St. Joseph and Benton Harbor

Sediment Quality

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Table of Contents

List of Tables

List of Figures

Introduction

This report is one in a series of studies designed to define the environmental state of the harbors on the Great Lakes. This report deals with sediment quality and primarily focuses on the extent of toxicant contamination in the subject area. It does not consider St. Joseph-Benton Harbor (SJ-BH) water quality since the water solubility of the toxicants, both organic and metallic, is so small that water toxicant concentrations would not prove meaningful and, taken out of context, could be misleading. Nor are the SJ-BH pollutional effects upon southeastern Lake Michigan considered because of the paucity of areawide lake sediment data.

Background

The St. Joseph River Basin is located primarily in the southwestern corner of the State of Michigan. The River and tributaries form a drainage network of approximately 4680 square miles (Mi^2). This includes 3020 Mi^2 of southwest Michigan and 1660 Mi^2 of northeast Indiana (1). The rivermouth is located in the City of St. Joseph and the headwaters are located approximately 210 rivermiles upstream in Hillsdale, Michigan. The St. Joseph River Basin includes seven counties within Michigan and six counties in Indiana. The river crosses the Michigan-Indiana border in Porter Township of Cass County and Bertrand Township of Berrien County. The Paw Paw River is a major tributary of the St. Joseph River. It's headwaters are in eastern Van Buren County and it flows southwesterly through Berrien County to the St. Joseph River. The confluence of the two rivers is just upstream of the mouth of the St. Joseph. The Paw Paw River is a slow moving stream with a broad flood plain, most of which is undeveloped. The drainage area of the Paw Paw River is approximately 450 Mi^2. A smaller, but important tributary is the Dowagiac River.

The topography of the Basin varies from flat to hilly. Among the more noteable features, produced by direct deposition of the Wisconsin Glacier, are a series of end moraines that trend northeast-southwest (1). These topographic divisions consist of a series of moderately rough and rolling belts of outwash, ground moraines, and lake plains. The dominant soil type throughout the region is loam, a mixture of silt, sand, and clay.

The major concentrations of population in the basin in Michigan are located in and around the Cities of St. Joseph, Benton Harbor, and Niles. All three cities are in Berrien County which at present has a population approximating 170,000 people.

Agriculture represents the primary land use in the basin in Michigan with forestry a distant second. In Berrien County for example, agriculture represents 71 percent of the land use while forestry accounts for 21 percent.

Being an interstate stream, the St. Joseph River drains areas of three states, Michigan, Indiana, and Ohio, with discharges from other populous areas including Niles, South Bend, Elkhart, and Mishiwaka. The flow of the St. Joseph River, as measured at the USGS gaging station at Niles, Michigan averages 3200 CFS (2). The maximum and minimum flows are 20,000 CFS, and 400 CFS respectively.

Methodology

Sediment samples were collected in the manner described in Methods Manual for Bottom Sediment Sample Collection, USEPA, January 1977 (3). Grab samples were retrieved using a Ponar (clam shell) dredge for both the chemistry and benthos analysis. For the benthos analysis, the sediment samples were strained through a 30 mesh sieve (U.S. Standard) and any invertebrates were picked off the seive with

a tweezer, transferred to a sample jar and preserved with 70 percent ethanol. The sediments for chemistry analysis were preserved by refrigeration at 4°C.

Prior to analysis, the sediment samples were allowed to thaw to 15-25°C. Each sample was manually mixed on a large, flat, Bakelite container. Any sample requiring further homogenization (discretion of analyst) was passed through a 10 mesh polypropylene seive by forcing it through the screen with a glass beaker.

The presence of a broad range of organic contaminants, (see Table 1) was determined by subjecting the sediments to GC/MS scans. The organics were first removed from the sediments using a Soxhlet extractor and a solvent consisting of a 1:1 mixture of acetone and hexane. The extract was then passed through a gel permeation column to remove interferring fatty materials. The organic residues were then subjected to a Hewlett-Packard 5985 Gas Chromotograph/Mass Spectrometer. Organic contaminants qualitatively identified on the GC/MS scans were confirmed and quantified using specific gas chromatographic procedures. All GC/MS scans and specific GC analyses followed USEPA standard procedures for dealing with priority pollutants.

