1.2% wet 1.6% wet		
Total Recoverable Petroleum Hydrocarbons		143			
Phenol			0.7		47,000
Methylene Chloride		0.0086			13
Benzo(a)anthracene		0.26			0.9 (background within the Metropolitan Statistical Area = 1.8)
Benzo(b)fluoranthene		0.26			0.9 (background within the Metropolitan Statistical Area = 2.0)
Benzo(k)fluoranthene		0.21			9 (background within the Metropolitan Statistical Area = 1.7)
Benzo(a)pyrene		0.22	0.119		0.09 (background within the

Constituent[1] (mg/kg unless otherwise noted)	1995	1998	2003	2005	TACO Residential level[2]
			0.209 0.128		Metropolitan Statistical Area = 2.1)
Bis(2-ethylhexyl)phthalate		0.3			46
Chrysene		0.33			88
Fluoranthene		0.52			3100
Naphthalene		0.12			170
Phenanthrene		0.41			
Pyrene		0.55			2300
DDD		0.00797		0.15 0.022 0.0046	3
DDE		0.00405		0.0092	2
DDT				0.056	2
Aldrin				0.0078 0.0046 0.0039 0.0062 0.0041 0.0057 0.007 0.0042 0.012	0.04
Dieldrin				0.0062	0.04
Beta BHC				0.0028 0.0029 0.007	

[1]All constituents reported in mg/kg dry weight unless otherwise noted.

[2]The lowest TACO residential level, for either ingestion or inhalation. Blanks indicate no TACO criteria for that constituent.

Table 2: Summary of Waukegan Outer Harbor Asbestos Results, 2005

Sample name	Sample date	Asbestos (%)	grain size % p200 (75 µm)	grain size % hydrometer (~30 µm)
WH-SD046 -17.4 to –18.4 LWD	01/12/2005	ND[3]	-[2]	-
WH-SD046 -18.4 to –19.4 LWD	01/12/2005	ND	-	-
WH-SD046 -19.4 to –19.9 LWD	01/12/2005	ND	-	-
WH-SD046 -19.9 to –21.4	01/12/2005	ND	-	-
WH-SD046 -21.4 to –23.4	01/12/2005	ND	-	-
WH-SD046[1] -23.4 to –25.4 LWD	01/12/2005	Trace, ND using TEM	41	23.9
WH-SD046 -25.4 to –27.4 LWD	01/12/2005	Trace, ND using TEM	-	-
WH-SD050 -19.8 to –21.8 LWD	01/11/2005	ND	38.5	20.7
WH-SD050 -21.8 to –23.8 LWD	01/11/2005	ND	38.9	22.6

[1]HIGHLIGHTED CELLS ARE BELOW PROPOSED DREDGE DEPTH

[2] "-" indicates that the sample was not analyzed for the parameter

[3]ND means asbestos was not detected.

2006 Sampling Event

In August 2006, sediment data were collected at Waukegan Outer Harbor. The sampling plan is included in Appendix A. The objectives of the data collection were:

a. To obtain limited physical data (grain size analysis) for the sediments to be dredged from Waukegan Outer Harbor in year 2007 or 2008. These data are being collected for engineering design purposes.

b. To obtain elutriate chemical data for determining quality of water that will be discharged to the sanitary sewer system of the NSSD. These data will also be used for a 404(b)1 Contaminant Determination, to request for a waiver from the 401 Water Quality Certification (due to lack of return water), and for permitting to discharge water into the NSSD sanitary sewer system.

c. To obtain asbestos data for water quality purposes. The methods used for this asbestos analysis are PLM and TEM of bulk sediment samples.

d. To obtain asbestos fiber quantitative data for the sediment by the Elutriator Method/TEM. A total of 12 sediment cores were taken for asbestos analysis. These data are used for statistical comparison to asbestos data obtained by others for Grant Park, WI and Highland Park, IL

(Cali et al., 2005). The Waukegan Outer Harbor asbestos data is also being used as the basis for a human health risk assessment based on the proposed sediment usage.

To meet these data objectives, twelve core samples were taken from the outer harbor. The actual sample locations are shown in Figure 3. The sediment and elutriate results are presented and discussed below. GPS locations for the samples are given in Appendix B.

Bulk Sediment Chemistry

Because past sediment analyses (see Table 1) have not indicated systematic sediment quality problems, only limited analyses were done for this event. The sediment analyses included grain size, and asbestos by multiple methods. These results are discussed below. To collect sediment for these analyses, twelve core locations were used. Figure 3 shows the field locations of the core samples.

Grain size

Grain size analysis was conducted for samples from each of the twelve core locations. Table 3 summarizes the results. The complete grain size results are given in Appendix B. In general, the sediment in Waukegan Outer Harbor is fine sand and silt. The average fines content (material passing a #230 sieve, or less than 63 µm) is 32.9%. In general, the fine nature of this sediment makes it inappropriate for beach application or open water disposal. The sediment would be suitable for upland application, however due to the fine nature of the material it will tend to drain slowly. Because of the high fine content, the Waukegan Outer Harbor sediment would be best suited to an application where slow drainage or limited ponding after heavy rains is not a problem.

Table 3: Grain size summary

Sieve Size (particle size)	WOH-2006-01	WOH-2006-02	WOH-2006-03	WOH-2006-04	WOH-2006-05	WOH-2006-06	WOH-2006-07	WOH-2006-08	WOH-2006-09	WOH-2006-10	WOH-2006-11	WOH-2006-12
% Coarse/ Medium sand	0.5	0.2	0.4	0.2	1.2	0.2 (0.4)*	0.4	0.4	0.5	0.6	0.3	0.5
% Fine sand	86.3	51.6	45.7	70.4	59.5	54.3 (54.1)	54.0	82.9	33.7	57.5	74.3	90.8
% Fines (passing 230 sieve, % <63 µm)	13.2	48.2	53.9	29.4	39.3	45.5 (45.5)	45.6	16.7	65.8	41.9	25.4	8.7

*value in parentheses is duplicate sample result

Asbestos

Asbestos was measured by Polarized Light Microscopy (PLM) and by Transmission Electron Microscopy (TEM). In addition, asbestos fibers were counted using the Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials (US EPA 540-R-97-028, 1997) and modified in the Draft Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material (Berman and Kolk, 2000; Berman, 2000); this method is referred to as the "elutriator" method in this report. The asbestos results are summarized in Table 4. Complete analytical results are included in Appendix B.

Table 4: Asbestos results summary

Asbestos Analytical Method	WOH-2006-01	WOH-2006-02	WOH-2006-03	WOH-2006-04	WOH-2006-05	WOH-2006-06	WOH-2006-07	WOH-2006-08	WOH-2006-09	WOH-2006-10	WOH-2006-11	WOH-2006-12
PLM	ND[1]	ND	ND	ND	ND	ND (ND)[4]	ND	ND	ND	ND	ND	ND
TEM	<1%	<1%	<1%	<1%	1-2%	1-2% (<1%)	<1%	<1%	<1%	<1%	<1%	<1%
Elutriator, MF/g[2]	3.9[3]	0	1.0	0	0	0 (0)	0	1.0	0	0	2.9	0

[1]ND means that asbestos was not detected in this sample.
[2]Results for the Elutriator method are given in units of "million fibers per gram respirable material". Respirable material is considered to be the fraction passing a 200 sieve (material finer than 75 µm).
[3]Total Chrysotile and Amphibole fibers.
[4]Value in parenthesis is duplicate.

The Elutriator results were used for a statistical comparison to asbestos measurements made on beach material from Grant Park, Wisconsin, and Highland Park, Illinois. Data for Grant Park, Highland Park, and the Waukegan Approach Channel were taken from the report by Cali et al. (Cali et al., 2006) A summary of the statistical descriptors is given in Table 5, including the statistics for the data sets reported by Cali et al and the calculated statistics for the Waukegan Outer Harbor data given in Table 4. The 95% upper confidence level was calculated using ProUCL (USEPA, 2004). A non-parametric method, the Mann-Whitney test, was used to compare the two populations (the combined Grant Park and Highland Park data verses the Waukegan Outer Harbor data.) Table 6 gives the probability and the Mann-Whitney U statistic. In addition to comparing the asbestos results to Grant Park and Highland Park, the Waukegan Outer Harbor data were compared to asbestos results for sediment taken in the Waukegan Approach Channel. It can be seen that the Waukegan Outer Harbor sediment is statistically different from the Grant Park/Highland Park beach material, as well as different from the Waukegan Approach Channel sediment. Because the Waukegan Outer Harbor sediment asbestos measurements are statistically different from the Grant Park/Highland Park results, a human health risk assessment was conducted.

The human health risk assessment was conducted assuming that the Waukegan Outer Harbor sediment would be used in an unconfined residential setting. The incremental cancer risk was calculated to be 4E-08, well below the acceptable risk limit of 1E-06. The very low amount of asbestos in the dredged material does not pose an unacceptable risk to human health, and would not preclude the use of the dredged material for beneficial re-use in a residential setting. The assumptions and calculations for the human health risk assessment are reported elsewhere (USACE Buffalo District, 2006).

Table 5: Asbestos Summary Statistics

	Grant Park, WI	Highland Park, IL	Waukegan Approach Channel	Waukegan Outer Harbor
# samples collected	12	12	12	12
# samples positive for Asbestos	2	1	12	4
Minimum Concentration (MF/g PM10)	0	0	1	0
Maximum Concentration (MF/g PM10)	0.97	0.97	25	3.9
Average Concentration (MF/g PM10)	0.16	0.08	6.24	0.73
95% UCL of Mean	0.63	0.43	10.19	2.39
Standard Deviation	0.38	0.28	6.46	1.32
Median	0	0	4	0

Table 6: Mann-Whitney results

	Number of data points, set 1	Number of data points, set 2	U	p-value	Result
Grant + Highland vs. Waukegan Approach Channel	24	12	288	<0.0001	Difference is statistically significant at the 99% confidence level (2 tailed).
Grant + Highland vs. Waukegan Outer Harbor	24	12	180	0.0803	Difference is statistically significant at the 90% confidence level (2 tailed).
Waukegan Approach Channel vs. Waukegan Outer Harbor	12	12	9	<0.0001	Difference is statistically significant at the 99% confidence level (2 tailed).

Elutriate Chemistry

Six elutriate (supernatant) tests were run on pairs of sediment samples from Waukegan Outer Harbor. Cores 1+2, 3+4, 5+9, 6+10, 7+11, and 8+12 were paired. Each elutriate test was conducted for five different settling times (0, 4, 24, 48, and 96 hours), and the elutriate was analyzed for all parameters for each settling time. A summary of the average results (the average of 6 samples for each time) is given in Table 7. Complete analytical results are included in Appendix B. A summary table of the elutriate results is also included in the beginning of Appendix B.

It can be seen that there is a general decrease in concentrations with settling time, particularly for those parameters that tend to be associated with suspended solids, such as heavy metals. Dissolved compounds, such as ammonia, and readily soluble compounds, such as sodium, do not follow this trend in the data. To demonstrate the trend, the analytical results for a few parameters were plotted (ammonia, TDS, TSS, copper, and Total PCBs) and are shown in Figures 4 through 8. The greatest improvement in water quality happens in the first 4 hours, with continued improvement until 24 hours. After 24 hours up to 96 hours there maybe a slight decrease in concentrations, but the bulk of settling has already occurred and further improvements in water quality are not significant. This is consistent with the fine sand and silt of the harbor, and indicates that the dredge water would be closer to meeting water quality standards if allowed to settle for up to 24 hours prior to discharge. However, it is important to note that the water would still not meet Lake Michigan water quality standards after settling for 24 hours, since dissolved constituents such as ammonia are not particularly affected by the settling time and still exceed the Lake Michigan water quality standard after even 96 hours settling time. To meet Lake Michigan water quality standards, additional treatment of the water would be needed.

Specific parameters that exceed water quality criteria for at least some elutriate samples include: ammonia, phosphorus, total dissolved solids, total suspended solids, total PCBs, copper, iron, manganese, mercury, and zinc. Values that exceed water quality criteria are highlighted. Except for mercury and iron, the metals are above water quality standards for the short settling times (zero and four hours), but meet water quality if the settling time is at least 24 hours. Mercury is above the wildlife standard in all cases, but is always below the acute and chronic standards. The very low mercury concentrations (nanogram per liter concentrations) found in the elutriate are not considered to represent a water quality problem since the concentrations are less than the chronic standard. Iron concentrations are high for unknown reasons, but probably are an artifact of industrial activities in the area. Iron is not particularly toxic, and the concentrations do show the trend of decreasing with increased settling time. A 24 hour settling time would reduce the iron concentrations to a few milligrams per liter.

Some elutriate samples had trace, but measurable, concentrations of Total PCBs. Because the human health standard is very low (26 pg/L), any measurable concentration represents a violation of the water quality standard. The outer harbor sediment has been shown to contain less than 1 mg/L PCBs. The concentrations of PCBs in the elutriate show the trend of decreasing over time, indicating that the PCBs are associated with the suspended solids. A settling time of

24 hours results in elutriate PCB concentrations less than the practical quantitation limit of 0.1 ug/L.

The total dissolved solids (TDS) and total suspended solids (TSS) also show a decrease with settling time, as would be expected. The TDS is still above or near the water quality standard of 180 mg/L after a settling time of 96 hours, but after 24 hours the TSS concentration is below the standard of 15 mg/L. Since the sediment is quite fine the high initial suspended solids is not unexpected. Fine sediments also typically contain high nutrient levels, and the Waukegan Outer Harbor sediment is typical with elevated ammonia and phosphorus concentrations.

The pesticide results should be considered inconclusive. Concentrations that were reported were flagged by the laboratory as estimated values, and as undetected (even though they are reported). The pesticides were found only for some samples, and tended to be found in the most turbid samples (with zero and 4 hour settling times). Thus, the results probably represent interference from the sediment, and in any case the low concentrations of pesticides appear to settle out with the suspended solids. The gamma-Chlordane results for the 48 hour elutriate samples are suspect since detectable concentrations of gamma-Chlordane were not found for any other settling times. For the gamma-Chlordane results, the laboratory had performance differences of more than 40% on repeat measures using different columns, and those results are flagged with a “P”. Based on professional judgment, the gamma-Chlordane results for the 48 hour settling times are artifacts and do not represent reliable concentration measurements.

Because the water quality exceeds multiple Lake Michigan water quality standards, the dredge water is not appropriate for direct, untreated return to Lake Michigan or a tributary of the Lake. Rather, it is proposed that the water be sent to a treatment facility or to an industry for re-use. Based on proximity and on preliminary discussions, it is assumed that the water will be sent to the North Shore Sanitary District (NSSD) treatment works in Waukegan, Illinois. The elutriate results were compared to the NSSD Regulations for Individual Dischargers. The only results that exceed the specific discharge limitations are the TSS results for zero settling time. The water would probably need to be allowed to settle for some time prior to decanting the water from the sediment and discharging to the sewer system. Since the sediment will be dredged into a barge and then transported to the dock area before decanting, it is suggested that some additional time be built into this process if needed, to allow the water sufficient time to settle before decanting and discharge.

Table 7
Waukegan Outer Harbor
Average Elutriate Results

Parameter Name	Units	Reporting Limit	Lake Michigan Water Quality Standard [1]	NSSD Discharge Limits	Water Sample from Waukegan Outer Harbor	0 Hours	4 Hours	24 Hours	48 Hours	96 Hours
Ammonia	mg/L	0.2	2.8 [3]	50	<0.2	4.2	3.7	4.4	3.0	4.5
Alkalinity, Total as CaCO3	mg/L	5			111	122.3	120.3	125.0	116.5	126.0
BOD	mg/L	2		300	3	3.0	11.3	<2	7.5	1.7
COD	mg/L	5		900	<5	63.7	31.5	17.4	3.6	6.8
Hardness by Calculation	mg/L	1.3			119	283.8	162.3	128.3	126.2	126.8
Hexavalent Chromium	mg/L	0.01	0.016	700	0.0049 B	<0.01	0.01	<0.01	0.0	0.0
Nitrogen, Total Kjeldahl as N	mg/L	0.4			0.25 B	4.7	4.4	4.6	3.1	4.9
Oil and Grease	mg/L	5		75	<5	18.3	10.8	4.6	4.3	<5
Phenolics, Total Recoverable	mg/L	0.005		4,000	<0.005	0.005	<0.005	0.0048	0.0196	0.0047
pH	pH units	0.5	7.0 - 9.0	5.0 - 9.0	8.5	7.9	7.9	7.9	7.9	7.9
Phosphorous	mg/L	0.05	0.007	20	0.016 B	0.201	0.103	0.168	0.069	0.067
Solids, Total Dissolved (TDS)	mg/L	10	180	3500	160	460.0	346.7	203.3	185.0	190.0
Solids, Total Suspended (TSS)	mg/L	10	15	350	<10	758.3	122.8	45.0	8.6	11.7
Solids, Total Volatile (TVS)	mg/L	5			64	98.0	70.7	81.7	21.8	74.0
PCB, total	ug/L	0.05	26 pg/L (human health standard)		<0.05	0.8	0.3	<0.05	<0.05	<0.05
Methylene Chloride	ug/L	5	47		<5	2.8	2.1	1.6	4.0	5.9
Benzo(a)anthracene	ug/L	5			<5	1.4	<5	<5	<5	<5
Benzo(b)fluoranthene	ug/L	5			<5	1.8	<5	<5	<5	<5
Benzo(k)fluoranthene	ug/L	5			<5	1.8	<5	<5	<5	<5
Benzo(a)pyrene	ug/L	5			<5	1.8	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	ug/L	5			<5	1.1	1.5	4.1	2.0	1.1
Chrysene	ug/L	5			<5	0.3	<5	<5	<5	<5
Fluoranthene	ug/L	5			<5	0.56	2.13	2.13	<5	<5
Naphthalene	ug/L	5			<5	0.8	<5	<5	<5	<5
Phenanthrene	ug/L	5			<5	0.48	2.17	2.13	<5	<5
Pyrene	ug/L	5			<5	0.61	2.16	2.15	<5	2.13
4,4-DDD	ug/L	0.0094			<0.0094	0.0097	0.0096	0.0095	0.0094	0.0094
4,4-DDE	ug/L	0.0094			<0.0094	0.0096	0.0095	<0.0094	0.0094	<0.0094
4,4-DDT	ug/L	0.0094	11 pg/L (wildlife standard for DDT and metabolites)		<0.0094	0.0096	0.0095	<0.0094	0.0094	<0.0094
Aldrin	ug/L	0.0047			<0.0047	0.0048	0.0047	<0.0047	0.0047	<0.0047
alpha-Chlordane	ug/L	0.0047			<0.0047	0.0048	0.0047	<0.0047	0.0047	<0.0047
beta-BHC	ug/L	0.0047			<0.0047	0.0048	0.0047	<0.0047	0.0047	<0.0047
Chlordane	ug/L	0.0047	0.00025 (human health standard)		<0.0047	0.0048	0.0047	<0.0047	0.0047	<0.0047
Dieldrin	ug/L	0.0094	0.0065 ng/L (human health standard)		<0.0094	0.0096	0.0095	<0.0094	0.0094	<0.0094
Endrin	ug/L	0.0094	0.0860		<0.0094	0.0096	0.0095	<0.0094	0.0094	<0.0094
gamma-BHC (Lindane)	ug/L	0.0045	0.4700		<0.0045	0.0048	0.0048	<0.0045	0.0047	<0.0045
gamma-Chlordane	ug/L	0.0047			<0.0047	0.0048	0.0047	<0.0047	0.0735	<0.0047
Aluminum	ug/L	91			142 B	20216.7	8550.0	2268.3	1203.0	1164.8
Arsenic	ug/L	2.4	50	150	<2.4	17.9	8.4	5.7	3.1	3.7
Barium	ug/L	0.72	1000	15,000	19 B	125.0	74.2	47.4	35.2	41.0
Cadmium	ug/L	1.5	5.5	1000.0	<1.5	1.2	0.8	0.8	0.8	0.8
Calcium	ug/L	28			30,900	66516.7	39683.3	32950.0	32366.7	32733.3
Chromium (total)	ug/L	1.1		3000	<1.1	55.7	23.4	6.3	3.9	3.6
Chromium III	ug/L	calculated	2079.1		<1.1	55.7	23.4	6.3	3.9	3.6
Cobalt	ug/L	2.7			<2.7	12.1	5.3	2.7	1.4	1.6
Copper	ug/L	3.5	16.5	3000.0	<3.5	55.6	22.0	8.4	6.0	6.9
Cyanide	ug/L	1.2	22	250	5.2 B	5.2	6.2	1.7	0.7	1.1
Iron	ug/L	37	300	50,000 (3000 dissolved)	152 B	23666.7	8696.7	2118.3	1158.0	877.5
Lead	ug/L	1.3	152.8	1000.0	<1.3	65.0	27.3	7.9	2.7	1.9
Magnesium	ug/L	60			10,200	28583.3	15366.7	11200.0	11033.3	10916.7
Manganese	ug/L	0.18	150	12,000	2	365.7	124.7	33.5	18.8	14.8
Mercury	ng/L	5	1.3 [2]	500 (daily average), 400 (monthly average)	1	57.0	36.1	16.3	8.7	7.7
Nickel	ug/L	1.2	542.5	5000.0	<1.2	34.2	12.3	3.4	3.1	3.8
Potassium	ug/L	160			1210 B	9908.3	5620.0	2990.0	2275.0	2700.0
Sodium	ug/L	290			5940	7508.3	6988.3	6611.7	6240.0	6563.3
Vanadium	ug/L	2.1			<2.1	38.6	15.4	4.8	2.6	2.8
Zinc	ug/L	2	135.8	4000.0	4.5 B	169.8	73.0	31.0	23.0	33.1

