An Assessment of Sediment Injury in the Grand Calumet River, Indiana Harbor Canal, Indiana Harbor, and the Nearshore Areas of Lake Michigan

Volume II - Tables

Prepared for:

U.S. Fish and Wildlife Service
Bloomington Field Office
620 South Walker Street
Bloomington, Indiana 47403

Prepared – October 2000 – by:

Donald D. MacDonald
MacDonald Environmental Sciences Ltd.
2376 Yellow Point Road
Nanaimo, British Columbia
V9X 1W5

Christopher G. Ingersoll
Columbia Environmental Research Center
United States Geological Survey
4200 New Haven Road
Columbia, Missouri 65201

In Association with:
Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, Massachusetts
02140

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List of Acronyms

%	percent
10-d	10 days
12-d	12 days
14-d	14 days
15-min	15 minutes
20-d	20 days
2,3,7,8-TCDD	tetrachlorodibenzo-*p*-dioxin
28-d	28 days
30-min	30 minutes
48-h	48 hours
7-d	7 days
8-d	8 days
96-h	96 hours
AOC	Area of Concern
ARCS Program	Assessment and Remediation of Contaminated Sediments in the Great Lakes Program
ASTM	American Society for Testing and Materials
AVS	acid volatile sulfides
BSAF	biota-sediment bioaccumulation factor
CCBP	Central Corn Belt Plain
CCME	Canadian Council of Ministers of the Environment
CCREM	Canadian Council of Resource and Environment Ministers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601 et seq.
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CI	confidence interval
CSO	combined sewer overflow
DDTs	*p,p*'-DDT, *o,p*'-DDT, *p,p*'-DDE, *o,p*'-DDE, *p,p*'-DDD, *o,p*'-DDD, and any metabolite or degradation product
DELT	deformities, fin erosion, lesions, and tumors
DL	detection limit
DO	dissolved oxygen
DQO	data quality objective
DuPont	E.I. du Pont de Nemours
DW	dry weight
EB	east branch
EBGCR	East Branch of the Grand Calumet River
EBGCR-I	East Branch of the Grand Calumet River I
EBGCR-II	East Branch of the Grand Calumet River II

EC	Environment Canada
EC_{50}	median effective concentration
ECBP	Eastern Corn Belt Plain
EPT	Ephemeroptera, Plecoptera, Trichoptera
FIELDS	Fully Integrated Environmental Location Decision Support
gamma-BHC	gamma-hexachlorocyclohexane (lindane)
GCRL	Grand Calumet River Lagoons
GIS	geographic information system
HC	Health Canada
HNTB	Howard, Needles, Tammen and Bergendoff Architects, Engineers, and Planners
IBI	Index of biotic integrity
ID	insufficient data
IDEM	Indiana Department of Environmental Management
IEC	Industrial Economics, Inc.
IH	Indiana Harbor
IHC	Indiana Harbor Canal
IJC	International Joint Commission
IL	Illinois
IN	Indiana
LC_{50}	median lethal concentration
LEP	Little East Pond
LGB	Lake George Branch
LM	Lake Michigan
LTI	Limno-Tech, Inc.
LWP	Little West Pond
mean PEC-Q	mean probable effect concentration quotient
MESL	MacDonald Environmental Sciences Ltd.
mg	milligrams
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mIBI	macroinvertebrate index of biotic integrity
mm	millimeters
MS	Microsoft
n	number of samples
NA	not applicable (i.e., all <DL values were >PEC; therefore total was not calculated)
NA'	not applicable (i.e., toxicity test or chemical analyses not performed).
ND	not determined; compounds were measured as less than the detection limit, but the detection limit is unknown
ND'	not determined; toxicity not determined because mortality was > 40%
ND"	not determined; the lab considered sample to be a hazard to personnel
NE	northeast
NG	no guideline available

NH_3	unionized ammonia
NH_4^+	ionized ammonia
NIPSCO	Northern Indiana Public Service Company
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge and Elimination System
NR	not reported
NRDA	Natural Resource Damage Assessment
NT	not toxic
NW	northwest
NYSDEC	New York State Department of Environmental Conservation
OC	organic carbon
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	probable effect concentration (consensus-based)
PEC-Q	probable effect concentration quotient
QA/QC	quality assurance/quality control
QHEI	qualitative habitat evaluation index
RCRA	Resource Conservation and Recovery Act
RETEC	Remediation Technologies, Inc.
S.U.	standard unit
SAB	Science Advisory Board
SE	southeast
SEC	sediment effect concentration (consensus-based)
SEM	simultaneously extracted metals
SEM-AVS	simultaneously extracted metal minus acid volatile sulfides
SETAC	Society of Environmental Toxicology and Chemistry
SOD	sediment oxygen demand
SQG	sediment quality guideline
STP	sewage treatment plant
sum DDD	*p,p*'-DDD + *o,p*'-DDD
sum DDE	*p,p*'-DDE + *o,p*'-DDE
sum DDT	*p,p*'-DDT + *o,p*'-DDT
SVOC	semi-volatile organic chemical
SW	southwest
T	toxic
TEC	threshold effect concentration (consensus-based)
ThermoRetec	ThermoRetec Consulting Corporation
TOC	total organic carbon
Total DDT	*p,p*'-DDT, *o,p*'-DDT, *p,p*'-DDE, *o,p*'-DDE, *p,p*'-DDD, and *o,p*'-DDD
TRG	tissue residue guideline
U.S. Steel	United States Steel (Division of USX Corporation)
USACE	United States Army Corps of Engineers
USC	United States Canal

USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USS Lead	USS Lead Refinery, Inc.
VOC	volatile organic compound
WB	west branch
WBGCR	West Branch of the Grand Calumet River
WBGCR-I	West Branch of the Grand Calumet River I
WBGCR-II	West Branch of the Grand Calumet River II
WW	wet weight
WWTP	wastewater treatment plant
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmol/g	micromoles per gram

Tables

Chapter 3 - Study Approach

Table 3.1. Summary of the consensus-based SECs for the chemicals of concern in the Assessment Area (from MacDonald *et al.* 2000a).

Chemicals of Concern	Units	Consensus-Based TEC	Consensus-Based PEC
Metals			
Arsenic	mg/kg (DW)	9.79	33.0
Cadmium	mg/kg (DW)	0.99	4.98
Chromium	mg/kg (DW)	43.4	111
Copper	mg/kg (DW)	31.6	149
Lead	mg/kg (DW)	35.8	128
Mercury	mg/kg (DW)	0.18	1.06
Nickel	mg/kg (DW)	22.7	48.6
Zinc	mg/kg (DW)	121	459
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	µg/kg (DW)	6.71[1]	88.9[2]
Acenaphthylene	µg/kg (DW)	5.87[1]	128[2]
Anthracene	µg/kg (DW)	57.2	845
Fluorene	µg/kg (DW)	77.4	536
2-Methylnaphthalene	µg/kg (DW)	20.2[1]	201[2]
Naphthalene	µg/kg (DW)	176	561
Phenanthrene	µg/kg (DW)	204	1170
Benz(a)anthracene	µg/kg (DW)	108	1050
Dibenz(a,h)anthracene	µg/kg (DW)	33.0	135[2]
Benzo(a)pyrene	µg/kg (DW)	150	1450
Chrysene	µg/kg (DW)	166	1290
Fluoranthene	µg/kg (DW)	423	2230
Pyrene	µg/kg (DW)	195	1520
Total PAHs	µg/kg (DW)	1610	22800
Polychlorinated Biphenyls			
Total PCBs	µg/kg (DW)	59.8	676
Pesticides			
Chlordane	µg/kg (DW)	3.24	17.6
Dieldrin	µg/kg (DW)	1.90	61.8
sum DDD	µg/kg (DW)	4.88	28.0
sum DDE	µg/kg (DW)	3.16	31.3
sum DDT	µg/kg (DW)	4.16	62.9
Total DDT	µg/kg (DW)	5.28	572
Endrin	µg/kg (DW)	2.22	207
Heptachlor epoxide	µg/kg (DW)	2.47	16.0
Lindane (gamma-BHC)	µg/kg (DW)	2.37	4.99

[1]TEL from CCME (1999).

[2]PEL from CCME (1999).

DW = dry weight.

Table 3.2. Toxicity thresholds for chemicals of concern in pore water in the Assessment Area.

Chemicals of Concern	Units	Aquatic Plants		10-d LC_{50} for *Hyalella azteca*	Other Aquatic Invertebrates		Fish	
		Acute	Chronic		Acute	Chronic	Acute	Chronic
Metals								
Cadmium	µg/L	30 [6]	1 [6]	2.94	3.6 [6]	0.17 [6]	< 0.5 [6]	0.47 [6]
Chromium	µg/L	2500 [7]	NR	NR	15 [2]	2.5 [2]	265 [2]	73 [2]
Copper	µg/L	NR	1 [1]	35 [4]	20 [1]	8 [1]	21 [1]	3.9 [2]
Lead	µg/L	4140 [7]	450 [7]	< 16 [4]	124 [7]	1 [7]	448 [2]	3.5 [7]
Nickel	µg/L	300 [5]	50 [5]	780 [4]	102 [5]	15 [2]	50 [5]	25 [5]
Zinc	µg/L	20 [7]	2 [7]	73 [4]	51 [7]	10 [7]	280 [7]	10 [7]
Phenolics								
o-Chlorophenol	µg/L	NR	NR	NR	5600 [3]	NR	NR	NR
p-Chlorophenol	µg/L	NR	NR	NR	5600 [3]	NR	NR	NR
o-Cresol	µg/L	NR	NR	NR	100 [3]	NR	NR	NR
p-Cresol	µg/L	NR	NR	NR	100 [3]	NR	NR	NR
2,4-Dichlorophenol	µg/L	NR	NR	NR	520 [3]	NR	NR	NR
2,4-Dinitrophenol	µg/L	NR	NR	NR	NR	NR	NR	NR
Phenol	µg/L	NR	NR	NR	45 [3]	NR	NR	NR
Other Substances								
Unionized ammonia	mg/L	NR	NR	NR	0.53 [2]	NR	0.083 [2]	0.002 [2]

[1] Spear and Pierce (1979).
[2] CCREM (1987).
[3] USEPA (1992a).
[4] USEPA (1994).
[5] EC and HC (1994).
[6] Outridge *et al.* (1994).
[7] USGS (1998).
NR = not reported.

Table 3.3. Bioaccumulation-based SQGs for the chemicals of concern in the Assessment Area (from NYSDEC 1994).

Chemicals of Concern	Units	Wildlife-Based SQGs	Human Health-Based SQGs
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene	µg/kg (DW; OC)	NG	1300
Polychlorinated Biphenyls			
Total PCBs	µg/kg (DW; OC)	1400	0.8
Pesticides			
Chlordane	µg/kg (DW; OC)	6	1
Dieldrin	µg/kg (DW; OC)	NG	100
Total DDT	µg/kg (DW; OC)	1000	10
Endrin	µg/kg (DW; OC)	800	800
Heptachlor	µg/kg (DW; OC)	30	0.8
Heptachlor epoxide	µg/kg (DW; OC)	30	0.8
Lindane (gamma-BHC)	µg/kg (DW; OC)	1500	60
Mirex	µg/kg (DW; OC)	3700	70
Toxaphene	µg/kg (DW; OC)	NG	20
Dioxins			
2,3,7,8-TCDD	µg/kg (DW; OC)	0.2	10

NG = no guideline; DW = dry weight; OC = organic carbon.

Table 3.4. Tissue residue guidelines for the protection of piscivorus wildlife (from Newell *et al.* 1987).

Chemical of Concern	Units	Tissue Residue Guidelines (TRGs)			TRGs used in this Assessment
		Carcinogenic Criteria	*Non-Carcinogenic Criteria*		
		1 in 100 Cancer Risk Criteria	Birds	Mammals	
PCBs					
Total PCBs	µg/kg (WW)	110	110	130	110
Pesticides					
Chlordane	µg/kg (WW)	370	NG	500	370
Dieldrin + Aldrin	µg/kg (WW)	22	200	120	22
Endrin	µg/kg (WW)	NG	25	430	25
Heptachlor + Heptachlor epoxide	µg/kg (WW)	210	25	200	25
Lindane	µg/kg (WW)	510	100	2000	100
Mirex	µg/kg (WW)	370	2000	330	330
Total DDT	µg/kg (WW)	270	200	500	200
Dioxins					
2,3,7,8-TCDD	µg/kg (WW)	0.0023	NG	0.003	0.0023

NG = no guideline; WW = wet weight.

Table 3.5. Maximum background concentration of metals in Indiana and Illinois stream and lake sediments.

Chemicals of Concern	Units	Illinois [a]	Indiana [b]
Metals			
Cadmium	mg/kg (DW)	1.0	1.0
Chromium	mg/kg (DW)	23.0	50.0
Copper	mg/kg (DW)	60.0	20.0
Nickel	mg/kg (DW)	NR	21.0
Lead	mg/kg (DW)	38.0	150.0
Zinc	mg/kg (DW)	100.0	130.0

[a] Maximum background concentrations of metals in Illinois stream and lake sediments (Adams 1995). Values reported represent the mean plus four standard deviations.

[b] Maximum background concentrations of metals in Indiana stream and lake sediments (IDEM 1992).

NR = not reported; DW = dry weight.

Tables

Chapter 5 - Grand Calumet River Lagoons

Table 5.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in GCRL sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	84 of 178 (47%)	1 of 13 (7.7%)	NG	NG
Cadmium	4 of 201 (2.0%)	0 of 9 (0%)	NG	NG
Chromium	33 of 201 (16%)	0 of 13 (0%)	NG	NG
Copper	4 of 201 (2.0%)	0 of 13 (0%)	NG	NG
Lead	35 of 201 (17%)	0 of 13 (0%)	NG	NG
Mercury	3 of 201 (1.5%)	0 of 13 (0%)	NG	NG
Nickel	2 of 198 (1.0%)	0 of 13 (0%)	NG	NG
Zinc	18 of 196 (9.2%)	0 of 13 (0%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	37 of 37 (100%)	1 of 1 (100%)	NG	NG
Acenaphthylene	18 of 18 (100%)	1 of 1 (100%)	NG	NG
Anthracene	27 of 87 (31%)	1 of 3 (33%)	NG	NG
Benz(a)anthracene	52 of 155 (34%)	1 of 4 (25%)	NG	NG
Benzo(a)pyrene	51 of 167 (31%)	1 of 4 (25%)	NG	NG
Chrysene	55 of 163 (34%)	1 of 4 (25%)	NG	NG
Dibenz(a,h)anthracene	27 of 29 (93%)	0 of 0 (0%)	NG	NG
Fluoranthene	47 of 181 (26%)	1 of 4 (25%)	NG	NG
Fluorene	26 of 40 (65%)	1 of 1 (100%)	NG	NG
2-Methylnaphthalene	22 of 31 (71%)	1 of 1 (100%)	NG	NG
Naphthalene	39 of 80 (49%)	1 of 1 (100%)	NG	NG
Phenanthrene	51 of 163 (31%)	1 of 4 (25%)	NG	NG
Pyrene	59 of 176 (34%)	1 of 4 (25%)	NG	NG
Total PAHs	37 of 194 (19%)	1 of 4 (25%)	NG	NG
PCBs				
Total PCBs	14 of 40 (35%)	0 of 0 (0%)	29 of 29 (100%)	0 of 0 (0%)

Table 5.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in GCRL sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	7 of 18 (39%)	0 of 0 (0%)	14 of 14 (100%)	0 of 0 (0%)
sum DDD	12 of 26 (46%)	0 of 1 (0%)	NG	NG
sum DDE	18 of 32 (56%)	0 of 1 (0%)	NG	NG
sum DDT	10 of 32 (31%)	0 of 1 (0%)	NG	NG
Total DDTs	7 of 33 (21%)	0 of 1 (0%)	20 of 33 (61%)	0 of 1 (0%)
Dieldrin	0 of 33 (0%)	0 of 1 (0%)	NG	NG
Endrin	0 of 33 (0%)	0 of 1 (0%)	1 of 22 (4.5%)	0 of 1 (0%)
Heptachlor	NG	NG	0 of 1 (0%)	0 of 0 (0%)
Heptachlor epoxide	0 of 32 (0%)	0 of 1 (0%)	0 of 1 (0%)	0 of 0 (0%)
Lindane (gamma-BHC)	0 of 17 (0%)	0 of 1 (0%)	0 of 33 (0%)	0 of 1 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	NM

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no guideline (i.e., no PEC or bioaccumulative-based SQG available); NM = substance was not measured.

Table 5.2. Proportion of sediment samples with various chemical characteristics in the GCRL.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	**$ 0.1 - < 0.7**	**$ 0.7 - < 4.0**	**$ 4.0**	**$ 0.7**
Surficial Sediments						
West Lagoon						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	58	4 of 58 (6.9%)	23 of 58 (40%)	15 of 58 (26%)	16 of 58 (28%)	31 of 58 (53%)
Middle Lagoon						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	49	4 of 49 (8.2%)	36 of 49 (73%)	7 of 49 (14%)	2 of 49 (4.1%)	9 of 49 (18%)
East Lagoon						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	47	4 of 47 (8.5%)	29 of 47 (62%)	14 of 47 (30%)	0 of 47 (0%)	14 of 47 (30%)
Little West Pond						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	25	9 of 25 (36%)	14 of 25 (56%)	2 of 25 (8.0%)	0 of 25 (0%)	2 of 25 (8.0%)
Little East Pond						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	23	12 of 23 (52%)	11 of 23 (48%)	0 of 23 (0%)	0 of 23 (0%)	0 of 23 (0%)
Total (all years and locations)	**202**	**33 of 202 (16%)**	**113 of 202 (56%)**	**38 of 202 (19%)**	**18 of 202 (8.9%)**	**56 of 202 (28%)**

NA = not applicable.

Table 5.2. Proportion of sediment samples with various chemical characteristics in the GCRL.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	**$ 0.1 - < 0.7**	**$ 0.7 - < 4.0**	**$ 4.0**	**$ 0.7**
Sub-Surface Sediments						
West Lagoon						
Prior to 1996	5	3 of 5 (60%)	1 of 5 (20%)	0 of 5 (0%)	1 of 5 (20%)	1 of 5 (20%)
1996 and later	1	0 of 1 (0%)	1 of 1 (100%)	0 of 1 (0%)	0 of 1 (0%)	0 of 1 (0%)
Middle Lagoon						
Prior to 1996	3	3 of 3 (100%)	0 of 3 (0%)	0 of 3 (0%)	0 of 3 (0%)	0 of 3 (0%)
1996 and later	0	NA	NA	NA	NA	NA
East Lagoon						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	0	NA	NA	NA	NA	NA
Little West Pond						
Prior to 1996	2	1 of 2 (50%)	1 of 2 (50%)	0 of 2 (0%)	0 of 2 (0%)	0 of 2 (0%)
1996 and later	0	NA	NA	NA	NA	NA
Little East Pond						
Prior to 1996	2	2 of 2 (100%)	0 of 2 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 2 (0%)
1996 and later	0	NA	NA	NA	NA	NA
Total (all years and locations)	**13**	**9 of 13 (69%)**	**3 of 13 (23%)**	**0 of 13 (0%)**	**1 of 13 (7.7%)**	**1 of 13 (7.7%)**

NA = not applicable.

Table 5.3. Concentrations of chemicals of concern in pore water from GCRL sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)				
		10-d LC_{50} for *Hyalella azteca*[1]	Acute Threshold for Aquatic Invertebrates[2]	IH-20	IH-21	IH-22	IH-23	IH-24
Metals								
Cadmium	µg/L	2.9	NG	< 0.11	< 0.11	< 0.11	< 0.11	0.16 (0.06)
Chromium	µg/L	NG	NG	NM	NM	NM	NM	NM
Copper	µg/L	35	NG	5.35 (0.15)	3.29 (0.09)	3.24 (0.09)	15.95 (0.46)	6.03 (0.17)
Lead	µg/L	<16	NG	8.22	4.45	4.62	4.41	15.78
Nickel	µg/L	780	NG	2.78 (0.004)	1.91 (0.002)	1.82 (0.002)	2.35 (0.003)	4.63 (0.01)
Zinc	µg/L	73	NG	23.55 (0.32)	11.59 (0.16)	8.59 (0.12)	13.15 (0.18)	24.17 (0.33)
Sum Toxic Units[3]		NG	NG	0.474	0.252	0.212	0.643	0.57
Phenolics								
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM	NM	NM
o-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM
p-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM	NM	NM	NM
Phenol	µg/L	NG	45	NM	NM	NM	NM	NM
Other Substances								
Unionized ammonia	mg/L	NG	0.53	NM	0.01	0.01	<0.01	0.01

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for unionized ammonia were obtained from CCREM (1987).