Heavy metals were determined by first digesting the sediment samples in a mixture of concentrated nitric and sulfuric acids. The acid extracts were analyzed for arsenic, mercury, and selenium using standard USEPA flameless atomic absorption spectrometry. In addition, a scan for over 20 metals was made using Inductively Coupled Argon Plasma (ICAP) techniques.

All metals and organic contaminants were reported as milligrams per kilogram (PPM) dry weight. Quality assurance procedures set variance limits for reference samples, sample splits, and spiked samples. Any results obtained outside USEPA

Table 1

Contaminants searched for in Pesticide and Organic Scans

Pesticides and PCB°s	Other Organic Compounds	
Aldrin	Acenaphthene	Indeno(1,2,3-cd)pyrene
Arochlor 1221	Acenaphthylene	Isopherone
Arochlor 1232	Anthracene	Napthalene
Arochlor 1242	Benzo(a)anthracene	Nitrobenzene
Arochlor 1248	Benzo(b)fluoranthene	N-Nitrosodimethylamine
Arochlor 1254	Benzo(k)fluoranthene	N-Nitrosodi-n-propyl ami
Arochlor 1260	Benzo(a)pyrene	N-Nitrosodiephenyl amine
Arochlor 1262	Benzo)g,h,i)perylene	Phenanthrene
BHC (beta and gamma isomers)	Benzidine	Pyrene
Chlordane (cis, trans, oxy)	Bis(2-chloroethyle)ether	1,2,4-Trichlorobenzene
Chlorobenzylate	Bis(2-chloroethyloxy)methane	Tetrachlorobenzene
2,4-D isopropylester	Bis(2-ethlhexyl)phthalate	Pentachlorobenzene
DCPA	Bis(2-chloroisopropyl)ether	Chlorostyrene
o,p-DDE	4-Bromophenyl phenyl ether	Dichlorostyrene
p,p-DDE	Butyl benzyl phthalate A	Trichlorostyrene
o,p-DDD	4-Chloro-3-methyl phenol	Tetrachlorostyrene
p,p-DDD	2-Chloronaphthalene	Endrin aldehyde
o,p-DDT	4-Chlorophenyl phenyl ether	Endosulfan sulfate
p,p-DDT	Chrysene	Kepone
Dieldrin	Dibenzo(a,h)anthracene	4-Chlor-3-methyl phenol
Endosulfan (I, II)	Di-n-butylphthalate	2-Chlorophenol
Endrin	1,3-Dichlorobenzene	2,4-Dichlorophenol
Heptachlor and its epoxide	1,4-Dichlorobenzene	2.4-Dimethylphenol
Hexachlorobenzene	1.2-Dichlorobenzene	2.4-Dinitrophenol
Isodrin	3,3-Dichlorobenzene	2-methyl-4,6-dinitrophen
Methoxychlor	Diethylphthalate	2-Nitrophenol
Mirex	Dimethylphthalate	4-Nitrophenol
Tetraditon	2.4-Dinitrotoluene	Pentachlorophenol
Trifluralin	Dioctylphthalate	Phenol
Zytron	1,2-Diphenylhydrazine	2.4.6-Trichlorophenol
	Fluoranthane	Tetrachlorophenol
	Fluorene	Toxaphene
	Hexachlorobutadiene	
	Hexachloroethane	
	Hexachlorocyclopentadiene	

quality assurance limits were discarded and the samples re-analyzed. More detailed descriptions of the methodology for sediment analysis can be obtained from the Chemistry Laboratory Manual for Bottom Sediments and Elutriate Testing, USEPA, March, 1979 (NTIS PB-294596) (4).

