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Suspended Sediment in the Indiana Harbor Canal and the Grand Calumet River, Northwestern Indiana, May 1996–June 1998

Water-Resources Investigations Report 00–4102

Prepared in cooperation with the US Army Corps of Engineers

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By Danny E. Renn

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Conversion Factors and Abbreviations

Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
foot per second (ft/s)	0.3048	meter per second
cubic foot (ft^3)	0.02832	cubic meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
ton, short (2,000 lb)	0.9072	megagram
ton per day (ton/d)	0.9072	megagram per day

Temperature is given in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Concentrations of chemical constituents in water are given in milligrams per liter (mg/L). Milligrams per liter is a unit expressing the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water.

The following terms and abbreviations are used in this report:

FISP	Federal Interagency Sedimentation Project
USACE	US Army Corps of Engineers
USGS	U.S. Geological Survey
mm	millimeter

Suspended Sediment in the Indiana Harbor Canal and the Grand Calumet River, Northwestern Indiana, May 1996–June 1998

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Abstract

Suspended-sediment samples and streamflow data were collected from May 1996 through June 1998 at three sites in the Grand Calumet River Basin—Indiana Harbor Canal at East Chicago, the east branch of the Grand Calumet River at Gary, and the west branch of the Grand Calumet River at Hammond. Sample analysis allowed for retention of sediments of 0.0015 millimeters or larger.

At Indiana Harbor Canal at East Chicago, an automated sampler collected 2,005 suspended-sediment samples from the canal and, of these, 1,856 had associated streamflow values. To evaluate any bias between instream concentrations of suspended sediment and samples collected by the automated sampler, 27 sets of suspended-sediment samples were collected manually in the canal at the same time samples were collected by the automated sampler. There was no consistent bias between the samples collected manually instream and the samples collected by the automated sampler; therefore, no correction factor was applied to the concentrations of suspended sediment for the samples collected by the automated sampler. For the 2,005 and 1,856 samples, the mean suspended-sediment concentrations were the same, 15 milligrams per liter (mg/L), and the range in suspended-sediment concentrations were the same, from less than 1 mg/L to 97 mg/L.

No apparent relation between the concentration of suspended sediment measured in samples from the Indiana Harbor Canal and streamflow was indicated, probably because of complex hydraulic conditions in the study area; most of the streamflow is from industrial and municipal discharges, and streamflow is affected by changes in water levels in Lake Michigan. There did appear to be a seasonal trend in the concentrations of suspended sediment, however, in that the largest concentrations generally were measured during the spring. During the study, four substantial rainfall events were recorded. Only for a rainfall event of 4.20 inches was there a substantial increase in the concentrations of suspended sediment and streamflow in the Indiana Harbor Canal. Six sets of samples were collected from the canal for determination of the percentage of organic material in the suspended sediment. Organic material in these samples averaged 26 percent. Bedload-sediment samples were collected three times in the canal with a bedload-sediment sampler; the collection-bag mesh size was 0.25 millimeter. No bedload sediments were collected in the sampler for any of the sample collections.

Seven suspended-sediment samples were collected from the Grand Calumet River at Gary and at Hammond. The mean suspended-sediment concentration measured in samples collected at Gary was 13 mg/L, and the mean suspended-sediment concentration measured in samples collected at Hammond was 6 mg/L.

For both sites, there was no apparent relation between the concentration of suspended sediment and streamflow. Four suspended-sediment samples were collected from the Grand Calumet River at Gary and at Hammond for determination of the percentage of organic material. The amount of organic material at Gary averaged 35 percent, and the amount of organic material at Hammond averaged 34 percent.

The concentrations of suspended sediment determined for samples collected from the Indiana Harbor Canal and from the Grand Calumet River are less than concentrations of suspended sediment in samples collected from other streams in northwestern Indiana and in other parts of the State.

Loads of suspended sediment were computed as the product of the weekly mean suspended-sediment concentration and the daily average streamflow for the Indiana Harbor Canal at East Chicago. The average suspended-sediment load computed for the canal was 29 tons per day for the first year of the study (June 1996 through May 1997) and 23 tons per day for the second year of the study (June 1997 through May 1998).

Loads of suspended sediment for the Grand Calumet River at Gary and at Hammond were estimated by use of the rating-curve method. The estimated average daily suspended-sediment load for the study was 20 tons per day at Gary and 2.9 tons per day at Hammond.