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 5.4. Summary of the available information on the toxicity of sediments and elutriates from the GCRL.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
West Lagoon	8	5	63%
Middle Lagoon	3	1	33%
East Lagoon	1	0	0%
Little West Pond	0	NA	NA
Little East Pond	0	NA	NA
Total	**12**	**6**	**50%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of GCRL sediments included amphipod survival and growth in 10-d and 20-d tests with whole sediments; cladoceran survival in 7-d tests with whole sediments and 8-d tests with elutriate; and, fish survival and growth in 10-d tests with whole sediments and 12-d tests with elutriate.

NA = not applicable.

Table 5.5. Levels of TOC in GCRL sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
West Lagoon	57	4.05	0.420 - 38.1
Middle Lagoon	49	1.36	0.320 - 10.4
East Lagoon	47	1.45	0.380 - 13.0
Little West Pond	25	1.32	0.0200 - 9.11
Little East Pond	23	0.941	0.140 - 1.00
All Segments	**201**	**2.09**	**0.0200 - 38.1**
Sub-Surface Sediments			
West Lagoon	6	8.19	0.100 - 34.1
Middle Lagoon	3	0.233	0.100 - 0.400
East Lagoon	0	NA	NA
Little West Pond	0	NA	NA
Little East Pond	0	NA	NA
All Segments	**9**	**5.54**	**0.100 - 34.1**

NA = not applicable.

Table 5.6. Levels of oil and grease in GCRL sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
West Lagoon	3	2630	1000 - 3700
Middle Lagoon	1	4000	NA
East Lagoon	1	20000	NA
Little West Pond	NA	NA	NA
Little East Pond	NA	NA	NA
All Segments	**5**	**6380**	**1000 - 20000**
Sub-Surface Sediments			
West Lagoon	NA	NA	NA
Middle Lagoon	NA	NA	NA
East Lagoon	NA	NA	NA
Little West Pond	NA	NA	NA
Little East Pond	NA	NA	NA
All Segments	**NA**	**NA**	**NA**

NA = not applicable.

Table 5.7. Summary of the available information on the toxicity of sediments from the GCRL to fish.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
West Lagoon	5	1	20%
Middle Lagoon	2	0	0%
East Lagoon	0	NA	NA
Little West Pond	0	NA	NA
Little East Pond	0	NA	NA
Total	**7**	**1**	**14%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of GCRL sediments included fish survival and growth in 10-d tests with whole sediments and 12-d tests with elutriate.

NA = not applicable.

Table 5.8. Frequency of exceedance of TRGs in the GCRL.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	17 of 18 (94%)	18 of 18 (100%)	18 of 18 (100%)	NM	NM
Pesticides					
Endrin	NM	NM	NM	NM	NM
Chlordane	0 of 6 (0%)	0 of 8 (0%)	0 of 8 (0%)	NM	NM
Dieldrin + Aldrin	NM	0 of 2 (0%)	NM	NM	NM
Heptachlor + Heptachlor epoxide	NM	0 of 1 (0%)	NM	NM	NM
Lindane	NM	NM	NM	NM	NM
Mirex	NM	NM	NM	NM	NM
Total DDTs	0 of 7 (0%)	4 of 10 (40%)	0 of 9 (0%)	NM	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole body = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 5.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the GCRL.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediments							
West Lagoon	58	555	0.0556	23800	0.146	26.6	1.04
Middle Lagoon	49	0.941	0.0914	16.1	0.101	2.18	0.290
East Lagoon	47	0.558	0.0768	2.30	0.106	1.28	0.376
Little West Pond	25	0.326	0.0646	2.51	0.0937	0.425	0.178
Little East Pond	23	0.111	0.0639	0.220	0.0668	0.141	0.0995
Overall	**202**	**160**	**0.0556**	**23800**	**0.0925**	**3.19**	**0.289**
Sub-Surface Sediments							
West Lagoon	6	427	0.0185	2560	0.0185	0.317	0.0964
Middle Lagoon	3	0.0336	0.0147	0.06	0.0147	0.026	0.026
East Lagoon	0	NA	NA	NA	NA	NA	NA
Little West Pond	2	0.120	0.0675	0.172	NA	NA	NA
Little East Pond	2	0.0412	0.0334	0.049	NA	NA	NA
Overall	**13**	**197**	**0.0147**	**2560**	**0.0185**	**0.172**	**0.049**

NA = not applicable.

Tables

Chapter 6 - East Branch of the Grand Calumet River - I

Table 6.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in EBGCR-I sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	58 of 130 (45%)	53 of 94 (56%)	NG	NG
Cadmium	57 of 134 (43%)	33 of 94 (35%)	NG	NG
Chromium	92 of 134 (69%)	27 of 94 (29%)	NG	NG
Copper	71 of 128 (55%)	46 of 94 (49%)	NG	NG
Lead	122 of 142 (86%)	64 of 99 (65%)	NG	NG
Mercury	36 of 130 (28%)	38 of 94 (40%)	NG	NG
Nickel	73 of 128 (57%)	27 of 94 (29%)	NG	NG
Zinc	112 of 128 (88%)	57 of 94 (61%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	60 of 60 (100%)	28 of 30 (93%)	NG	NG
Acenaphthylene	48 of 48 (100%)	16 of 23 (70%)	NG	NG
Anthracene	68 of 80 (85%)	24 of 47 (51%)	NG	NG
Benz(a)anthracene	77 of 91 (85%)	29 of 55 (53%)	NG	NG
Benzo(a)pyrene	76 of 87 (87%)	29 of 55 (53%)	NG	NG
Chrysene	76 of 89 (85%)	28 of 55 (51%)	NG	NG
Dibenz(a,h)anthracene	52 of 58 (90%)	15 of 35 (43%)	NG	NG
Fluoranthene	76 of 93 (82%)	34 of 61 (56%)	NG	NG
Fluorene	64 of 74 (86%)	25 of 45 (56%)	NG	NG
2-Methylnaphthalene	21 of 22 (95%)	7 of 14 (50%)	NG	NG
Naphthalene	67 of 74 (91%)	31 of 53 (58%)	NG	NG
Phenanthrene	75 of 94 (80%)	35 of 61 (57%)	NG	NG
Pyrene	83 of 93 (89%)	37 of 61 (61%)	NG	NG
Total PAHs	79 of 98 (81%)	33 of 63 (52%)	NG	NG
PCBs				
Total PCBs	83 of 100 (83%)	22 of 39 (56%)	54 of 54 (100%)	16 of 16 (100%)

Table 6.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in EBGCR-I sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	15 of 25 (60%)	13 of 38 (34%)	12 of 12 (100%)	9 of 9 (100%)
sum DDD	4 of 26 (15%)	1 of 30 (3.3%)	NG	NG
sum DDE	11 of 32 (34%)	9 of 38 (24%)	NG	NG
sum DDT	9 of 65 (14%)	5 of 46 (11%)	NG	NG
Total DDTs	8 of 66 (12%)	8 of 47 (17%)	10 of 30 (33%)	2 of 22 (9.1%)
Dieldrin	8 of 66 (12%)	2 of 41 (4.9%)	NG	NG
Endrin	0 of 77 (0%)	0 of 42 (0%)	2 of 26 (7.7%)	1 of 25 (4.0%)
Heptachlor	NG	NG	5 of 5 (100%)	1 of 1 (100%)
Heptachlor epoxide	4 of 23 (17%)	0 of 31 (0%)	5 of 5 (100%)	0 of 0 (0%)
Lindane (gamma-BHC)	9 of 17 (53%)	6 of 25 (24%)	4 of 58 (6.9%)	1 of 39 (2.6%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	0 of 0 (0%)

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.

0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.

NG = no guideline (i.e., no PEC or bioaccumulative-based SQG available); NM = substance was not measured.

Table 6.2. Proportion of sediment samples with various chemical characteristics in the EBGCR-I.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments						
EB and WB Confluence to Kennedy Avenue						
Prior to 1996	6	0 of 6 (0%)	1 of 6 (17%)	2 of 6 (33%)	3 of 6 (50%)	5 of 6 (83%)
1996 and later	23	0 of 23 (0%)	6 of 23 (26%)	10 of 23 (43%)	7 of 23 (30%)	17 of 23 (74%)
USS Lead Canal						
Prior to 1996	17	0 of 17 (0%)	0 of 17 (0%)	1 of 17 (5.9%)	16 of 17 (94%)	17 of 17 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Kennedy Avenue to Cline Avenue						
Prior to 1996	6	0 of 6 (0%)	0 of 6 (0%)	0 of 6 (0%)	6 of 6 (100%)	6 of 6 (100%)
1996 and later	45	0 of 45 (0%)	3 of 45 (6.7%)	20 of 45 (44%)	22 of 45 (49%)	42 of 45 (93%)
Cline Avenue to Cline/I-90 Ramps						
Prior to 1996	7	0 of 7 (0%)	0 of 7 (0%)	4 of 7 (57%)	3 of 7 (43%)	7 of 7 (100%)
1996 and later	8	0 of 8 (0%)	1 of 8 (13%)	3 of 8 (38%)	4 of 8 (50%)	7 of 8 (88%)
Cline/I-90 Ramps to Industrial Highway						
Prior to 1996	6	0 of 6 (0%)	0 of 6 (0%)	3 of 6 (50%)	3 of 6 (50%)	6 of 6 (100%)
1996 and later	15	0 of 15 (0%)	0 of 15 (0%)	4 of 15 (27%)	11 of 15 (73%)	15 of 15 (100%)
Industrial Highway to ConRail Bridge						
Prior to 1996	3	0 of 3 (0%)	0 of 3 (0%)	3 of 3 (100%)	0 of 3 (0%)	3 of 3 (100%)
1996 and later	9	0 of 9 (0%)	0 of 9 (0%)	4 of 9 (44%)	5 of 9 (56%)	9 of 9 (100%)
EB Wetland						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	17	1 of 17 (5.9%)	2 of 17 (12%)	6 of 17 (35%)	8 of 17 (47%)	14 of 17 (82%)
Total (all years and locations)	**162**	**1 of 162 (0.6%)**	**13 of 162 (21%)**	**60 of 162 (37%)**	**88 of 162 (54%)**	**148 of 162 (91%)**

Table 6.2. Proportion of sediment samples with various chemical characteristics in the EBGCR-I.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Sub-Surface Sediments						
EB and WB Confluence to Kennedy Avenue						
Prior to 1996	3	0 of 3 (0%)	1 of 3 (33%)	2 of 3 (67%)	0 of 3 (0%)	2 of 3 (67%)
1996 and later	15	1 of 15 (7%)	3 of 15 (20%)	7 of 15 (47%)	4 of 15 (27%)	11 of 15 (73%)
USS Lead Canal						
Prior to 1996	9	0 of 9 (0%)	0 of 9 (0%)	0 of 9 (0%)	9 of 9 (100%)	9 of 9 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Kennedy Avenue to Cline Avenue						
Prior to 1996	7	1 of 7 (14%)	1 of 7 (14%)	1 of 7 (14%)	4 of 7 (57%)	5 of 7 (71%)
1996 and later	47	6 of 47 (13%)	10 of 47 (21%)	12 of 47 (26%)	19 of 47 (40%)	31 of 47 (66%)
Cline Avenue to Cline/I-90 Ramps						
Prior to 1996	4	0 of 4 (0%)	0 of 4 (0%)	3 of 4 (75%)	1 of 4 (25%)	4 of 4 (100%)
1996 and later	3	1 of 3 (33%)	2 of 3 (67%)	0 of 3 (0%)	0 of 3 (0%)	0 of 3 (0%)
Cline/I-90 Ramps to Industrial Highway						
Prior to 1996	5	0 of 5 (0%)	0 of 5 (0%)	2 of 5 (40%)	3 of 5 (60%)	5 of 5 (100%)
1996 and later	7	1 of 7 (14%)	3 of 7 (43%)	3 of 7 (43%)	0 of 7 (0%)	3 of 7 (43%)
Industrial Highway to ConRail Bridge						
Prior to 1996	2	0 of 2 (0%)	1 of 2 (50%)	0 of 2 (0%)	1 of 2 (50%)	1 of 2 (50%)
1996 and later	4	0 of 4 (0%)	0 of 4 (0%)	2 of 4 (50%)	2 of 4 (50%)	4 of 4 (100%)
EB Wetland						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	1	0 of 1 (0%)	1 of 1 (100%)	0 of 1 (0%)	0 of 1 (0%)	0 of 1 (0%)
Total (all years and locations)	**107**	**10 of 107 (9.3%)**	**22 of 107 (21%)**	**32 of 107 (30%)**	**43 of 107 (40%)**	**75 of 107 (70%)**

NA = not applicable.

Table 6.3. Concentrations of chemicals of concern in pore water from EBGCR-I sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)						
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	IH-02	IH-03	IH-04	IH-05	IH-06	IH-07	IH-08
Metals										
Cadmium	µg/L	2.9	NR	< 0.12	< 0.12	< 0.12	< 0.12	20.42 (7.04)	< 0.12	0.58 (0.20)
Chromium	µg/L	NR	NR	NR	NR	NR	NR	NR	NR	NR
Copper	µg/L	35	NR	6.98 (0.20)	3.19 (0.09)	1.4 (0.04)	1.66 (0.05)	755.5 (21.59)	5 (0.14)	28.68 (0.82)
Lead	µg/L	<16	NR	1.58	8.30	7.37	1.56	2080.00	10.31	107.62
Nickel	µg/L	780	NR	14.47 (0.02)	6.08 (0.01)	5.28 (0.01)	4.24 (0.01)	135.79 (0.17)	14.83 (0.02)	5.97 (0.01)
Zinc	µg/L	73	NR	< 4.4	< 4.4	20.77 (0.28)	< 4.4	2480 (33.97)	< 4.4	81.44 (1.12)
Sum Toxic Units[3]		NR	NR	0.22	0.10	0.33	0.06	62.77	0.16	2.15
Phenolics										
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM	NM	NM	NM	NM
o-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM	NM	NM
p-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NR	NM	NM	NM	NM	NM	NM	NM
Phenol	µg/L	NG	45	NM	NM	NM	NM	NM	NM	NM
Other Substances										
Unionized ammonia	mg/L	NG	0.53	0.10	0.05	0.06	0.02	6.61	0.04	0.01

Table 6.3. Concentrations of chemicals of concern in pore water from EBGCR-I sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)						
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	IH-09	IH-10	IH-11	IH-12	IH-15	IH-15D	IH-16
Metals										
Cadmium	µg/L	2.9	NR	0.69 (0.24)	1.29 (0.44)	< 0.12	< 0.12	< 0.12	2.73 (0.94)	< 0.11
Chromium	µg/L	NR	NR	NR	NR	NR	NR	NR	NR	NR
Copper	µg/L	35	NR	21.77 (0.62)	37.73 (1.08)	< 0.65	10.65 (0.30)	2.77 (0.08)	141.63 (4.05)	< 0.51
Lead	µg/L	<16	NR	9.08	257.95	0.28	30.23	5.15	470.95	< 0.4
Nickel	µg/L	780	NR	13.88 (0.02)	29.75 (0.04)	< 0.69	5.24 (0.01)	6.3 (0.01)	75 (0.10)	3.72 (0.005)
Zinc	µg/L	73	NR	31.07 (0.43)	390.87 (5.35)	< 4.4	49.55 (0.68)	< 4.4	1410 (19.32)	< 8.0
Sum Toxic Units[3]		NR	NR	1.31	6.91	ND	0.99	0.09	24.41	0.01
Phenolics										
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM	NM	NM	NM	NM
o-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM	NM	NM
p-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NR	NM	NM	NM	NM	NM	NM	NM
Phenol	µg/L	NG	45	NM	NM	NM	NM	NM	NM	NM
Other Substances										
Unionized ammonia	mg/L	NG	0.53	<0.01	0.04	NM	0.01	NM	NM	0.01

Table 6.3. Concentrations of chemicals of concern in pore water from EBGCR-I sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)		Sample Site (Hoke *et al.* 1993)			
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	IH-17	IH-18	UG-3	UG-4	UG-5	UG-6
Metals									
Cadmium	µg/L	2.9	NG	< 0.11	14.43 (4.98)	<10	<5	<10	<10
Chromium	µg/L	NG	NG	NM	NM	<10	<10	<10	<10
Copper	µg/L	35	NG	1.44 (0.04)	143.03 (4.09)	180 (5.14)	61 (1.74)	17 (0.49)	7 (0.20)
Lead	µg/L	<16	NG	0.59	< 0.4	23	<20	<20	<20
Nickel	µg/L	780	NG	8.41 (0.01)	99.54 (0.13)	<100	<100	<100	<100
Zinc	µg/L	73	NG	< 8.0	104.67 (1.43)	28 (0.38)	134 (1.84)	7 (0.10)	490 (6.71)
Sum Toxic Units[3]		NG	NG	0.05	10.63	5.52	3.58	0.59	6.91
Phenolics									
o-Chlorophenol	µg/L	NG	5600	NM	NM	21.6	5.2	63.2	5.8
p-Chlorophenol	µg/L	NG	5600	NM	NM	0.9	0.2	5.9	1.3
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	14.6	15.5	7.4	14.3
o-Cresol	µg/L	NG	100	NM	NM	4.8	3.7	12.6	0.8
p-Cresol	µg/L	NG	100	NM	NM	6.3	6.2	16.2	2.5
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM	26.0	7.3	34.4	15.8
Phenol	µg/L	NG	45	NM	NM	189.9	27.8	256.6	207.1
Other Substances									
Unionized ammonia	mg/L	NG	0.53	0.03	<0.01	1.4	5.3	0.5	0.8

[1] The 10-d LC_{50} concentrations for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 6.4. Summary of the available information on the toxicity of sediments and pore water from the EBGCR-I.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
EB and WB Confluence to Kennedy Avenue	3	3	100%
USS Lead Canal	0	NA	NA
Kennedy Avenue to Cline Avenue	4	3	75%
Cline Avenue to Cline/I-90 Ramps	8	3	38%
Cline/I-90 Ramps to Industrial Highway	16	12	75%
Industrial Highway to ConRail Bridge	6	6	100%
EB Wetland	7	5	71%
Total	**44**	**32**	**73%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of EBGCR-I sediments included amphipod survival and growth in 10-d and 96-h with whole sediments; midge survival and growth in 10-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; 30 min Microtox with pore water; and, fish survival in 96-h tests with whole sediments.

NA = not applicable.

Table 6.5. Status of benthic invertebrate communities in the EBGCR-I.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Artificial Substrate										
Simon *et al.* (2000)	7	26.5	0.0	48.0	0.0	0.6	6.1	0.0	1.40	Altered
IDEM (2000a)	Kennedy Avenue	63.9	0.0	3.8	0.0	17.7	12.3	0.0	2.1	Altered
Simon *et al.* (2000)	5a	59.9	0.0	29.8	0.0	0.0	2.6	0.5	1.13	Altered
IDEM (2000a)	Cline Avenue	47.6	0.0	19.2	0.2	26.5	6.2	0.0	2.4	Altered
Simon *et al.* (2000)	4	57.9	0.0	19.5	0.1	1.6	19.0	0.0	1.67	Altered
Simon *et al.* (2000)	3	59.8	0.0	37.2	0.2	0.1	1.6	0.2	1.13	Altered
Simon *et al.* (2000)	2	32.9	0.0	57.1	0.1	8.1	1.2	0.0	0.87	Altered
Sobiech *et al.* (1994)	Transect 36	0.8	0.5	89.2	0.5	8.7	0.0	0.0	ND	Altered
Simon *et al.* (2000)	1	65.0	0.0	33.2	0.2	0.0	0.8	0.2	0.87	Altered
Simon *et al.* (2000)	8	77.1	0.0	8.6	0.2	5.0	5.1	0.0	0.53	Altered
Grab										
Polls *et al.* (1993)	2-82	98.2	0.2	0.3	0.0	0.1	1.2	0.0	ND	Altered
Polls *et al.* (1993)	2-86	99.2	0.3	0.2	0.0	0.0	0.3	0.0	ND	Altered
Polls *et al.* (1993)	3-86	78.0	1.1	1.5	0.0	14.9	4.2	0.0	ND	Altered
Polls *et al.* (1993)	3-82	97.2	1.3	0.9	0.0	0.4	0.0	0.0	ND	Altered
Percent Altered Samples										**100% (14 of 14)**

[1] Reported values are percent of total abundance of invertebrates.

ND = not determined.

Table 6.6. Levels of TOC in EBGCR-I sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
EB and WB Confluence to Kennedy Avenue	22	4.66	0.320 - 15.9
USS Lead Canal	0	NA	NA
Kennedy Avenue to Cline Avenue	44	2.87	0.340 - 14.3
Cline Avenue to Cline/I-90 Ramps	8	6.17	1.80 - 12.5
Cline/I-90 Ramps to Industrial Highway	15	8.43	3.10 - 13.0
Industrial Highway to ConRail Bridge	8	3.97	0.340 - 9.00
EB Wetland	16	8.44	0.170 - 14.0
All Segments	**113**	**5.06**	**0.170 - 15.9**
Sub-Surface Sediments			
EB and WB Confluence to Kennedy Avenue	16	2.89	0.550 - 8.50
USS Lead Canal	0	NA	NA
Kennedy Avenue to Cline Avenue	51	2.63	0.140 - 14.0
Cline Avenue to Cline/I-90 Ramps	5	3.05	0.230 - 4.85
Cline/I-90 Ramps to Industrial Highway	10	4.38	0.320 - 10.0
Industrial Highway to ConRail Bridge	6	7.88	1.50 - 13.0
EB Wetland	1	5.10	NA
All Segments	**89**	**3.28**	**0.140 - 14.0**

NA = not applicable.