Figure 1 shows the sediment sites sampled by the U.S Army Corps of Engineers (COE) in 1980 (black star) and the USEPA sites sampled in 1981 (white star). The COE sampling program was designed to determine which sediments in the deep draft navigation portion of the harbor would require confined as opposed to open Lake disposal. The COE analyses include the conventional pollutants (COD, TKN, oil and grease, etc.), metals, and polychlorinated Bi-phenyls (PCB). A benthic analysis was also performed for the COE program. The USEPA program extended the geographical scope of the sediment sampling to include the main stem of the St. Joseph River approximately 2.5 miles upstream to the Harbor Ann Oil Company (site #1), and the tributary Paw Paw River and Ox Creek channel approximately one (1) mile upstream to Benton Harbor Malleable Industries (site #19). The emphasis of the USEPA program was placed on the characterization of the sediments with respect to synthetic organics, vis-a-vis, the priority pollutants, although the ~~metals and~~ conventional pollutants were also included. A benthic analysis was not performed for the USEPA program.

Due to laboratory resource constraints, all sediments sampled were not analyzed. Based upon visual examination, ~~an educated guess~~ was made by the USEPA sampling crew with respect to which samples were to be analyzed. The remaining samples were logged, preserved, and stored for future analysis should the need arise.

Table 2 lists point sources discharging to the St. Joseph River Basin (7). It includes only those facilities known to discharge directly to the St. Joseph River or it's tributaries.

Table 2

Berrien County Discharges to
St. Joseph River Basin

Berrien Springs W.W.T.P.	nicipal, Flow is 0.3 MGD, activated udge system, Design flow 0.35 MGD, Discharge to St. Joseph River, 201 underway.
Buchanan W.W.T.P.	Municipal, Flow is 1.1[illegible] MGD, activated sludge system, Design flow 1.5 MGD, Discharge to St. Joseph River.
Eau Claire W.W.S.L.	Municipal, Flow is estimated at 0.87 MGD, stabilization lagoons, Discharge location is Farmers Creek, 201 underway.
Niles W.W.T.P.	Municipal, Flow is 3.59 MGD, activated sludge system, Design flow 3.0 MGD, Discharge to St. Joseph River, 201 underway.
Benton Harbor/St. Joseph W.W.	Municipal, Flow is 11.3 MGD, activated sludge system, Design flow 13.0 MGD, Discharge to St. Joseph River, 201 underway.
Paw Paw Lake W.W.T.P.	Municipal, Flow is 1.28 MGD, trickling filter system, Design flow is 3.5 MGD, Discharge to Paw Paw River, 201 underway.
Riverside M.H. Estates	Semi-public, Flow 13.4 KGD, 80 licenced sites, Package Plant, extended aeration Desgin flow 16 KGD, Discharge to Pipestone Creek.
Meadow Stream Estates	Semi-public, .29 KGD, 73 licenced sites, stabilization lagoon system, Design flow 14.6 KGD, Discharge to Pipestone Creek.
Hill Haven M.H.P.	Semi-public, flow 7.2 KGD Package Plant, extend aeration, 56 licenced sites, Design flow is 11.2 KGD, Discharge to St. Joseph River.
Ravine View Estates	Semi-public, flow is 4.7, 66 licenced sites Package Plant, extended aeration Design flow 22 KGD, Discharge to Paw Paw River.

Table 2 (Cont.)

Auto Specialties Manufacturing	Foundry, .34 MGD cooling to Paw Paw Village
Bendix Corporation	Foundry, hydr. auto parts, .30 MGD GW, .013 MGD cooling to Hickory Creek
Clark Equipment Company	Manufacture axle housings and fork lift metal works, 2.7 MGD to McCoy Creek
Eau Claire Pack Company	Fruit & vegetable canning, .39 MGD to G.W., .0004 cooling to Co. Drain
Flamm Pickle & Packing Company	Pickle processing & canning, GW discharge
French Paper Company	Paper Mill, 0.677 MGD to St. Joseph River
Jenos Inc.	Fruit & vegetable canning, .042 MGD to C and .305 MGD to Bittner drain, cooling
Watervliet Paper Company	Paper mill, .88 MGD to G.W. cooling, .138 MGD cooling to Paw Paw River, process to sewer system
Whirlpool Corporation, Plant 7	Appliance mfg., metal finishing, .825 MGD and .287 MGD to Benton Harbor Canal, cooling
Whirlpool Corporation, Plants 1-6	Appliance mfg., metal finishing .42 MGD and 1.7 MGD to St. Joseph River, cooling
Ball Corporation	Formed rubber parts, vulcanizing .079 MGD to Abraham drain, cooling
Modern Plastics Corporation	Plastic molding .172 MGD cooling to OX Creek
S. Michigan Cold Storage	.153 MGD cooling to Pipestone Creek
New Products Corporation	Die casting, .07 MGD cooling to OX Creek
Superior Steel Casting Company	Steel casting .35 MGD cooling to Ox Creek
National Standard Company	Recirculating flows, no discharge
U.S. Aviex Company	Aersol mfg. G.W. discharge of cooling
National Standard Company	Steel wire fabricator, .707 cooling