[1] Water Quality Standards are from IAC 35 Part 302. Unless otherwise noted, these are the acute standards.

[2] For total mercury, the acute standard is 1700 ng/L, the chronic standard is 910 ng/L, the human health standard is 3.1 ng/L, the wildlife standard is 1.3 ng/L.

[3] Ammonia standard is 0.33 mg/L (acute standard for un-ionized ammonia, April through October), based on this the total concentration of ammonia for a pH of 8.5 and a temperature of 20 C is 2.8 mg/L

B- Analye is also detected in blank sample.

Exceeds Lake Michigan WQ standard

Exceeds both LM and NSSD WQ standards

Sediment Placement Recommendations

The Waukegan Outer Harbor sediment is predominantly fine sand and silt, with low concentrations of metals, organic compounds or other anthropogenic pollutants. Due to the fine nature of the material, it is not suitable for open water or beach placement. It is recommended that upland placement be used for this material; the chemical quality of the sediment is sufficient to allow unrestricted placement in a beneficial location. The fine nature of the sediment will cause the material to be generally slow draining, so the placement location selection should consider drainage and run-off requirements. Erosion control, such as topsoil and seeding or other cover, will be needed at the placement location to prevent the erosion of the fine grained material during storm events.

Water that will be entrained with the sediment during dredging is likely to be high in some constituents (ammonia, turbidity/suspended solids) that make it unsuitable for direct, untreated return to Lake Michigan or other surface waters. The water quality will generally improve if allowed to settle fines for a 4 to 24 hour period, but will still exceed water quality standards for dissolved constituents. The water should be treated or used in a process, but can not be discharged directly into surface waters. Even if the water is sent to a treatment process, such as the NSSD POTW, it is recommended that the sediment/water be allowed to settle for at least 4 hours prior to decanting and discharging the water.

Applicability of Sections 404 and 401 of the Clean Water Act

As proposed, the Waukegan Outer Harbor dredging project would involve mechanically dredging sediment and transporting it to an upland location for use as clean fill. Water decanted from the dredged sediment would either be used by a local industry for process water, or would be discharged to the sanitary sewer system under an NPDES permit. Because there is no direct return to waters of the United States and there is no fill activity included in this project, the project is not regulated under Section 404 or 401 of the Clean Water Act.

Concurrence with 404/401 regulatory status:

1/24/07

USACE Chicago District Regulatory Branch date

References

a. QST Environmental, Report on the Collection of Sediment Samples from Waukegan Inner Harbor, January 1998.

b. CH2M Hill, Technical Memorandum: Data Evaluation Summary Report, Waukegan Harbor Area of Concern, Waukegan, Illinois, April 8, 2005.

c. Letter from Stefanie Bishop and Adrian Stanca, ProScience Analytical Services, Inc. to Don Dawicki, Severn Trent Laboratories STL Burlington, regarding asbestos sediment results for Waukegan Harbor, February 2, 2005.

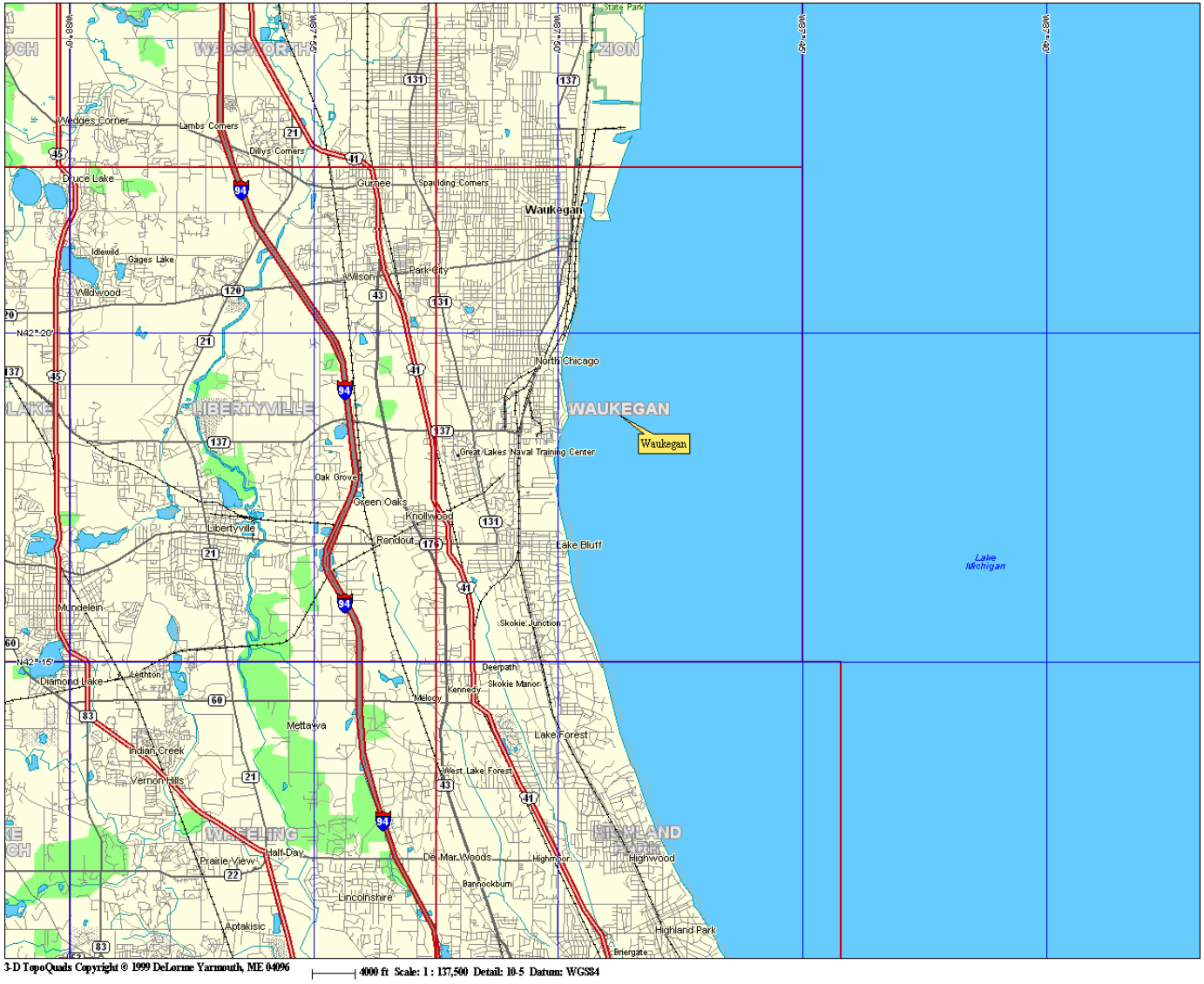
d. Cali, Salvatore, Peter Scheff, Rosemary Sokas, and others, June 6, 2005, Illinois Beach State Park (IBSP): Determination of Asbestos Contamination in Beach Nourishment Sand, Interim Report of Findings, University of Illinois at Chicago.

e. US Environmental Protection Agency, EPA/600/R04/079, A. Singh, A. Singh, R. Maichle, ProUCL Version 3.0 User Guide, April 2004.

f. US Army Corps of Engineers, Buffalo District, Human Health Risk Assessment Potentia, Asbestos Risks in Beneficial Use of Dredged Material from Waukegan Outer Harbor, Waukegan, Illinois, October 2006.

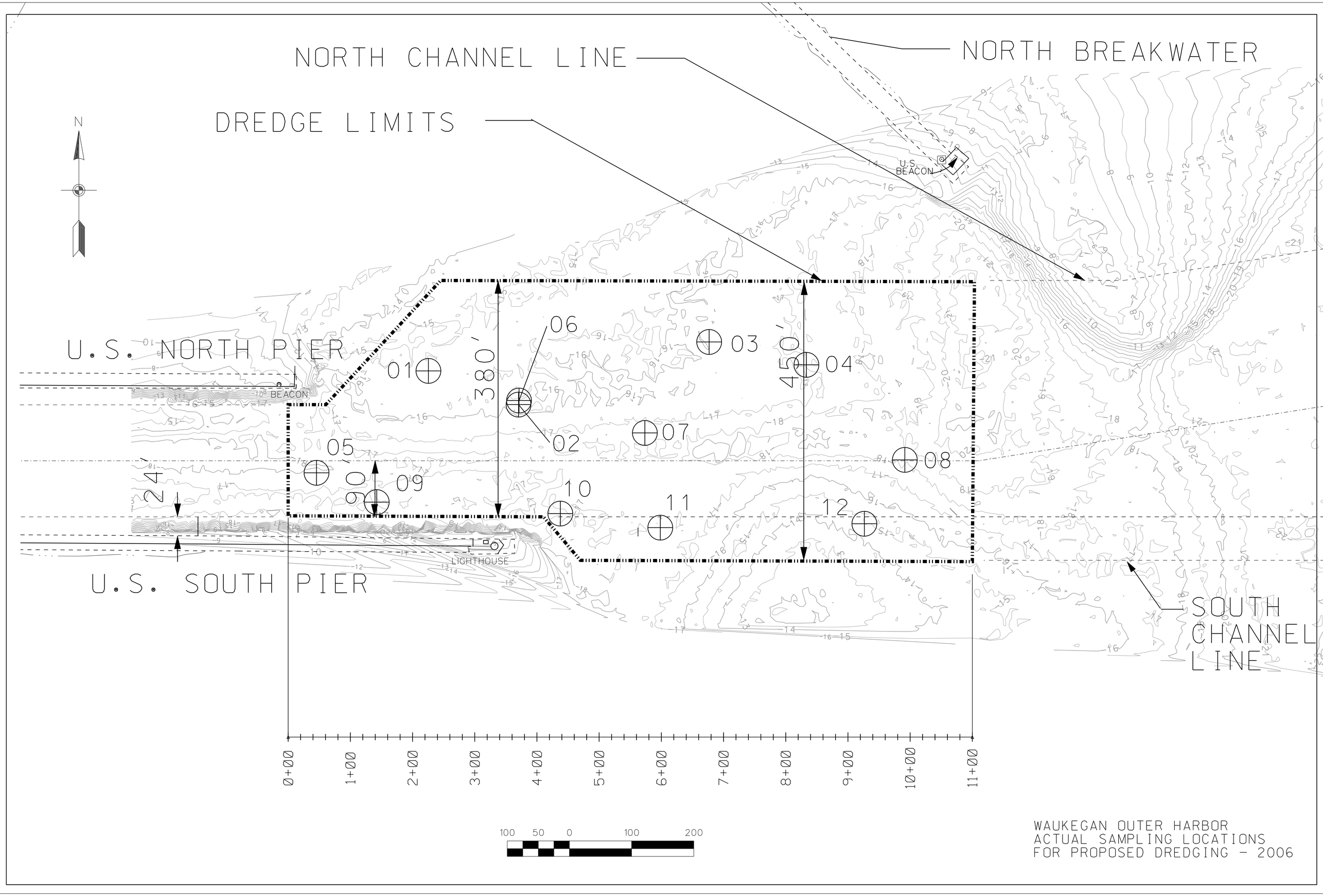
g. US Army Corps of Engineers, Chicago District, Summary of Sediment Sampling Events and Analytical Results for Waukegan Inner Harbor and Entrance Channel, April 1998.

Figure 1: Site Map for Waukegan Harbor



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 4000 ft Scale: 1 : 137,500 Detail: 10-5 Datum: WGS84