Table 6.7. Levels of oil and grease in EBGCR-I sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
EB and WB Confluence to Kennedy Avenue	18	25900	500 - 133000
USS Lead Canal	NA	NA	NA
Kennedy Avenue to Cline Avenue	39	31100	1300 - 147000
Cline Avenue to Cline/I-90 Ramps	5	24200	1400 - 66400
Cline/I-90 Ramps to Industrial Highway	10	3190	15500 - 63600
Industrial Highway to ConRail Bridge	5	34700	3000 - 64400
EB Wetland	15	26700	600 - 101000
All Segments	**92**	**29300**	**500 - 147000**
Sub-Surface Sediments			
included fish survival in 96-h tests with whole sedimen	15	19400	300 - 52200
USS Lead Canal	NA	NA	NA
Kennedy Avenue to Cline Avenue	46	20700	<730 - 93600
Cline Avenue to Cline/I-90 Ramps	3	800	200 - 1400
Cline/I-90 Ramps to Industrial Highway	7	11700	300 - 39100
Industrial Highway to ConRail Bridge	4	15200	3100 - 28900
EB Wetland	1	4200	NA
All Segments	**76**	**18400**	**200 - 93600**

NA = not applicable.

Table 6.8. Summary of the available information on the toxicity of sediments and elutriates from the EBGCR-I to fish.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
EB and WB Confluence to Kennedy Avenue	0	NA	NA
USS Lead Canal	0	NA	NA
Kennedy Avenue to Cline Avenue	2	1	50%
Cline Avenue to Cline/I-90 Ramps	6	1	17%
Cline/I-90 Ramps to Industrial Highway	11	7	64%
Industrial Highway to ConRail Bridge	4	4	100%
EB Wetland	0	NA	NA
Total	**23**	**13**	**57%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoint that was used to evaluate the toxicity of EBGCR-I sediments included fish survival in 96-h tests with whole sediments.

NA = not applicable.

Table 6.9. Frequency of exceedance of TRGs in the EBGCR-I.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	6 of 6 (100 %)	8 of 10 (80%)	NM	6 of 6 (100 %)	NM
Pesticides					
Chlordane	0 of 6 (0 %)	1 of 10 (10 %)	NM	0 of 6 (0 %)	NM
Dieldrin + Aldrin	1 of 6 (17 %)	3 of 8 (38 %)	NM	0 of 6 (0 %)	NM
Endrin	0 of 6 (0 %)	1 of 7 (14 %)	NM	0 of 6 (0 %)	NM
Heptachlor + Heptachlor epoxide	0 of 6 (0 %)	0 of 8 (0 %)	NM	0 of 6 (0 %)	NM
Lindane	0 of 5 (0%)	0 of 8 (0%)	NM	0 of 6 (0 %)	NM
Mirex	NM	NM	NM	0 of 6 (0 %)	NM
Total DDTs	2 of 6 (33 %)	5 of 10 (50%)	NM	0 of 6 (0 %)	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole body = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 6.10. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the EBGCR-I.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediments							
EB and WB Confluence to Kennedy Avenue	29	8.34	0.112	77.4	0.255	25.9	2.88
USS Lead Canal	17	27.7	3.60	72.6	5.45	65.3	13.0
Kennedy Avenue to Cline Avenue	51	7.20	0.457	58.2	1.20	12.3	4.61
Cline Avenue to Cline/I-90 Ramps	15	4.59	0.104	12.1	1.31	7.29	3.73
Cline/I-90 Ramps to Industrial Highway	21	28.9	0.71	184	2.12	45.4	5.94
Industrial Highway to ConRail Bridge	12	36.8	1.92	357	2.24	18.9	3.58
EB Wetland	17	3.99	0.0655	15.7	0.208	6.88	3.23
Overall	**162**	**14.0**	**0.0655**	**357**	**0.875**	**30.3**	**4.58**
Sub-Surface Sediments							
EB and WB Confluence to Kennedy Avenue	18	3.51	0.0692	13.1	0.193	8.30	2.77
USS Lead Canal	9	24.2	5.64	80.8	5.64	54.4	12.1
Kennedy Avenue to Cline Avenue	54	16.9	0.0286	497	0.0887	16.9	3.06
Cline Avenue to Cline/I-90 Ramps	7	1.47	0.0555	4.20	0.0555	2.63	1.21
Cline/I-90 Ramps to Industrial Highway	12	3.55	0.0847	13.6	0.123	5.50	2.78
Industrial Highway to ConRail Bridge	6	18.6	0.593	99.1	0.593	5.15	2.98
EB Wetland	1	0.627	0.627	0.627	NA	NA	NA
Overall	**107**	**12.7**	**0.0286**	**497**	**0.107**	**16.9**	**2.98**

NA = not applicable.

Tables

Chapter 7 - East Branch of the Grand Calumet River - II

Table 7.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in EBGCR-II sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	20 of 85 (24%)	8 of 29 (28%)	NG	NG
Cadmium	21 of 95 (22%)	9 of 29 (31%)	NG	NG
Chromium	19 of 95 (20%)	5 of 29 (17%)	NG	NG
Copper	11 of 93 (12%)	7 of 29 (24%)	NG	NG
Lead	55 of 95 (58%)	21 of 29 (72%)	NG	NG
Mercury	9 of 93 (9.7%)	10 of 29 (34%)	NG	NG
Nickel	10 of 93 (11%)	2 of 29 (7%)	NG	NG
Zinc	52 of 91 (57%)	20 of 29 (69%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	49 of 49 (100%)	29 of 29 (100%)	NG	NG
Acenaphthylene	40 of 42 (95%)	28 of 28 (100%)	NG	NG
Anthracene	42 of 67 (63%)	29 of 29 (100%)	NG	NG
Benz(a)anthracene	55 of 91 (60%)	33 of 33 (100%)	NG	NG
Benzo(a)pyrene	55 of 93 (59%)	31 of 33 (94%)	NG	NG
Chrysene	54 of 92 (59%)	33 of 33 (100%)	NG	NG
Dibenz(a,h)anthracene	25 of 26 (96%)	9 of 9 (100%)	NG	NG
Fluoranthene	54 of 97 (56%)	31 of 33 (94%)	NG	NG
Fluorene	45 of 49 (92%)	29 of 29 (100%)	NG	NG
2-Methylnaphthalene	11 of 13 (85%)	NM	NG	NG
Naphthalene	54 of 66 (82%)	32 of 33 (97%)	NG	NG
Phenanthrene	57 of 97 (59%)	33 of 33 (100%)	NG	NG
Pyrene	59 of 97 (61%)	33 of 33 (100%)	NG	NG
Total PAHs	49 of 98 (50%)	33 of 33 (100%)	NG	NG
PCBs				
Total PCBs	51 of 53 (96%)	15 of 16 (94%)	46 of 46 (100%)	12 of 12 (100%)

Table 7.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in EBGCR-II sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	4 of 4 (100%)	4 of 4 (100%)	2 of 2 (100%)	0 of 0 (0%)
sum DDD	2 of 12 (17%)	0 of 0 (0%)	NG	NG
sum DDE	6 of 10 (60%)	4 of 4 (100%)	NG	NG
sum DDT	4 of 16 (25%)	3 of 4 (75%)	NG	NG
Total DDTs	4 of 21 (19%)	4 of 4 (100%)	6 of 17 (35%)	0 of 0 (0%)
Dieldrin	4 of 51 (7.8%)	3 of 4 (75%)	NG	NG
Endrin	0 of 57 (0%)	NM	0 of 28 (0%)	NM
Heptachlor	NG	NG	2 of 2 (100%)	0 of 0 (0%)
Heptachlor epoxide	1 of 37 (2.7%)	NM	0 of 0 (0%)	NM
Lindane (gamma-BHC)	4 of 35 (11%)	4 of 4 (100%)	1 of 37 (2.7%)	0 of 0 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	0 of 0 (0%)

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no guideline (i.e., no PEC or bioaccumulative-based SQG available); NM = substance was not measured.

Table 7.2. Proportion of sediment samples with various chemical characteristics in the EBGCR-II.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments						
ConRail Bridge to Bridge Street						
Prior to 1996	6	0 of 6 (0%)	0 of 6 (0%)	0 of 6 (0%)	6 of 6 (100%)	6 of 6 (100%)
1996 and later	2	0 of 2 (0%)	0 of 2 (0%)	0 of 2 (0%)	2 of 2 (100%)	2 of 2 (100%)
Bridge Street to Grant Street						
Prior to 1996	6	0 of 6 (0%)	0 of 6 (0%)	1 of 6 (17%)	5 of 6 (83%)	6 of 6 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Grant Street to I-90						
Prior to 1996	3	0 of 3 (0%)	0 of 3 (0%)	0 of 3 (0%)	3 of 3 (100%)	3 of 3 (100%)
1996 and later	0	NA	NA	NA	NA	NA
I-90 to Broadway						
Prior to 1996	9	0 of 9 (0%)	0 of 9 (0%)	3 of 9 (33%)	6 of 9 (67%)	9 of 9 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Broadway to Virginia Street						
Prior to 1996	4	0 of 4 (0%)	0 of 4 (0%)	1 of 4 (25%)	3 of 4 (75%)	4 of 4 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Virginia Street to Tennessee Street						
Prior to 1996	4	0 of 4 (0%)	0 of 4 (0%)	0 of 4 (0%)	4 of 4 (100%)	4 of 4 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Tennessee Street to GCRL Culvert						
Prior to 1996	9	0 of 9 (0%)	0 of 9 (0%)	3 of 9 (33%)	6 of 9 (67%)	9 of 9 (100%)
1996 and later	0	NA	NA	NA	NA	NA
EB Wetland						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	55	10 of 55 (18%)	27 of 55 (49%)	16 of 55 (29%)	2 of 55 (3.6%)	18 of 55 (33%)
Total (all years and locations)	**98**	**10 of 98 (10%)**	**27 of 98 (28%)**	**24 of 98 (24%)**	**37 of 98 (38%)**	**61 of 98 (62%)**

Table 7.2. Proportion of sediment samples with various chemical characteristics in the EBGCR-II.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Sub-Surface Sediments						
ConRail Bridge to Bridge Street						
Prior to 1996	9	0 of 9 (0%)	0 of 9 (0%)	3 of 9 (33%)	6 of 9 (67%)	9 of 9 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Bridge Street to Grant Street						
Prior to 1996	4	0 of 4 (0%)	0 of 4 (0%)	1 of 4 (25%)	3 of 4 (75%)	4 of 4 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Grant Street to I-90						
Prior to 1996	4	0 of 4 (0%)	0 of 4 (0%)	2 of 4 (50%)	2 of 4 (50%)	4 of 4 (100%)
1996 and later	0	NA	NA	NA	NA	NA
I-90 to Broadway						
Prior to 1996	6	0 of 6 (0%)	0 of 6 (0%)	1 of 6 (17%)	5 of 6 (83%)	6 of 6 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Broadway to Virginia Street						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	0	NA	NA	NA	NA	NA
Virginia Street to Tennessee Street						
Prior to 1996	3	0 of 3 (0%)	0 of 3 (0%)	0 of 3 (0%)	3 of 3 (100%)	3 of 3 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Tennessee Street to GCRL Culvert						
Prior to 1996	7	0 of 7 (0%)	0 of 7 (0%)	1 of 7 (14%)	6 of 7 (86%)	7 of 7 (100%)
1996 and later	0	NA	NA	NA	NA	NA
EB Wetland						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	0	NA	NA	NA	NA	NA
Total (all years and locations)	**33**	**0 of 33 (0%)**	**0 of 33 (0%)**	**8 of 33 (24%)**	**25 of 33 (76%)**	**33 of 33 (100%)**

NA = not applicable.

Table 7.3. Concentrations of chemicals of concern in pore water from EBGCR-II sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (Hoke *et al.* 1993)	
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	UG-1	UG-2
Metals					
Cadmium	µg/L	2.9	NG	<5	<5
Chromium	µg/L	NG	NG	<10	<10
Copper	µg/L	35	NG	<5	60 (1.71)
Lead	µg/L	<16	NG	<20	54
Nickel	µg/L	780	NG	<100	<100
Zinc	µg/L	73	NG	19 (0.26)	106 (1.45)
Sum Toxic Units[3]		NG	NG	0.26	3.16
Phenolics					
o-Chlorophenol	µg/L	NG	5600	23.5	13.5
p-Chlorophenol	µg/L	NG	5600	1.4	0.7
2,4-Dichlorophenol	µg/L	NG	520	16.5	5.7
2,4-Dinitrophenol	µg/L	NG	NR	23.1	15.4
o-Cresol	µg/L	NG	100	4.7	4.0
p-Cresol	µg/L	NG	100	8.3	0.3
Phenol	µg/L	NG	45	226.1	50.3
Other Substances					
Unionized ammonia	mg/L	NG	0.53	8.1	0.2

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline

Table 7.4. Summary of the available information on the toxicity of sediments and pore water from the EBGCR-II.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
ConRail Bridge to Bridge Street	9	8	89%
Bridge Street to Grant Street	3	3	100%
Grant Street to I-90	3	2	67%
I-90 to Broadway	10	8	80%
Broadway to Virginia Street	6	5	83%
Virginia Street to Tennessee Street	3	3	100%
Tennessee Street to GCRL Culvert	18	17	94%
EB Wetland	0	NA	NA
Total	**52**	**46**	**88%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of EBGCR-II sediments included amphipod survival in 10-d and 96-h tests with whole sediments; midge growth in 10-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; 30-min Microtox with pore water; and, fish survival in 96-h tests with whole sediments.

NA = not applicable

Table 7.5. Status of benthic invertebrate communities in the EBGCR-II.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Artificial Substrate										
Sobiech *et al* . (1994)	Transect 32	23.3	20.0	10.0	0.0	46.7	0.0	0.0	ND	Altered
IDEM (2000a)	Bridge Street	80.4	0.0	11.2	0.4	5.6	0.7	0.0	1.3	Altered
Sobiech *et al* . (1994)	Transect 24	13.2	21.0	60.5	0.0	5.3	0.0	0.0	ND	Altered
Sobiech *et al* . (1994)	Transect 16	0.0	0.0	37.3	0.0	61.4	1.2	0.0	ND	Altered
Sobiech *et al* . (1994)	Transect 5	4.2	0.0	70.8	0.0	24.0	0.0	0.0	ND	Altered
Percent Altered Samples										**100% (5 of 5)**

[1] Reported values are percent of total abundance of invertebrates.

ND = not determined.

Table 7.6. Levels of TOC in EBGCR-II sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
ConRail Bridge to Bridge Street	6	4.61	2.23 - 6.40
Bridge Street to Grant Street	4	3.99	1.60 - 6.45
Grant Street to I-90	3	3.73	3.30 - 4.40
I-90 to Broadway	8	4.34	2.10 - 11.0
Broadway to Virginia Street	4	1.97	1.20 - 2.70
Virginia Street to Tennessee Street	4	11.0	2.30 - 16.7
Tennessee Street to GCRL Culvert	8	10.4	2.20 - 28.1
EB Wetland	54	1.02	0.0400 - 1.70
All Segments	**91**	**3.08**	**0.0400 - 28.1**
Sub-Surface Sediments			
ConRail Bridge to Bridge Street	9	3.30	1.55 - 4.80
Bridge Street to Grant Street	4	3.61	1.60 - 4.85
Grant Street to I-90	4	2.38	1.20 - 3.70
I-90 to Broadway	4	2.90	1.60 - 5.10
Broadway to Virginia Street	0	NA	NA
Virginia Street to Tennessee Street	3	2.96	1.30 - 5.79
Tennessee Street to GCRL Culvert	5	5.86	1.20 - 12.0
EB Wetland	0	NA	NA
All Segments	**29**	**3.57**	**1.20 - 12.0**

NA = not applicable.

Table 7.7. Summary of the available information on the toxicity of sediments from the EBGCR-II to fish.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
ConRail Bridge to Bridge Street	6	5	83%
Bridge Street to Grant Street	2	2	100%
Grant Street to I-90	2	1	50%
I-90 to Broadway	7	5	71%
Broadway to Virginia Street	5	4	80%
Virginia Street to Tennessee Street	2	2	100%
Tennessee Street to GCRL Culvert	16	15	94%
EB Wetland	0	NA	NA
Total	**40**	**34**	**85%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of EBGCR-II sediments included fish survival in 96-h tests with whole sediments.

NA = not applicable.

Table 7.8. Frequency of exceedance of TRGs in the EBGCR-II.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	2 of 2 (100%)	3 of 3 (100%)	NM	NM	NM
Pesticides					
Chlordane	0 of 2 (0%)	0 of 3 (0%)	NM	NM	NM
Dieldrin + Aldrin	0 of 2 (0%)	1 of 3 (33%)	NM	NM	NM
Endrin	0 of 2 (0%)	1 of 3 (33%)	NM	NM	NM
Heptachlor + Heptachlor epoxide	0 of 2 (0%)	0 of 3 (0%)	NM	NM	NM
Lindane	0 of 2 (0%)	0 of 3 (0%)	NM	NM	NM
Mirex	NM	NM	NM	NM	NM
Total DDTs	0 of 2 (0%)	1 of 3 (33%)	NM	NM	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole body = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 7.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the EBGCR-II.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediments							
ConRail Bridge to Bridge Street	8	25.3	13.1	51.9	13.1	38.3	22.5
Bridge Street to Grant Street	6	10.7	2.58	17.6	2.58	13.4	11.1
Grant Street to I-90	3	30.0	4.66	68.8	4.66	16.6	16.6
I-90 to Broadway	9	52.1	1.54	375	1.54	39.5	6.44
Broadway to Virginia Street	4	27.5	2.59	63.4	2.59	29.9	22.1
Virginia Street to Tennessee Street	4	473	87.2	821	87.2	705	492
Tennessee Street to GCRL Culvert	9	286	1.43	987	1.43	589	9.25
EB Wetland	55	1.12	0.000636	16.0	0.0901	2.75	0.230
Overall	**98**	**55.7**	**0.000636**	**987**	**0.0986**	**63.4**	**2.42**
Sub-Surface Sediments							
ConRail Bridge to Bridge Street	9	14.1	2.55	65.3	2.55	19.1	7.21
Bridge Street to Grant Street	4	4.94	2.47	6.58	2.47	5.89	5.36
Grant Street to I-90	4	4.43	2.09	7.19	2.09	6.28	4.21
I-90 to Broadway	6	29.1	2.13	116	2.13	36.2	7.84
Broadway to Virginia Street	0	NA	NA	NA	NA	NA	NA
Virginia Street to Tennessee Street	3	450	118	937	118	296	296
Tennessee Street to GCRL Culvert	7	218	2.80	765	2.80	458	66.3
EB Wetland	0	NA	NA	NA	NA	NA	NA
Overall	**33**	**97.6**	**2.09**	**937**	**2.47**	**188**	**7.21**

NA = not applicable.