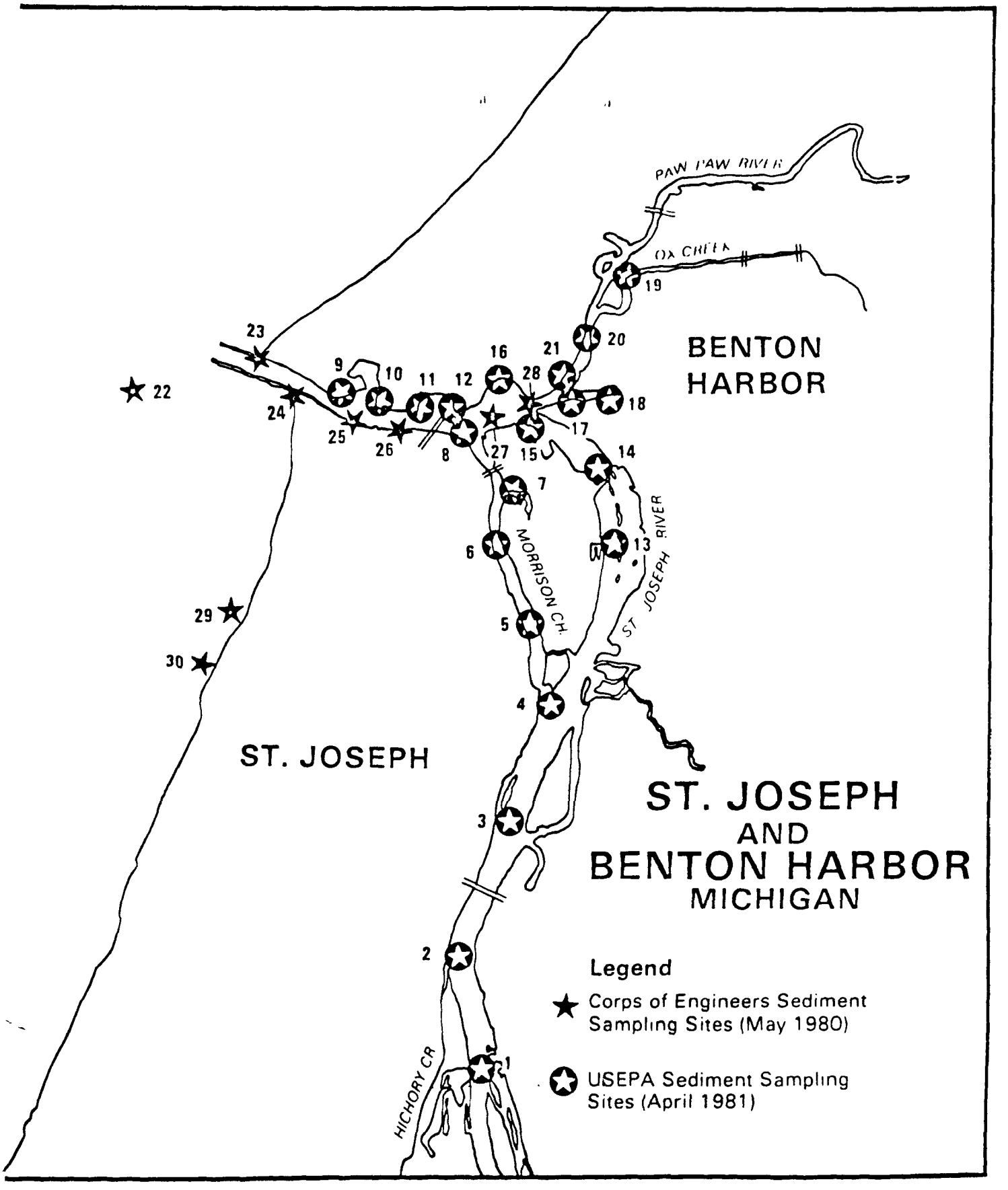
PAW PAW RIVER
OX CREEK
BENTON HARBOR
ST. JOSEPH
MORRISON CH.
ST JOSEPH RIVER
HICHORY CR
ST. JOSEPH AND BENTON HARBOR MICHIGAN
Legend
Corps of Engineers Sediment Sampling Sites (May 1980)
USEPA Sediment Sampling Sites (April 1981)

