

Table ES.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 ≥ 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 ES.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
<i>Grand Calumet River Lagoons</i>							
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
<i>East Branch Grand Calumet River-I</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
<i>East Branch Grand Calumet River-II</i>							
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

Table ES.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
<i>West Branch Grand Calumet River-I</i>							
EB and WB Confluence to Indianapolis Boulevard	19	29.5	1.13	231	1.35	56.9	11.7
<i>West Branch Grand Calumet River-II</i>							
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
<i>Indiana Harbor Canal</i>							
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
<i>Lake George Branch</i>							
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

Table ES.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
<i>US Canal</i>							
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
<i>IH and Nearshore Areas of Lake Michigan</i>							
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 ES.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
<i>Grand Calumet River Lagoons</i>							
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
<i>East Branch Grand Calumet River-I</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
<i>East Branch Grand Calumet River-II</i>							
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

Table ES.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
<i>West Branch Grand Calumet River-I</i>							
EB and WB Confluence to Indianapolis Boulevard	12	4.80	0.139	13.7	0.368	8.80	3.77
<i>West Branch Grand Calumet River-II</i>							
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
<i>Indiana Harbor Canal</i>							
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
<i>Lake George Branch</i>							
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

Table ES.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
<i>US Canal</i>							
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
<i>IH and nearshore areas of Lake Michigan</i>							
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 ES.4. Summary of the available information on SEM-AVS in the Assessment Area.

Reach/Segment	n	Number of Samples with SEM > AVS¹	Percent Samples with SEM > AVS¹
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%

¹As determined using the molar concentrations of simultaneously extracted metals (SEM) and acid volatile sulfides (AVS).

n = number of samples.

NA = not applicable.

Table ES.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 ES.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 ES.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 ≤ 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 ES.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 ES.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 ES.9. Summary of IBI scores for the various reaches in the Assessment Area, 1985-1998.

Date	Sample	Reach								Indiana Harbor/ Lake Michigan
		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	
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 ES.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 ES.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).