Tables

Chapter 8 - West Branch of the Grand Calumet River - I

Table 8.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in WBGCR-I sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	13 of 15 (87%)	5 of 10 (50%)	NG	NG
Cadmium	14 of 16 (88%)	5 of 10 (50%)	NG	NG
Chromium	9 of 16 (56%)	0 of 10 (0%)	NG	NG
Copper	8 of 9 (89%)	5 of 10 (50%)	NG	NG
Lead	16 of 16 (100%)	7 of 10 (70%)	NG	NG
Mercury	12 of 15 (80%)	5 of 10 (50%)	NG	NG
Nickel	5 of 9 (56%)	0 of 10 (0%)	NG	NG
Zinc	9 of 9 (100%)	7 of 10 (70%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	8 of 8 (100%)	1 of 1 (100%)	NG	NG
Acenaphthylene	4 of 4 (100%)	2 of 2 (100%)	NG	NG
Anthracene	14 of 14 (100%)	5 of 6 (83%)	NG	NG
Benz(a)anthracene	16 of 17 (94%)	6 of 7 (86%)	NG	NG
Benzo(a)pyrene	15 of 16 (94%)	4 of 7 (57%)	NG	NG
Chrysene	16 of 16 (100%)	7 of 8 (88%)	NG	NG
Dibenz(a,h)anthracene	7 of 7 (100%)	2 of 3 (67%)	NG	NG
Fluoranthene	13 of 16 (81%)	5 of 8 (63%)	NG	NG
Fluorene	13 of 13 (100%)	4 of 4 (100%)	NG	NG
2-Methylnaphthalene	4 of 4 (100%)	NM	NG	NG
Naphthalene	11 of 11 (100%)	6 of 6 (100%)	NG	NG
Phenanthrene	16 of 16 (100%)	9 of 9 (100%)	NG	NG
Pyrene	14 of 15 (93%)	6 of 9 (67%)	NG	NG
Total PAHs	16 of 17 (94%)	7 of 9 (78%)	NG	NG
PCBs				
Total PCBs	11 of 11 (100%)	2 of 2 (100%)	2 of 2 (100%)	0 of 0 (0%)

Table 8.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in WBGCR-I sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	4 of 4 (100%)	2 of 4 (50%)	1 of 1 (100%)	0 of 0 (0%)
sum DDD	3 of 3 (100%)	0 of 3 (0%)	NG	NG
sum DDE	3 of 3 (100%)	2 of 4 (50%)	NG	NG
sum DDT	4 of 6 (67%)	1 of 5 (20%)	NG	NG
Total DDTs	4 of 7 (57%)	2 of 5 (40%)	1 of 1 (100%)	0 of 1 (0%)
Dieldrin	0 of 5 (0%)	0 of 3 (0%)	NG	NG
Endrin	0 of 10 (0%)	0 of 4 (0%)	0 of 0 (0%)	0 of 1 (0%)
Heptachlor	NG	NG	1 of 1 (100%)	0 of 0 (0%)
Heptachlor epoxide	0 of 0 (0%)	0 of 2 (0%)	0 of 0 (0%)	0 of 0 (0%)
Lindane (gamma-BHC)	2 of 2 (100%)	1 of 3 (33%)	1 of 4 (25%)	0 of 3 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	NM

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no guideline (i.e., no PEC or bioaccumulative-based SQG available); NM = substance was not measured.

Table 8.2. Proportion of sediment samples with various chemical characteristics in the WBGCR-I.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	**$ 0.1 - < 0.7**	**$ 0.7 - < 4.0**	**$ 4.0**	**$ 0.7**
Surficial Sediments						
EB and WB Confluence to Indianapolis Boulevard						
Prior to 1996	5	0 of 5 (0%)	0 of 5 (0%)	0 of 5 (0%)	5 of 5 (100%)	5 of 5 (100%)
1996 and later	14	0 of 14 (0%)	0 of 14 (0%)	2 of 14 (14%)	12 of 14 (86%)	14 of 14 (100%)
Total (all years and locations)	**19**	**0 of 19 (0%)**	**0 of 19 (0%)**	**2 of 19 (11%)**	**17 of 19 (89%)**	**19 of 19 (100%)**
Sub-Surface Sediments						
EB and WB Confluence to Indianapolis Boulevard						
Prior to 1996	8	0 of 8 (0%)	2 of 8 (25%)	2 of 8 (25%)	4 of 8 (50%)	6 of 8 (75%)
1996 and later	4	0 of 4 (0%)	1 of 4 (25%)	2 of 4 (50%)	1 of 4 (25%)	3 of 4 (75%)
Total (all years and locations)	**12**	**0 of 12 (0%)**	**3 of 12 (25%)**	**4 of 12 (33%)**	**5 of 12 (42%)**	**9 of 12 (75%)**

Table 8.3. Concentrations of chemicals of concern in pore water from WBGCR-I sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)	Sample Site (Hoke *et al. 1* 993)
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	IH-01	UG-8
Metals					
Cadmium	µg/L	2.9	NG	0.43 (0.15)	<16
Chromium	µg/L	NG	NG	NM	<10
Copper	µg/L	35	NG	11.64 (0.33)	8 (0.23)
Lead	µg/L	<16	NG	54.52	37
Nickel	µg/L	780	NG	16.02 (0.02)	<100
Zinc	µg/L	73	NG	66.80 (0.92)	74 (1.01)
Sum Toxic Units[3]		NG	NG	1.42	1.24
Phenolics					
o-Chlorophenol	µg/L	NG	5600	NM	40.5
p-Chlorophenol	µg/L	NG	5600	NM	3.7
2,4-Dichlorophenol	µg/L	NG	520	NM	23.7
o-Cresol	µg/L	NG	100	NM	10.2
p-Cresol	µg/L	NG	100	NM	9.1
2,4-Dinitrophenol	µg/L	NG	NG	NM	54.1
Phenol	µg/L	NG	45	NM	225.3
Other Substances					
Unionized ammonia	mg/L	NG	0.53	0.07	6.4

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured

Table 8.4. Summary of the available information on the toxicity of sediments and pore water from the WBGCR-I.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
EB and WB Confluence to Indianapolis Boulevard	2	2	100%
Total	**2**	**2**	**100%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of WBGCR-I sediments included amphipod survival in 10-d tests with whole sediments; midge growth in 10-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; and, 30-min Microtox with pore water.

Table 8.5. Status of benthic invertebrate communities in the WBGCR-I.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Artificial Substrate										
Simon *et al.* (2000)	8	77.1	0.0	8.6	0.2	5.0	5.1	0.0	0.53	Altered
Simon *et al.* (2000)	9	58.4	0.2	35.2	0.2	0.4	0.2	0.2	0.87	Altered
Rainbolt (1993)	ST 1	4.4	0.0	95.6	0.0	0.0	0.0	0.0	ND	Altered
Percent Altered Samples										**100% (3 of 3)**

[1] Reported values are percent of total abundance of invertebrates.

ND = not determined.

Table 8.6. Levels of TOC in WBGCR-I sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
EB and WB Confluence to Indianapolis Boulevard	9	11.0	1.30 - 40.0
Sub-Surface Sediments			
EB and WB Confluence to Indianapolis Boulevard	10	4.24	0.130- 8.60

Table 8.7. Levels of oil and grease in WBGCR-I sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
EB and WB Confluence to Indianapolis Boulevard	5	181000	15900 - 404000
Sub-Surface Sediments			
EB and WB Confluence to Indianapolis Boulevard	4	6930	400 - 23300

Table 8.8. Frequency of exceedance of TRGs in the WBGCR-I.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	3 of 3 (100%)	4 of 4 (100%)	NM	NM	NM
Pesticides					
Chlordane	0 of 3 (0%)	1 of 4 (25%)	NM	NM	NM
Dieldrin + Aldrin	0 of 3 (0%)	1 of 2 (50%)	NM	NM	NM
Endrin	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Heptachlor + Heptachlor epoxide	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Lindane	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Mirex	NM	NM	NM	NM	NM
Total DDTs	1 of 3 (33%)	3 of 4 (75%)	NM	NM	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole body = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 8.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the WBGCR-I.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediment							
EB and WB Confluence to Indianapolis Boulevard	19	29.5	1.13	231	1.35	56.9	11.7
Sub-Surface Sediment							
EB and WB Confluence to Indianapolis Boulevard	12	4.80	0.139	13.7	0.368	8.80	3.77

Tables

Chapter 9 - West Branch of the Grand Calumet River - II

Table 9.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in WBGCR-II sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	19 of 60 (32%)	8 of 65 (12%)	NG	NG
Cadmium	50 of 75 (67%)	20 of 84 (24%)	NG	NG
Chromium	38 of 69 (55%)	8 of 69 (12%)	NG	NG
Copper	44 of 71 (62%)	21 of 70 (30%)	NG	NG
Lead	67 of 76 (88%)	36 of 84 (43%)	NG	NG
Mercury	17 of 29 (59%)	7 of 36 (19%)	NG	NG
Nickel	35 of 71 (49%)	8 of 70 (11%)	NG	NG
Zinc	56 of 71 (79%)	26 of 70 (37%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	39 of 39 (100%)	39 of 39 (100%)	NG	NG
Acenaphthylene	13 of 13 (100%)	5 of 5 (100%)	NG	NG
Anthracene	46 of 53 (87%)	35 of 47 (74%)	NG	NG
Benz(a)anthracene	54 of 66 (82%)	36 of 48 (75%)	NG	NG
Benzo(a)pyrene	61 of 71 (86%)	31 of 44 (70%)	NG	NG
Chrysene	59 of 67 (88%)	38 of 50 (76%)	NG	NG
Dibenz(a,h)anthracene	13 of 13 (100%)	0 of 0 (0%)	NG	NG
Fluoranthene	59 of 76 (78%)	42 of 59 (71%)	NG	NG
Fluorene	46 of 49 (94%)	36 of 47 (77%)	NG	NG
2-Methylnaphthalene	40 of 41 (98%)	38 of 39 (97%)	NG	NG
Naphthalene	50 of 59 (85%)	43 of 55 (78%)	NG	NG
Phenanthrene	66 of 75 (88%)	54 of 64 (84%)	NG	NG
Pyrene	69 of 77 (90%)	49 of 58 (84%)	NG	NG
Total PAHs	67 of 82 (82%)	50 of 67 (75%)	NG	NG
PCBs				
Total PCBs	25 of 30 (83%)	6 of 14 (43%)	3 of 5 (60%)	0 of 0 (0%)

Table 9.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in WBGCR-II sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	20 of 23 (87%)	8 of 13 (62%)	2 of 2 (100%)	0 of 0 (0%)
sum DDD	11 of 21 (52%)	4 of 11 (36%)	NG	NG
sum DDE	17 of 17 (100%)	8 of 13 (62%)	NG	NG
sum DDT	17 of 19 (89%)	8 of 16 (50%)	NG	NG
Total DDTs	18 of 27 (67%)	8 of 16 (50%)	3 of 4 (75%)	0 of 5 (0%)
Dieldrin	17 of 25 (68%)	8 of 16 (50%)	NG	NG
Endrin	0 of 6 (0%)	0 of 9 (0%)	0 of 2 (0%)	0 of 5 (0%)
Heptachlor	NG	NG	2 of 2 (100%)	0 of 0 (0%)
Heptachlor epoxide	0 of 0 (0%)	0 of 5 (0%)	0 of 0 (0%)	0 of 0 (0%)
Lindane (gamma-BHC)	19 of 22 (86%)	8 of 10 (80%)	2 of 8 (25%)	0 of 9 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	NM

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no PEC or bioaccumulative-based SQG available; NM = substance was not measured.

Table 9.2. Proportion of sediment samples with various chemical characteristics in the WBGCR-II.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments						
Indianapolis Boulevard to I-90						
Prior to 1996	7	0 of 7 (0%)	3 of 7 (43%)	1 of 7 (14%)	3 of 7 (43%)	4 of 7 (57%)
1996 and later	7	0 of 7 (0%)	0 of 7 (0%)	1 of 7 (14%)	6 of 7 (86%)	7 of 7 (100%)
Roxana Marsh						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	5	0 of 5 (0%)	5 of 5 (100%)	0 of 5 (0%)	0 of 5 (0%)	0 of 5 (0%)
I-90 to Columbia Avenue						
Prior to 1996	22	1 of 22 (4.5%)	1 of 22 (4.5%)	5 of 22 (23%)	15 of 22 (68%)	20 of 22 (91%)
1996 and later	0	NA	NA	NA	NA	NA
Columbia Avenue to Calumet Avenue						
Prior to 1996	2	0 of 2 (0%)	1 of 2 (50%)	0 of 2 (0%)	1 of 2 (50%)	1 of 2 (50%)
1996 and later	0	NA	NA	NA	NA	NA
Calumet Avenue to Hohman Avenue						
Prior to 1996	7	0 of 7 (0%)	1 of 7 (14%)	2 of 7 (29%)	4 of 7 (57%)	6 of 7 (86%)
1996 and later	2	0 of 2 (0%)	0 of 2 (0%)	0 of 2 (0%)	2 of 2 (100%)	2 of 2 (100%)
Hohman Avenue to State Line Avenue						
Prior to 1996	8	0 of 8 (0%)	0 of 8 (0%)	1 of 8 (13%)	7 of 8 (88%)	8 of 8 (100%)
1996 and later	13	0 of 13 (0%)	0 of 13 (0%)	3 of 13 (23%)	10 of 13 (77%)	13 of 13 (100%)
Illinois Portion						
Prior to 1996	11	0 of 11 (0%)	0 of 11 (0%)	3 of 11 (27%)	8 of 11 (73%)	11 of 11 (100%)
1996 and later	0	NA	NA	NA	NA	NA
Total (all years and locations)	**84**	**1 of 84 (1.2%)**	**11 of 84 (13%)**	**16 of 84 (19%)**	**56 of 84 (67%)**	**72 of 84 (86%)**

Table 9.2. Proportion of sediment samples with various chemical characteristics in the WBGCR-II.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	**≥ 0.1 - < 0.7**	**≥ 0.7 - < 4.0**	**≥ 4.0**	**≥ 0.7**
Sub-Surface Sediments						
Indianapolis Boulevard to I-90						
Prior to 1996	4	0 of 4 (0%)	4 of 4 (100%)	0 of 4 (0%)	0 of 4 (0%)	0 of 4 (0%)
1996 and later	6	1 of 6 (17%)	5 of 6 (83%)	0 of 6 (0%)	0 of 6 (0%)	0 of 6 (0%)
Roxana Marsh						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	5	3 of 5 (60%)	2 of 5 (40%)	0 of 5 (0%)	0 of 5 (0%)	0 of 5 (0%)
I-90 to Columbia Avenue						
Prior to 1996	25	2 of 25 (80%)	5 of 25 (20%)	6 of 25 (24%)	12 of 25 (48%)	18 of 25 (72%)
1996 and later	0	NA	NA	NA	NA	NA
Columbia Avenue to Calumet Avenue						
Prior to 1996	3	0 of 3 (0%)	1 of 3 (33%)	1 of 3 (33%)	1 of 3 (33%)	2 of 3 (67%)
1996 and later	0	NA	NA	NA	NA	NA
Calumet Avenue to Hohman Avenue						
Prior to 1996	9	0 of 9 (0%)	2 of 9 (22%)	2 of 9 (22%)	5 of 9 (56%)	7 of 9 (78%)
1996 and later	4	0 of 4 (0%)	0 of 4 (0%)	4 of 4 (100%)	0 of 4 (0%)	4 of 4 (100%)
Hohman Avenue to State Line Avenue						
Prior to 1996	4	0 of 4 (0%)	0 of 4 (0%)	1 of 4 (25%)	3 of 4 (75%)	4 of 4 (100%)
1996 and later	21	1 of 21 (4.8%)	1 of 21 (4.8%)	0 of 21 (0%)	19 of 21 (90%)	19 of 21 (90%)
Illinois Portion						
Prior to 1996	7	0 of 7 (0%)	2 of 7 (29%)	2 of 7 (29%)	3 of 7 (43%)	5 of 7 (71%)
1996 and later	0	NA	NA	NA	NA	NA
Total (all years and locations)	**88**	**7 of 88 (8.0%)**	**22 of 88 (25%)**	**16 of 88 (18%)**	**43 of 88 (49%)**	**59 of 88 (67%)**

NA = not applicable.

Table 9.3. Concentrations of chemicals of concern in pore water from WBGCR-II sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (Hoke *et al.* 1993)		Sample Site (URS Greiner Woodward Clyde 1999)			
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	UG-9	UG-10	01RA01SE00	01RA03SE00	01RB01SE00	01RC01SE02
Metals									
Cadmium	µg/L	2.9	NG	<10	<10	NM	NM	NM	NM
Chromium	µg/L	NG	NG	<10	<10	NM	NM	NM	NM
Copper	µg/L	35	NG	25 (0.71)	<5	NM	NM	NM	NM
Lead	µg/L	<16	NG	<20	<20	NM	NM	NM	NM
Nickel	µg/L	780	NG	<100	<100	NM	NM	NM	NM
Zinc	µg/L	73	NG	114 (1.56)	28 (0.38)	NM	NM	NM	NM
Sum Toxic Units[3]		NG	NG	2.27	0.38	NM	NM	NM	NM
Phenolics									
o-Chlorophenol	µg/L	NG	5600	100.4	88.6	NM	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	15.2	17.5	NM	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	23.5	24.0	NM	NM	NM	NM
o-Cresol	µg/L	NG	100	23.6	20.9	NM	NM	NM	NM
p-Cresol	µg/L	NG	100	10.3	24.2	NM	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NG	34.5	30.6	NM	NM	NM	NM
Phenol	µg/L	NG	45	326.2	255.5	NM	NM	NM	NM
Other Substances									
Unionized ammonia	mg/L	NG	0.53	3.4	3.3	4.59	1.83	4.37	2.41

Table 9.3. Concentrations of chemicals of concern in pore water from WBGCR-II sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (URS Greiner Woodward Clyde 1999)	
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	01RC02SE00	01RC03SE00
Metals					
Cadmium	µg/L	2.9	NG	NM	NM
Chromium	µg/L	NG	NG	NM	NM
Copper	µg/L	35	NG	NM	NM
Lead	µg/L	<16	NG	NM	NM
Nickel	µg/L	780	NG	NM	NM
Zinc	µg/L	73	NG	NM	NM
Sum Toxic Units[3]		NG	NG	NM	NM
Phenolics					
o-Chlorophenol	µg/L	NG	5600	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM
o-Cresol	µg/L	NG	100	NM	NM
p-Cresol	µg/L	NG	100	NM	NM
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM
Phenol	µg/L	NG	45	NM	NM
Other Substances					
Unionized ammonia	mg/L	NG	0.53	0.38	8.02

[1] The 10-d LC_{50} concentrations for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 9.4. Summary of the available information on the toxicity of sediments and pore water from the WBGCR-II.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
Indianapolis Boulevard to I-90	2	2	100%
Roxana Marsh	4	1	25%
I-90 to Columbia Avenue	5	5	100%
Columbia Avenue to Calumet Avenue	0	NA	NA
Calumet Avenue to Hohman Avenue	1	1	100%
Hohman Avenue to State Line Avenue	5	5	100%
Illinois Portion	1	1	100%
Total	**18**	**15**	**83%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of WBGCR-II sediments included amphipod survival and growth in 10-d tests with whole sediments; midge survival and growth in 10-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; 30 min Microtox with pore water; and, fish survival in 10-d tests with elutriate.

NA = not applicable.

Table 9.5. Status of benthic invertebrate communities in the WBGCR-II.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropod	Bivalvia			
Artificial Substrate										
IDEM (2000a)	Indianapolis Boulevard	47.3	0.0	29.7	0.3	21.1	0.0	0.0	1.7	Altered
IDEM (2000a)	Sohl Avenue	61.5	0.0	18.4	0.0	0.7	0.0	0.0	1.1	Altered
Rainbolt (1993)	ST 2	77.8	0.0	14.7	7.5	0.0	0.0	0.0	ND	Altered
Rainbolt (1993)	ST 3	73.9	0.0	10.0	11.3	2.3	0.0	0.0	ND	Altered
Rainbolt (1993)	ST 4	87.8	0.0	4.7	2.9	0.0	0.0	0.0	ND	Altered
Rainbolt (1993)	ST 5	14.4	0.0	85.6	0.0	0.0	0.0	0.0	ND	Altered
Grab										
Polls *et al.* (1993)	1-82	97.9	0.0	2.1	0.0	0.0	0.0	0.0	ND	Altered
Polls *et al.* (1993)	1-86	99.8	0.1	0.1	0.0	0.0	0.0	0.0	ND	Altered
ThermoRetec (1999)	SD-98-24	60.0	0.0	20.0	0.0	20.0	0.0	0.0	ND	Unaltered
ThermoRetec (1999)	SD-98-17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Unaltered
ThermoRetec (1999)	SD-98-20	63.0	0.0	31.5	0.0	5.5	0.0	0.0	ND	Unaltered
URS Greiner Woodward Clyde (1999)	C01	62.8	0.0	36.8	0.1	0.0	0.0	0.0	ND	Unaltered
URS Greiner Woodward Clyde (1999)	A03	97.6	0.0	1.9	0.0	0.0	0.0	0.0	ND	Altered
URS Greiner Woodward Clyde (1999)	C02	94.0	0.0	0.9	2.2	0.0	0.0	0.0	ND	Altered
Percent Altered Samples										**71% (10 of 14)**

[1] Reported values are percent of total abundance of invertebrates.
ND = not determined.

Table 9.6. Levels of TOC in WBGCR-II sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
Indianapolis Boulevard to I-90	8	11.6	5.80 - 18.6
Roxana Marsh	5	19.2	12.4 - 27.4
I-90 to Columbia Avenue	17	9.79	1.30 - 19.2
Columbia Avenue to Calumet Avenue	0	NA	NA
Calumet Avenue to Hohman Avenue	5	7.40	1.96 - 11.3
Hohman Avenue to State Line Avenue	13	11.2	4.44 - 15.0
Illinois Portion	2	11.7	11.7 - 11.7
All segments	**50**	**11.2**	**1.30 - 27.4**
Sub-Surface Sediments			
Indianapolis Boulevard to I-90	10	6.05	2.92 - 11.1
Roxana Marsh	5	4.14	2.39 - 5.33
I-90 to Columbia Avenue	21	7.76	0.470 - 15.2
Columbia Avenue to Calumet Avenue	3	17.4	8.47 - 24.9
Calumet Avenue to Hohman Avenue	10	8.12	0.420 - 25.3
Hohman Avenue to State Line Avenue	8	8.95	4.60 - 12.1
Illinois Portion	5	5.13	0.570 - 11.7
All segments	**62**	**7.66**	**0.420 - 25.3**

NA = not applicable.