Figure 2: Waukegan Harbor



WAUKEGAN OUTER HARBOR
ACTUAL SAMPLING LOCATIONS
FOR PROPOSED DREDGING - 2006

Figure 4: Elutriate Ammonia Results

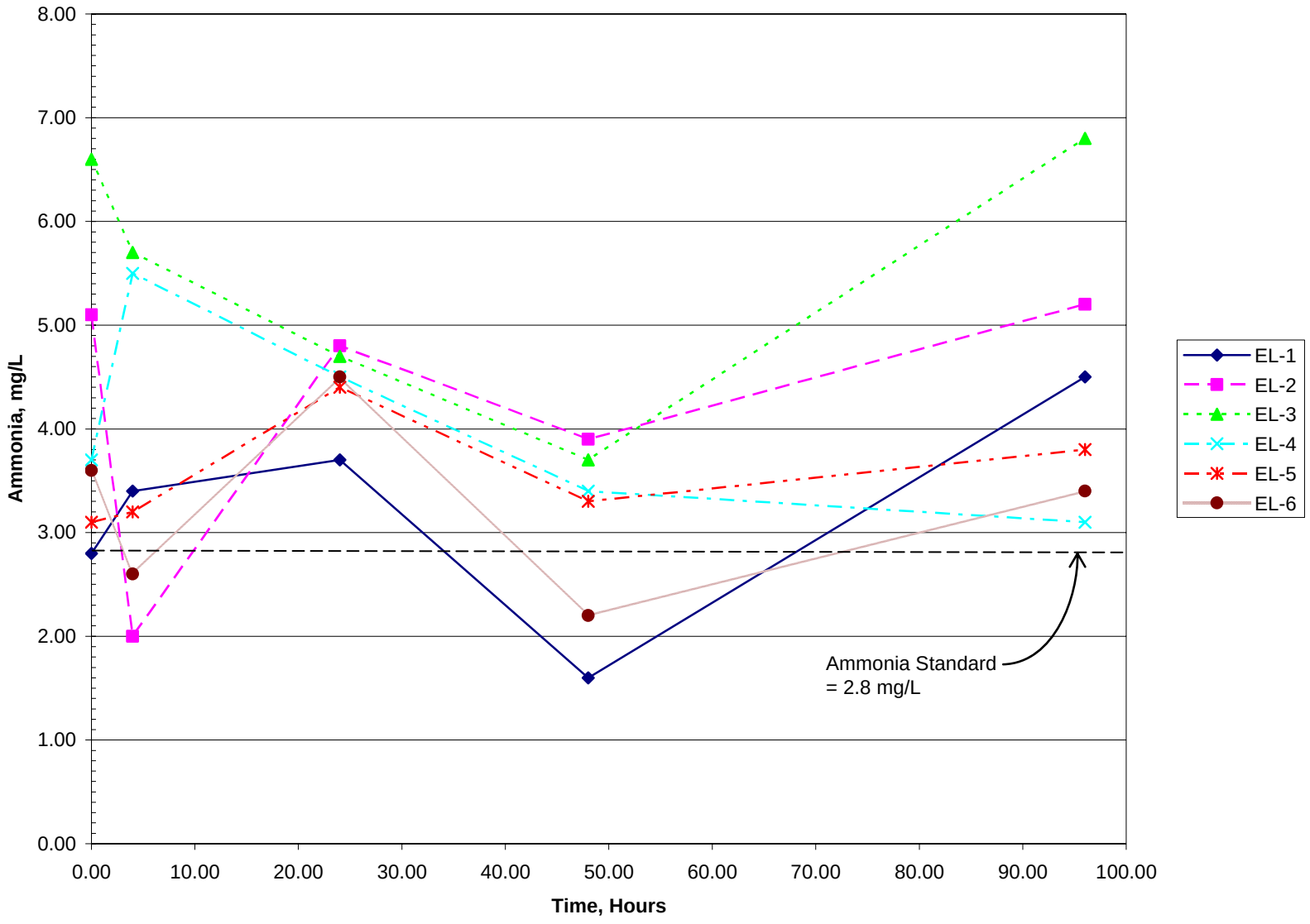


Figure 5: Elutriate Total Dissolved Solids (TDS) Results

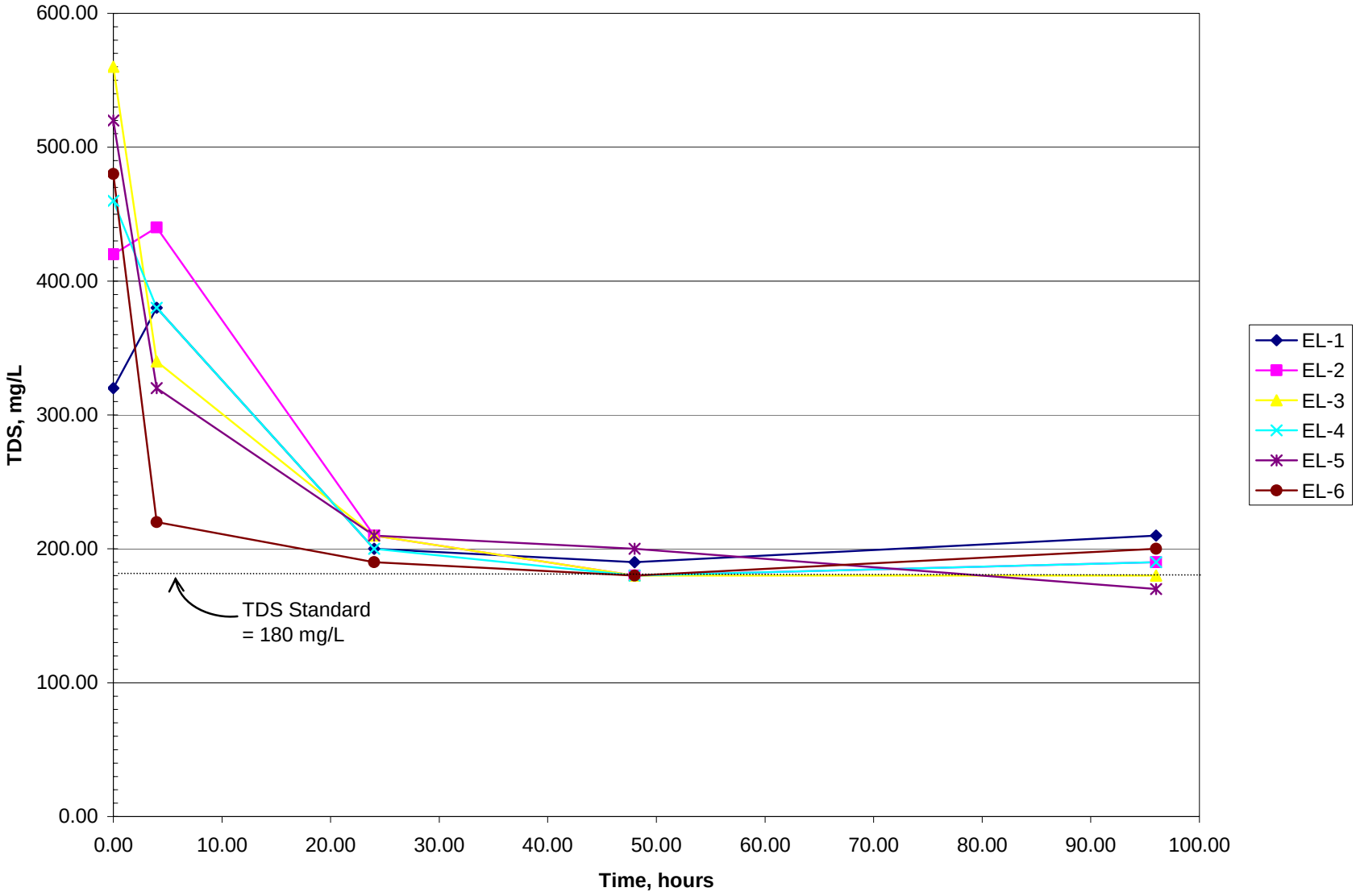


Figure 6: Elutriate Total Suspended Solids Results

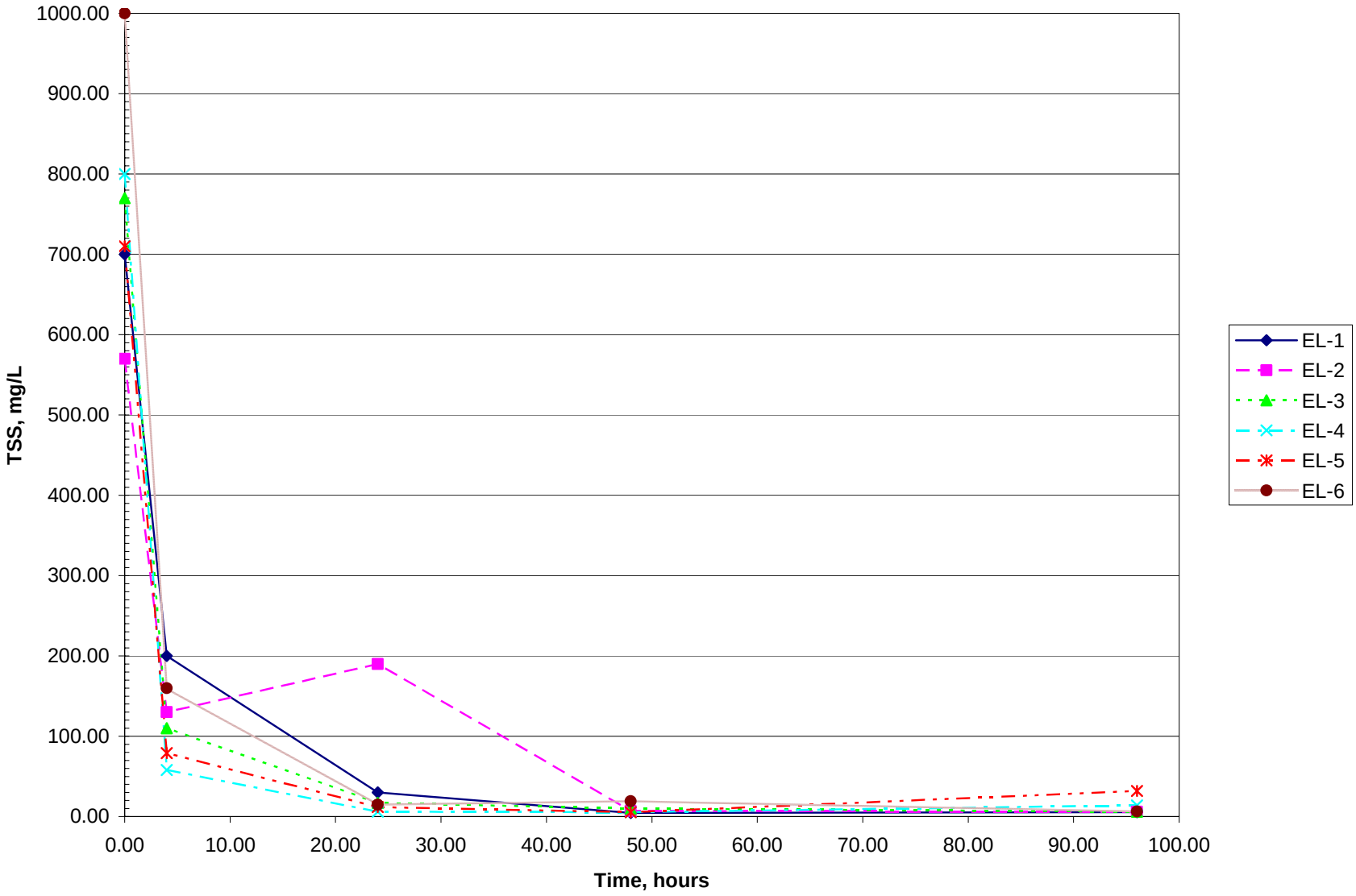


Figure 7: Elutriate Copper Results

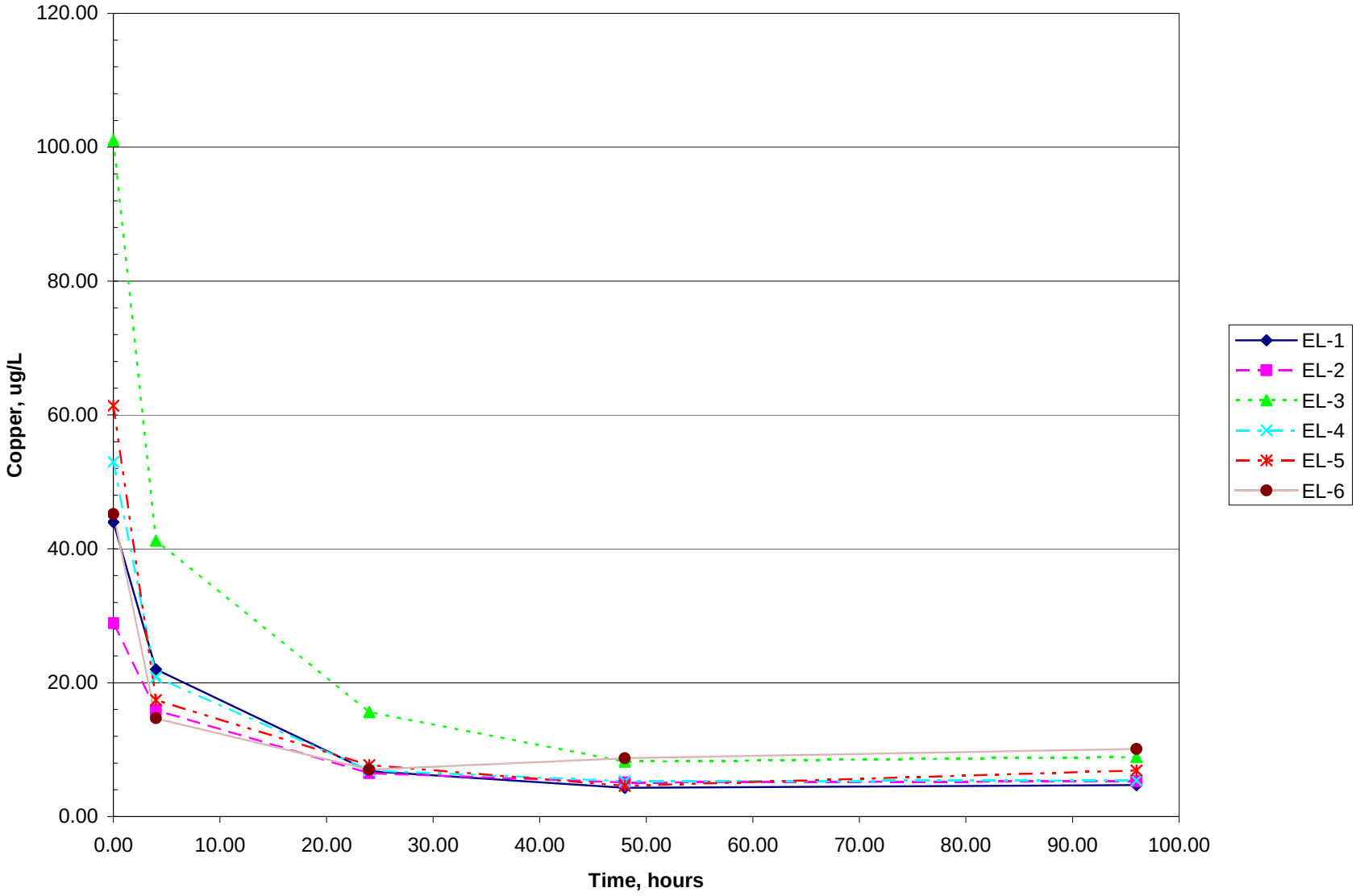
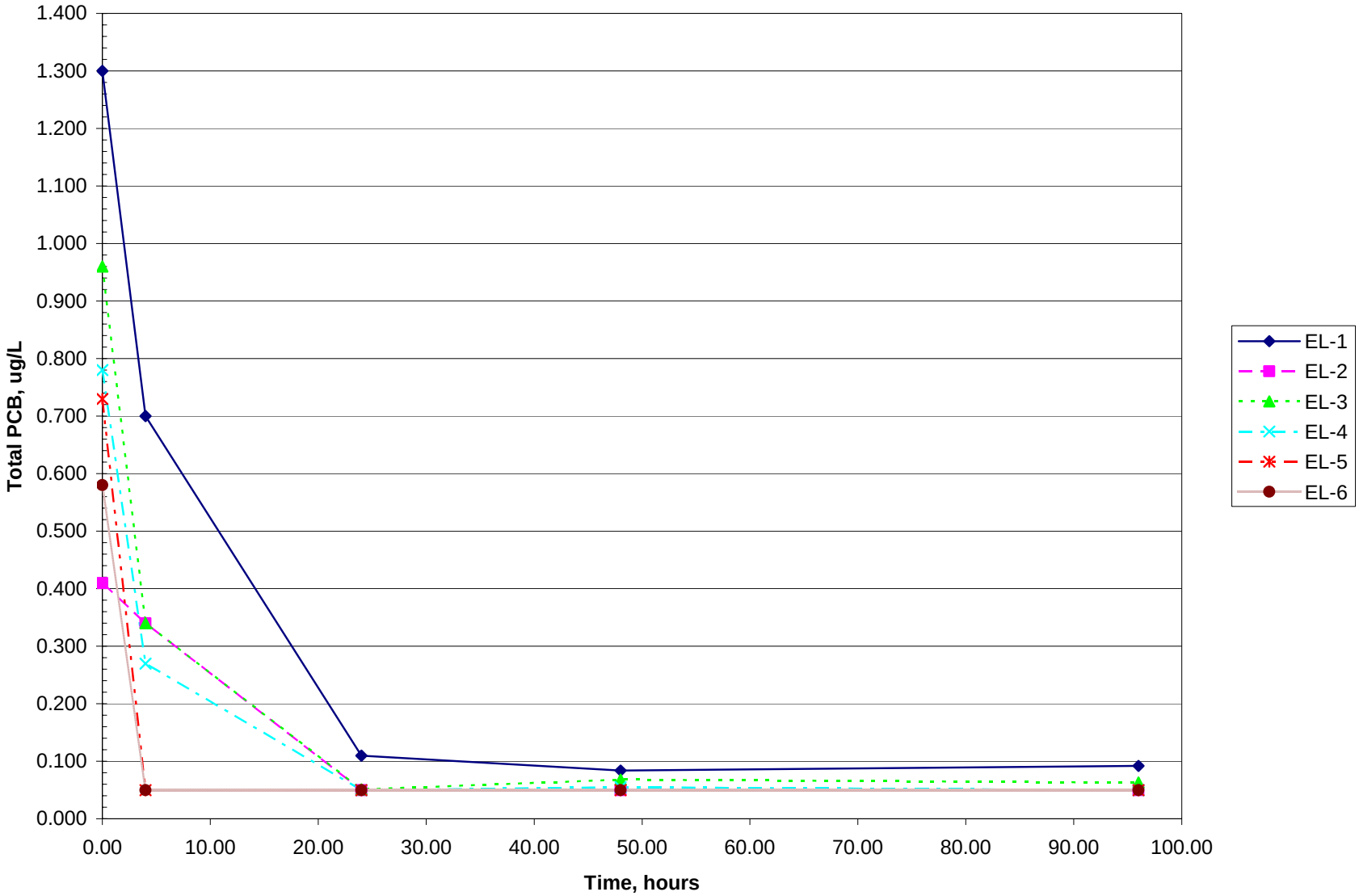


Figure 8: Elutriate Total PCB Results



Appendix A
Sampling Plan

SCOPE OF WORK
FOR
COLLECTION AND ANALYSIS OF SEDIMENT AND WATER SAMPLES
AT
WAUKEGAN OUTER HARBOR, IL

PREPARED BY:

U.S. ARMY CORPS OF ENGINEERS, CHICAGO DISTRICT
111 NORTH CANAL STREET
CHICAGO, ILLINOIS 60606

May 2006

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1 Introduction

The U.S. Army Corps of Engineers (USACE), Chicago District, is preparing to dredge Waukegan Outer Harbor, in Waukegan, Illinois. Waukegan Harbor is located along the shoreline of Lake Michigan, several miles south of the Illinois/Wisconsin border (Figure 1). The federally maintained navigational facility consists of an approach channel, an outer harbor, an entrance channel, and an inner harbor. There are also privately owned and maintained slips and an extension to the inner harbor which is federal authorized but not maintained. Waukegan Harbor is used for both recreational and industrial activities.

The harbor is shown in Figure 2, with the outer harbor area outlined. Although the USACE regularly dredges shoaled sediment in the approach channel, the outer harbor has not been dredged in a number of years. A superfund project removed the most heavily contaminated sediment from the inner harbor, although PCBs are still present in the sediment of the inner harbor.

The Waukegan Outer Harbor requires maintenance dredging to remove shoaled sediment to a depth of -22' Low Water Datum (LWD) + 1' allowable overdredge. Sediment sampling is needed for additional characterization of the material to be dredged. This Scope of Work (SOW) is being prepared in conformity with the guidelines set forth in the Inland Testing Manual (Reference 8(a)) and the Great Lakes Dredged Material Testing Manual (Reference 8(b)), which were prepared jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

1.1 Previous 404(b)(1) Contaminant Determination

In general, the Corps of Engineers is required to prepare a 404(b)(1) Contaminant Determination Report for its dredging projects to determine the suitability of open water disposal of the dredged sediments, as per Section 404(b)(1) of the Clean Water Act. The 404(b)(1) report begins with a Tier 1 evaluation, which looks at the historical data about the dredge site. If the historical data provides insufficient information to make a contaminant determination, a Tier 2 evaluation may be conducted to collect additional physical and chemical data. If needed, the Tier 2 evaluation may be followed by a Tier 3 evaluation based on biological effects testing of the sediments. A Tier 4 evaluation is a last possible step, depending on results obtained during the first three tiers. Based on the historical data, and physical, chemical, and biological characterization of the sediments, a Contaminant Determination Report is prepared.

In the case of Waukegan Harbor, there have been numerous sampling events over the recent past. USACE sampling events at the inner and outer harbors occurred in 1995, 1998, and 2003 (USACE, 1998; QST, 1998). In addition, the USEPA conducted additional sampling in 2005 (CH2M Hill, 2005; Bishop and Stanca, 2005). Data from these sampling events indicate that the sediment in the outer harbor is fine sand and silt. The sediment contains low levels (< 1 mg/kg) of PCBs, and low levels of metals, pesticides, VOCs, and SVOCs. Ammonia and nutrient concentrations are somewhat elevated. Asbestos fibers have not been detected in the outer harbor within proposed dredging depths (-23 LWD) using PLM and TEM analysis techniques. Although the sediment contains low levels of some constituents, the levels are all below TACO

residential levels, indicating that the material would be suitable for land application or beneficial re-use. Table 1 is a summary of recent past sediment data from the outer harbor. Table 1 lists only detectable results within the outer harbor dredging limits (above -23 LWD). Table 2 is a summary of the asbestos sample data from the outer harbor.