Fig. 1

Results

Using the USEPA Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments (see Table 3), the harbor sediments downstream of the confluence of the Paw Paw and the St. Joseph Rivers are classified as heavily polluted with nitrogen, phosphorus, oil and grease, chemical oxygen demand, arsenic, copper, and lead (Tables 4, 5, 6). In addition, varying concentrations of certain polynuclear aromatic hydrocarbons (Anthracene, phenanthrene, pyrene) are present although the ecological significance of the concentrations found has not been established (Table 7).

The most highly contaminated area is site #1 (Fig 1) (Table 6,7) which is just upstream of the confluence of Hickory Creek and the St. Joseph River (approximately seven (7) miles upstream from the Harbor mouth). These sediments are contaminated with large concentrations of barium, chromium, copper, nickel, zinc, and the animal carcinogens and mutagens, benz(a)anthracene, chrysene, and pyrene. Benz(a)-anthracene and chrysene were found in concentrations over 700 ppm. Other polynuclear aromatice hydrocarbons are also present at site #1 in concentrations similar to those found in the area downstream of the Paw Paw River confluence. The segment of the St. Joseph River downstream from site #1 and stretching to the confluence with the Paw Paw River (approximately 6.5 miles) and including Morrison Channel, is moderately polluted.

Table 8 lists the benthic invertebrates inhabiting the sites sampled in the COE program. Only four (4) genuses of invertebrates were found and all specimens had pollution tolerant characteristics. The largest numbers of the most pollution tolerant species were found at site #26 which is in the most polluted stretch of the area dredged to accommodate deep draft navigation. While site #26 is heavily

Table 3

USEPA - Region V

GUIDELINES FOR THE POLLUTIONAL CLASSIFICATION

OF GREAT LAKES HARBOR SEDIMENTS

	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED
olatile Solids (%)	<5	5 - 8	>8
OD (mg/kg dry weight)	<40,000	40,000-80,000	>80,000
KN " " "	<1,000	1,000-2,000	>2,000
il and Grease (Hexane Solubles) (mg/kg dry weight)	<1,000	1,000-2,000	>2,000
ead (mg/kg dry weight)	<40	40-60	>60
inc " " "	<90	90-200	>200
Ammonia (mg/kg dry weight)	<75	75-200	>200
Cyanide " " "	<0.10	0.10-0.25	>0.25
Phosphorus " " "	<420	420-650	>650
Iron " " "	<17,000	17,000-25,000	>25,000
Nickel " " "	<20	20-50	>50
Manganese " " "	<300	300-500	>500
Arsenic " " "	<3	3-8	>8
Cadmium " " "	*	*	>6
Chromium " " "	<25	25-75	>75
Barium " " "	<20	20-60	>60
Copper " " "	<25	25-50	>50