Table 9.7. Summary of the available information on the toxicity of elutriates from the WBGCR-II to fish.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
Indianapolis Boulevard to I-90	0	NA	NA
Roxana Marsh	0	NA	NA
I-90 to Columbia Avenue	4	4	100%
Columbia Avenue to Calumet Avenue	0	NA	NA
Calumet Avenue to Hohman Avenue	1	1	100%
Hohman Avenue to State Line Avenue	1	1	100%
Illinois Portion	1	1	100%
Total	**7**	**7**	**100%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of WBGCR-II sediments included fish survival in 10-d tests with elutriate.

NA = not applicable.

Table 9.8. Frequency of exceedance of TRGs in the WBGCR-II.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	3 of 3 (100%)	2 of 2 (100%)	NM	NM	NM
Pesticides					
Chlordane	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Dieldrin + Aldrin	0 of 3 (0%)	1 of 2 (50%)	NM	NM	NM
Endrin	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Heptachlor + Heptachlor epoxide	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Lindane	0 of 3 (0%)	0 of 2 (0%)	NM	NM	NM
Mirex	NM	NM	NM	NM	NM
Total DDTs	1 of 3 (33%)	1 of 2 (50%)	NM	NM	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole sample = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 9.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the WBGCR-II.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediment							
Indianapolis Boulevard to I-90	14	15.5	0.149	75.3	0.243	35.3	6.22
Roxana Marsh	5	0.428	0.123	0.603	0.123	0.595	0.515
I-90 to Columbia Avenue	22	12.3	0.0395	76.0	1.01	16.2	6.53
Columbia Avenue to Calumet Avenue	2	3.71	0.259	7.17	NA	NA	NA
Calumet Avenue to Hohman Avenue	9	37.6	0.311	210	0.311	88.6	6.85
Hohman Avenue to State Line Avenue	21	47.5	0.875	304	2.51	94.9	28.7
Illinois Portion	11	6.00	2.71	10.1	2.97	9.65	4.89
Overall	**84**	**22.6**	**0.0395**	**304**	**0.347**	**67.1**	**6.71**
Sub-Surface Sediment							
Indianapolis Boulevard to I-90	10	0.191	0.0976	0.357	0.0976	0.278	0.205
Roxana Marsh	5	0.0905	0.0652	0.111	0.0652	0.101	0.0919
I-90 to Columbia Avenue	25	8.18	0.0658	30.2	0.128	16.9	3.34
Columbia Avenue to Calumet Avenue	3	3.21	0.215	5.89	0.215	3.53	3.53
Calumet Avenue to Hohman Avenue	13	13.1	0.109	97.3	0.325	17.9	3.78
Hohman Avenue to State Line Avenue	25	51.0	0.0712	193	2.47	129	33.4
Illinois Portion	7	4.69	0.148	13.3	0.148	8.45	3.74
Overall	**88**	**19.3**	**0.0652**	**193**	**0.101**	**51.7**	**3.84**

NA = not applicable.

Tables

Chapter 10 - Indiana Harbor Canal

Table 10.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in IHC sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	13 of 25 (52%)	1 of 4 (25%)	NG	NG
Cadmium	16 of 26 (62%)	3 of 4 (75%)	NG	NG
Chromium	11 of 26 (42%)	1 of 4 (25%)	NG	NG
Copper	6 of 20 (30%)	2 of 4 (50%)	NG	NG
Lead	20 of 26 (77%)	2 of 4 (50%)	NG	NG
Mercury	12 of 25 (48%)	1 of 4 (25%)	NG	NG
Nickel	2 of 20 (10%)	1 of 4 (25%)	NG	NG
Zinc	14 of 20 (70%)	2 of 4 (50%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	17 of 17 (100%)	3 of 3 (100%)	NG	NG
Acenaphthylene	12 of 12 (100%)	2 of 2 (100%)	NG	NG
Anthracene	15 of 19 (79%)	3 of 3 (100%)	NG	NG
Benz(a)anthracene	22 of 27 (81%)	3 of 4 (75%)	NG	NG
Benzo(a)pyrene	17 of 21 (81%)	1 of 3 (33%)	NG	NG
Chrysene	24 of 27 (89%)	5 of 5 (100%)	NG	NG
Dibenz(a,h)anthracene	4 of 7 (57%)	1 of 1 (100%)	NG	NG
Fluoranthene	20 of 26 (77%)	4 of 5 (80%)	NG	NG
Fluorene	14 of 18 (78%)	2 of 2 (100%)	NG	NG
2-Methylnaphthalene	3 of 3 (100%)	NM	NG	NG
Naphthalene	15 of 18 (83%)	5 of 5 (100%)	NG	NG
Phenanthrene	19 of 25 (76%)	6 of 6 (100%)	NG	NG
Pyrene	24 of 27 (89%)	6 of 6 (100%)	NG	NG
Total PAHs	20 of 27 (74%)	5 of 6 (83%)	NG	NG
PCBs				
Total PCBs	21 of 25 (84%)	3 of 3 (100%)	13 of 13 (100%)	1 of 1 (100%)

Table 10.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in IHC sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	3 of 7 (43%)	2 of 2 (100%)	1 of 1 (100%)	0 of 0 (0%)
sum DDD	1 of 9 (11%)	NM	NG	NG
sum DDE	2 of 10 (20%)	2 of 2 (100%)	NG	NG
sum DDT	2 of 16 (13%)	0 of 2 (0%)	NG	NG
Total DDTs	2 of 16 (13%)	2 of 2 (100%)	3 of 6 (50%)	0 of 0 (0%)
Dieldrin	2 of 15 (13%)	2 of 2 (100%)	NG	NG
Endrin	0 of 16 (0%)	NM	0 of 3 (0%)	NM
Heptachlor	NG	NG	1 of 1 (100%)	0 of 0 (0%)
Heptachlor epoxide	1 of 8 (13%)	NM	0 of 0 (0%)	NM
Lindane (gamma-BHC)	2 of 5 (40%)	2 of 2 (100%)	1 of 12 (8%)	0 of 0 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	0 of 0 (0%)

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no PEC or bioaccumulative-based SQG available; NM = substance was not measured.

Table 10.2. Proportion of sediment samples with various chemical characteristics in the IHC.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments						
EB and WB Confluence to 151st Street						
Prior to 1996	5	0 of 5 (0%)	0 of 5 (0%)	2 of 5 (40%)	3 of 5 (60%)	5 of 5 (100%)
1996 and later	2	0 of 2 (0%)	0 of 2 (0%)	0 of 2 (0%)	2 of 2 (100%)	2 of 2 (100%)
151st Street to Chicago Avenue						
Prior to 1996	2	0 of 2 (0%)	0 of 2 (0%)	1 of 2 (50%)	1 of 2 (50%)	2 of 2 (100%)
1996 and later	8	0 of 8 (0%)	3 of 8 (38%)	4 of 8 (50%)	1 of 8 (13%)	5 of 8 (63%)
Chicago Avenue to Columbus Drive						
Prior to 1996	3	0 of 3 (0%)	0 of 3 (0%)	1 of 3 (33%)	2 of 3 (67%)	3 of 3 (100%)
1996 and later	9	0 of 9 (0%)	0 of 9 (0%)	3 of 9 (33%)	6 of 9 (67%)	9 of 9 (100%)
IHC Wetland						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	1	0 of 1 (0%)	0 of 1 (0%)	1 of 1 (100%)	0 of 1 (0%)	1 of 1 (100%)
Total (all years and locations)	**30**	**0 of 30 (0%)**	**3 of 30 (10%)**	**12 of 30 (40%)**	**15 of 30 (50%)**	**27 of 30 (90)%**
Sub-Surface Sediments						
EB and WB Confluence to 151st Street						
Prior to 1996	4	0 of 4 (0%)	1 of 4 (25%)	1 of 4 (25%)	2 of 2 (100%)	3 of 4 (75%)
1996 and later	0	NA	NA	NA	NA	NA
151st Street to Chicago Avenue						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	0	NA	NA	NA	NA	NA
Chicago Avenue to Columbus Drive						
Prior to 1996	2	0 of 2 (0%)	0 of 2 (0%)	1 of 2 (50%)	1 of 2 (50%)	2 of 2 (100%)
1996 and later	0	NA	NA	NA	NA	NA
IHC Wetland						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	0	NA	NA	NA	NA	NA
Total (all years and locations)	**6**	**0 of 6 (0%)**	**1 of 6 (17%)**	**2 of 6 (33%)**	**3 of 6 (50%)**	**5 of 6 (83%)**

NA = not applicable.

Table 10.3. Concentrations of chemicals of concern in pore water from IHC sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)			Sample Site (Hoke *et al.* 1993)	
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	IH-13	IH-14	IH-19	UG-7	UG-11
Metals								
Cadmium	µg/L	2.9	NG	< 0.12	< 0.12	0.15 (0.05)	<10	<5
Chromium	µg/L	NG	NG	NM	NM	NM	<10	<10
Copper	µg/L	35	NG	< 0.65	< 0.65	8.10 (0.23)	73 (2.09)	<5
Lead	µg/L	<16	NG	0.42	3.23	8.95	29	<20
Nickel	µg/L	780	NG	8.24 (0.01)	2.70 (0.004)	6.73 (0.009)	<100	<100
Zinc	µg/L	73	NG	< 4.4	< 4.4	105.37 (1.44)	81 (1.11)	35 (0.48)
Sum Toxic Units[3]		NG	NG	0.01	0.004	1.73	3.20	0.48
Phenolics								
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM	19.2	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM	2.0	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM	17.1	NM
o-Cresol	µg/L	NG	100	NM	NM	NM	4.8	NM
p-Cresol	µg/L	NG	100	NM	NM	NM	2.6	NM
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM	NM	14.5	NM
Phenol	µg/L	NG	45	NM	NM	NM	107.6	NM
Other Substances								
Unionized ammonia	mg/L	NG	0.53	NM	0.01	<0.01	1.6	1.0

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 10.4. Summary of the available information on the toxicity of sediments and pore water from the IHC.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
EB and WB Confluence to 151st Street	1	1	100%
151st Street to Chicago Avenue	1	1	100%
Chicago Avenue to Columbus Drive	2	2	100%
IHC Wetland	1	0	0%
Total	**5**	**4**	**80%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of IHC sediments included amphipod survival and growth in 10-d tests with whole sediments; midge growth in 10-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; and, 30-min Microtox in pore water.

Table 10.5. Status of benthic invertebrate communities in the IHC.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Artificial Substrate										
Simon *et al.* (2000)	12	41.4	0.0	51.4	0.0	0.3	1.8	0.0	1.07	Altered
Simon *et al.* (2000)	11	44.4	0.0	48.6	0.0	0.0	2.0	0.2	1.07	Altered
Simon *et al.* (2000)	8	77.1	0.0	8.6	0.2	5.0	5.1	0.0	0.53	Altered
Simon *et al.* (2000)	10	37.1	0.0	39.9	0.2	2.6	3.8	0.0	1.13	Altered
Grab										
Polls *et al.* (1993)	4-82	99.8	0.1	0.0	0.0	0.1	0.0	0.0	ND	Altered
Polls *et al.* (1993)	4-86	99.9	0.0	0.0	0.0	0.1	0.0	0.0	ND	Altered
Percent Altered Samples										**100% (6 of 6)**

[1] Reported values are percent of total abundance of invertebrates.

ND = not determined.

Table 10.6. Levels of TOC in IHC sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
EB and WB Confluence to 151st Street	3	5.49	0.860 - 14.7
151st Street to Chicago Avenue	7	1.52	0.510 - 3.10
Chicago Avenue to Columbus Drive	8	4.58	1.07 - 13.0
IHC Wetland	1	13.0	NA
All Segments	**19**	**4.04**	**0.510 - 14.7**
Sub-Surface Sediments			
EB and WB Confluence to 151st Street	2	2.10	1.00 - 3.20
151st Street to Chicago Avenue	0	NA	NA
Chicago Avenue to Columbus Drive	2	6.20	0.950 - 11.5
IHC Wetland	0	NA	NA
All Segments	**4**	**4.1**	**0.950 - 11.5**

NA = not applicable.

Table 10.7. Levels of oil and grease in IHC sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
EB and WB Confluence to 151st Street	NA	NA	NA
151st Street to Chicago Avenue	5	1940	200 - 7200
Chicago Avenue to Columbus Drive	5	19800	3300 - 54800
IHC Wetland	1	1100	NA
All Segments	**11**	**9980**	**200 - 54800**
Sub-Surface Sediments			
EB and WB Confluence to 151st Street	NA	NA	NA
151st Street to Chicago Avenue	NA	NA	NA
Chicago Avenue to Columbus Drive	NA	NA	NA
IHC Wetland	NA	NA	NA
All Segments	NA	NA	NA

NA = not applicable.

Table 10.8. Frequency of exceedance of TRGs in the IHC.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	NM	2 of 2 (100%)	NM	5 of 5 (100%)	NM
Pesticides					
Chlordane	NM	1 of 2 (50%)	NM	0 of 5 (0%)	NM
Dieldrin + Aldrin	NM	NM	NM	0 of 5 (0%)	NM
Endrin	NM	NM	NM	0 of 5 (0%)	NM
Heptachlor + Heptachlor epoxide	NM	NM	NM	0 of 5 (0%)	NM
Lindane	NM	NM	NM	0 of 5 (0%)	NM
Mirex	NM	NM	NM	0 of 5 (0%)	NM
Total DDTs	NM	2 of 2 (100%)	NM	0 of 5 (0%)	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole sample = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 10.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the IHC.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediment							
EB and WB Confluence to 151st Street	7	5.44	2.10	10.4	2.10	8.21	4.85
151st Street to Chicago Avenue	10	3.00	0.191	8.84	0.191	7.19	2.29
Chicago Avenue to Columbus Drive	12	7.29	1.09	25.9	1.69	11.5	5.34
IHC Wetland	1	0.718	0.718	0.718	NA	NA	NA
Overall	**30**	**5.21**	**0.191**	**25.9**	**0.491**	**10.4**	**4.08**
Sub-Surface Sediment							
EB and WB Confluence to 151st Street	4	2.90	0.434	4.36	0.434	4.12	3.41
151st Street to Chicago Avenue	0	NA	NA	NA	NA	NA	NA
Chicago Avenue to Columbus Drive	2	5.87	2.09	9.64	NA	NA	NA
IHC Wetland	0	NA	NA	NA	NA	NA	NA
Overall	**6**	**3.89**	**0.434**	**9.64**	**0.434**	**4.36**	**3.41**

NA = not applicable.

Tables

Chapter II - Lake George Branch

Table 11.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in LGB sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	7 of 22 (32%)	4 of 10 (40%)	NG	NG
Cadmium	5 of 22 (23%)	4 of 10 (40%)	NG	NG
Chromium	9 of 23 (39%)	4 of 10 (40%)	NG	NG
Copper	5 of 22 (23%)	3 of 10 (30%)	NG	NG
Lead	21 of 23 (91%)	8 of 10 (80%)	NG	NG
Mercury	4 of 22 (18%)	3 of 10 (30%)	NG	NG
Nickel	8 of 23 (35%)	1 of 10 (10%)	NG	NG
Zinc	15 of 23 (65%)	6 of 10 (60%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	7 of 7 (100%)	5 of 5 (100%)	NG	NG
Acenaphthylene	0 of 0 (0%)	1 of 1 (100%)	NG	NG
Anthracene	6 of 10 (60%)	7 of 9 (78%)	NG	NG
Benz(a)anthracene	13 of 17 (76%)	7 of 9 (78%)	NG	NG
Benzo(a)pyrene	10 of 15 (67%)	7 of 10 (70%)	NG	NG
Chrysene	16 of 19 (84%)	8 of 10 (80%)	NG	NG
Dibenz(a,h)anthracene	4 of 4 (100%)	5 of 5 (100%)	NG	NG
Fluoranthene	9 of 18 (50%)	7 of 9 (78%)	NG	NG
Fluorene	10 of 11 (91%)	7 of 9 (78%)	NG	NG
2-Methylnaphthalene	NM	NM	NG	NG
Naphthalene	1 of 2 (50%)	0 of 3 (0%)	NG	NG
Phenanthrene	12 of 16 (75%)	8 of 10 (80%)	NG	NG
Pyrene	18 of 21 (86%)	8 of 10 (80%)	NG	NG
Total PAHs	9 of 22 (41%)	7 of 10 (70%)	NG	NG
PCBs				
Total PCBs	13 of 16 (81%)	5 of 7 (71%)	15 of 16 (94%)	7 of 7 (100%)

Table 11.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in LGB sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	0 of 3 (0%)	0 of 2 (0%)	0 of 0 (0%)	0 of 0 (0%)
sum DDD	0 of 3 (0%)	0 of 3 (0%)	NG	NG
sum DDE	2 of 7 (29%)	1 of 3 (33%)	NG	NG
sum DDT	0 of 3 (0%)	0 of 2 (0%)	NG	NG
Total DDTs	0 of 7 (0%)	0 of 4 (0%)	1 of 6 (17%)	1 of 4 (25%)
Dieldrin	0 of 3 (0%)	0 of 2 (0%)	NG	NG
Endrin	0 of 12 (0%)	0 of 5 (0%)	0 of 3 (0%)	0 of 2 (0%)
Heptachlor	NG	NG	0 of 0 (0%)	0 of 0 (0%)
Heptachlor epoxide	0 of 3 (0%)	0 of 2 (0%)	0 of 0 (0%)	0 of 0 (0%)
Lindane (gamma-BHC)	0 of 3 (0%)	0 of 2 (0%)	0 of 6 (0%)	0 of 6 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	NM	NM

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no PEC or bioaccumulative-based SQG available; NM = substance was not measured.

Table 11.2. Proportion of sediment samples with various chemical characteristics in the LGB.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments						
Indianapolis Boulevard to B & O Railroad Bridge						
Prior to 1996	2	0 of 2 (0%)	0 of 2 (0%)	1 of 2 (50%)	1 of 2 (50%)	2 of 2 (100%)
1996 and later	5	0 of 5 (0%)	0 of 5 (0%)	3 of 5 (60%)	2 of 5 (40%)	5 of 5 (100%)
B & O Railroad Bridge to Fill Area						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	4	0 of 4 (0%)	0 of 4 (0%)	1 of 4 (25%)	3 of 4 (75%)	4 of 4 (100%)
Lake George Wetlands						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	12	2 of 12 (17%)	2 of 12 (17%)	8 of 12 (67%)	0 of 12 (0%)	8 of 12 (67%)
Total (all years and locations)	**23**	**2 of 23 (8.7%)**	**2 of 23 (8.7%)**	**13 of 23 (57%)**	**6 of 23 (26%)**	**19 of 23 (83%)**
Sub-Surface Sediments						
Indianapolis Boulevard to B & O Railroad Bridge						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	3	0 of 3 (0%)	0 of 3 (0%)	2 of 3 (67%)	1 of 3 (33%)	3 of 3 (100%)
B & O Railroad Bridge to Fill Area						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	6	0 of 6 (0%)	1 of 6 (17%)	2 of 6 (33%)	3 of 6 (50%)	5 of 6 (83%)
Lake George Wetlands						
Prior to 1996	0	NA	NA	NA	NA	NA
1996 and later	1	1 of 1 (100%)	0 of 1 (0%)	0 of 1 (0%)	0 of 1 (0%)	0 of 1 (0%)
Total (all years and locations)	**10**	**1 of 10 (10%)**	**1 of 10 (10%)**	**4 of 10 (40%)**	**4 of 10 (40%)**	**8 of 10 (80%)**

NA = not applicable.

Table 11.3. Concentrations of chemicals of concern in pore water from LGB sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (USGS 1999)					
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	IH-25	IH-26	IH-27	IH-28	IH-29	IH-30
Metals									
Cadmium	µg/L	2.9	NG	< 0.11	0.24 (0.08)	0.28 (0.10)	0.13 (0.05)	0.39 (0.13)	< 0.11
Chromium	µg/L	NG	NG	NM	NM	NM	NM	NM	NM
Copper	µg/L	35	NG	3.39 (0.10)	7.78 (0.22)	17.91 (0.51)	7.97 (0.23)	26.20 (0.75)	2.58 (0.07)
Lead	µg/L	<16	NG	0.49	17.16	47.88	20.51	48.73	24.77
Nickel	µg/L	780	NG	123.37 (0.16)	4.41 (0.01)	4.08 (0.01)	3.40 (0.00)	7.04 (0.01)	5.89 (0.01)
Zinc	µg/L	73	NG	8.45 (0.12)	11.52 (0.16)	46.43 (0.64)	18.08 (0.25)	98.40 (1.35)	16.63 (0.23)
Sum Toxic Units[3]		NG	NG	0.38	0.47	1.26	0.53	2.24	0.31
Phenolics									
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM	NM	NM	NM
o-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM	NM
p-Cresol	µg/L	NG	100	NM	NM	NM	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM	NM	NM	NM	NM
Phenol	µg/L	NG	45	NM	NM	NM	NM	NM	NM
Other Substances									
Unionized ammonia	mg/L	NG	0.53	<0.01	0.01	0.01	0.02	0.03	0.01

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 11.4. Summary of the available information on the toxicity of sediments and elutriates from the LGB.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
Indianapolis Boulevard to B & O Railroad Bridge	2	2	100%
B & O Railroad Bridge to Fill Area	1	1	100%
Lake George Wetlands	4	1	25%
Total	**7**	**4**	**57%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of LGB sediments included amphipod survival and growth in 10-d tests with whole sediments; and, 15-min Microtox in elutriate.