Table 1: Summary of Waukegan Outer Harbor Sediment Results, 1995 - 2005

Constituent[1]	1995	1998	2003	2005	TACO Residential level[2]
PCB 1242		0.613			1[3]
PCB 1248	0.21 0.91		0.0481 0.152 0.165	0.12 0.13 0.1 0.1 0.088 0.09 0.092 0.12 0.79 0.076 0.087 0.076 0.14 0.075 0.074 0.085 0.11 0.076 0.12 0.099 0.14 0.069 0.057 0.072 0.064 0.13 0.13 0.23	
PCB 1254	0.037 0.35	0.113			
Aluminum		1920			(background within the Metropolitan Statistical Area = 9500)
Arsenic		3.32	1.7 1.8 6.6 3.7 4.1 7.4		750 (background within the Metropolitan Statistical Area = 213)
Barium		18.2	4.6 4.8 34 15		5500 (background within the Metropolitan Statistical Area = 110)

Constituent[1]	1995	1998	2003	2005	TACO Residential level[2]
			18 29		
Calcium		84,400			background within the Metropolitan Statistical Area = 9300
Chromium		16.4	1.9 9.7 4.5 6.5 7.0		270 (background within the Metropolitan Statistical Area = 16.2)
Cobalt		2.78			4700 (background within the Metropolitan Statistical Area = 8.9)
Copper		17.8	17 8.1 12 15		2900 (background within the Metropolitan Statistical Area = 19.6)
Iron		7,860	3500 3500 19000 9000 10000 19000		background within the Metropolitan Statistical Area = 15,900
Lead		18.5	3.4 4.1 11 13 19 10		400 (background within the Metropolitan Statistical Area = 3.6)
Magnesium		43,700			background within the Metropolitan Statistical Area = 4820
Manganese		407			3700 (background within the Metropolitan Statistical Area = 636)
Mercury		0.047	0.04		10 (background within the Metropolitan Statistical Area = 0.06)
Nickel		7.2	3 3.1 21 8.3 9.8 21		1600 (background within the Metropolitan Statistical Area = 18.0)
Potassium		239			background within the Metropolitan Statistical Area = 1268
Sodium		165			background within the Metropolitan Statistical Area = 130
Vanadium		7.85			550 (background within the Metropolitan Statistical Area = 25.2)
Zinc		70	29 28 57 71 85 95		23,000 (background within the Metropolitan Statistical Area = 95)
Ammonia as N		160	26.4 8.92 63		

Constituent[1]	1995	1998	2003	2005	TACO Residential level[2]
			35.1		
Total Kjeldahl Nitrogen		300			
pH		8.13			
Total Phosphorus		165			
Total Solids (%)	79.6 71.8		78.9 79.8 89.5 79.8 80.5 84.1		
Total Volatile Solids (%)			1.74 1.18 1.26 1.06		
Chemical Oxygen Demand		1870			
Total Organic Carbon		55,900	2.1% wet 1.2% wet 1.6% wet		
Total Recoverable Petroleum Hydrocarbons		143			
Phenol			0.7		47,000
Methylene Chloride		0.0086			13
Benzo(a)anthracene		0.26			0.9 (background within the Metropolitan Statistical Area = 1.8)
Benzo(b)fluoranthene		0.26			0.9 (background within the Metropolitan Statistical Area = 2.0)
Benzo(k)fluoranthene		0.21			9 (background within the Metropolitan Statistical Area = 1.7)
Benzo(a)pyrene		0.22	0.119 0.209 0.128		0.09 (background within the Metropolitan Statistical Area = 2.1)
Bis(2-ethylhexyl)phthalate		0.3			46
Chrysene		0.33			88
Fluoranthene		0.52			3100
Naphthalene		0.12			170
Phenanthrene		0.41			
Pyrene		0.55			2300
DDD		0.00797		0.15 0.022 0.0046	3
DDE		0.00405		0.0092	2

Constituent[1]	1995	1998	2003	2005	TACO Residential level[2]
DDT				0.056	2
Aldrin				0.0078 0.0046 0.0039 0.0062 0.0041 0.0057 0.007 0.0042 0.012	0.04
Dieldrin				0.0062	0.04
Beta BHC				0.0028 0.0029 0.007	

[1]All constituents reported in mg/kg dry weight unless otherwise noted.
[2]The lowest TACO residential level, for either ingestion or inhalation. Blanks indicate no TACO criteria for that constituent.
[3]The total for all PCBs (Arochors or congeners) is 1 mg/kg.

Table 2: Summary of Waukegan Outer Harbor Asbestos Results, 2005

Sample name	Sample date	PCB concentration mg/Kg	Asbestos (%)	grain size % p200 (75 µm)	grain size % hydrometer (~30 µm)
WH-SD046 -17.4 to –18.4 LWD	01/12/2005	0.074	ND[3]	-[2]	-
WH-SD046 -18.4 to –19.4 LWD	01/12/2005	0.085	ND	-	-
WH-SD046 -19.4 to –19.9 LWD	01/12/2005	0.11	ND	-	-
WH-SD046 -19.9 to –21.4	01/12/2005	0.076	ND	-	-
WH-SD046 -21.4 to –23.4	01/12/2005	0.12	ND	-	-
WH-SD046[1] -23.4 to –25.4 LWD	01/12/2005	0.15	Trace, ND using TEM	41	23.9
WH-SD046 -25.4 to –27.4 LWD	01/12/2005	0.076	Trace, ND using TEM	-	-
WH-SD050 -19.8 to –21.8 LWD	01/11/2005	0.054	ND	38.5	20.7
WH-SD050 -21.8 to –23.8 LWD	01/11/2005	0.11	ND	38.9	22.6

[1]HIGHLIGHTED CELLS ARE BELOW PROPOSED DREDGE DEPTH
[2] "-" indicates that the sample was not analyzed for the parameter
[3]ND means asbestos was not detected.

1.2 Current 404(b)(1) Contaminant Determination

The USACE proposes to dredge the outer harbor sediment to not deeper than -23' LWD. The sediment will then be dewatered and used by the City of Waukegan to construct a railroad embankment south of the harbor, or it may be used as cover material for the inner harbor after environmental dredging. The purpose of this investigation is to obtain elutriate data and limited sediment data for the outer harbor, to be used for an asbestos risk assessment, for permitting for water discharge, and during the design phase of the USACE project. Since there are sufficient, recent data documenting the sediment chemical quality and suitability for the proposed re-use, extensive chemical analysis of the sediment is not required. No biological testing of the sediment will occur. A total of 12 separate sediment cores will be taken for grain size analysis and asbestos analysis only.

Because recent sediment data indicate elevated ammonia concentrations in the Outer Harbor sediment, it is anticipated that the water entrained with the sediment would also be high in ammonia. For this reason, at this time it is anticipated that water drained from the dredged sediment will be discharged into the North Shore Sanitary District (NSSD) sanitary sewer system, rather than in the harbor or open lake. Elutriate testing will include the chemical parameters listed in Table 4.

1.3 Project Objectives

The major objectives of this sample collection and analysis effort include the following:

- To obtain limited physical data (grain size analysis) for the sediments to be dredged from Waukegan Outer Harbor in year 2007. These data are being collected for engineering design purposes.
- To obtain elutriate chemical data for determining quality of water that will be discharged to the sanitary sewer system of the NSSD. These data will also be used for a 404(b)1 Contaminant Determination, to request for a waiver from the 401 Water Quality Certification (due to lack of return water), and for permitting to discharge water into the NSSD sanitary sewer system.
- To obtain asbestos data for water quality purposes. The methods used for this asbestos analysis are PLM and TEM of bulk sediment samples.
- To obtain asbestos fiber quantitative data for the sediment by the Elutriator Method/TEM (discussed further in paragraph 4.1). A total of 12 sediment cores will be taken for asbestos analysis. These data will be used for statistical comparison to asbestos data obtained by others for Grant Park, WI and Highland Park, IL (Cali et al., 2005). If the Waukegan Outer Harbor sediment asbestos content is significantly different than the data for those two sites, the Waukegan Outer Harbor asbestos data will be used as the basis for a risk assessment based on the proposed sediment usage.

2 Proposed Dredging Area

The sediments in the Outer Harbor need sampling and analysis for physical characterization and for elutriate analysis. The Outer Harbor is considered one management unit. Samples will be

taken throughout the Outer Harbor. Figure 3 shows the proposed sampling locations. The analyses to be performed are described in paragraph 4.

3 Sample Collection and Preparation

This sampling event will consist of the collection of sediment core and site water samples. Up to two representatives from the USACE Chicago District will be present on board the sampling vessel at the time of sampling.

3.1 Sediment Samples

The contractor shall collect sediment core samples using a split spoon sampler, an Osterburg piston tube sampler, or any other sampling method approved by the Chicago District that will yield a representative core sample. *Note that because of the granular nature of the sediments in Waukegan Harbor, it is anticipated that sample collection using a Vibracore may not be successful.* ***Complete recovery of representative samples is essential. If the sampling method selected by the Contractor does not provide complete recovery of representative samples, the Contractor shall be responsible for providing an alternative sampling method and for collecting representative samples. There will be no adjustment in contract price if an alternative sampling method is required after field work begins.***

Core samples will be collected at 12 locations within the Outer Harbor area, at approximately the coordinates given in Table 3 (and shown in Figure 3). Core samples will be taken at depths from the top of sediment to -23' LWD (one foot below authorized federal depth). Exact sample locations will be directed in the field by the USACE representative, and the exact sample locations will be documented by the Contractor in the field using GPS. It should also be noted that multiple core samples may be required in some locations to obtain a sufficient quantity of sample for the proposed analyses.

Based on the latest soundings, the approximate core depths will range from approximately five to eleven feet. The exact depth of the samples will be calculated at the time of sampling based on the Lake Michigan water level (lake levels can be checked at http://co-ops.nos.noaa.gov/data_retrieve.shtml?input_code=101011111pgl or other websites) and the depth of the sediment below the water surface. The Contractor is responsible for ensuring that sediment samples represent the entire sediment column from the sediment surface to -23' LWD. Core samples shall be composite samples.

3.2 Site Water Samples

One site water sample will be collected in the Waukegan Outer Harbor. The site water sample will be used by the laboratory for mixture with sediment samples to form the elutriate samples. In addition to the elutriate samples, the water will also be analyzed separately for the same parameters measured in the elutriate samples. Sufficient site water volume must be collected to cover all of the tests required.

3.3 Elutriate Samples

The Supernatant Test for nonsettleable material from 2540 (f) of Standard Methods for Water and Wastewater Analysis (20th edition, 1998) is required for elutriate testing. The supernatant/elutriate samples for chemical analysis are prepared in the laboratory by mixing sediments and site water at a specified ratio, holding the mixture in a column, and withdrawing supernatant from the column at specified time intervals. Additional requirements for the supernatant/elutriate testing are included in Attachment 2. Sufficient sediment and site water volume should be collected such that elutriate samples may be prepared in the Contractor's laboratory (hereinafter referred to as the "Laboratory"). A total of 6 supernatant samples shall be prepared. Sediment from two core locations will be combined for each supernatant test. The pairs of cores that will be used for the supernatant test will be: 1 + 2, 3 + 4, 5 + 9, 6 + 10, 7 + 11, and 8 + 12. The sediment sample volume for the elutriate testing shall be homogenized in the Laboratory. Each supernatant preparation will be sampled at the following settling times: 0, 4, 24, 48, and 96 hours. A site water sample will also be analyzed.

3.4 Sample Inventory

Table 3 provides a summary of the samples to be collected for this event, and the sample type and purpose of each sample. The Contractor should review this table and determine exactly how much volume of sediment and site water will be required to perform the analyses. Significant sample volume is anticipated to be needed for elutriate, grain size, and asbestos analyses.

Table 3: Sample number and type

Sample ID #	Sample Type	Sample Location*	Remarks
WOH-2006-01	Core	N42° 21.686', W87° 48.834'	For Grain Size and Asbestos analyses
WOH-2006-02	Core	N42° 21.693', W87° 48.782'	For Grain Size and Asbestos analyses
WOH-2006-03	Core	N42° 21.693', W87° 48.717'	For Grain Size and Asbestos analyses
WOH-2006-04	Core	N42° 21.693', W87° 48.656'	For Grain Size and Asbestos analyses
WOH-2006-05	Core	N42° 21.661', W87° 48.863'	For Grain Size and Asbestos analyses
WOH-2006-06	Core	N42° 21.673', W87° 48.782'	For Grain Size and Asbestos analyses
WOH-2006-07	Core	N42° 21.673', W87° 48.717'	For Grain Size and Asbestos analyses
WOH-2006-08	Core	N42° 21.673', W87° 48.656'	For Grain Size and Asbestos analyses
WOH-2006-09	Core	N42° 21.653', W87° 48.846'	For Grain Size and Asbestos analyses
WOH-2006-10	Core	N42° 21.653', W87° 48.782'	For Grain Size and Asbestos analyses
WOH-2006-11	Core	N42° 21.653', W87° 48.717'	For Grain Size and Asbestos analyses
WOH-2006-12	Core	N42° 21.653', W87° 48.656'	For Grain Size and Asbestos analyses
WOH-2006-EL	Elutriate	see paragraph 3.3	Mixture of site water and composite sediment sample for elutriate test, conducted on 6 samples, each with 5 different settling times (0, 4, 24, 48, and 96 hours)
WOH-2006-W	Water	Outer Harbor	One water sample will be taken in the Outer Harbor for preparing elutriate samples and for water analysis.

*Location coordinates are in NAD83

3.5 Sediment Handling and Logging

The contractor shall log the sediment samples as they are collected. The contractor shall homogenize the sediment samples using decontaminated stainless steel mixing equipment. The contractor shall place the homogenized samples in containers to be delivered to the laboratory, fill out the container labels with sample date, location, sampler name, unique sample number, and any other required information. The contractor shall pack the samples in coolers with ice sufficient to maintain the samples at 4°C for 24 hours using proper Chain-of-Custody procedures.

3.6 Sample Shipping

The contractor shall place the samples in appropriate containers, fill out the container labels with sample date, location, sampler name, unique sample number, and any other required information. Individual sample containers must be packed into sealable plastic bags to prevent direct contact with ice melt. The contractor shall pack the containers in insulated shipping boxes or coolers with ice sufficient to maintain the samples at 4°C for 24 hours. Ice must be placed inside sealable bags before being placed inside the shipping boxes. The contractor shall prepare Chain of Custody documentation for all samples collected. Final Chain of Custody documentation must be submitted with the report and/or the analytical data package. The contractor shall ship the sediment samples via overnight delivery to the analytical laboratory. Samples must be maintained at 4°C during shipping.

3.7 Sample Location and Positioning

The vessel operator shall guide the vessel to the approximate sampling locations shown in Figure 3 and referenced in Table 3 based on visual comparison with landmarks on shore, GPS readings, and depth readings. The USACE representative may adjust the sample locations in the field, if needed to obtain a sample. Once the vessel is positioned in the sampling location, the Contractor shall measure and record the horizontal coordinates and elevations of the water surface and sediment surface. Horizontal coordinates shall be measured using Global Positioning System (GPS) satellite readings, corrected using either real time broadcasted Coast Guard corrections or post processing referenced to a known point. The exact depth of the samples will be calculated at the time of sampling based on the Lake Michigan water level (lake levels can be checked at http://co-ops.nos.noaa.gov/data_retrieve.shtml?input_code=101011111pgl or other websites) and the depth of the sediment below the water surface. The Contractor is responsible for ensuring that sediment samples represent the entire sediment column from the sediment surface to -23' LWD. Horizontal GPS data provided to USACE shall be accurate to within 1 meter. Water and sediment surface elevations should be referenced to LWD (LWD is equal to NAVD 88 + 577.5', NAVD88 is equal to IGLD 1985). Horizontal locations should be referenced to North American Datum (NAD) 1983.

3.8 Decontamination

Since the samples collected are intended for environmental analysis, decontamination of any sampling or processing equipment which will come into direct contact with the sediment or water samples is required. The Contractor shall perform decontamination prior to collection of

the first sample (either in the field or prior to arriving at the site). In addition, decontamination of sampling and processing equipment shall also be performed after each sampling location has been completed. Please note that decontamination is not required between successive sediment core samples collected at the same sampling location. Decontamination is required for water sampling equipment as well. Decontamination shall consist of at least washing with a Liquinox® solution (or equivalent phosphate-free detergent) using an inert stiff-bristled brush, and double rinse with distilled de-ionized water. **The detergent must be free of phosphorous.**

3.9 Investigation Derived Waste

The contractor shall collect all non-aqueous waste generated from the execution of the field sampling activity, such as used personal protective equipment (gloves, tyvek suits, etc.), and any other non-aqueous investigation derived waste (IDW) into large high density polyethylene bags. The bags shall be stored with the sampling vessel and equipment until they can be properly disposed. The IDW generated in this sampling event is not anticipated to be hazardous, however it is the responsibility of the contractor to dispose of the IDW in accordance with applicable Federal and State laws and regulations. If decontamination of sampling equipment and personnel is performed on the sampling vessel in the project area, rinsate and residual sediment need not be collected, but rather may be disposed of back into the lake/harbor. Any material returned to the water must not cause a water quality violation.

4 Sample Analysis

The analytical work for this project will include grain size analysis and asbestos fiber quantitative analysis for the sediment, and liquid phase chemical analysis for site water and elutriate samples.

4.1 Sediment Analyses

One duplicate sediment sample will be collected in the field and will be analyzed for grain size and asbestos. This sample is part of the quality control requirements, discussed further in paragraph 5.

4.1.1 Grain Size Analysis

Sediment samples will be analyzed for grain size. The Grain Size Distribution protocol is provided in Attachment 1. Additional guidance is provided in Attachment 2. All sieve sizes listed must be used for the grain size analyses. Samples from each of the twelve sample locations will be analyzed for grain size.

4.1.2 Asbestos Analysis by PLM and TEM

Sediment samples from each of the twelve sample locations, including the duplicate, will be analyzed for asbestos by PLM. The samples will then be analyzed by TEM.

4.1.3 Asbestos Analysis by the "Elutriator Method"

Sediment samples from all twelve sample locations will be analyzed for asbestos fibers using a technique known as the Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials (US EPA 540-R-97-028, 1997) and modified in the Draft Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material (Berman and Kolk, 2000; Berman, 2000). Additional discussion of the particular asbestos method to be used can be found in the "Illinois Beach State Park (IBSP): Determination of Asbestos Contamination in Beach Nourishment Sand, Interim Report of Findings," June 6, 2005, Salvatore Cali et al., University of Illinois at Chicago. *This report is available electronically upon request from the USACE*. United Analytical Services (UAS) (1515 Center Circle Drive, Downers Grove, Illinois 60515, contact: Kevin Aikman; 630-691-8271) was the prime environmental contractor for the task force project, and did the beach sampling. UAS had also subcontracted to Aeolus (751 Taft St., Albany, California 94706) for assistance. EMS Laboratories (117 West Bellevue Drive, Pasadena, California 91105, contact: Tony Kolk; 626-568-4065) performed the elutriator work and subsequent lab analysis. For QA/QC purposes, Aeolus sent some of the electron microscopy grids back to UAS, (who does TEM analysis, but does not have an elutriator) for repeat counting.