*Lower limits not established

	POLLUTED
Mercury	≥ 1 mg/kg dry weight
Total PCB's	≥ 10 mg/kg dry weight

St. Joseph-Benton Harbor Sediments
COE May 1980

Parameter	Sediment Sites 22	23	24	25	26
Total Kjeldahl (mg N/kg dry)	567	1,686	550	2,662	4,613
NH_3 (mg N/kg dry)	15.1	18.6	24.5	36.4	90.1
COD (mg/kg dry)	25,000	25,200	26,600	66,700	143,000
Oil & Grease (mg/kg dry)	940	375	153	1,590	3,790
% Moisture	22.36	28.31	21.73	47.69	65.93
TVS %	0.38	1.18	0.33	4.24	6.63
Grain Size					
>1.00 mm	0.11	0.04	0.28	27.87	0.96
1.00 - 0.43 mm	1.67	2.40	2.35	11.68	3.82
0.43 - 0.075 mm	97.80	93.20	96.72	40.51	45.65
<0.075 mm	0.42	4.36	0.65	19.94	45.77
Fecal Coliform (colonies/100 ml)	0	0	0	0	0
Total Phosphorus (mg P/kg dry)	85	298	85	1,169	1,539
Arsenic (mg/kg)	0.957	1.03	0.658	6.23	8.38
Cadmium (mg/kg)	1.031	0.396	0.019	1.88	2.40
Iron (mg/kg)	76.8	69.2	64.1	85.2	96.2
Copper (mg/kg)	1.58	22.3	1.98	18.6	17.3
Chromium (mg/kg)	1.28	4.14	1.08	6.27	2.62
Nickel (mg/kg)	1.38	2.58	1.88	6.67	4.14
Manganese (mg/kg)	48.9	65.5	50.8	197	231
Lead (mg/kg)	2.44	4.48	2.54	96.5	195
Mercury (mg/kg)	<0.2	<0.2	<0.2	<0.2	<0.2
PCB's	ND	ND	ND	ND	ND

TABLE 4 (continued)

	Sediment Sites			
	27	28	29	30
Total Kjeldahl (mg N/kg dry)	3,502	4,594	230	234
NH_3 (mg N/kg dry)	60.2	19.9	12.6	13.4
COD (mg/kg dry)	93,000	148,000	20,500	17,200
Oil & Grease (mg/kg dry)	2,280	2,060	61.8	36.1
% Moisture	55.9	67.1	2.87	2.95
Total Volative Solids (%)	5.87	11.80	0.09	0.11
Grain Size				
>1.00 mm	22.92	3.99	0.02	0.04
1.00 - 0.43 mm	10.04	8.27	1.47	3.03
0.43 - 0.075 mm	45.65	57.07	98.52	96.92
<0.075 mm	21.39	30.67	<0.01	0.01
Fecal Coliform (colonies/100 ml)	0	0	0	0
Total Phosphorus (mg P/kg dry)	1,315	2,069	54	49
Arsenic (mg/kg)	8.11	20.4	0.246	0.310
Cadmium (mg/kg)	1.56	1.04	0.016	0.025
Iron (mg/kg)	104.4	132.2	64.8	47.2
Copper (mg/kg)	31.4	92.0	1.19	1.01
Chromium (mg/kg)	1.94	3.38	0.557	0.708
Nickel (mg/kg)	0.654	3.96	0.615	0.446
Manganese (mg/kg)	241	319	13.1	17.4
Lead (mg/kg)	160	135	1.39	1.61
Mercury (mg/kg)	<0.2	<0.2	<0.2	<0.2
PCB's	ND	ND	ND	ND

Table 5
St. Joseph - Benton Harbor Sediments
(mg/kg)
April 1981

Site	Total Solids (%)	Volatile Solids (%)	Chemical Oxygen Demand	Total Kjeldahl Nitrogen	Total Phosphorus
1	70	2.7	2200	950	500
2	79	0.9	3200	160	130
5	67	3.3	26000	640	260
7	65	2.9	21000	600	340
13	68	2.2	20000	666	430
14	69	2.6	19000	670	300
15	53	7.8	66000	2800	480
17	63	3.8	28000	70	80
20	59	5.7	48000	1550	370