Table 11.5. Status of benthic invertebrate communities in the LGB.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other	Gastropod	Bivalvia			
Artificial Substrate										
Simon *et al.* (2000)	15a	35.0	0.0	65.6	0.6	0.0	0.2	1.7	0.87	Altered
Simon *et al.* (2000)	15	75.8	0.0	20.7	0.2	0.0	0.0	0.9	0.40	Altered
Simon *et al.* (2000)	14	41.0	0.0	0.1	0.0	2.8	0.0	0.0	0.87	Altered
Grab										
Risatti and Ross (1989)	1	77.6	0.0	0.0	1.0	0.0	21.4	0.0	ND	Altered
Percent Altered Samples										**100% (4 of 4)**

[1] Reported values are percent of total abundance of invertebrates.

ND = not determined.

Table 11.6. Levels of TOC in LGB sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
Indianapolis Boulevard to B & O Railroad Bridge	7	5.21	1.80 - 12.6
B & O Railroad Bridge to Fill Area	4	18.3	14.0 - 22.0
Lake George Wetlands	12	5.30	1.10 - 17.0
All Segments	**23**	**7.52**	**1.10 - 22.0**
Sub-Surface Sediments			
Indianapolis Boulevard to B & O Railroad Bridge	3	6.80	3.50- 12.0
B & O Railroad Bridge to Fill Area	6	9.61	1.70 - 16.0
Lake George Wetlands	1	0.750	NA
All Segments	**10**	**7.88**	**0.750 - 16.0**

NA = not applicable.

Table 11.7. Levels of oil and grease in LGB sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
Indianapolis Boulevard to B & O Railroad Bridge	5	23300	7500 - 54200
B & O Railroad Bridge to Fill Area	4	141000	62400 - 227000
Lake George Wetlands	11	17700	1100 - 53700
All Segments	**20**	**43700**	**1100 - 227000**
Sub-Surface Sediments			
Indianapolis Boulevard to B & O Railroad Bridge	3	51300	21300 - 107000
B & O Railroad Bridge to Fill Area	6	59500	1000 - 154000
Lake George Wetlands	1	500	NA
All Segments	**10**	**51200**	**500 - 154000**

NA = not applicable.

Table 11.8. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the LGB.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediments							
Indianapolis Boulevard to B & O Railroad Bridge	7	4.81	1.75	14.5	1.75	6.00	2.91
B & O Railroad Bridge to Fill Area	4	13.9	3.13	31.5	3.13	16.4	10.5
Lake George Wetlands	12	0.870	0.0786	1.67	0.0916	1.60	0.729
Overall	**23**	**4.33**	**0.0786**	**31.5**	**0.484**	**6.00**	**1.67**
Sub-Surface Sediments							
Indianapolis Boulevard to B & O Railroad Bridge	3	5.88	2.66	11.8	2.66	3.19	3.19
B & O Railroad Bridge to Fill Area	6	6.15	0.367	14.2	0.367	9.87	5.40
Lake George Wetlands	1	0.0457	0.0457	0.0457	NA	NA	0.0457
Overall	**10**	**5.46**	**0.0457**	**14.2**	**0.0457**	**11.8**	**3.20**

NA = not applicable.

Tables

Chapter I2 - US Canal

Table 12.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in USC sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	24 of 56 (43%)	29 of 33 (88%)	NG	NG
Cadmium	66 of 90 (73%)	66 of 82 (80%)	NG	NG
Chromium	77 of 92 (84%)	64 of 83 (77%)	NG	NG
Copper	71 of 90 (79%)	63 of 83 (76%)	NG	NG
Lead	84 of 92 (91%)	70 of 83 (84%)	NG	NG
Mercury	16 of 25 (64%)	24 of 33 (73%)	NG	NG
Nickel	70 of 90 (78%)	60 of 83 (72%)	NG	NG
Zinc	86 of 92 (93%)	70 of 83 (84%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	36 of 36 (100%)	18 of 18 (100%)	NG	NG
Acenaphthylene	32 of 32 (100%)	18 of 18 (100%)	NG	NG
Anthracene	50 of 53 (94%)	18 of 18 (100%)	NG	NG
Benz(a)anthracene	54 of 55 (98%)	18 of 18 (100%)	NG	NG
Benzo(a)pyrene	46 of 47 (98%)	18 of 18 (100%)	NG	NG
Chrysene	54 of 56 (96%)	18 of 18 (100%)	NG	NG
Dibenz(a,h)anthracene	19 of 19 (100%)	18 of 18 (100%)	NG	NG
Fluoranthene	56 of 57 (98%)	18 of 18 (100%)	NG	NG
Fluorene	46 of 47 (98%)	18 of 18 (100%)	NG	NG
2-Methylnaphthalene	40 of 41 (98%)	NM	NG	NG
Naphthalene	48 of 49 (98%)	NM	NG	NG
Phenanthrene	54 of 56 (96%)	18 of 18 (100%)	NG	NG
Pyrene	54 of 56 (96%)	18 of 18 (100%)	NG	NG
Total PAHs	54 of 61 (89%)	18 of 18 (100%)	NG	NG
PCBs				
Total PCBs	30 of 38 (79%)	42 of 51 (82%)	15 of 19 (79%)	16 of 16 (100%)

Table 12.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in USC sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	9 of 9 (100%)	0 of 0 (0%)	9 of 9 (100%)	0 of 0 (0%)
sum DDD	6 of 7 (86%)	17 of 18 (94%)	NG	NG
sum DDE	7 of 8 (88%)	12 of 18 (67%)	NG	NG
sum DDT	2 of 7 (29%)	0 of 18 (0%)	NG	NG
Total DDTs	1 of 11 (9.1%)	0 of 18 (0%)	7 of 9 (78%)	11 of 18 (61%)
Dieldrin	4 of 9 (44%)	0 of 18 (0%)	NG	NG
Endrin	0 of 10 (0%)	0 of 18 (0%)	0 of 7 (0%)	0 of 18 (0%)
Heptachlor	NG	NG	6 of 6 (100%)	0 of 11 (0%)
Heptachlor epoxide	8 of 9 (89%)	0 of 18 (0%)	7 of 7 (100%)	4 of 14 (29%)
Lindane (gamma-BHC)	1 of 3 (33%)	1 of 18 (5.6%)	0 of 10 (0%)	0 of 18 (0%)
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	2 of 4 (50%)	NM

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or
the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no PEC or bioaccumulative-based SQG available; NM = substance was not measured.

Table 12.2. Proportion of sediment samples with various chemical characteristics in the USC.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments (all Prior to 1996)						
Columbus Drive to Forks	12	0 of 12 (0%)	0 of 12 (0%)	4 of 12 (33%)	8 of 12 (67%)	12 of 12 (100%)
Indianapolis Boulevard to Forks	11	0 of 11 (0%)	0 of 11 (0%)	1 of 11 (9.1%)	10 of 11 (91%)	11 of 11 (100%)
Forks to Highway 912	21	0 of 21 (0%)	1 of 21 (4.8%)	6 of 21 (29%)	14 of 21 (67%)	20 of 21 (95%)
Highway 912 to Dickey Road	18	1 of 18 (5.6%)	2 of 18 (11%)	7 of 18 (39%)	8 of 18 (44%)	15 of 18 (83%)
Dickey Road to B & O Railroad Bridge	36	1 of 36 (2.7%)	2 of 36 (5.6%)	12 of 36 (33%)	21 of 36 (58%)	33 of 36 (92%)
B & O Railroad to the Entrance to IH	16	0 of 16 (0%)	2 of 16 (13%)	5 of 16 (31%)	9 of 16 (56%)	14 of 16 (88%)
Total (all years and locations)	**114**	**2 of 114 (1.8%)**	**7 of 114 (6.1%)**	**35 of 114 (31%)**	**70 of 114 (61%)**	**105 of 114 (92%)**
Sub-Surface Sediments (all Prior to 1996)						
Columbus Drive to Forks	33	0 of 33 (0%)	0 of 33 (0%)	0 of 33 (0%)	33 of 33 (100%)	33 of 33 (100%)
Indianapolis Boulevard to Forks	18	0 of 18 (0%)	4 of 18 (22%)	2 of 18 (11%)	12 of 18 (67%)	14 of 18 (78%)
Forks to Highway 912	23	1 of 23 (4.3%)	3 of 23 (13%)	3 of 23 (13%)	16 of 23 (70%)	19 of 23 (83%)
Highway 912 to Dickey Road	6	2 of 6 (33%)	0 of 6 (0%)	2 of 6 (33%)	2 of 6 (33%)	4 of 6 (67%)
Dickey Road to B & O Railroad Bridge	12	0 of 12 (0%)	4 of 12 (33%)	0 of 12 (0%)	8 of 12 (67%)	8 of 12 (67%)
B & O Railroad to the Entrance to IH	9	0 of 9 (0%)	1 of 9 (11%)	5 of 9 (56%)	3 of 9 (33%)	8 of 9 (89%)
Total (all years and locations)	**101**	**3 of 101 (3.0%)**	**12 of 101 (12%)**	**12 of 101 (12%)**	**74 of 101 (73%)**	**86 of 101 (85%)**

Table 12.3. Concentrations of chemicals of concern in pore water from USC sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (Hoke *et al.* 1993)	Sample Site (USEPA 1996a)	
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	UG-12	IH 01 06	IH 01 07
Metals						
Cadmium	µg/L	2.9	NG	<5	0.19 (0.07)	14.3 (4.93)
Chromium	µg/L	NG	NG	<10	2.46	350.0
Copper	µg/L	35	NG	<5	5.3 (0.15)	126.3 (3.61)
Lead	µg/L	<16	NG	<20	5.3	1284.0
Nickel	µg/L	780	NG	<100	5.9 (0.01)	171.4 (0.22)
Zinc	µg/L	73	NG	36 (0.49)	6.3 (0.09)	1081 (14.8)
Sum Toxic Units[3]		NG	NG	0.49	0.32	23.6
Phenolics						
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM
o-Cresol	µg/L	NG	100	NM	NM	NM
p-Cresol	µg/L	NG	100	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM	NM
Phenol	µg/L	NG	45	NM	NM	NM
Other Substances						
Unionized ammonia	mg/L	NG	0.53	6.2	NR	NR

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (1994; 2000b).

[2] Acute toxicity thresholds for phenols and unionized ammonia were obtained from USEPA (1992a) and in CCREM (1987), respectively.

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 12.4. Summary of the available information on the toxicity of sediments, pore water and elutriates from the USC.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
Columbus Drive to Forks	21	20	95%
Indianapolis Boulevard to Forks	17	15	88%
Forks to Highway 912	20	16	80%
Highway 912 to Dickey Road	12	7	58%
Dickey Road to B & O Railroad Bridge	8	6	75%
B & O Railroad Bridge to the Entrance to IH	12	8	67%
Total	**90**	**72**	**80%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of USC sediments included amphipod survival growth, number of antennal segments, and % mature in 14-d and 28-d tests with whole sediments; midge survival and growth in 10-d and 14-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; cladoceran survival in 48-h tests with elutriate; 30-min Microtox with pore water; and, 15-min Microtox with elutriate.

Table 12.5. Status of benthic invertebrate communities in the USC.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other	Gastropoda	Bivalvia			
Artificial Substrate										
IDEM (2000a)	Dickey Road (1994)	90.7	0.0	0.0	0.0	2.1	0.0	1.0	2.2	Altered
Simon *et al* . (2000)	16	88.5	0.0	8.3	0.0	0.0	1.8	0.2	0.20	Altered
IDEM (2000a)	129th Street (1993)	98.4	0.0	0.0	0.0	0.0	0.0	0.0	2.8	Altered
IDEM (2000a)	Dickey Road (1996)	81.3	0.0	2.7	0.3	0.0	0.0	0.0	1.7	Altered
Simon *et al* . (2000)	13	85.7	0.1	5.8	0.1	0.0	0.0	0.0	0.33	Altered
Grab										
Polls *et al* . (1993)	6-82	97.7	0.3	0.0	0.0	0.0	1.9	0.0	ND	Altered
Polls and Dennison (1984)	C-2	99.0	0.3	0.0	0.0	0.1	0.6	0.0	ND	Altered
Polls *et al* . (1993)	6-86	98.8	0.1	0.0	0.0	0.3	0.3	0.0	ND	Altered
Polls and Dennison (1984)	C-1	95.1	0.9	0.0	0.0	0.0	3.9	0.0	ND	Altered
USEPA (1996a)	IH 01 05	98.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
Polls and Dennison (1984)	D-3	98.8	0.1	0.0	0.0	0.0	0.1	0.0	ND	Altered
Risatti and Ross (1989)	3	99.9	0.0	0.0	0.0	0.0	0.1	0.0	ND	Altered
Polls *et al* . (1993)	5-86	72.5	0.2	0.1	0.0	0.0	27.30	0.0	ND	Unaltered
USEPA (1996a)	IH 01 06	100.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
Polls *et al* . (1993)	5-82	98.3	0.0	0.0	0.0	0.0	1.7	0.0	ND	Altered
Polls and Dennison (1984)	D-4	93.7	1.2	0.0	0.0	0.1	0.0	0.0	ND	Altered
Risatti and Ross (1989)	12a	100.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
Risatti and Ross (1989)	2	99.7	0.3	0.0	0.0	0.0	0.0	0.0	ND	Altered
Polls and Dennison (1984)	F-1	99.9	0.1	0.0	0.0	0.0	0.0	0.0	ND	Altered
Polls and Dennison (1984)	F-2	99.9	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
USEPA (1996a)	IH 01 10	100.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
USEPA (1996a)	IH 01 08	99.9	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
Polls and Dennison (1984)	E-2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
Polls and Dennison (1984)	E-1	99.9	0.0	0.0	0.0	0.0	0.1	0.0	ND	Altered
USEPA (1996a)	IH 01 07	90.6	0.0	0.0	0.0	0.0	1.3	0.0	ND	Altered
Percent Altered Samples										**96% (24 of 25)**

[1] Reported values are percent of total abundance of invertebrates.

ND = not determined.

Table 12.6. Levels of TOC in USC sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
Columbus Drive to Forks	10	14.6	7.1 - 23.7
Indianapolis Boulevard to Forks	8	10.4	5.6 - 14.8
Forks to Highway 912	12	14.6	2.3 - 23.0
Highway 912 to Dickey Road	11	13.2	2.3 - 38.0
Dickey Road to B & O Railroad Bridge	17	13.4	2.1 - 37.0
B & O Railroad Bridge to the Entrance of IH	5	10.4	0.8 - 17.7
All Segments	**63**	**13.2**	**0.8 - 38.0**
Sub-Surface Sediments			
Columbus Drive to Forks	26	12.6	7.27 - 34.9
Indianapolis Boulevard to Forks	13	7.38	0.5 - 12.8
Forks to Highway 912	12	7.33	1.15 - 11.3
Highway 912 to Dickey Road	6	4.34	1.32 - 10.8
Dickey Road to B & O Railroad Bridge	4	9.87	1.07 - 21.0
B & O Railroad Bridge to the Entrance to IH	7	9.14	1.41 - 19.6
All Segments	**68**	**9.41**	**0.5 - 34.9**

Table 12.7. Levels of oil and grease in USC sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
Columbus Drive to Forks	1	65400	NA
Indianapolis Boulevard to Forks	2	136000	96600 - 175000
Forks to Highway 912	1	97500	NA
Highway 912 to Dickey Road	NA	NA	NA
Dickey Road to B & O Railroad Bridge	2	54500	43200 - 65700
B & O Railroad Bridge to the Entrance to IH	2	25100	8600 - 41600
All Segments	**8**	**74200**	**8600 - 175000**
Sub-Surface Sediments			
Columbus Drive to Forks	4	54300	44600 - 66600
Indianapolis Boulevard to Forks	5	81500	15800 - 119000
Forks to Highway 912	2	101000	96000 - 106000
Highway 912 to Dickey Road	NA	NA	NA
Dickey Road to B & O Railroad Bridge	2	34100	550 - 67700
B & O Railroad Bridge to the Entrance to IH	2	14300	2200 - 26400
All Segments	**15**	**61600**	**550 - 119000**

NA = not applicable.

Table 12.8. Frequency of exceedance of TRGs in the USC.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	3 of 3 (100%)	13 of 13 (100%)	NM	2 of 2 (100%)	1 of 1 (100%)
Pesticides					
Chlordane	0 of 3 (0%)	NM	NM	NM	NM
Dieldrin + Aldrin	2 of 3 (67%)	NM	NM	NM	NM
Endrin	0 of 3 (0%)	NM	NM	NM	NM
Heptachlor + Heptachlor epoxide	0 of 3 (0%)	NM	NM	NM	NM
Lindane	0 of 3 (0%)	NM	NM	NM	NM
Mirex	NM	NM	NM	NM	NM
Total DDTs	1 of 3 (33%)	NM	NM	NM	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole body = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 12.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the USC.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediments							
Columbus Drive to Forks	12	5.99	2.25	22.0	2.25	7.98	4.41
Indianapolis Boulevard to Forks	11	13.2	3.51	35.2	4.10	24.9	8.18
Forks to Highway 912	21	10.5	0.610	61.3	3.07	23.7	5.21
Highway 912 to Dickey Road	18	5.72	0.0652	29.3	0.55	12.6	3.14
Dickey Road to B & O Railroad Bridge	36	18.8	0.0395	177	1.17	29.7	9.90
B & O Railroad Bridge to the Entrance to IH	16	7.04	0.233	25.2	0.691	10.8	6.33
Overall	**114**	**11.7**	**0.0395**	**177**	**1.11**	**24.9**	**5.16**
Sub-Surface Sediments							
Columbus Drive to Forks	33	20.9	4.35	57.9	4.90	43.0	13.8
Indianapolis Boulevard to Forks	18	12.8	0.178	37.8	0.207	34.4	6.72
Forks to Highway 912	23	14.9	0.0557	45.3	0.222	36.5	6.71
Highway 912 to Dickey Road	6	2.45	0.0522	5.28	0.0522	5.18	2.08
Dickey Road to B & O Railroad Bridge	12	34.2	0.222	170	0.256	67.9	8.21
B & O Railroad Bridge to the Entrance to IH	9	3.23	0.225	5.04	0.225	4.96	3.47
Overall	**101**	**17.0**	**0.0522**	**170**	**0.245**	**38.8**	**7.25**

Tables

Chapter 13 - Indiana Harbor

Table 13.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in IH and nearshore areas of Lake Michigan sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Metals				
Arsenic	13 of 59 (22%)	4 of 6 (67%)	NG	NG
Cadmium	19 of 44 (43%)	14 of 24 (58%)	NG	NG
Chromium	40 of 75 (53%)	14 of 24 (58%)	NG	NG
Copper	25 of 50 (50%)	14 of 24 (58%)	NG	NG
Lead	36 of 77 (47%)	18 of 24 (75%)	NG	NG
Mercury	0 of 14 (0%)	0 of 7 (0%)	NG	NG
Nickel	28 of 77 (36%)	12 of 24 (50%)	NG	NG
Zinc	43 of 77 (56%)	18 of 24 (75%)	NG	NG
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	19 of 19 (100%)	NM	NG	NG
Acenaphthylene	26 of 26 (100%)	NM	NG	NG
Anthracene	30 of 31 (97%)	NM	NG	NG
Benz(a)anthracene	22 of 32 (69%)	NM	NG	NG
Benzo(a)pyrene	27 of 30 (90%)	NM	NG	NG
Chrysene	33 of 33 (100%)	NM	NG	NG
Dibenz(a,h)anthracene	9 of 9 (100%)	NM	NG	NG
Fluoranthene	35 of 36 (97%)	NM	NG	NG
Fluorene	28 of 30 (93%)	NM	NG	NG
2-Methylnaphthalene	25 of 26 (96%)	NM	NG	NG
Naphthalene	33 of 33 (100%)	NM	NG	NG
Phenanthrene	35 of 35 (100%)	NM	NG	NG
Pyrene	35 of 36 (97%)	NM	NG	NG
Total PAHs	33 of 44 (75%)	NM	NG	NG
PCBs				
Total PCBs	6 of 40 (15%)	2 of 7 (29%)	29 of 33 (88%)	0 of 0 (0%)

Table 13.1. Frequency of exceedances of the PECs and bioaccumulation-based SQGs in IH and nearshore areas of Lake Michigan sediments.