The asbestos fiber counting will be conducted by two different methods for each sample: NIOSH Method 7402 (PCM equivalent) counting rules, and the Protocol (Superfund Method) counting rules (See "Illinois Beach State Park (IBSP): Determination of Asbestos Contamination in Beach Nourishment Sand, Interim Report of Findings", UIC, June 6, 2005, p. 24). Both counting protocols will be conducted on "elutriator" samples. A low detection limit, as obtained for the task force study, is required for this scope of work.

It is critical that the Contractor coordinate with the laboratory(ies) that will perform the asbestos analyses prior to sediment sampling activities, to ensure that adequate sample volume is collected for asbestos analysis. *The Contractor is cautioned that the specified analytical method involves the laboratory homogenization and splitting of a large sample into a much smaller aliquot for analysis*. ***The Contractor shall include the name of a laboratory to complete the asbestos testing as part of the submitted proposal. The laboratory must have demonstrated experience performing the sediment asbestos analysis given above. The laboratory that will perform the work must be approved by the government.***

4.2 Liquid Phase Chemistry

All site water and elutriate samples shall be analyzed for the list of parameters provided in Table 4. The required methods and reporting limits are provided on the table, and are taken from 40 CFR 136. The Supernatant Test for nonsettleable material from 2540 (f) of Standard Methods for Water and Wastewater Analysis (20th edition, 1998) is required for elutriate testing. Attachment 2 has additional information on the requirements for supernatant/elutriate preparation. Alternative analytical methods, approved under 40 CFR 136, may be proposed by the Contractor to meet the required reporting limits.

4.3 Elutriate Testing

Elutriate samples will be prepared in the laboratory for chemical analysis by mixing site water and sediment. Separate volumes of site water and sediment will be sent to the laboratory performing the chemical analyses. The Supernatant Test for nonsettleable material from 2540 (f) of Standard Methods for Water and Wastewater Analysis (20th edition, 1998) is required for elutriate testing. Additional guidance is provided Attachment 2. According to the above references, the water to sediment ratio is 4:1. The sediment sample volume for the elutriate testing shall be homogenized in the Laboratory. The elutriate procedure shall be performed on pairs of cores. A total of 6 elutriate samples will be prepared, from homogenized samples of the following core pairs: 1 + 2, 3 + 4, 5 + 9, 6 + 10, 7 + 11, and 8 + 12.

Supernatant samples from the water/sediment mixture will be taken at the following settling times: zero, four, twenty-four, forty-eight and ninety-six hours (0, 4, 24, 48, and 96 hours). Each sample will be analyzed for all the parameters listed in Table 4. A sample of lake water will also be analyzed for all of the listed parameters. The total number of liquid phase samples to be analyzed is 31 (6 solutions at 5 settling times each, plus one lake water sample.)

Table 4: List of Parameters for Water/Elutriate Analyses

Parameter	Method(s)[1]	Reporting Limit (mg/L unless otherwise noted)
Ammonia Nitrogen as N	350.1	0.01
Total Kjeldahl Nitrogen (TKN)	351.3	0.5
Total Phosphorus	365.2	0.02
pH	150.1	.050 std unit
Alkalinity as $CaCO_3$	310.1	10
Hardness	130.1	2
Temperature	170.1	0.1°C
Biochemical Oxygen Demand (BOD_5)	405.1	2
Chemical Oxygen Demand (COD)	410.4	5.0
Total Dissolved Solids (Filterable residue)	160.1	1
Total Suspended Solids (nonfilterable residue)	160.2	1
Total Volatile Solids (volatile residue)	160.4	1
Cyanide (Total)	335.4	0.005
Phenols	420.1/420.2	0.01
Oil and grease	413.1	1
Mercury[2]	1631	0.0002 µg/L
Metals by ICP/AES: includes Al, As, Ba, Ca, Cd, Cr (total), Cr III, Co, Cu, Fe, Pb, Mg, Mn, Ni, K, Na, V, Zn)	200.7	Arsenic 0.01 Cadmium (total) 0.005 Chromium III 0.005 Copper 0.01 Lead 0.005 Nickel 0.025 Zinc 0.10 All other metals 0.1
Organic compounds (includes methylene chloride, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Bis(2-ethylhexyl)phthalate, Chrysene, Fluoranthene, Naphthalene, Phenanthrene, Pyrene)	624/625	Benzo(a)anthracene 0.01 Phenanthrene 0.01 all other organic compounds 0.005
Total PCBs	625	0.1 µg/L
Pesticides (includes DDD, DDE, DDT, Aldrin, Chlordane, Dieldrin, Endrin, Lindane, Beta BHC)	608/625 8081/8082	Chlordane 0.01 µg/L DDT and metabolites 0.01 µg/L Dieldrin 0.01 µg/L Endrin 0.03 µg/L Lindane 0.01 µg/L Aldrin 0.1 µg/L Beta BHC 0.1 µg/L

[1]Alternative methods that are acceptable under 40 CFR 136 and that meet the required reporting limit may be proposed by the contractor.
[2]Mercury analysis requires a particularly low detection limit. A list of laboratories that are known to use this method is provided as Attachment 3.

5 Quality Assurance / Quality Control

All aspects of data quality shall be guided by the Great Lakes Dredged Material Testing and Evaluation Manual (USEPA/USACE, 1998) and EM 200-1-10 Guidance for Evaluating Performance-Based Chemical Data (USACE, 2005). Sampling and analytical procedures shall be documented in writing as standard operating procedures, which include the minimum QC requirements for the procedures. Quality assurance and quality control will be addressed in a Quality Assurance Project Plan (QAPP), to be submitted as part of the project workplan (see paragraph 6 for Submittals information.)

The Contractor shall use a NELAP accredited laboratory for the water/elutriate analyses. The laboratory shall meet the QA/QC requirements described in the analyses' respective laboratory procedures (found in USEPA methods, Standard Methods, etc.). As a minimum, QA/QC samples will include one set of Matrix Spike / Matrix Spike Duplicate, one set of Field Duplicate Samples, an aqueous trip blank, and one aqueous equipment blank for every batch of up to twenty samples. The analytical data package shall include, but is not limited to, sample data summary sheets, raw data, laboratory control sample (LCS) recoveries, matrix spike / matrix spike duplicate (MS/MSD) recoveries and relative percent differences, surrogate recoveries, data flags, case narratives, instrument and extraction blank results, check standard recoveries, and initial calibration data. The Contractor's shall conduct a performance based data review for 100% of the data, and shall develop a data review report. At a minimum, the performance based data review shall include an evaluation of the following elements:

- Data completeness
- Holding times and sample preservation,
- Initial calibration and verification,
- Continuing calibration and verification,
- Sensitivity (detection and quantitation limits),
- Blanks (field and method),
- Laboratory control samples,
- Matrix spikes and matrix spike duplicates,
- Field duplicates,
- Surrogates,
- Non-conformances.

The data review report shall discuss the data evaluation and any data quality issues. The data review report shall be submitted as part of the reporting package submittal. As a minimum, the data review report shall include:

- Project name and location,
- Names of laboratories performing analyses and data reviewers,
- Description of the samples that were evaluated, including the number of samples, matrix, ID numbers and sample names, dates for sample collection and analysis, and analyses performed for each sample,

- Summary of the performance based data review, including any data quality issues identified during the review and any data qualifiers,
- Any other project data quality documentation or issues.

6 Submittals

The Contractor will provide the following submittals for review and approval prior to the start of sampling work: (a) Work Plan, and (b) Health and Safety Plan. A copy of the Scope of Work, as well as a copy of the Work Plan and of the Health and Safety Plan must be kept with the Contractor at all times during the sampling project. After the sampling and analysis are completed, the Contractor will provide a reporting package for review and approval. The project schedule for this scope of work is included in paragraph 7.

All submittals and reports shall be submitted to the following address. The technical Point of Contact for this Scope of Work is:

Dr. Jennifer Miller
U.S. Army Corps of Engineers, Chicago District
111 N. Canal St., Suite 600
Chicago, Illinois 60606-7206
(312) 846-5505
jennifer.miller@usace.army.mil

6.1 Work Plan

Prior to performing any field work, the Contractor must have an approved Work Plan for sampling and analysis activities. The plan must include detailed discussion of at least the following items:

- Type of sampling vessel to be used;
- Vessel launch locations;
- Quality Assurance Project Plan (QAPP), including standard methods or procedures, and project specific variations of these. As a minimum, the plan should address:
  - Method to be used for collecting sediment core samples;
  - Make and model for sediment and water sampling equipment;
  - A detailed itemized listing of the sample volume that will be required for each and every sediment, water, and elutriate analysis. Particular emphasis must be placed on the sediment and water volume required to prepare the elutriate sample for chemical analysis, as well as for the asbestos analysis;
  - A description of how the samples will be collected and composited for each type of analysis, including the sediment analyses, site water, and elutriate testing;
  - Methods for determining latitude and longitude, and elevation of sampling locations, including information on the GPS equipment to be used;
  - Methods for sample shipment, incl. sample shipping containers (drums, buckets, etc.);
  - Methods for maintaining samples at 4°C immediately after collection;

  - Quality assurance and quality control procedures for sample collection and handling activities.
  - Procedures that will ensure data usability, including items that may be reported in the performance based data usability report.
- Field sampling crew members names and credentials;
- Laboratory(ies) to be used for all analyses, including water/elutriate, grain size, and sediment asbestos;
- Laboratory's in-house QAPP (may be provided separately);
- Sample chain of custody form;
- Sample field data logging form.

The Contractor shall submit the Work Plan for review to USACE within 14 calendar days of the award of this contract. Chicago District will review the Work Plan and provide comments to the Contractor. The Contractor shall incorporate the USACE comments (if provided) and resubmit the Work Plan within 5 calendar days of having received the USACE comments. An approved Work Plan must be in place before any field work can begin. The Contractor should assume that the USACE review of the Work Plan will require 7 calendar days.

6.2 Health and Safety Plan

Prior to the start of any field work, the Contractor shall have an approved project and site-specific Health and Safety Plan (HSP) for this work. The Contractor is referred to the *USACE Safety and Health Requirements Manual (EM 385-1-1)* and 29 CFR. The plan must, as a minimum, include the following sections:

- Standard Operating Procedures
  - Personal Precautions
  - Operations
- Employee Safety Training and Medical Surveillance
- Personal Protective Equipment
- On-Site Safety Requirements
- Emergency Response Plan
  - Pre-emergency planning
  - Roles of Authority
  - Emergency Recognition and Prevention
  - Emergency Alerting and Response Procedures
  - Emergency Medical Treatment and First Aid
  - Emergency Equipment
  - Local Emergency Contacts
  - Route to Hospital
- Accident Prevention Plan
  - Administration Plan
  - Activity Hazard Analysis Plan
- Appendices
  - Substance Abuse Policy
  - Certifications

- Hazard Communications Program and MSDS

The Contractor shall submit the Health and Safety Plan for review to USACE within 14 calendar days of the award of this contract. The USACE will review the Health and Safety Plan and provide comments to the Contractor. The Contractor shall incorporate USACE comments (if provided) and resubmit the Health and Safety Plan within 5 calendar days of receipt of the comments. An approved Health and Safety Plan must be in place before any field work can begin. The Contractor should assume that the USACE review of the Health and Safety Plan will require 7 calendar days.

6.3 Project Coordination/Kick-off Meeting

The contractor, including subcontractors and laboratories, will participate in a meeting (or conference call) to discuss the project requirements, including the analytical requirements. It is anticipated that this meeting will take no more than 2 hours. USACE will provide a conference call line if needed. The meeting will occur within 7 days of NTP.

6.4 Reporting Package

All field work, including sample collection and shipment, must be completed within 21 days of final approval of the Work Plan and Health and Safety Plan. The Contractor shall prepare a draft reporting package for review and approval within 28 calendar days of the laboratory receipt of the last sample. The reporting package shall include:

- Draft analytical results, including QA/QC documentation,
- Performance based data review report,
- Narrative report on the project, including
  - Narrative project description – summary of sample collection activities
  - Map of actual sampling locations, with table of sampling locations including GPS coordinates, water depth, sediment depth referenced to LWD;
  - Water Surface elevation data for each day of sampling;
  - Water depths at each sampling location;
  - Chain of Custody sheets and field notes;
  - Other pertinent information.
- Data spreadsheet in an electronic format compatible with Microsoft Excel.

The draft reporting package shall be submitted as an electronic data deliverable. Chicago District will review the draft reporting package and provide comments or notification that the draft report is acceptable.

After review of the draft document, the Contractor shall provide 3 copies (2 bound, 1 un-bound) and one complete electronic copy in PDF format of the final Reporting Package (with Chicago District comments incorporated) within 14 calendar days of having received Chicago District comments or notification that the draft data package is acceptable. The final document and all final results must be received, reviewed, and approved by the Chicago District.

7 Project Schedule

The following schedule is a summary of the submittal and reporting requirement times for this project.

Table 5: Project Schedule

Activity	Time
Coordination/Kick-off meeting	Within 7 days of NTP
Submit Draft Work Plan, Submit Draft Health and Safety Plan	Within 14 calendar days of NTP
USACE provides comments on draft work plan and draft health and safety plan	Approximately 7 calendar days from submittal
Submit Final Work Plan, Submit Final Health and Safety Plan	Within 5 calendar days of receipt of comments from USACE
USACE approves final submittals	Within 7 calendar days of submittal
Complete all field work	Within 21 calendar days of final plan approval
Submit draft report and data, including QA/QC documentation, as electronic data deliverable	Within 28 calendar days of laboratory receipt of samples
USACE reviews draft report	Within 14 calendar days of submittal
Final document submittal, including paper and electronic copies	Within 14 calendar days of USACE comments on draft report

8 References

a) Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual, 'Inland Testing Manual', joint USEPA / USACE publication, Reference #: EPA-823-B-98-004, February 1998.

b) Great Lakes Dredged Material Testing and Evaluation Manual, joint USEPA-USACE publication, Final Draft Version, September 30, 1998, available web-site as follows: http://www.epa.gov/glnpo/sediment/gltem/manual.htm

c) Plumb, Russell H., Procedures for Handling and Chemical Analysis of Sediment and Water Samples, USEPA/USACE Technical Committee on Criteria for Dredged and Fill Material, May 1981.

d) USACE Safety and Health Requirements Manual (EM 385-1-1), available electronically at http://www.usace.army.mil/publications/

e) USACE Guidance for Evaluating Performance Based Chemical Data (EM 200-1-10), available electronically at http://www.usace.army.mil/publications/

f) Berman, D. Wayne, and Anthony Kolk, Draft Elutriator Method for the Determination of Asbestos in Solids and Bulk Material, Aeolus, Inc. publication, May 23, 2000, p. 2 – 15.

g) Berman, D.W., "Asbestos Measurement in Soils and Bulk Materials: Sensitivity, Precision, and Interpretation – You can Have It All," American Society for Testing and Materials, ASTM STP 1342, 2000.
h) USEPA, Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials, 540-R-97-028, 1997.
i) USACE, Summary of Sediment Sampling Events and Analytical Results for Waukegan Inner Harbor and Entrance Channel, April 1998.
j) QST Environmental, Report on the Collection of Sediment Samples from Waukegan Inner Harbor, January 1998.
k) CH2M Hill, Technical Memorandum: Data Evaluation Summary Report, Waukegan Harbor Area of Concern, Waukegan, Illinois, April 8, 2005.
l) Letter from Stefanie Bishop and Adrian Stanca, ProScience Analytical Services, Inc. to Don Dawicki, Severn Trent Laboratories STL Burlington, regarding asbestos sediment results for Waukegan Harbor, February 2, 2005.
m) Cali, Salvatore, Peter Scheff, Rosemary Sokas, and others, June 6, 2005, Illinois Beach State Park (IBSP): Determination of Asbestos Contamination in Beach Nourishment Sand, Interim Report of Findings, University of Illinois at Chicago.

Attachment 1: Grain Size Determination Protocol

Provide the results of a particle size analysis (sand/fine split). The analysis will follow procedures detailed below for the separation of sand from fines, and results will be reported as the percentage by weight passing a 62 micron sieve (#230 US sieve). The physical characteristics of the material shall be noted.

1. Significant organic matter should be removed as follows: Add 5 ml of 6-percent solution of hydrogen peroxide from each gram of dry sample which is in 40 ml of water. Stir and cover. Large fragments may be skimmed off if they are free of sediment. If oxidation is slow or has slowed, the mixture is heated to 93°C and stirred. More hydrogen peroxide solution may be necessary to complete oxidation. After the reaction has completely stopped, wash with distilled water.

2. The composite sediment is placed in the soil dispersion cup and diluted to 250 - 300 ml with distilled water. Mix for 5 minutes at 10,000 RPM.

3. The sediment is then wet-sieved using distilled water and a #230 US sieve (62 micron mesh). Washing should be continued until no sediment passes the screen. Material is then oven dried at 103° - 105°C prior to weighing.

4. In addition to the #230 US sieve, the following sieve sizes will also be used to determine the overall grain size distribution.

SIEVE SIZE
3/4
3/8
#4
#8
#16
#30
#50
#100
#200
#230

Attachment 2

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276

217/782-3362

[redacted]

MATERIAL ANALYSIS FOR DREDGE AND FILL ACTIVITIES
Section 401 Water Quality Certification

Generally, a particle size analysis (sand/fine split) is required for all projects or activities involving the movement of any material. This analysis is necessary for the issuance of a Section 401 Water Quality Certification in conjunction with the US Army Corps of Engineers Section 404 Dredge and Fill permit. Excluded from the following analysis are concrete, commercially graded sand and gravel, and other nondegradable, nontoxic, clean fill materials. Testing is not necessary for mechanically excavated material used for fill in upland areas, which is nonpollutional, placed away from public water supplies, and is prevented from returning to the waterway. For further clarification on these exclusions, contact the IEPA. IF YOUR PROPOSED PROJECT INVOLVES THE MOVEMENT OF MATERIAL INTO OR OUT OF A WATERWAY, YOU MUST PROVIDE THE FOLLOWING INFORMATION:

1. Provide the results of **PARTICLE SIZE ANALYSIS (SAND/FINE SPLIT).** The analysis will follow procedures detailed below for the separation of sand from fines, and results will be reported as the percentage by weight passing a 62-micron sieve (#230 US sieve). The physical characteristics of the material should be noted.

   a. Significant organic matter should be removed as follows: Add 5ml of 6% solution of hydrogen peroxide for each gram of dry sample which is in 40 ml water. Stir and cover. Large fragments may be skimmed off if they are free of sediment. If oxidation is slow or has slowed, the mixture is heated to 93°C and stirred. More hydrogen peroxide solution may be necessary to complete oxidation. After the reaction has completely stopped, wash with distilled water.

   b. The composited sediment is placed in the soil dispersion cup and diluted to 250-300 ml with distilled water. Mix for 5 minutes at 10,000 RPM.

   c. The sediment is then wet-sieved using distilled water and a #230 US sieve (62 micron mesh). Washing should be continued until no sediment passes the screen. Material is then oven-dried at 100°-105°C prior to weighing.