Introduction

The Grand Calumet River Basin in northwestern Indiana drains one of the most industrialized areas in the United States. Major industries in the basin include steel production and petroleum refining. Other industrial activities such as chemical manufacturing, scrap processing, and wastewater-treatment facilities also are located within the basin. The basin is hydrologically complex because of industrial and municipal inflows and outflows and reversals of streamflow caused by changes in the water level in Lake Michigan. The Grand Calumet River Basin was identified in the Great Lakes Water Quality Agreement of 1978 (International Joint Commission United States and Canada, 1978) as one of 43 areas of concern with one or more specific impairments to beneficial uses of Great Lakes waters. The Agreement directed that Remedial Action Plans be developed and implemented at each area of concern to restore the lakes for beneficial uses.

The US Army Corps of Engineers (USACE), Chicago District, is developing a Sediment Cleanup and Restoration Alternatives Project for the Grand Calumet River Basin. Little or no historical information for loads of suspended sediment for the Indiana Harbor Canal and the Grand Calumet River is available; such information could be useful in determining remediation strategies. To provide estimates for loads of suspended sediment, the U.S. Geological Survey (USGS) collected suspended-sediment data at three locations in the Grand Calumet River Basin from May 7, 1996, through June 25, 1998, as part of the cooperative investigation with the USACE. The locations were selected to take advantage of existing USGS streamflow-gaging stations that provide data for determining loads of suspended sediment.

Purpose and Scope

This report presents (1) concentrations of suspended sediment and streamflow data; (2) percentages of organic material measured in suspended-sediment samples; and (3) estimates of average loads of suspended sediment for the Indiana Harbor Canal at East Chicago, the east branch of the Grand Calumet River at Gary, and the west branch of the Grand Calumet River at Hammond during May 1996 through June 1998. In addition, the report describes the hydrologic system and the methodology used to collect suspended-sediment samples and to determine loads of suspended sediment. The report also describes the attempts to measure bedload-sediment movement in the Indiana Harbor Canal at East Chicago.

Description of Study Area

The Grand Calumet River Basin is primarily within northwestern Indiana but extends into northeastern Illinois (fig. 1). The river system consists of three parts—the east and west branches of the Grand Calumet River and the Indiana Harbor Canal. The east and west branches of the river are defined by their confluence with the Indiana Harbor Canal. The east branch of the river starts near Gary, Indiana, and flows towards the west. Most of the time, streamflow in the east branch is discharged to the Indiana Harbor Canal, which is virtually an extension of the east branch. A topographic high in the streambed, approximately 1.5 mi (miles) west of the confluence with the Indiana Harbor Canal, divides streamflow in the west branch of the river. West of the divide, flow is toward the west to the Calumet River in Illinois. East of the divide, the river flows toward the east to the Indiana Harbor Canal. The Indiana Harbor Canal primarily flows towards the north and discharges into the Indiana Harbor and then into Lake Michigan.

Water levels in Lake Michigan can greatly affect flow in the Indiana Harbor Canal and parts of the Grand Calumet River. A rise in the lake water level can cause the direction of flow to reverse in the Indiana Harbor Canal. Depending on the magnitude of the rise in lake level in relation to water levels in the river, flow in the river can be affected for several miles upstream from the Canal. When water levels in Lake Michigan rise above the flow divide in the west branch, flow from the east branch is diverted to the west branch.

As a result of human activities, the Grand Calumet River Basin is a complex hydrologic system. In a 24-hour water-quality study in the Indiana part of the basin in 1984, it was determined that almost all of the flow in the Grand Calumet River and Indiana Harbor Canal resulted from industrial and municipal discharges (Crawford and Wangsness, 1987). These discharges accounted for more than 90 percent of the flow observed at the confluence of the east branch and the canal and almost all of the flow in the west branch. Variations in streamflow of as much as 300 ft^3/s (cubic feet per second) were measured during the study. Although flow in the west branch was not as great as in the east branch, variations in flow in the west branch were greater than those in the east branch and complete reversals of flow were observed at some sites.