Chemical of Concern	Sediment-Dwelling Organisms		Wildlife	
	Surficial Sediments	Sub-Surface Sediments	Surficial Sediments	Sub-Surface Sediments
Pesticides				
Chlordane	1 of 1 (100%)	NM	1 of 1 (100%)	NM
sum DDD	0 of 0 (0%)	NM	NG	NG
sum DDE	1 of 1 (100%)	NM	NG	NG
sum DDT	0 of 2 (0%)	NM	NG	NG
Total DDTs	0 of 2 (0%)	NM	0 of 2 (0%)	NM
Dieldrin	1 of 2 (50%)	NM	NG	NG
Endrin	0 of 2 (0%)	NM	0 of 2 (0%)	NM
Heptachlor	NG	NG	0 of 0 (0%)	NM
Heptachlor epoxide	0 of 0 (0%)	NM	0 of 0 (0%)	NM
Lindane (gamma-BHC)	0 of 0 (0%)	NM	0 of 2 (0%)	NM
Toxaphene	NG	NG	NG	NG
Dioxins				
2,3,7,8-TCDD	NG	NG	1 of 1 (100%)	NM

Note: The absence of a chemical substance on this list does not necessarily mean that the substance does not pose a hazard to sediment dwelling organisms, wildlife, or fish consumption.
0 of 0 (0%) = the substance was measured but all values were excluded from analyses because they were less than a detection limit that exceeded a PEC or other SQG; or the substance was measured but cannot be compared to the TOC-normalized SQG because TOC was not reported for the station.
NG = no guideline (i.e., no PEC or bioaccumulative-based SQG available); NM = substance was not measured.

Table 13.2. Proportion of sediment samples with various chemical characteristics in the IH and nearshore areas of Lake Michigan.

Reach Segment	Number of Samples	Mean PEC-Qs				
		< 0.1	≥ 0.1 - < 0.7	≥ 0.7 - < 4.0	≥ 4.0	≥ 0.7
Surficial Sediments (all Prior to 1996)						
Indiana Harbor	55	1 of 55 (1.8%)	5 of 55 (9.1%)	37 of 55 (67%)	12 of 55 (22%)	49 of 55 (89%)
Nearshore Areas of Lake Michigan	32	7 of 32 (22%)	24 of 32 (75%)	1 of 32 (3.1%)	0 of 32 (0%)	1 of 32 (3.1%)
Total (all years and locations)	**87**	**8 of 87 (9.2%)**	**29 of 87 (33%)**	**38 of 87 (44%)**	**12 of 87 (14%)**	**50 of 87 (57%)**
Sub-Surface Sediments (all Prior to 1996)						
Indiana Harbor	23	3 of 23 (13%)	2 of 23 (8.7%)	14 of 23 (61%)	4 of 23 (17%)	18 of 23 (78%)
Nearshore Areas of Lake Michigan	1	0 of 1 (0%)	1 of 1 (100%)	0 of 1 (0%)	0 of 1 (0%)	0 of 1 (0%)
Total (all years and locations)	**24**	**3 of 24 (13%)**	**3 of 24 (13%)**	**14 of 24 (58)%**	**4 of 24 (17%)**	**18 of 24 (75%)**

Table 13.3. Concentrations of chemicals of concern in pore water from IH sediments.

Chemical of Concern	Units	Toxicity Threshold		Sample Site (Hoke *et al.* 1993)	Sample Site (USEPA 1996a)	
		10-d LC_{50} for *Hyalella azteca* [1]	Acute Threshold for Aquatic Invertebrates[2]	UG-13	IH 01 04	IH 01 03
Metals						
Cadmium	µg/L	2.9	NG	<5	1.0 (0.34)	1.1 (0.38)
Chromium	µg/L	NG	NG	<10	28.6	13.2
Copper	µg/L	35	NG	<5	21.3 (0.61)	21.4 (0.61)
Lead	µg/L	<16	NG	<20	92.8	96.8
Nickel	µg/L	780	NG	<100	7.5 (0.01)	10.4 (0.01)
Zinc	µg/L	73	NG	132 (1.81)	50.3 (0.69)	60.8 (0.83)
Sum Toxic Units[3]		NG	NG	1.81	1.65	1.83
Phenolics						
o-Chlorophenol	µg/L	NG	5600	NM	NM	NM
p-Chlorophenol	µg/L	NG	5600	NM	NM	NM
2,4-Dichlorophenol	µg/L	NG	520	NM	NM	NM
o-Cresol	µg/L	NG	100	NM	NM	NM
p-Cresol	µg/L	NG	100	NM	NM	NM
2,4-Dinitrophenol	µg/L	NG	NG	NM	NM	NM
Phenol	µg/L	NG	45	NM	NM	NM
Other Substances						
Unionized ammonia	mg/L	NG	0.53	0.3	NM	NM

[1] The 10-d LC_{50}s for the amphipod *Hyalella azteca* for water-only exposures were obtained from USEPA (2000b).

[2] Acute toxicity thresholds for unionized ammonia were obtained from CCREM (1987).

[3] Sum toxic units were calculated as the sum of the toxic units that were determined for each substance (i.e., as shown in parenthesis and calculated as the chemical concentration divided by the 10-d LC_{50}).

NG = no guideline; NM = not measured.

Table 13.4. Summary of the available information on the toxicity of sediments, pore water and elutriates from the IH and nearshore areas of Lake Michigan.

Reach Segment	Number of Samples	Number of Toxic Samples	% Toxicity
Overall Toxicity			
Indiana Harbor	32	26	81%
Nearshore Areas of Lake Michigan	6	2	33%
Total	**38**	**28**	**74%**

Overall toxicity was determined when the sample was toxic to one or more species. The species and endpoints that were used to evaluate the toxicity of IH and nearshore areas of Lake Michigan sediments included amphipod survival, growth, # antennal segments and % mature in 14-d and 28-d tests with whole sediments; midge survival and growth in 10-d and 14-d tests with whole sediments; cladoceran survival in 48-h tests with pore water; cladoceran survival in 48-h tests with elutriate; 30-min Microtox with pore water; and, 15-min Microtox with elutriate.

Table 13.5. Status of benthic invertebrate communities in the IH and nearshore areas of Lake Michigan.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Artificial Substrate										
Simon *et al* . (2000)	17	69.4	0.0	1.9	0.0	0.0	9.2	0.2	0.80	Altered
Grab										
Polls *et al* . (1993)	15-86	46.3	0.0	30.5	0.0	3.2	2.7	0.5	ND	Unaltered
Polls *et al* . (1993)	18-86	61.7	1.6	22.9	0.0	1.5	10.4	0.1	ND	Unaltered
Polls *et al* . (1993)	17-86	20.0	0.0	50.0	0.0	2.9	8.6	0.0	ND	Unaltered
Polls *et al* . (1993)	14-86	26.1	1.9	37.9	0.0	5.0	11.5	0.0	ND	Unaltered
Polls *et al* . (1993)	16-86	29.9	0.8	22.4	0.0	7.8	6.9	0.0	ND	Unaltered
LTI (1984)	WS-1	60.8	0.0	26.0	0.0	0.0	4.4	0.0	ND	Unaltered
Polls *et al* . (1993)	13-86	20.0	5.6	25.6	0.0	26.7	20.0	0.0	ND	Unaltered
LTI (1984)	WS-2	76.2	0.0	5.3	0.5	3.7	9.0	0.0	ND	Altered
Polls *et al* . (1993)	17-82	36.2	0.1	57.8	0.3	0.0	0.4	0.0	ND	Unaltered
LTI (1984)	WS-3	74.9	0.0	9.1	2.3	0.0	6.8	0.0	ND	Altered
LTI (1984)	WS-4	84.9	0.0	12.6	0.0	0.0	2.5	0.0	ND	Altered
LTI (1984)	WS-5	78.2	0.0	8.9	1.6	0.8	8.1	0.0	ND	Altered
LTI (1984)	WS-6	51.2	0.0	9.7	4.9	19.5	12.2	0.0	ND	Unaltered
LTI (1984)	WS-7	58.2	0.0	25.0	0.0	0.0	8.4	0.0	ND	Unaltered
LTI (1984)	WS-8	79.5	0.7	4.9	1.4	0.0	9.2	0.0	ND	Altered
Risatti and Ross (1989)	6	66.7	0.0	0.0	0.0	0.0	0.0	0.0	ND	Unaltered
Risatti and Ross (1989)	11	66.7	0.0	7.0	0.0	7.0	7.0	0.0	ND	Unaltered
LTI (1984)	S8-7	96.6	0.0	3.4	0.0	0.0	0.0	0.0	ND	Altered
LTI (1984)	WS-9	75.0	0.0	13.1	2.4	1.2	0.0	0.0	ND	Altered
Polls *et al* . (1993)	10-82	72.7	0.2	16.9	0.0	0.9	4.9	0.3	ND	Unaltered
Polls *et al* . (1993)	12-82	74.5	1.5	19.3	0.0	2.7	0.3	0.2	ND	Altered
Polls *et al* . (1993)	13-82	32.7	0.6	29.4	0.0	10.8	14.4	0.0	ND	Unaltered
Polls *et al* . (1993)	14-82	57.4	1.5	25.7	0.0	2.8	9.5	0.9	ND	Unaltered
Risatti and Ross (1989)	9a	76.7	0.0	10.3	0.0	0.9	3.7	0.0	ND	Altered
Polls *et al* . (1993)	16-82	14.0	1.5	49.9	0.0	6.4	5.1	0.1	ND	Unaltered

Table 13.5. Status of benthic invertebrate communities in the IH and nearshore areas of Lake Michigan.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Grab (cont.)										
Polls *et al* . (1993)	12-86	38.5	4.6	54.5	0.0	0.3	0.0	0.3	ND	Unaltered
Risatti and Ross (1989)	10a	73.1	0.0	0.0	0.0	4.5	0.0	0.0	ND	Unaltered
Polls *et al* . (1993)	18-82	53.1	0.9	36.9	0.3	0.0	0.6	0.0	ND	Unaltered
Risatti and Ross (1989)	8	95.5	1.9	0.6	0.0	0.6	0.0	0.0	ND	Altered
Risatti and Ross (1989)	7	20.7	0.0	0.0	0.0	3.4	13.8	0.0	ND	Unaltered
Polls *et al* . (1993)	10-86	62.5	0.0	14.9	0.0	2.7	19.9	0.0	ND	Unaltered
Polls *et al* . (1993)	11-86	67.0	0.9	18.9	0.0	5.7	7.6	0.0	ND	Unaltered
Polls *et al* . (1993)	15-82	43.4	0.6	36.4	0.0	1.1	11.2	0.0	ND	Unaltered
LTI (1984)	Indiana Hrb.-4	57.3	0.0	28.3	0.0	0.0	0.0	0.0	ND	Unaltered
Polls and Dennison (1984)	H-1	56.8	0.0	7.9	0.0	3.0	4.1	0.0	ND	Unaltered
LTI (1984)	S8-5	94.8	0.0	3.5	0.0	0.0	0.0	0.0	ND	Altered
LTI (1984)	WS-10	40.2	0.0	0.0	0.0	0.0	0.0	0.0	ND	Unaltered
Polls and Dennison (1984)	G-2	94.75	0.47	0.57	0.00	1.53	2.39	0.00	ND	Altered
Polls and Dennison (1984)	G-3	83.7	0.5	3.8	0.0	0.9	5.0	0.0	ND	Altered
Polls and Dennison (1984)	H-2	76.4	0.3	11.1	0.0	2.6	2.8	0.0	ND	Altered
Polls and Dennison (1984)	H-3	15.5	0.0	1.5	0.0	0.2	6.7	0.0	ND	Unaltered
Polls and Dennison (1984)	G-1	92.8	0.4	1.7	0.0	0.2	3.6	0.0	ND	Altered
LTI (1984)	Indiana Hrb.-3	93.8	0.0	0.0	0.0	0.0	6.3	0.0	ND	Altered
LTI (1984)	Indiana Hrb.-2	50.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Unaltered
LTI (1984)	S8-12	66.7	0.0	0.0	0.0	33.3	0.0	0.0	ND	Unaltered
LTI (1984)	S8-10	88.8	5.6	0.0	0.0	0.0	0.0	0.0	ND	Altered
LTI (1984)	S8-2	74.3	0.0	11.4	5.7	0.0	0.0	0.0	ND	Altered
LTI (1984)	S8-9	85.2	2.9	5.9	3.0	1.5	0.0	0.0	ND	Altered
LTI (1984)	S8-8	76.8	7.7	0.0	0.0	7.7	7.8	0.0	ND	Altered
LTI (1984)	S8-6	95.8	0.0	1.4	2.8	0.0	0.0	0.0	ND	Altered
LTI (1984)	WS-11	74.2	0.0	7.0	3.0	0.0	7.9	0.0	ND	Altered
LTI (1984)	S8-4	100.0	0.0	0.0	0.0	0.0	0.0	0.0	ND	Altered
LTI (1984)	S8-3	54.6	0.0	15.2	6.0	0.0	12.1	0.0	ND	Unaltered

Table 13.5. Status of benthic invertebrate communities in the IH and nearshore areas of Lake Michigan.

Source	Sample Number	Annelida (%)[1]		Diptera (%)[1]		Mollusca (%)[1]		EPT Taxa	mIBI	Altered/ Unaltered
		Oligochaetea	Hirudinea	Chironomidae	Other Diptera	Gastropoda	Bivalvia			
Grab (cont.)										
LTI (1984)	S8-1	97.5	0.0	1.2	1.2	0.0	0.0	0.0	ND	Altered
LTI (1984)	S8-11	60.3	0.0	39.7	0.0	0.0	0.0	0.0	ND	Unaltered
LTI (1984)	WS-12	72.7	0.0	3.7	3.6	3.7	10.9	0.0	ND	Unaltered
Polls *et al* . (1993)	9-82	97.5	0.1	1.0	0.0	0.0	1.2	0.0	ND	Altered
Polls *et al* . (1993)	8-82	96.2	0.2	0.0	0.0	0.2	3.3	0.0	ND	Altered
Polls *et al* . (1993)	7-82	95.4	0.1	0.0	0.0	0.1	4.5	0.0	ND	Altered
Risatti and Ross (1989)	4	60.0	0.0	0.0	0.0	20.0	0.0	0.0	ND	Unaltered
USEPA (1996a)	IH 01 04	98.5	0.0	0.0	0.0	0.0	0.1	0.0	ND	Altered
Risatti and Ross (1989)	5	71.4	0.0	0.0	0.0	0.0	19.1	0.0	ND	Unaltered
LTI (1984)	Indiana Hrb.-1	98.2	0.0	0.3	0.0	0.0	1.5	0.0	ND	Altered
Polls and Dennison (1984)	B-2	90.7	1.0	0.0	0.0	1.0	3.9	0.0	ND	Altered
Polls and Dennison (1984)	B-1	88.6	1.7	0.0	0.0	0.0	5.3	0.0	ND	Altered
USEPA (1996a)	IH 01 03	99.3	0.0	0.0	0.0	0.0	0.2	0.0	ND	Altered
Polls *et al* . (1993)	7-86	96.4	0.2	0.0	0.0	0.5	2.8	0.0	ND	Altered
Polls and Dennison (1984)	A-1	93.2	0.0	1.0	0.0	0.7	1.5	0.0	ND	Altered
Polls *et al* . (1993)	9-86	86.4	0.0	9.7	0.0	0.6	0.6	0.0	ND	Altered
Polls and Dennison (1984)	A-2	60.3	0.0	0.0	0.0	0.0	2.7	0.0	ND	Unaltered
Polls *et al* . (1993)	8-86	81.4	1.6	0.8	0.0	1.9	14.0	0.0	ND	Altered
Percent Altered Samples										**51% (37 of 72)**

[1] Report values are percent of total abundance of invertebrates.

ND = not determined.

Table 13.6. Levels of TOC in IH and nearshore areas of Lake Michigan sediments.

Reach Segment	Number of Samples	TOC (%)	
		Mean	Range
Surficial Sediments			
Indiana Harbor	24	11.8	0.13 - 32.0
Nearshore Areas of Lake Michigan	31	0.511	0.00240 - 7.64
All Segments	**55**	**5.45**	**0.00240 - 32.0**
Sub-Surface Sediments			
Indiana Harbor	17	13.4	0.080 - 60.2
Nearshore Areas of Lake Michigan	0	NA	NA
All Segments	**17**	**13.4**	**0.080 - 60.2**

NA = not applicable.

Table 13.7. Levels of oil and grease in IH and nearshore areas of Lake Michigan sediments.

Reach Segment	Number of Samples	Oil and Grease (mg/kg)	
		Mean	Range
Surficial Sediments			
Indiana Harbor	3	42600	510 - 100000
Nearshore Areas of Lake Michigan	1	310	NA
All Segments	**4**	**32000**	**310 - 100000**
Sub-Surface Sediments			
Indiana Harbor	6	43800	680 - 76000
Nearshore Areas of Lake Michigan	1	520	NA
All Segments	**7**	**37600**	**520 - 76000**

NA = not applicable.

Table 13.8. Frequency of exceedance of TRGs in IH and nearshore areas of Lake Michigan.

Chemical of Concern	Fish			Invertebrates	Algae
	Fillets[1]	Whole Body[2]	GI Tract[3]	Composite Sample	Composite Sample
PCBs					
Total PCBs	NM	15 of 17 (88%)	NM	3 of 4 (75%)	3 of 5 (60%)
Pesticides					
Chlordane	NM	NM	NM	NM	NM
Dieldrin + Aldrin	NM	NM	NM	NM	NM
Endrin	NM	NM	NM	NM	NM
Heptachlor + Heptachlor epoxide	NM	NM	NM	NM	NM
Lindane	NM	NM	NM	NM	NM
Mirex	NM	NM	NM	NM	NM
Total DDTs	NM	NM	NM	NM	NM
Dioxins					
2,3,7,8-TCDD	NM	NM	NM	NM	NM

[1]Fillets = skin-off fillets.

[2]Whole body = head, gills, skin, bones and attached flesh (i.e., without fillets or GI tract).

[3]GI tract = organs in body cavity post gills.

NM = not measured.

Table 13.9. Summary of the distribution of mean PEC-Qs in surficial and sub-surface sediments in the IH and nearshore areas of Lake Michigan.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Surficial Sediments							
Indiana Harbor	55	6.81	0.0699	90.1	0.652	6.84	2.35
Nearshore Areas of Lake Michigan	32	0.215	0.0447	1.31	0.0523	0.379	0.142
Overall	**87**	**4.38**	**0.0447**	**90.1**	**0.104**	**4.92**	**1.27**
Sub-Surface Sediments							
Indiana Harbor	23	2.45	0.0412	7.19	0.0607	5.90	1.81
Nearshore Areas of Lake Michigan	1	0.136	0.136	0.136	NA	NA	NA
Overall	**24**	**2.35**	**0.0412**	**7.19**	**0.0607**	**5.9**	**1.75**

NA = not applicable.

Tables

Chapter I4 - Summary of Sediment Injury for the Assessment Area

Table 14.1. Summary of assessment of sediment injury to sediment-dwelling organisms.

Reach/Segment	Indicator of Injury to Sediment-Dwelling Organisms[1]				Number of Lines of Evidence for Demonstrating Injury to Sediment-Dwelling Organisms
	Sediment Chemistry[2]	Pore Water Chemistry[3]	Sediment Toxicity[4]	Benthic Community[5]	
Grand Calumet River Lagoons	27% (n=215)*	0% (n=5)	50% (n=12)*	ID (n=0)	2
East Branch Grand Calumet River-I	83% (n=269)*	55% (n=20)*	73% (n=44)*	100% (n=14)*	4
East Branch Grand Calumet River-II	72% (n=131)*	100% (n=2)*	88% (n=52)*	100% (n=5)*	4
West Branch Grand Calumet River-I	90% (n=31)*	100% (n=2)*	100% (n=2)*	100% (n=3)*	4
West Branch Grand Calumet River-II	76% (n=172)*	88% (n=8)*	83% (n=18)*	71% (n=14)*	4
Indiana Harbor Canal	89% (n=36)*	60% (n=5)*	80% (n=5)*	100% (n=6)*	4
Lake George Branch	82% (n=33)*	83% (n=6)*	57% (n=7)*	100% (n=4)*	4
US Canal	89% (n=215)*	67% (n=3)*	80% (n=90)*	96% (n=25)*	4
Indiana Harbor / Lake Michigan	61% (n=111)*	100% (n=3)*	74% (n=38)*	51% (n=72)*	4
Overall	**70% (n=1213)***	**65% (n=54)***	**78% (n=268)***	**72% (n=143)***	**4**

[1] For each line of evidence, sediment injury is indicated if two or more samples have conditions sufficient to cause or substantially contribute to sediment injury. Evidence of sediment injury is denoted with an asterisk (*).