2. If the particle size analysis shows 20% or greater passage of material through a #230 US sieve (or 20% of the material has settling velocities of particles with diameters of 62 microns or less), chemical constituent testing of the sediment and receiving disposal waters will be required and must demonstrate that the sediment does not contain significant levels of toxic materials.

   a. **For hydraulically moved material,** a **SUPERNATANT TEST** for nonsettleable material from 2540 (f) of Standard Methods for Water and Wastewater Analysis (20th edition, 1998) is required. This analysis for a four-hour settling of 1:4 sediment to natural background water slurry (vol./vol.) is to be compared to the receiving waters. Provide laboratory analysis on the sediment/background water slurry and the receiving water for the following parameters: total suspended solids (TSS), total volatile solid (TVS), ammonia-nitrogen (as N), lead (total), and zinc. Additional parameters may be required based on documented sediment contamination. If supernatant test results exceed background TSS or the TSS standard of 35 Ill. Adm. Code, Subtitle C: Water Pollution, additional supernatant tests are required. These detailed tests should be conducted with the same settling time(s) as the proposed disposal facilities. Consideration should be given to background variability with differences in flow volume and flow rate, and subsequent project scheduling. Contact the Illinois EPA (Watershed Management Section at 217/782-3362) for further information concerning additional suspended phase testing.

   b. **For mechanically moved material** placed out of the water, an **ELUTRIATE TEST** using 2540(f) of Standard Methods is required for lead, zinc, and ammonia-nitrogen as N. Additional testing and/or additional parameters may be required.

   c. **For mechanically moved material** placed in a waterway, follow procedures in 2a.

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Attachment 3

Commercial Laboratories Known to Use Method 1631
Mercury Testing (EPA Method 1631)

Battelle Marine Sciences
1529 West Sequim Road
Sequim, WA 98382
(360) 681-3650

Brooks Rand LTD
3950 Sixth Avenue NW
Seattle, WA 98107
(206) 632-6206

Pace Analytical (formerly EnChem, Inc.)
1241 Bellvue Street, Suite 9
Green Bay, WI 54302
(920) 469-2436

Frontier Geoscience
414 Pontius Avenue N Suite B
Seattle, WA 98109
(206) 622-6960

Northern Lake Service
400 North Lake Avenue
Crandon, WI 54520
(715) 478-2777

STL North Canton, Ohio Laboratory
For information in Illinois contact;
Joe Walker or Donna Ingersoll
STL Decatur Service Center
920 W Pershing Road
Decatur, IL 62526
Tel.: (217) 872-0340
Fax.: (217) 872-0344

Disclaimer: Inclusion of a laboratory on this list does not constitute an endorsement. Other laboratories may be capable of conducting low-level mercury analysis using method 1631. If you have a question about a laboratory on this list or know of a laboratory that should be included, please contact Mike Henebry at (217) 785-3944 or mikehenebry@epa.state.il.us.

Figure 1: Site Map for Waukegan Harbor

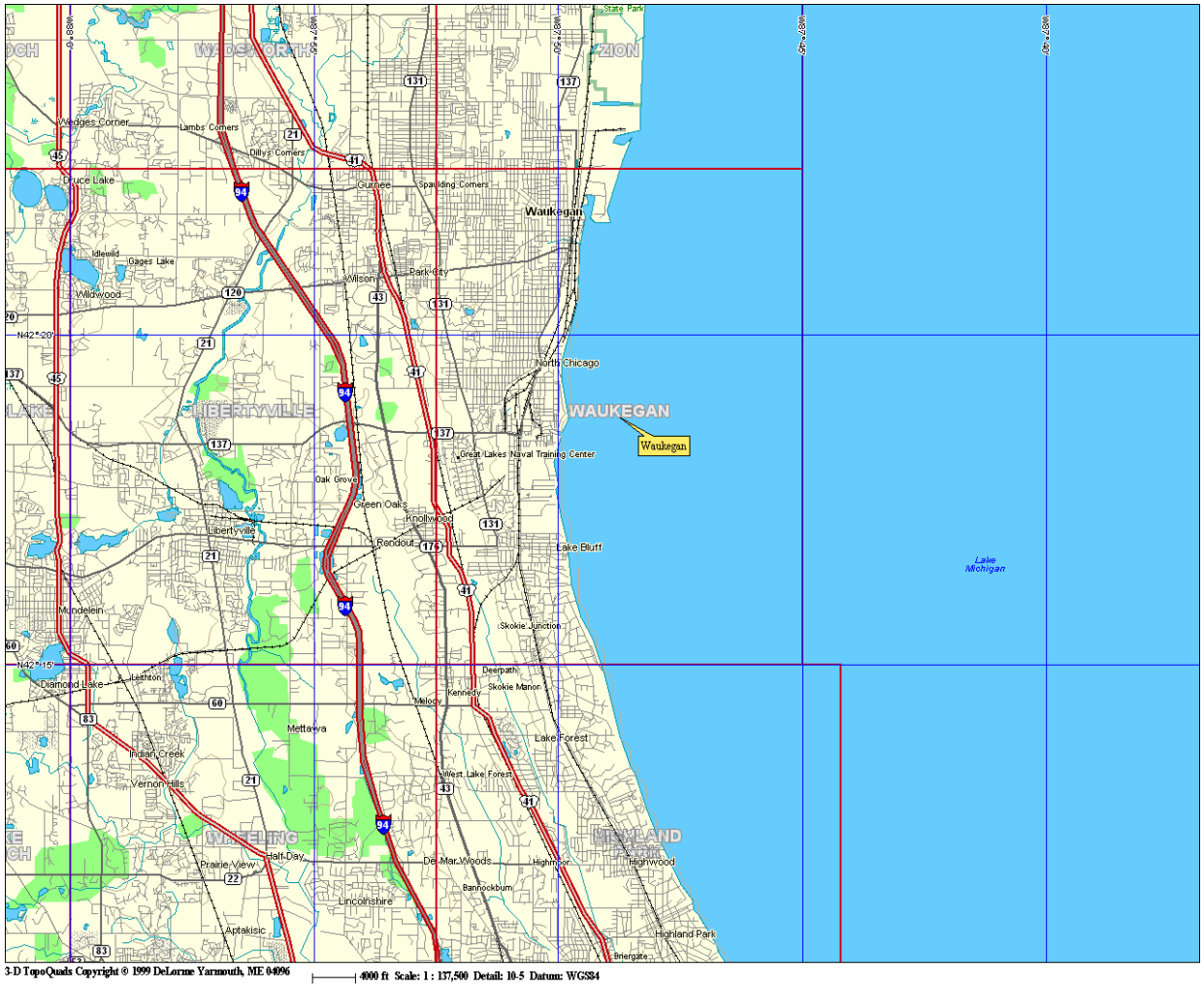
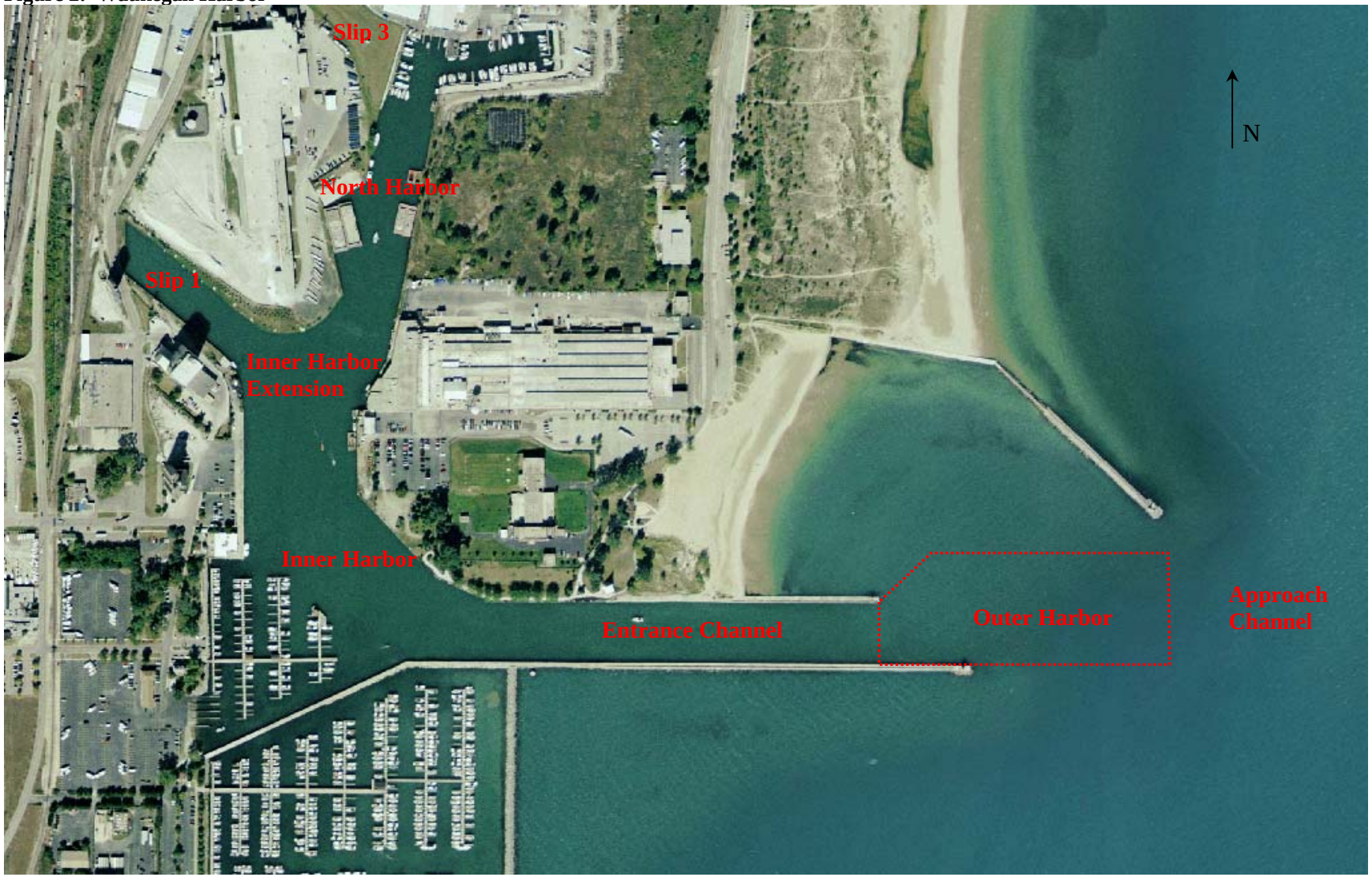


Figure 2: Waukegan Harbor



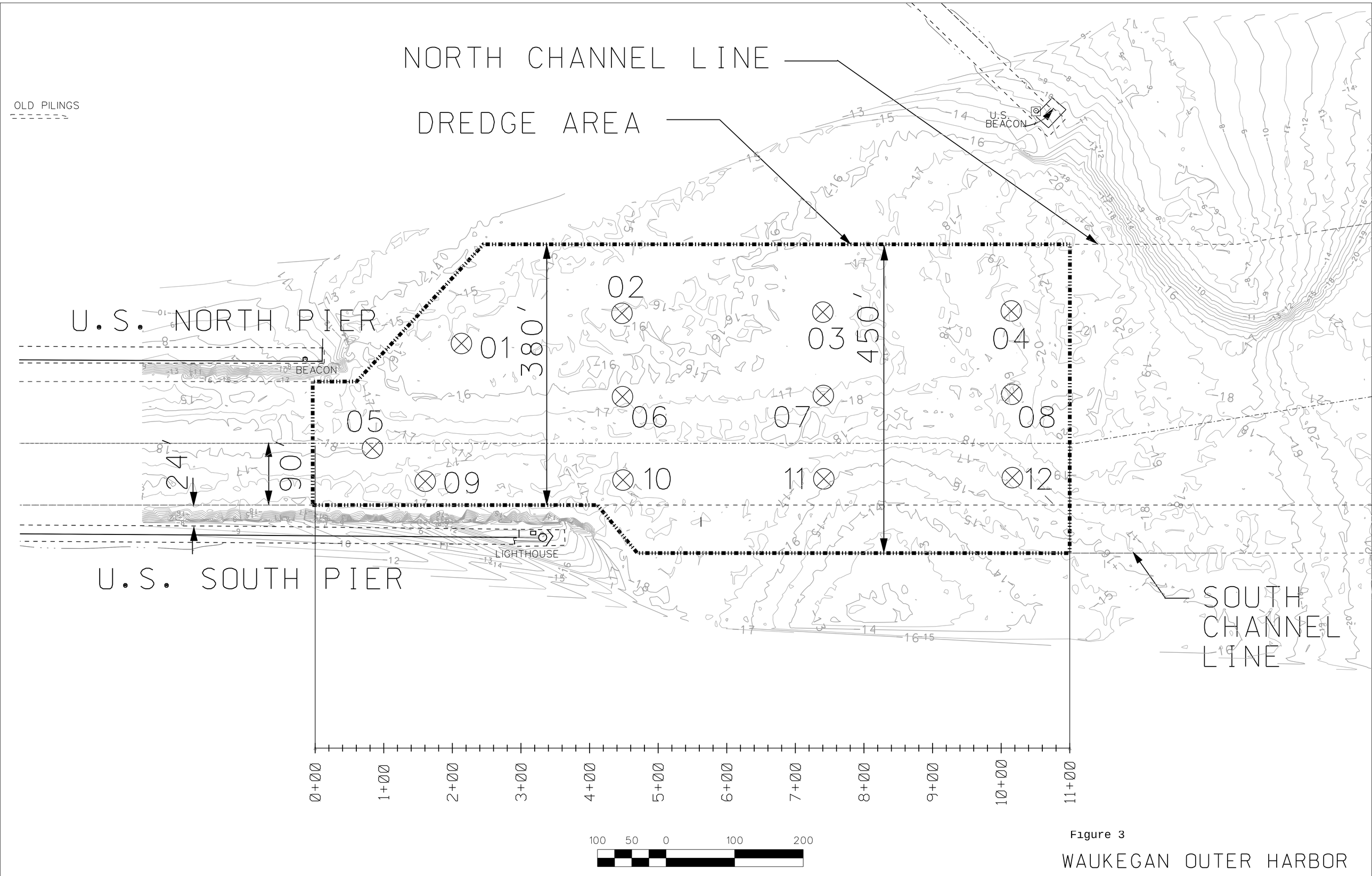


Figure 3

WAUKEGAN OUTER HARBOR
SAMPLING LOCATIONS FOR
PROPOSED DREGDING 2006

Appendix B
Analytical Results

Summary elutriate data table included in hard copy.
Data Quality Assessment including in hard copy.
Complete analytical results in electronic format only.