Table 6
St. Joseph - Benton Harbor Sediments
(mg/kg)
April 1981

Site	1	2	5	7	13	14	15	17	20
Metals									
AG	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
B	11.	8.	8.	8.	8.	10.	18.	19.	13.
BA	120	14	40.	36.	30.	26.	110.	56.	71.
BE	0.9	0.2	0.2	0.2	0.2	0.3	0.7	0.5	0.5
CD	0.2	0.2	0.4	0.2	0.5	0.2	3.0	0.2	0.5
CO	7.9	3.5	2.9	3.1	2.4	3.0	5.6	2.8	6.3
CR	420.	4.7	12	6.	17.	8.4	31.	6.	17.
CU	1600.	2.	16.	9.	23.	15.	31.	5.	33.
LI	17.	3.9	4.4	3.2	3.9	4.5	11.	7.9	9.2
MN	270.	180	360	200.	310.	240.	910.	13.	370.
MO	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
NI	170.	5.2	8.1	12.	25.	8.7	17.	7.	18.
PB	7.	7.	18.	22.	7.	11.	51.	14.0	31.
SN	4.0	4.0	4.0	4.0	4.0	5.3	5.6	4.0	4.0
SR	730.	18.	28.	13.	23.	20.	47.	76.	110.
V	25.	4.4	4.5	4.	5.	8.0	16.	10.	19.
Y	6.4	1.5	1.9	1.7	2.0	2.0	5.3	2.5	5.4
ZN	1000.	20.	57.	61.	86.	52.	160.	7.	78.
CA	47000.0	24000.0	40000.0	13000.0	29000.0	28000.0	58000.0	2000.0	43000.0
K	2300.0	200.0	400.0	300.0	300.0	500.0	1200.0	1500.0	1100.0
MG	8100.0	8300.0	5000.0	3600.0	5500.	9300.0	12000.0	500.0	7500.0
NA	200.0	100.0	100.0	100.0	100.0	100.0	200.0	100.0	100.0
AL	11000.0	1500.0	2000.0	1900.0	1900.0	2200.0	7200.0	5500.0	5400.0
FE	16000.0	5400.0	6300.0	5000.0	6000.0	7300.0	1600.0	1900.0	12000.0

Table 7
St. Joseph-Benton Harbor Sediments
(mg/kg)
April 1981

Site	1	2	5	11	13	15	17	20
Aromatic Hydrocarbon								
Acenaphthene	- -	- -	- -	- -	- -	0.5	0.3	- -
Anthracene	16	0.7	4.3	T	- -	16.2	3.4	2.6
Benz(a) anthracene	716	- -	- -	- -	- -	- -	- -	- -
Bis (2-Ethylhexyl) Phthalate	7.6	0.3	- -	- -	- -	2.8	- -	- -
Chrysene	716	- -	- -	- -	- -	- -	- -	- -
Di-m-Butyl Phthalate	0.4	- -	T	- -	0.2	1.9	- -	5.5
Diethyl Pathalate	- -	- -	- -	- -	- -	1.6	0.5	0.3
Fluoranthane	18.9	0.1	- -	0.7	- -	1.6	2.7	0.2
Fluorene	- -	- -	- -	- -	- -	0.1	0.3	- -
Naphthalene	- -	- -	- -	- -	- -	0.1	2.0	0.2
n-Butylphthalate	- -	- -	- -	- -	- -	1.9	- -	6.4
Phenanthrene	16	0.7	14.1	T	- -	16.2	3.4	2.6
Pyrene	73.5	32.3	T	0.6	- -	8.3	33.1	2.4
Kepone	- -	- -	- -	- -	1.6	- -	- -	- -
Chlordane	- -	- -	- -	- -	0.6	- -	- -	- -
Total DDT	- -	- -	- -	- -	7.9	- -	- -	- -
PCB	- -	- -	- -	- -	- -	T	T	- -

polluted with arsenic and lead, it appears that the arsenic and lead concentrations present are not sufficient to adversely, acutely affect the pollution tolerant invertebrates residing there. The heavy pollution is adequate, however, to discourage the sustenance of a highly varied species population indicative of a clean water benthos.