[2] Percent of sediment samples with mean PEC-Qs of $\geq$ 0.7.

[3] Percent of pore water samples with chemical concentrations > published toxicity thresholds.

[4] Percent of sediment samples that are toxic to aquatic organisms in laboratory tests.

[5] Percent of samples with altered benthic invertebrate community structure.

ID = insufficient data; n = number of samples.

Table 14.2. Summary of the distribution of mean PEC-Qs in surficial sediments in the Assessment Area.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Grand Calumet River Lagoons							
West Lagoon	58	555	0.0556	23800	0.146	26.6	1.04
Middle Lagoon	49	0.941	0.0914	16.1	0.101	2.18	0.290
East Lagoon	47	0.558	0.0768	2.30	0.106	1.28	0.376
Little West Pond	25	0.326	0.0646	2.51	0.0937	0.425	0.178
Little East Pond	23	0.111	0.0639	0.220	0.0668	0.141	0.0995
Overall	**202**	**160**	**0.0556**	**23800**	**0.0925**	**3.19**	**0.289**
East Branch Grand Calumet River-I							
EB and WB Confluence to Kennedy Avenue	29	8.34	0.112	77.4	0.255	25.9	2.88
USS Lead Canal	17	27.7	3.60	72.6	5.45	65.3	13.0
Kennedy Avenue to Cline Avenue	51	7.20	0.457	58.2	1.20	12.3	4.61
Cline Avenue to Cline/I-90 Ramps	15	4.59	0.104	12.1	1.31	7.29	3.73
Cline/I-90 Ramps to Industrial Highway	21	28.9	0.71	184	2.12	45.4	5.94
Industrial Highway to ConRail Bridge	12	36.8	1.92	357	2.24	18.9	3.58
EB Wetland	17	3.99	0.0655	15.7	0.208	6.88	3.23
Overall	**162**	**14.0**	**0.0655**	**357**	**0.875**	**30.3**	**4.58**
East Branch Grand Calumet River-II							
EB II Wetland	55	1.12	0.000636	16.0	0.0901	2.75	0.230
ConRail Bridge to Bridge Street	8	25.3	13.1	51.9	13.1	38.3	22.5
Bridge Street to Grant Street	6	10.7	2.58	17.6	2.58	13.4	11.1
Grant Street to I-90	3	30.0	4.66	68.8	4.66	16.6	16.6
I-90 to Broadway	9	52.1	1.54	375	1.54	39.5	6.44
Broadway to Virginia Street	4	27.5	2.59	63.4	2.59	29.9	22.1
Virginia Street to Tennessee Street	4	473	87.2	821	87.2	705	492
Tennessee Street to Lagoon Culvert	9	286	1.43	987	1.43	589	9.25
Overall	**98**	**55.7**	**0.000636**	**987**	**0.0986**	**63.4**	**2.42**
West Branch Grand Calumet River-I							
EB and WB Confluence to Indianapolis Boulevard	**19**	**29.5**	**1.13**	**231**	**1.35**	**56.9**	**11.7**

Table 14.2. Summary of the distribution of mean PEC-Qs in surficial sediments in the Assessment Area.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
West Branch Grand Calumet River-II							
Indianapolis Boulevard to I-90	14	15.5	0.149	75.3	0.243	35.3	6.22
Roxana Marsh	5	0.428	0.123	0.603	0.123	0.595	0.515
I-90 to Columbia Avenue	22	12.3	0.0395	76.0	1.01	16.2	6.53
Columbia Avenue to Calumet Avenue	2	3.71	0.259	7.17	NA	NA	NA
Calumet Avenue to Hohman Avenue	9	37.6	0.311	210	0.311	88.6	6.85
Hohman Avenue to State Line Avenue	21	47.5	0.875	304	2.51	94.9	28.7
Illinois Portion	11	6.00	2.71	10.1	2.97	9.65	4.89
Overall	**84**	**22.6**	**0.0395**	**304**	**0.347**	**67.1**	**6.71**
Indiana Harbor Canal							
EB and WB Confluence to 151st Street	7	5.44	2.10	10.4	2.10	8.21	4.85
151st Street to Chicago Avenue	10	3.00	0.191	8.84	0.191	7.19	2.29
Chicago Avenue to Columbus Drive	12	7.29	1.09	25.9	1.69	11.5	5.34
IHC Wetland	1	0.718	0.718	0.718	NA	NA	NA
Overall	**30**	**5.21**	**0.191**	**25.9**	**0.491**	**10.4**	**4.08**
Lake George Branch							
Indianapolis Boulevard to B & O Railroad Bridge	7	4.81	1.75	14.5	1.75	6.00	2.91
B & O Railroad Bridge to Fill Area	4	13.9	3.13	31.5	3.13	16.4	10.5
Lake George Wetlands	12	0.870	0.0786	1.67	0.0916	1.60	0.729
Overall	**23**	**4.33**	**0.0786**	**31.5**	**0.484**	**6.00**	**1.67**
US Canal							
Columbus Drive to Forks	12	5.99	2.25	22.0	2.25	7.98	4.41
Indianapolis Boulevard to Forks	11	13.2	3.51	35.2	4.10	24.9	8.18
Forks to Highway 912	21	10.5	0.61	61.3	3.07	23.7	5.21
Highway 912 to Dickey Road	18	5.72	0.0652	29.3	0.55	12.6	3.14
Dickey Road to B & O Railroad Bridge	36	18.8	0.0395	177	1.17	29.7	9.90
B & O Railroad Bridge to IH	16	7.04	0.233	25.2	0.691	10.8	6.33
Overall	**114**	**11.7**	**0.0395**	**177**	**1.11**	**24.9**	**5.16**

Table 14.2. Summary of the distribution of mean PEC-Qs in surficial sediments in the Assessment Area.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
IH and Nearshore Areas of Lake Michigan							
Indiana Harbor	55	6.81	0.0699	90.1	0.652	6.84	2.35
Nearshore areas of Lake Michigan	32	0.215	0.0447	1.31	0.0523	0.379	0.142
Overall	**87**	**4.4**	**0.0447**	**90.1**	**0.104**	**4.92**	**1.27**

NA = not applicable.

Table 14.3. Summary of the distribution of mean PEC-Qs in sub-surface sediments in the Assessment Area.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
Grand Calumet River Lagoons							
West Lagoon	6	427	0.0185	2560	0.0185	0.317	0.0964
Middle Lagoon	3	0.0336	0.0147	0.0600	0.0147	0.0260	0.0260
East Lagoon	0	NA	NA	NA	NA	NA	NA
Little West Pond	2	0.120	0.0675	0.172	NA	NA	NA
Little East Pond	2	0.0412	0.0334	0.0490	NA	NA	NA
Overall	**13**	**197**	**0.0147**	**2560**	**0.0185**	**0.172**	**0.0490**
East Branch Grand Calumet River-I							
EB and WB Confluence to Kennedy Avenue	18	3.51	0.0692	13.1	0.193	8.30	2.77
USS Lead Canal	9	24.2	5.64	80.8	5.64	54.4	12.1
Kennedy Avenue to Cline Avenue	54	16.9	0.0286	497	0.0887	16.9	3.06
Cline Avenue to Cline/I-90 Ramps	7	1.47	0.0555	4.20	0.0555	2.63	1.21
Cline/I-90 Ramps to Industrial Highway	12	3.55	0.0847	13.6	0.123	5.50	2.78
Industrial Highway to ConRail Bridge	6	18.6	0.593	99.1	0.593	5.15	2.98
EB Wetland	1	0.627	0.627	0.627	NA	NA	NA
Overall	**107**	**12.7**	**0.0286**	**497**	**0.107**	**16.9**	**2.98**
East Branch Grand Calumet River-II							
EB II Wetland	0	NA	NA	NA	NA	NA	NA
ConRail Bridge to Bridge Street	9	14.1	2.55	65.3	2.55	19.1	7.21
Bridge Street to Grant Street	4	4.94	2.47	6.58	2.47	5.89	5.36
Grant Street to I-90	4	4.43	2.09	7.19	2.09	6.28	4.21
I-90 to Broadway	6	29.1	2.13	116	2.13	36.2	7.84
Broadway to Virginia Street	0	NA	NA	NA	NA	NA	NA
Virginia Street to Tennessee Street	3	450	118	937	118	296	296
Tennessee Street to Lagoon Culvert	7	218	2.80	765	2.80	458	66.3
Overall	**33**	**97.6**	**2.09**	**937**	**2.47**	**188**	**7.21**
West Branch Grand Calumet River-I							
EB and WB Confluence to Indianapolis Boulevard	**12**	**4.80**	**0.139**	**13.7**	**0.368**	**8.80**	**3.77**

Table 14.3. Summary of the distribution of mean PEC-Qs in sub-surface sediments in the Assessment Area.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
West Branch Grand Calumet River-II							
Indianapolis Boulevard to I-90	10	0.191	0.0976	0.357	0.0976	0.278	0.205
Roxana Marsh	5	0.0905	0.0652	0.111	0.0652	0.101	0.0919
I-90 to Columbia Avenue	25	8.18	0.0658	30.2	0.128	16.9	3.34
Columbia Avenue to Calumet Avenue	3	3.21	0.215	5.89	0.215	3.53	3.53
Calumet Avenue to Hohman Avenue	13	13.1	0.109	97.3	0.325	17.9	3.78
Hohman Avenue to State Line Avenue	25	51.0	0.0712	193	2.47	129	33.4
Illinois Portion	7	4.69	0.148	13.3	0.148	8.45	3.74
Overall	**88**	**19.3**	**0.0652**	**193**	**0.101**	**51.7**	**3.84**
Indiana Harbor Canal							
EB and WB Confluence to 151st Street	4	2.90	0.434	4.36	0.434	4.12	3.41
151st Street to Chicago Avenue	0	NA	NA	NA	NA	NA	NA
Chicago Avenue to Columbus Drive	2	5.87	2.09	9.64	NA	NA	NA
IHC Wetland	0	NA	NA	NA	NA	NA	NA
Overall	**6**	**3.89**	**0.434**	**9.64**	**0.434**	**4.36**	**3.41**
Lake George Branch							
Indianapolis Boulevard to B & O Railroad Bridge	3	5.88	2.66	11.8	2.66	3.19	3.19
B & O Railroad Bridge to Fill Area	6	6.15	0.367	14.2	0.367	9.87	5.40
Lake George Wetlands	1	0.0457	0.0457	0.0457	NA	NA	0.0457
Overall	**10**	**5.46**	**0.0457**	**14.2**	**0.0457**	**11.8**	**3.20**
US Canal							
Columbus Drive to Forks	33	20.9	4.35	57.9	4.90	43.0	13.8
Indianapolis Boulevard to Forks	18	12.8	0.178	37.8	0.207	34.4	6.72
Forks to Highway 912	23	14.9	0.0557	45.3	0.222	36.5	6.71
Highway 912 to Dickey Road	6	2.45	0.0522	5.28	0.0522	5.18	2.08
Dickey Road to B & O Railroad Bridge	12	34.2	0.222	170	0.256	67.9	8.21
B & O Railroad Bridge to IH	9	3.23	0.225	5.04	0.225	4.96	3.47
Overall	**101**	**17.0**	**0.0522**	**170**	**0.245**	**38.8**	**7.25**

Table 14.3. Summary of the distribution of mean PEC-Qs in sub-surface sediments in the Assessment Area.

Reach Segment	Number of Samples	Average of Mean PEC-Q	Minimum Mean PEC-Q	Maximum Mean PEC-Q	10th Percentile	90th Percentile	Median
IH and nearshore areas of Lake Michigan							
Indiana Harbor	23	2.45	0.0412	7.19	0.0607	5.90	1.81
Nearshore areas of Lake Michigan	1	0.136	0.136	0.136	NA	NA	NA
Overall	**24**	**2.35**	**0.0412**	**7.19**	**0.0607**	**5.90**	**1.75**

NA = not applicable.

Table 14.4. Summary of the available information on SEM-AVS in the Assessment Area.

Reach/Segment	n	Number of Samples with SEM > AVS[1]	Percent Samples with SEM > AVS[1]
Grand Calumet River Lagoons	5	0	0%
East Branch Grand Calumet River-I	105	51	49%
East Branch Grand Calumet River-II	0	NA	NA
West Branch Grand Calumet River-I	9	5	56%
West Branch Grand Calumet River-II	0	NA	NA
Indiana Harbor Canal	11	10	91%
Lake George Branch	30	4	13%
US Canal	5	0	0%
Indiana Harbor / Lake Michigan	2	0	0%
Overall	**169**	**70**	**41%**

[1]As determined using the molar concentrations of simultaneously extracted metals (SEM) and acid volatile sulfides (AVS).
n = number of samples.
NA = not applicable.

Table 14.5. Summary of mIBI scores for the various reaches in the Assessment Area, 1993-1998.

Date	Sample	Reach								
		Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
October, 1993	1								2.8	
September, 1994	1								2.2	
October, 1996	1		2.1	1.3		1.1			1.7	
	2		2.4			1.7				
August, 1998	1		1.40		0.87		1.13	0.87	0.33	0.8
	2		1.13		0.53		1.07	0.40	0.20	
	3		1.67				1.07	0.87		
	4		1.13							
	5		0.87							
	6		0.87							
Average mIBI Score		NA	1.4	1.3	0.7	1.4	1.1	0.7	1.4	0.8
Standard Deviation		NA	0.57	NA	0.24	0.42	0.03	0.27	1.15	NA
Number of Samples		0	8	1	2	2	3	3	5	1

Sources: Sobiech *et al.* (1994); Simon and Stewart (1998); Simon *et al.* (2000).
NA = not applicable.

Table 14.6. Summary of QHEI scores for the various reaches in the Assessment Area, 1993-1998.

Date	Sample	Reach								
		Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
September, 1992	1				65.5	57.9				
	2					50.7				
	3					54.7				
	4					51.8				
	5					56.9				
	6					46.0				
June-July 1994	1		48	22						
	2			41						
	3			46						
	4			51						
1998	1		47.4		48.6	49.7	16	16	18	17
	2		41.3		49.7		24	45.2	21	
	3		45.2				24			
	4		42.8							
	5		48.8							
	6		43.0							
	7		39.5							
	8		42.5							
	9		48.6							
Average QHEI Score		NA	44.7	40	54.6	52.5	21.3	30.6	19.5	17
Standard Deviation		NA	3.34	12.68	9.46	4.23	4.62	20.65	2.12	NA
Number of Samples		0	10	4	3	7	3	2	2	1

Sources: Sobiech *et al.* (1994); Simon and Stewart (1988); Simon *et al.* (2000).

NA = not applicable.

Table 14.7. Summary of assessment of effects on fish and wildlife resources.

Reach/Segment	Indicator of Effects on Fish and Wildlife Resources[1]					Number of Lines of Evidence for Demonstrating Ecosystem Impacts
	Toxicity to Fish[2]	Fish Health[3]	Fish Community[4]	Whole Sediment Chemistry[5]	Tissue Chemistry[6]	
Grand Calumet River Lagoons	14% (n=7)	0% (n=12)	38% (n=13)*	84% (n=58)*	100% (n=18)*	3
East Branch Grand Calumet River-I	57% (n=23)*	40% (n=10)*	100% (n=29)*	74% (n=110)*	100% (n=22)*	5
East Branch Grand Calumet River-II	85% (n=40)*	75% (n=4)*	100% (n=22)*	66% (n=90)*	100% (n=5)*	5
West Branch Grand Calumet River-I	ID (n=0)	100% (n=3)*	100% (n=12)*	29% (n=7)*	100% (n=7)*	4
West Branch Grand Calumet River-II	100% (n=7)*	100% (n=1)	100% (n=17)*	18% (n=17)*	100% (n=5)*	4
Indiana Harbor Canal	ID (n=0)	33% (n=3)	100% (n=4)*	93% (n=15)*	100% (n=7)*	3
Lake George Branch	ID (n=0)	50% (n=2)	50% (n=2)	83% (n=29)*	ID (n=0)	1
US Canal	ID (n=0)	50% (n=2)	100% (n=8)*	84% (n=37)*	100% (n=18)*	3
Indiana Harbor / Lake Michigan	ID (n=0)	100% (n=1)	100% (n=1)	88% (n=33)*	86% (n=21)*	2
Overall	**71% (n=77)***	**39% (n=38)***	**92% (n=108)***	**74% (n=396)***	**97% (n=103)***	**5**

[1] For each line of evidence, sediment injury is indicated if two or more samples have conditions sufficient to cause or substantially contribute to sediment injury. Evidence of sediment injury is denoted with an asterisk (*).

[2] Percent of sediment samples that were toxic to fish in laboratory tests.

[3] Percent of fish samples with > 1.3% DELT abnormalities.

[4] Percent of fish samples with IBI scores of $\leq$34 (i.e., poor, very poor, or no fish).

[5] Percent of sediment samples with one or more chemical concentrations in excess of the bioaccumulation SQGs for wildlife.

[6] Percent of fish and invertebrate tissue samples with one or more chemical concentrations in excess of the TRGs for wildlife.

ID = insufficient data; n = number of samples.

Table 14.8. Summary of DELT scores for the various reaches in the Assessment Area, 1993-1998.

Date	Sample	Reach								
		Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
October, 1993	1	0								
	2	0								
	3	0								
	4	0								
	5	0								
	6	0								
	7	0								
	8	0								
	9	0								
	10	0								
	11	0								
	12	0								
June-July, 1994	1		2.7	5.6						
	2			8.0						
	3			17.4						
	4			0						
September, 1992	1				10.8					
1998	1		0		6.15	2.8	6.15	1.68	0	12.8
	2		0.74		2.8		0	0	3.28	
	3		1.57				0.36			
	4		0							
	5		0.65							
	6		0.7							

Table 14.8. Summary of DELT scores for the various reaches in the Assessment Area, 1993-1998.

Date	Sample	Reach								
		Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
1998 (cont.)	7		0.15							
	8		2.4							
	9		6.15							
Average DELT Score		0	1.5	7.8	6.6	2.8	2.2	0.8	1.6	12.8
Standard Deviation		NA	1.89	7.25	4.02	NA	3.45	1.19	2.32	NA
Number of Samples		12	10	4	3	1	3	2	2	1

Sources: Sobiech *et al.* (1994); Simon and Stewart (1998); Simon *et al.* (2000); Simon (1993)

NA = not applicable.

DELT score = % incidence of deformities, fin erosion, lesions, and tumors.

Table 14.9. Summary of IBI scores for the various reaches in the Assessment Area, 1985-1998.

Date	Sample	Reach								
		Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
October, 1985	1		24	24		24				
	2		24			0				
June, 1986	1	32	24	26	22	22			24	
	2		24	24						
October, 1986	1		30	28	20	20			26	
	2		28	28						
April, 1987	1		22	30	24	24	22			
	2		22	32	22	24				
	3		22	24						
April, 1987	1		24	24	22	22			28	
	2		26	26						
November, 1987	1		30	32	0	0			34	
	2		30	30						
May, 1988	1		22	26	0	0				
	2		24	24						
July, 1988	1		32	28	0	0			24	
	2		26	26						
July, 1990	1		20	24	21	21			16	
	2		32	32						

Table 14.9. Summary of IBI scores for the various reaches in the Assessment Area, 1985-1998.

Date	Sample	Reach								
		Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
September, 1992	1				29	24				
	2					24				
	3					12				
	4					12				
	5					19				
June, 1994	1		22	12						
	2			18						
	3			22						
	4			22						
1994	1	42								
	2	42								
	3	42								
	4	34								
	5	32								
	6	31								
	7	38								
	8	32								
	9	43								
	10	43								
	11	42								
	12	42								
1998	1		16		16	22	16	14	12	14
	2		22		22		12	38	18	
	3		16				20			

Table 14.9. Summary of IBI scores for the various reaches in the Assessment Area, 1985-1998.

Date	Sample	Reach: Grand Calumet River Lagoons	East Branch Grand Calumet River-I	East Branch Grand Calumet River-II	West Branch Grand Calumet River-I	West Branch Grand Calumet River-II	Indiana Harbor Canal	Lake George Branch	US Canal	Indiana Harbor/ Lake Michigan
1998 (cont.)	4		18							
	5		20							
	6		24							
	7		24							
	8		26							
	9		18							
Average IBI Score		38.1	23.9	25.5	16.5	15.9	17.5	26.0	22.8	14.0
Standard Deviation		5.0	4.3	4.7	10.4	9.8	4.4	17.0	7.1	NA
Number of Samples		13	29	22	12	17	4	2	8	1
Percent Altered		38%	100%	100%	100%	100%	100%	50%	100%	100%
Classification for Average Score		fair-poor	poor-very poor	poor-very poor	very poor	very poor	very poor	poor-very poor	poor-very poor	very poor

Sources: Sobiech *et al.* (1994); Simon and Stewart (1988); Simon (1993); Stewart *et al* . (1999); Simon *et al.* (2000).