Parameter Name	Units	Reporting Limit	Lake Michigan Water Quality Standard [1]	NSSD Discharge Limits	Water Sample from Waukegan Outer Harbor	EL-1-00 (Cores 1 and 2)	EL-1-04	EL-1-24	EL-1-48	EL-1-96	EL-2-00 (Cores 3 and 4)	EL-2-04	EL-2-24	EL-2-48	EL-2-96	EL-3-00 (Cores 5 and 9)	EL-3-04	EL-3-24	EL-3-48	EL-3-96	EL-4-00 (Cores 6 and 10)	EL-4-04
Ammonia	mg/L	0.2	2.8 [3]	50	<0.2	2.8	3.4	3.7	1.6	4.5	5.1	2	4.8	3.9	5.2	6.6	5.7	4.7	3.7	6.8	3.7	5.5
Alkalinity, Total as CaCO3	mg/L	5			111	121	119	119	112	130	134	118	126	118	136	130	125	128	120	138	113	127
BOD	mg/L	2		300	3	<2	9	<2	2	<2	3	15	<2	2	<2	5	3	<2	20	6	3	28
COD	mg/L	5		900	<5	73	22	14	<5	<5	17	54	9.7	5.0	<5	86	33	3.7 B	11	19	72	47
Hardness by Calculation	mg/L	1.3			119	348	177	123	120	127	229	158	123	130	125	269	172	140	128	133	267	152
Hexavalent Chromium	mg/L	0.01	0.016	700	0.0049 B	<0.01	<0.01	<0.01	0.01 UJ	0.01 UJ	<0.01	0.0095 B	<0.01	0.01 UJ	0.01 UJ	<0.01	0.0072 B	<0.01	0.01 UJ	0.01 UJ	<0.01	<0.01
Nitrogen, Total Kjeldahl as N	mg/L	0.4			0.25 B	2.9	3.9	3.7	2.0	4.1	5.3	2.9	4.4	3.6	6.3	7.4	6.5	5.4	3.7	7.7	4.5	6.3
Oil and Grease	mg/L	5		75	<5	16	18	<5	<5	<5	19	18	3.8 B	3.6 B	<5	20	2.4 B	<5	<5	<5	17	3.4 B
Phenolics, Total Recoverable	mg/L	0.005		4,000	<0.005	<0.005	<0.005	<0.005	0.010	<0.005	0.0033 B	<0.005	<0.005	0.0049 B	<0.005	<0.005	<0.005	0.0038 B	0.087	<0.005	<0.005	<0.005
pH	pH units	0.5	7.0 - 9.0	5.0 - 9.0	8.5	7.91	7.90	7.88	8.04	7.95	7.88	7.95	7.91	7.97	7.88	7.88	7.54	7.93	7.98	7.90	7.80	7.87
Phosphorous	mg/L	0.05	0.007	20	0.016 B	0.23 J	0.037 JB	0.11J	0.047 JB	0.059 J	0.17 J	0.10 J	0.17 J	0.067 J	0.054 J	0.39 J	0.17 J	0.26 J	0.10 J	0.12 J	0.38 J	0.13 J
Solids, Total Dissolved (TDS)	mg/L	10	180	3500	160	320	380	200	190	210	420	440	210	180	190	560	340	210	180	180	460	380
Solids, Total Suspended (TSS)	mg/L	10	15	350	<10	700	200	30	4.5 B	5.5	570	130	190	7.0	6.0	770	110	17	10	6.0	800	58
Solids, Total Volatile (TVS)	mg/L	5			64	96	66	74	40	68	84	66	98	4.0 B	76	116	78	76	26	86	90	66
PCBs																						
PCB, total	ug/L	0.05	26 pg/L (human health standard), PQL = 0.1 ug/L		<0.05	1.3	0.7	0.11	0.084	0.092	0.41	0.34	<0.05	<0.05	<0.05	0.96	0.34	0.051	0.068	0.063	0.78	0.27
Volatile Organic Compounds																						
Methylene Chloride	ug/L	5	47		<5	3.1 J	1.6 J	2 J	5.2	13	1.5 J	1.5 J	2.4 J	6.9	9.4	2.2 J	0.94 J	2.1 J	6.5	8.5	0.98 J	1.8 J
Semi-Volatile Organic Compounds																						
Benzo(a)anthracene	ug/L	5			<5	0.24 J	<5	<5	<5	<5	<5	<5	<5	<5	<5	0.51 J	<5	<5	<5	<5	<5	<5
Benzo(b)fluoranthene	ug/L	5			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0.3 J	<5	<5	<5	<5	<5	<5
Benzo(k)fluoranthene	ug/L	5			<5	0.22 J	<5	<5	<5	<5	<5	<5	<5	<5	<5	0.46 J	<5	<5	<5	<5	<5	<5
Benzo(a)pyrene	ug/L	5			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0.43 J	<5	<5	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	ug/L	5			<5	0.99 J	0.8 J	4.8 U	0.63 J	0.91	<5	5.0 U	0.45 JB	2.5 J	1.2 J	0.44 J	0.41 J	4.8 U	3.8 J	0.75 J	0.63 J	0.61 J
Chrysene	ug/L	5			<5	0.33 J	<5	<5	<5	<5	0.23 J	<5	<5	<5	<5	0.64 J	<5	<5	<5	<5	0.22 J	<5
Fluoranthene	ug/L	5			<5	0.53 J	<5	<5	<5	<5	0.41 J	<5	<5	<5	<5	1 J	0.3 J	0.25 J	<5	<5	0.35 J	<5
Naphthalene	ug/L	5			<5	4.7	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Phenanthrene	ug/L	5			<5	0.39 J	<5	<5	<5	<5	0.29 J	<5	<5	<5	<5	1.2 J	0.53 J	0.29 J	<5	<5	0.25 J	<5
Pyrene	ug/L	5			<5	0.57 J	<5	<5	<5	<5	0.38 J	<5	<5	<5	<5	1.3 J	0.46 J	0.41 J	<5	0.26 J	0.35 J	<5
Pesticides																						
4,4-DDD	ug/L	0.0094			<0.0094	0.094 UJ	0.094 UJ	0.098 UJ	0.0094 UJ	0.094 UJ	0.097 UJ	0.094 UJ	0.094 UJ	0.0094 UJ	0.094 UJ	0.097 UJ	0.098 UJ	0.094 UJ	0.0094 UJ	0.095 UJ	0.097 UJ	0.098 UJ
4,4-DDE	ug/L	0.0094			<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.097 UJ	0.098 UJ	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094
4,4-DDT	ug/L	0.0094	11 pg/L (wildlife standard for DDT andmetabolites)		<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.097 UJ	0.098 UJ	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094
Aldrin	ug/L	0.0047			<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.048 UJ	0.049 UJ	<0.0047	<0.0047	<0.0047	0.048 UJ	<0.0047
alpha-Chlordane	ug/L	0.0047			<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.048 UJ	0.049 UJ	<0.0047	<0.0047	<0.0047	0.048 UJ	<0.0047
beta-BHC	ug/L	0.0047			<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.048 UJ	0.049 UJ	<0.0047	<0.0047	<0.0047	0.048 UJ	<0.0047
Chlordane	ug/L	0.0047	0.00025 (human health standard)		<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.48 UJ	0.49 UJ	<0.0047	<0.0047	<0.0047	0.48 UJ	<0.0047
Dieldrin	ug/L	0.0094	0.0065 ng/L (human health standard)		<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.097 UJ	0.098 UJ	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094
Endrin	ug/L	0.0094	0.0860		<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.097 UJ	0.098 UJ	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094
gamma-BHC (Lindane)	ug/L	0.0045	0.4700		<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	0.048 UJ	0.049 UJ	<0.0045	<0.0045	<0.0045	0.048 UJ	<0.0045
gamma-Chlordane	ug/L	0.0047			<0.0047	<0.0047	<0.0047	<0.0047	0.0081 P	<0.0047	<0.0047	<0.0047	<0.0047	0.056 P	<0.0047	0.048 UJ	0.049 UJ	<0.0047	0.08 EP	<0.0047	0.048 UJ	<0.0047
Metals/Inorganics - Total																						
Aluminum	ug/L	91			142 B	15400 J	8680 J	1960 J	758 J	1100 J	14200 J	7220 J	2180 J	1180J	1270 J	26000 J	11000 J	3010 J	1680 J	1800 J	21700 J	8930 J
Arsenic	ug/L	2.4	50	150	<2.4	18.1 J	9.5 JB	3.6 JB	3.1 B	5.5	13.1 J	5.5 JB	5.6 JB	<2.4	3 B	18.6 J	10.5 J	8.2 JB	3.6 B	4.1 B	19.4 J	9.4 JB
Barium	ug/L	0.72	1000	15,000	19 B	104 B	74.2 B	44.5 B	27.7 B	43.9	101 B	66.3 B	46.9 B	38.7 B	42.5 B	154 B	87 B	48 B	35.9 B	45.7 B	135 B	81.4 B
Cadmium	ug/L	1.5	5.5	1000.0	<1.5	1.9 B	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	2.1 B	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Calcium	ug/L	28			30,900	81400	42900	31100	30800	32600	54500	38900	31700	33500	32000	61600	41400	35700	32900	34800	62000	37000
Chromium (total)	ug/L	1.1		3000	<1.1	50.4 J	28.4 J	6.4 JB	3.3 JB	4.3 J	29.9 J	16.8 J	4.6 JB	3 JB	3.3 JB	89.4 J	37.2 J	13.1J	6.4 JB	6.4 JB	62.1 J	23.3 J
Chromium III	ug/L	calculated	2079.1		<1.1	50.4	28.4	6.4	3.3	4.3	29.9	16.8	4.6	3	3.3	89.4	37.2	13.1	6.4	6.4	62.1	23.3
Cobalt	ug/L	2.7			<2.7	9.8 JB	5.1 JB	2.9 JB	<2.7	<2.7	8.1 JB	4.2 JB	2.7 UJ	<2.7	<2.7	14.1 JB	6.2 JB	2.7 UJ	<2.7	3 B	12.3 JB	5.5 JB
Copper	ug/L	3.5	16.5	3000.0	<3.5	44 J	22 JB	6.8 JB	4.3 JB	4.7 J	28.9 J	15.9 JB	6.5 JB	5.1 JB	5.3 JB	101 J	41.2 J	15.6 JB	8.2 JB	8.9 JB	53 J	20.8 JB
Cyanide	ug/L	1.2	22	250	5.2 B	5.2 JB	8.7 JB	1.9 JB	1.2 JB	<1.2	5.1 JB	6.4 JB	3.4 JB	<1.2	<1.2	5.4 JB	5.3 JB	1.2 UJ	<1.2	<1.2	4.3 JB	5.5 JB
Iron	ug/L	37	300 (dissolved)	50,000 (3000 dissolved)	152 B	19200 J	9300 J	1910 J	795 J	841 J	15400 J	7450 J	2080 J	1020 J	999 J	28200 J	11100 J	3160 J	1510 J	1300 J	25200 J	8660 J
Lead	ug/L	1.3	152.8	1000.0	<1.3	60.8	33.3	7.7 B	1.5 B	1.3	39.2	23.8	7 B	3.4 B	3 B	89.2	37.2	13.2	4.3 B	2.5 B	72.8	29.2
Magnesium	ug/L	60			10,200	35100	17000	10900	10500	11100	22500	14800	10700	11400	10900	28000	16600	12300	11200	11200	27400	14400
Manganese	ug/L	0.18	150	12,000	2	393	136	28.6	10.5 B	14.2	241	107	32.8	15.9	16.3	404	172	52.6	24.3	21.8	368	120
Mercury	ng/L	5	1.3 [2]	500 (daily average), 400 (monthly average)	1	50.9 J	40.8 J	13.5 J	4.5 J	4.9 J	29.2 J	23.3 J	11.9 J	13.2 J	2.7 J	122 J	78.1 J	40.8 J	18.1 J	23.7 J	52.9 J	43.2 J
Nickel	ug/L	1.2	543.6	5000.0	<1.2	32.1 B	13.2 B	4.5 B	2.9 B	6.8	19.6 B	10.2 B	3.9 B	3.8 B	5.5 B	58.2	17.7 B	4.8 B	4.3 B	4.8 B	30.2 B	11.2 B
Potassium	ug/L	160			1210 B	8110	5650	2600 B	1870 B	2700	8000	4800 B	2800 B	2420 B	2810 B	12100	6610	3400 B	2590 B	3430 B	9940	5800
Sodium	ug/L	290			5940	7380	7000	6450	6020	6940	7570	6910	6400	6540	6580	8730	7180	6780	6290	6630	7130	6970
Vanadium	ug/L	2.1			<2.1	30.2 JB	15.8 JB	5.2 JB	2.1 UJ	4.6 J	25.9 JB	12.7 JB	5.5 JB	2.1 UJ	3.4 JB	45.4 JB	18.4 JB	5.3 JB	2.6JB	3.6 JB	41 JB	15 JB
Zinc	ug/L	2	138.8	4000.0	4.5 B	160 J	86.5 J	25 J	17.2 B	20.6	108 J	61.2 J	27 J	18.1 B	26.7	221 J	93.9 J	39.2 J	23	24.4	179 J	70.2 J

0- Analyte not detected
J- Analyte was posively identified, value was an approximate concentration.
U- Analyte was not detected above the reporting quanitation limit.
UJ- The analyte was not detected above the reported quantation limit; however the reported limit is approximate a0 may not be actual quanita
B- Analye is also detected in blank sample.
P - Professional judgment based on data use.

[1] Water Quality Standards are from IAC 35 Part 302. Unless otherwise noted, these are the acute standards.

[2] For total mercury, the acute standard is 1700 ng/L, the chronic standard is 910 ng/L, the human health standard is 3.1 ng/L, and the wildlife standard is 1.3 ng/L.

[3] Ammonia standard is 0.33 mg/L (acute standard for un-ionized ammonia, April through October), based on this the total concentration of ammonia for a pH of 8.5 and a temperature of 20 C is 2.8 mg/L

Exceeds Lake Michigan WQ standard

Exceeds both LM and NSSD WQ standards

Parameter Name	Units	Reporting Limit	Lake Michigan Water Quality Standard [1]	EL-4-24	EL-4-48	EL-4-96	EL-5-00 (Cores 7 and 11)	EL-5-04	EL-5-24	EL-5-48	EL-5-96	EL-6-00 (Cores 8 and 12)	EL-6-04	EL-6-24	EL-6-48	EL-6-96
Ammonia	mg/L	0.2	2.8 [3]	4.5	3.4	3.1	3.1	3.2	4.4	3.3	3.8	3.6	2.6	4.5	2.2	3.4
Alkalinity, Total as CaCO3	mg/L	5		122	118	115	115	116	124	115	119	121	117	131	116	118
BOD	mg/L	2		<2	2	<2	3	<2	<2	17	<2	4	13	<2	2	4
COD	mg/L	5		25	<5	<5	35	33	23	<5	22	99	<5	29	5.7	<5
Hardness by Calculation	mg/L	1.3		126	127	128	283	152	126	121	120	307	163	132	131	128
Hexavalent Chromium	mg/L	0.01	0.016	<0.01	0.011J	0.01 UJ	<0.01	<0.01	<0.01	0.01 UJ	0.01 UJ	<0.01	0.013	<0.01	0.01 UJ	0.01 UJ
Nitrogen, Total Kjeldahl as N	mg/L	0.4		5.2	3.7	3.4	3.9	3.3	4.6	3.3	4.0	4.4	3.2	4.5	2.4	3.6
Oil and Grease	mg/L	5		<5	<5	<5	19	3.7 B	<5	<5	<5	19	19	3.5 B	2.3 B	<5
Phenolics, Total Recoverable	mg/L	0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0055	<0.005	0.0067	<0.005	<0.005	<0.005	0.0031 B
pH	pH units	0.5	7.0 - 9.0	7.96	8.01	8.03	7.95	7.95	8.00	7.51	7.79	7.91	8.02	7.91	8.06	8.09
Phosphorous	mg/L	0.05	0.007	0.16 J	0.072 J	0.048 JB	0.016 JB	0.098 J	0.13 J	0.059 J	0.063 J	0.019 JB	0.085 J	0.18 J	0.070 J	0.058 J
Solids, Total Dissolved (TDS)	mg/L	10	180	200	180	190	520	320	210	200	170	480	220	190	180	200
Solids, Total Suspended (TSS)	mg/L	10	15	6.0	5.5	14	710	79	12	5.5	32	1000	160 J	15	19	6.5
Solids, Total Volatile (TVS)	mg/L	5		74	20	66	92	76	70	<5	68	110	72	98	36	80
PCBs																
PCB, total	ug/L	0.05	26 pg/L (human health standard), PQL = 0.1 ug/L	<0.05	0.055	<0.05	0.73	<0.05	<0.05	<0.05	<0.05	0.58	<0.05	<0.05	<0.05	<0.05
Volatile Organic Compounds																
Methylene Chloride	ug/L	5	47	1.4 J	1.2 J	1.8 J	3.3 J	<5	0.99 J	2.2 J	1.2 J	5.5	2 J	0.91 J	1.8 J	1.3 J
Semi-Volatile Organic Compounds																
Benzo(a)anthracene	ug/L	5		<5	<5	<5	<5	<5	<5	<5	<5	0.27 J	<5	<5	<5	<5
Benzo(b)fluoranthene	ug/L	5		<5	<5	<5	<5	<5	<5	<5	<5	0.26 J	<5	<5	<5	<5
Benzo(k)fluoranthene	ug/L	5		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Benzo(a)pyrene	ug/L	5		<5	<5	<5	<5	<5	<5	<5	<5	0.23 J	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	ug/L	5		4.8 U	3.1 J	0.81 J	0.79 J	0.64 J	4.8 U	1 J	1.2 J	1 J	1.4 J	4.8 U	0.68 J	1.5 J
Chrysene	ug/L	5		<5	<5	<5	0.27 J	<5	<5	<5	<5	0.35 J	<5	<5	<5	<5
Fluoranthene	ug/L	5		<5	<5	<5	0.45 J	<5	<5	<5	<5	0.6 J	<5	<5	<5	<5
Naphthalene	ug/L	5		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Phenanthrene	ug/L	5		<5	<5	<5	0.32 J	<5	<5	<5	<5	0.44 J	<5	<5	<5	<5
Pyrene	ug/L	5		<5	<5	<5	0.43 J	<5	<5	<5	<5	0.61 J	<5	<5	<5	<5
Pesticides																
4,4-DDD	ug/L	0.0094		0.095 UJ	0.0094 UJ	0.094 UJ	0.097 UJ	0.098 UJ	0.094 UJ	0.0094 UJ	0.094 UJ	0.098 UJ	0.095 UJ	0.095 UJ	0.0094 UJ	0.094 UJ
4,4-DDE	ug/L	0.0094		<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.0094 UJ	<0.0094
4,4-DDT	ug/L	0.0094	11 pg/L (wildlife standard for DDT andmetabolites)	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.0094 UJ	<0.0094
Aldrin	ug/L	0.0047		<0.0047	<0.0047	<0.0047	0.048 UJ	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.0047 UJ	<0.0047
alpha-Chlordane	ug/L	0.0047		<0.0047	<0.0047	<0.0047	0.048 UJ	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.0047 UJ	<0.0047
beta-BHC	ug/L	0.0047		<0.0047	<0.0047	<0.0047	0.048 UJ	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.0047 UJ	<0.0047
Chlordane	ug/L	0.0047	0.00025 (human health standard)	<0.0047	<0.0047	<0.0047	0.48 UJ	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	0.047 UJ	<0.0047
Dieldrin	ug/L	0.0094	0.0065 ng/L (human health standard)	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.0094 UJ	<0.0094
Endrin	ug/L	0.0094	0.0860	<0.0094	<0.0094	<0.0094	0.097 UJ	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	<0.0094	0.0094 UJ	<0.0094
gamma-BHC (Lindane)	ug/L	0.0045	0.4700	<0.0045	<0.0045	<0.0045	0.048 UJ	0.049 UJ	<0.0045	<0.0045	<0.0045	<0.0045	0.048 UJ	<0.0045	0.0047 UJ	<0.0045
gamma-Chlordane	ug/L	0.0047		<0.0047	0.057 P	<0.0047	0.048 UJ	<0.0047	<0.0047	0.06 P	<0.0047	<0.0047	<0.0047	<0.0047	0.18 EP	<0.0047
Metals/Inorganics - Total																
Aluminum	ug/L	91		2440 J	1250 J	1020 J	21900 J	7390 J	2050 J	1050 J	789 J	22100 J	8080 J	1970 J	1300 J	1010 J
Arsenic	ug/L	2.4	50	6.6 JB	6.2 B	4.9 B	19.9 J	7.4 JB	4.4 JB	<2.4	3.4 B	18.1 J	8.1 B	5.8 JB	3 B	<2.4
Barium	ug/L	0.72	1000	48.6 B	37.9 B	37 B	131 B	67.9 B	45.3 B	35.4 B	36.8 B	125 B	68.5 B	51.2 B	35.5 B	40.1 B
Cadmium	ug/L	1.5	5.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Calcium	ug/L	28		32700	32500	33000	66100	37400	32200	31000	30800	73500	40500	34300	33500	33200
Chromium (total)	ug/L	1.1		6.1 JB	4.4 JB	2.9 JB	54.8 J	17.4 J	4.6 JB	3.2 JB	2.1 B	47.7 J	17.1 J	3.1 JB	3.3 JB	2.4 JB
Chromium III	ug/L	calculated	2079.1	6.1	4.4	2.9	54.8	17.4	4.6	3.2	2.1	47.7	17.1	3.1	3.3	2.4
Cobalt	ug/L	2.7		2.7 UJ	<2.7	<2.7	13 JB	4.4 JB	2.7 UJ	<2.7	<2.7	15.1 JB	6.1 B	2.7 UJ	<2.7	<2.7
Copper	ug/L	3.5	16.5	6.9 JB	5.3 JB	5.4 JB	61.4 J	17.4 JB	7.7 JB	4.6 JB	6.9 B	45.2 J	14.7 JB	7 JB	8.7 JB	10.1 JB
Cyanide	ug/L	1.2	22	1.2 JB	<1.2	<1.2	5.5 JB	4.8 JB	1.2 JB	<1.2	2.2 JB	5.6 JB	6.2 JB	1.2 UJ	<1.2	2 JB
Iron	ug/L	37	300 (dissolved)	2100 J	1200 J	917 J	25600 J	7560 J	1820 J	983 J	656 J	28400 J	8110 J	1640 J	1440 J	852 J
Lead	ug/L	1.3	152.8	8.2 B	3.1 B	3.3 B	78.6	24.3	7 B	2.7 B	<1.3	49.5	15.8	4.3 B	1.4 B	<1.3
Magnesium	ug/L	60		10800	11000	11000	28600	14300	11200	10700	10400	29900	15100	11300	11400	10900
Manganese	ug/L	0.18	150	32.7	20.1	15.9	383	109	28.2	15.4	9.5 B	405	104	26.3	26.3	11.1 B
Mercury	ng/L	5	1.3 [2]	11.8 J	4.5 J	4.5 J	48.7 J	20.7 J	11.8 J	4.2 J	8.2 J	38.1 J	10.4 J	8.2 J	7.8 J	2.4 JB
Nickel	ug/L	1.2	543.6	2.9 B	2.8 B	2 B	30.4 B	9.6 B	1.7 B	2.7 B	1.6 B	34.8 B	11.7 B	2.6 B	2.1 B	2.1 B
Potassium	ug/L	160		2990 B	2350 B	2230 B	10500	4980 B	2880 B	2160 B	2330 B	10800	5880	3270 B	2260 B	2700 B
Sodium	ug/L	290		6650	6300	6360	7140	6980	6650	6140	6300	7100	6890	6740	6150	6570
Vanadium	ug/L	2.1		4 JB	3.5 JB	2.1 UJ	43.4 JB	13.2 JB	4.1 JB	2.1 UJ	<2.1	45.6 JB	17.1 B	4.6 JB	3 JB	2.1 UJ
Zinc	ug/L	2	138.8	26.8 J	25	25.4	183 J	66.8 J	48.3 J	37.4	83.4	168 J	59.4	19.4 JB	17.2 B	17.9 B

0- Analyte not detected

J- Analyte was posively identified, value was an approximate concentration.