Discussion

The sediment load from the St. Joseph River Basin is such that annual harbor dredging is required to accommodate deep draft traffic. The most recent dredging was completed in June 1981 (5). To date the dredge spoils have been used for Lake Michigan beaches augmentation. Since the sediment sampling for both the COE and the USEPA programs was performed using clam shell equipment (surface grab samples), the analytical results shown in all tables reflect fairly recently deposited sediments and pollutants. This indicates that at least some point source discharges to the St. Joseph River may still not be receiving adequate treatment.

Of particular concern are the sediments in the site #1 area. Aside from a large marina in the immediate vicinity, it appears that no point sources of any consequence (with respect to size) discharge to the immediate area or within a reasonable distance upstream. The cities of Berrien Springs, Buchanan, and Niles are approximately 32, 40, and 52 miles respectively further upstream (6).

No data characterizing sediments further upstream from site #1 exist, therefore, it is impossible to determine whether the site #1 pollutants were discharged in the immediate vicinity or else where.

Table 8
St. Joseph-Benton Harbor Benthos
COE - May 1981

Taxa	Sampling Site 22	23	24	25	26	27	28
Nematoda					4.78		6.37
Oligochaeta							
Tubificidae							
Limnodrilus cervix		25.48	70.07	112.75	309.17	111.09	12.74
L. hoffmeisteri		6.37	38.22	326.97	309.17	201.36	38.22
L. spiralis			19.11	33.82	182.69	180.53	
L. clapardianus				67.65			12.74
L. udekemianus						20.83	
Immature w/o capilliform chaetae[a]		6.37	210.21	586.29	604.28	180.53	89.18
Arthropoda							
Chironomidae							
Chironomus sp.				57.33	28.68	25.48	19.11
Procladius sp.			6.37	6.37	19.12	6.37	44.59
Xenochironomus sp.					4.78		
Tanypus sp.							6.37
Phaenospectra sp.			6.37				
Cryptochironomus sp.		12.74					
Chironominae[a]	4.78	6.37	12.74		14.34		
Orthocladinae[a]	4.78						
Ceratopogonidae			6.37				
TOTAL TAXA	2	5	8	7	9	7	8
Density (No./m^2)	9.56	57.33	369.46	1191.18	1477.01	726.19	229.32
Number of grabs taken	4	3	3	3	4	3	3

[a]Unidentifiable because of damage to specimen or too immature.

Recommendations

(1) Unless a suitable, contained dredge disposal site is available, a ban on St. Joseph-Benton Harbor navigational channel dredging should be instituted.

(2) Sediment sampling upstream of site #1 should be performed to determine if the source of contamination at site #1 is immediate or further upstream.

(3) Since all point source dischargers re-applying for NPDES permits are being required to analyze respective effluents for priority pollutants and to treat same, if present, to appropriate levels, it remains that the effects of closely proximate wastewater pits, ponds, and lagoons on St. Joseph-Benton Harbor sediment quality should be determined.

(4) Evaluations of the study area dumps and landfills should also be undertaken to determine if a potential exists for these disposal areas to be contributing to St. Joseph-Benton Harbor pollution.

(5) Determine environmental significance of priority pollutants with relatively high levels of concentration, e.g. chrysene, benz(a)anthracene and pyrene, the PAH's found at site #1.

References

(1) Southwestern Michigan 208 Areawide Waste Treatment Management Plan

(2) The Water Encyclopedia, Water Information Center, Port Washington, N.Y. 1970

(3) Methods Manual for Bottom Sediment Sample Collection, USEPA 1977

(4) Chemistry Laboratory Manual for Bottom Sediments and Elutriate Testing USEPA 1979

(5) Personal communication, Mr. S. Bolla, COE, Detroit, Michigan; February 1982

(6) Personal communication, Mr. O. Scott, COE, Chicago, Illinois; February 1982

(7) Personal communication, Mr. A. Anthony, Berrien County Planning Department February 1982