U- Analyte was not detected above the reporting quanitation limit.

[1] Water Quality Standards are from IAC 35 Part 302. Unless otherwise noted, these are the acute standard

[2] For total mercury, the acute standard is 1700 ng/L, the chronic standard is 910 ng/L, the human health sta

[3] Ammonia standard is 0.33 mg/L (acute standard for un-ionized ammonia, April through October), based

Exceeds Lake Michigan WQ standard

Exceeds both LM and NSSD WQ standards

CELRC-TS-DH 26 October 2006

MEMORANDUM FOR RECORD

SUBJECT: Data Quality Assessment for Waukegan Outer Harbor Sampling, Contract #W912P6-06-D-0002, Task Order 0001

1. References:

    a. USACE Chicago District, May 2006, Scope of work for Collection and Analysis of Sediment and Water Samples at Waukegan Outer Harbor, Illinois.

    b. STL Burlington, Sept 25, 2006, Sample Data Summary Package 115725, Summary Data Package 115726, Summary Data Package 115752, Extended Data Package 115725, Extended Data Package 115726, and Extended Data Package 115752.

    c. STAT Analysis Corporation, August 15, 2006, Asbestos Analysis by Polarized Light Microscopy, STAT Batch No. 266957.

    d. STAT Analysis Corporation, August 17, 2006, Bulk Asbestos Analysis by Transmission Electron Microscopy, STAT Batch No. 266958.

    e. EMS Laboratories, August 31, 2006, Elutriator Report, Laboratory Report No. 108740.

2. The USACE, Chicago District Environmental Engineering Section reviewed the data submitted by Matrix Environmental, Inc. Data from STL Burlington, STAT Analysis, and EMS Laboratories was submitted for elutriate and grain size analysis, PLM and TEM asbestos analysis, and "Elutriator" asbestos analysis, respectively. A level 1 review was conducted. The scope of work, including reporting limits and data quality assurance and quality control requirements, was reviewed. The data requirements were compared to the reported results, and the submitted laboratory documentation was reviewed in it's entirety. Two separate evaluations were done: one on the physical sediment data (asbestos and grain size), and one on the elutriate data. The findings are discussed further, below.

3. The sediment physical data, including the grain size and asbestos data, had no quality assurance or quality control issues. Sample analyses followed standard methods, and there were no variations or deficiencies noted. The sediment physical data quality is considered acceptable and it is recommended that these data be accepted for use.

4. For the elutriate samples, the holding times were met although during shipping one batch of low level mercury samples was received at the laboratory at an elevated temperature of 21.7°C. Since mercury is a volatile metaloid, it is possible that the samples could have been

impacted by the elevated temperature. However, based on a comparison to the remaining data, the mercury results were not impacted.

5. Reporting limits were not met for a number of compounds. Table 1 is a summary of the required reporting limits and the actual reporting limits obtained for those compounds that had variations from the scope of work. Except for the oil and grease sample, there is no impact to the results because the measured concentrations of the parameters were greater than both the required and actual reporting limits. For oil and grease, it is possible that some of the "non-detectable" samples actually do contain low concentrations of oil and grease since the required reporting limit was not met. The oil and grease analysis was conducted for the North Shore Sanitary District sewer connection permit. The higher reporting limit should not impact that permit application since the NSSD discharge (to the sewer system) standard is 75 mg/L. The analytical results for all elutriate samples are below the discharge standard.

Table 1: Comparison of Required and Actual Obtained Reporting Limits

Parameter	Required Reporting Limit	Actual Reporting Limit
Sodium	100 ug/L	290 ug/L
Potassium	100 ug/L	160 ug/L
Ammonia	0.01 mg/L	0.2 mg/L
Phosphorus	0.02 mg/L	0.05 mg/L
Total Dissolved Solids	1 mg/L	10 mg/L
Total Suspended Solids	1 mg/L	10 mg/L
Total Volatile Solids	1 mg/L	5 mg/L
Oil and Grease	1 mg/L	5 mg/L

6. A number of metals blanks contained trace concentrations, including the arsenic, barium, cadmium, copper, lead, nickel, potassium, vanadium, zinc, and chromium VI blanks. Cyanide, phenolics and phosphorus blanks also contained trace concentrations. The low metals concentrations found by the laboratory in the blanks are not considered to have impacted data useability. The sample analytical data are consistent between samples and with settling times, indicating that the concentrations are not likely to have been impacted by the positive blanks. In addition, although methylene chloride was not measured in the blanks, the laboratory cautions that the low methylene chloride concentrations measured in the elutriate samples may be an artifact of the laboratory handling associated with generating the elutriate. The methylene chloride results are all below Lake Michigan water quality standards.

7. The laboratory duplicates, matrix spikes, matrix spike duplicates, and calibration standards for the pesticide samples were out of range for multiple samples and individual parameters. In particular, there were multiple problems for the gamma-chlordane measurements, and the 48 hour gamma-chlordane results should be considered suspect. The only positive gamma-chlordane results were for the 48 hour settling time samples, and the inconsistency between results further underscores the lack of confidence in these data. There were also some PCB

matrix spike/matrix spike duplicate and spike recovery problems, but since these affected Arochlors that were not previously found at Waukegan Harbor there is no impact on the elutriate sample results.

8. Some of the laboratory control samples for metals were slightly outside the acceptable range, but since the recoveries were close to the acceptable range, this is not considered to have impacted the results. Surrogate recoveries were within limits. Data are flagged appropriately in the laboratory results as well as in the summary table.

9. With the exception of the gamma-chlordane results, it is recommended that the data be accepted. The gamma-chlordane results are not consistent and due to laboratory data quality problems should not be used.

JENNIFER MILLER, PhD, PE
Environmental Engineering

Enclosures (2)

ENCLOSURE 1

DATA QUALITY ASSESSMENT WORKSHEET

Project Name: Waukegan Outer Harbor

Sample Medium: Sediment

Reviewer: Jennifer Miller

Review Date: October 25, 2006

Brief Description of Project: Dredging project. Data being reviewed are grain size and asbestos by Elutriator, TEM, PLM methods.

Objectives for Data Quality (See DQA Step 1):

Documents Reviewed (check all that apply):

- [X] Scope of Work
- [X] Quality Assurance Project Plan
- [X] Data Quality Objectives
- [ ] Other: _____

Level of Review Required:

- [X] Level 1: (100% of analytical data, 100% of lab QC data)
- [ ] Level 2: (20% of analytical data, 100% of lab QC data)
- [ ] Level 3: (Only summary data of the laboratory analysis are evaluated)
- [ ] Level 4: (No additional assessment of the data is performed. The internalreviews performed by the laboratory are judged adequate for the project.)
- [ ] Other: (_____% of analytical data, _____% of lab QC data)

Data Presence (See DQA Step 2):

Is all the requested data present? [X] Yes [ ] No (describe missing data) _____

Holding Times (See DQA Step 3):

Were all analyte specific holding times met? [X] Yes [ ] No (list exceeded holding times) _____

All asbestos and grain size samples were transported to the laboratory within 1 week and analyzed within 1 month.

Detection Limits (See DQA Step 4):

Were all required detection limits met? [X] Yes [ ] No (list exceeded detection limits and any explanation included in the lab report)

No DL for PLM, TEM, grain size results. Appropriate low level detection limits obtained for Elutriator results.

Field and Method Blanks (See DQA Step 5):

Were field and method blanks run at the required frequency? [X] Yes [ ] No (describe deficiencies) _____

Laboratory blank on elutriator asbestos only. No blanks on grain size, PLM and TEM asbestos.

Were any quantifiable concentrations detected in the blanks? [X] No [ ] Yes (which analytes were detected?) _____

DATA QUALITY ASSESSMENT WORKSHEET (Page 2)

Matrix Spikes / Matrix Spike Duplicates (See DQA Step 6):

Were the Matrix Spikes / Matrix Spike Duplicates run at the required frequency? ☐ Yes ☒ No (document any deficiencies)

Are the % recoveries within the limits established by the acceptance criteria? ☐ Yes ☒ No (document any deficiencies)

Are the relative % differences within the limits established by the acceptance criteria? ☐ Yes ☒ No (document any deficiencies)

No MS/MSD for physical samples. Laboratory blank run for elutriator asbestos.

Field and Laboratory Duplicates (See DQA Step 7):

Were the field and laboratory duplicates run at the required frequency? ☒ Yes ☐ No (document any deficiencies)

Were the relative % differences within the limits established by the acceptance criteria? ☒ Yes ☐ No (document any deficiencies)

Laboratory Control Samples (See DQA Step 8):

Were the laboratory control samples run at the required frequency? ☒ Yes ☐ No (document any deficiencies)

Were the % recoveries (or other measures such as response factor, where appropriate) within the limits established by the acceptance criteria?

☒ Yes ☐ No (document any deficiencies)

Surrogate Recoveries (See DQA Step 9):

Were the surrogate spikes run at the required frequency and with the correct analytes? ☐ Yes ☒ No (document any deficiencies)

Were the % recoveries within the limits established by the acceptance criteria? ☐ Yes ☒ No (document any deficiencies)

No surrogate samples, other than laboratory blanks.

Corrective Action Forms (See DQA Step 10):

Are corrective action forms present for all deficiencies identified in the above steps? ☒ Yes ☐ No (document any deficiencies)

Are corrective actions documented sufficient and appropriate? ☒ Yes ☐ No (document any deficiencies)

Related Laboratory Parameters (See DQA Step 11):

Are all related laboratory parameters logical and reasonable? (A more detailed discussion of this evaluation is found in the DQA Standard Operating Procedure) ☒ Yes ☐ No (document any deficiencies)

Reviewer's Recommendation (See DQA Step 12):

Based on the review items outlined here, acceptance of this data package is (circle one) **RECOMMENDED** **NOT RECOMMENDED**

Is the data acceptable for its intended use? ☒ Yes ☐ No

Reviewer's Signature:

If acceptance of the data package is not recommended, identify the deficiencies which must be corrected before the data package is accepted:

ENCLOSURE 2

DATA QUALITY ASSESSMENT WORKSHEET

Project Name: Waukegan Outer Harbor

Sample Medium: Elutriate (supernatant, water)

Reviewer: Jennifer Miller

Review Date: October 26, 2006

Brief Description of Project: Dredging project. Data being reviewed are elutriate data from sediment from Waukegan Outer harbor.

Elutriate samples were allowed to settle for multiple settling times.

Objectives for Data Quality (See DQA Step 1):

Documents Reviewed (check all that apply):

[X] Scope of Work [X] Quality Assurance Project Plan [X] Data Quality Objectives [ ] Other: _____

Level of Review Required:

[X] Level 1: (100% of analytical data, 100% of lab QC data)

[ ] Level 2: (20% of analytical data, 100% of lab QC data)

[ ] Level 3: (Only summary data of the laboratory analysis are evaluated)

[ ] Level 4: (No additional assessment of the data is performed. The internalreviews performed by the laboratory are judged adequate for the project.)

[ ] Other: (_____% of analytical data, _____% of lab QC data)

Data Presence (See DQA Step 2):

Is all the requested data present? [X] Yes [ ] No (describe missing data) _____

Holding Times (See DQA Step 3):

Were all analyte specific holding times met? [X] Yes [ ] No (list exceeded holding times) _____

Although holding times were met for low level mercury analysis, the first batch of samples arrived at the laboratory at 21.7 C, with ice still present. Because of the low concentrations involved and since mercury is a volatile metaloid, it is possible that the results could have been impacted. However, based on a comparison of that batch of sample results to the remaining mercury data, it is concluded that the sample shipping temperature did not impact the results.
Other sample holding times were less than 3 weeks, and most samples were held for less than 2 weeks prior to analysis.
Elutriate was generated within a week of sample receipt at the laboratory.

Detection Limits (See DQA Step 4):

Were all required detection limits met? [ ] Yes [X] No (list exceeded detection limits and any explanation included in the lab report)

The short settling time samples had high suspended solids concentrations that may have interferred with specific analyses; a few individual samples exceeded required reporting limits for a few parameters such as individual pesticides. Sodium and potassium both exceeded the required reporting limit of 100 ug/L, with RLs of 290 and 160 ug/L, respectively. This does not impact the results, since the measured concentrations are in the 1000's of ug/L (well above both the required RL and the actual RL.) Similarly, the actual RL for ammonia was 0.2 mg/L while the required was 0.01 mg/L, the actual RL for phosphorus was 0.05 mg/L while the required was 0.02 mg/L, the actual RLs for the TDS, TSS, and TVS were in the range of 5 - 10 mg/L while the required RL was 1 mg/L, and oil and grease had an actual RL of 5 mg/L while the required RL was 1 mg/L. The ammonia, phosphorus, and solids were all detectable at concentrations much greater than either the required or actual RL so there is no impact to the variance. However, oil and grease concentrations were around the actual RL and there may have been measurable oil and grease in some samples had the required RL been met.

DATA QUALITY ASSESSMENT WORKSHEET (Page 2)

Field and Method Blanks (See DQA Step 5):

Were field and method blanks run at the required frequency? [X] Yes [ ] No (describe deficiencies) _____

No field blanks. Lab blanks run for various methods (metals, semivol, volatiles, PCBs, pesticides).

Were any quantifiable concentrations detected in the blanks? [ ] No [X] Yes (which analytes were detected?) _____

Cyanide, arsenic, barium, cadmium, copper, lead, nickel, potassium, vanadium, zinc, phenolics, phosphorus, and chromium VI had detectable blank concentrations. The low metals in the blanks are not considered to have impacted data useability, and the sample analytical data are consistent between samples and with settling times indicating that the concentrations are probably not impacted by the positive blanks. The methylene chloride data are considered suspect, and may reflect laboratory contamination rather than actual concentrations in the samples. Data are flagged in the summary table.

Matrix Spikes / Matrix Spike Duplicates (See DQA Step 6):

Were the Matrix Spikes / Matrix Spike Duplicates run at the required frequency? [X] Yes [ ] No (document any deficiencies)

Are the % recoveries within the limits established by the acceptance criteria? [ ] Yes [X] No (document any deficiencies)

Are the relative % differences within the limits established by the acceptance criteria? [ ] Yes [X] No (document any deficiencies)

The pesticide results had recovery and calibration problems. In particular, calibration problems effected the gamma-chlordane results for the 48 hour settling time samples. The gamma-chlordane results in particular should be considered suspect.
The PCB samples had some MS/MSD and spike recovery problems for some arochlors. These problems do not impact the results since those problems were related to arochlors not previously found at Waukegan Harbor.

Field and Laboratory Duplicates (See DQA Step 7):

Were the field and laboratory duplicates run at the required frequency? [X] Yes [ ] No (document any deficiencies)

Were the relative % differences within the limits established by the acceptance criteria? [ ] Yes [X] No (document any deficiencies)

No field duplicates were run for the elutriate data. The lab duplicates were run at the required frequency, but the pesticide data showed relative high differences. This is related to the calibrations problems noted above. Because of the analytical problems, the pesticide data should not be considered to represent the actual conditions, particularly the gamma chlordane results.

Laboratory Control Samples (See DQA Step 8):

Were the laboratory control samples run at the required frequency? [X] Yes [ ] No (document any deficiencies)

Were the % recoveries (or other measures such as response factor, where appropriate) within the limits established by the acceptance criteria?
[ ] Yes [X] No (document any deficiencies)

Metals control samples had some recoveries outside the acceptable range. These are not considered to impact the results because the recoveries were close to the acceptable range.

Surrogate Recoveries (See DQA Step 9):

Were the surrogate spikes run at the required frequency and with the correct analytes? [X] Yes [ ] No (document any deficiencies)

Were the % recoveries within the limits established by the acceptance criteria? [X] Yes [ ] No (document any deficiencies)

Surrogate recoveries for the pesticide data were low.

Corrective Action Forms (See DQA Step 10):

Are corrective action forms present for all deficiencies identified in the above steps? [X] Yes [ ] No (document any deficiencies)

Are corrective actions documented sufficient and appropriate? [X] Yes [ ] No (document any deficiencies) _____

No corrective action was taken other than flagging the data and discussing the issues in the case narrative.

Related Laboratory Parameters (See DQA Step 11):

Are all related laboratory parameters logical and reasonable? (A more detailed discussion of this evaluation is found in the DQA Standard Operating Procedure) [X] Yes [ ] No (document any deficiencies) _____

Concentrations of sediment associated compounds decrease with increased settling time as expected. Ammonia and other dissolved constituents do not show impact of settling time, as expected.

Reviewer's Recommendation (See DQA Step 12):

Based on the review items outlined here, acceptance of this data package is (circle one) **RECOMMENDED** **NOT RECOMMENDED**

Is the data acceptable for its intended use? [X] Yes [ ] No

Reviewer's Signature: [signature]

If acceptance of the data package is not recommended, identify the deficiencies which must be corrected before the data package is accepted:

Recommended with exception of gamma chlordane results.