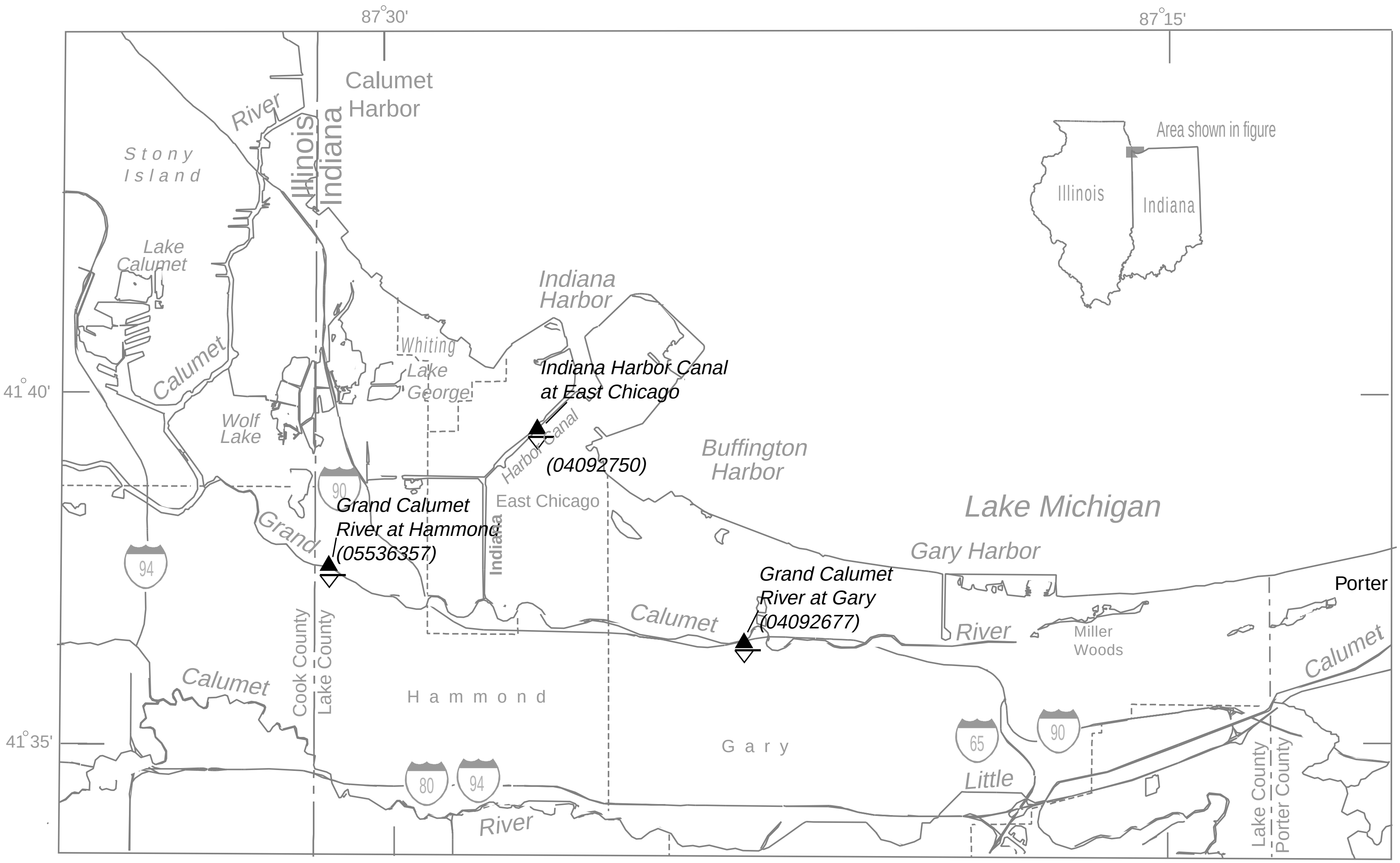
Parts of the river have been dredged and channelized. Metal sheet-pile walls line large sections of the canal and parts of the river. The contribution of surface-water runoff is relatively small because of the small drainage area and sandy textures of the soils. The drainage area for the Indiana part is indeterminate (Stewart and others, 1999); however, it is estimated to be less than 50 mi^2 (square miles) (David Cohen, U.S. Geological Survey, oral commun., 1999).

Data-Collection Network

Data were collected at three USGS streamflow-gaging stations: the Indiana Harbor Canal at East Chicago, the east branch of the Grand Calumet River at Gary, and the west branch of the Grand Calumet River at Hammond (fig. 1).

Indiana Harbor Canal

The Indiana Harbor Canal at East Chicago streamflow-gaging station (station number 04092750) is 3.35 river miles downstream from the confluence with the Grand Calumet River, 1.10 river miles downstream from the confluence with the Lake George Canal, 0.96 river miles upstream from the Indiana Harbor, and 2.35 river miles upstream from Lake Michigan (fig. 1). At this station, the canal is narrowed by the abutments of a bridge that has been removed. The narrow section of the canal is 75 feet (ft) wide, 125 ft long, and 30 ft deep (fig. 2). Upstream and downstream from this narrow section, the canal is 275 ft wide and 30 ft deep. The sides of the canal are lined with metal sheet pile for several thousand feet in the vicinity of the station. The direction of flow at



Base from U.S. Geological Survey digital data 1:24,000, 1991
Albers Equal Area projection
Standard parallels 29°30' and 45°30', Central meridian -86°

0 1 2 3 4 5 MILES

0 1 2 3 4 5 KILOMETERS

EXPLANATION

▲ STREAMFLOW-GAGING STATION

▽ SEDIMENT-SAMPLING SITE

Figure 1. Location of the study area showing sediment-sampling sites.

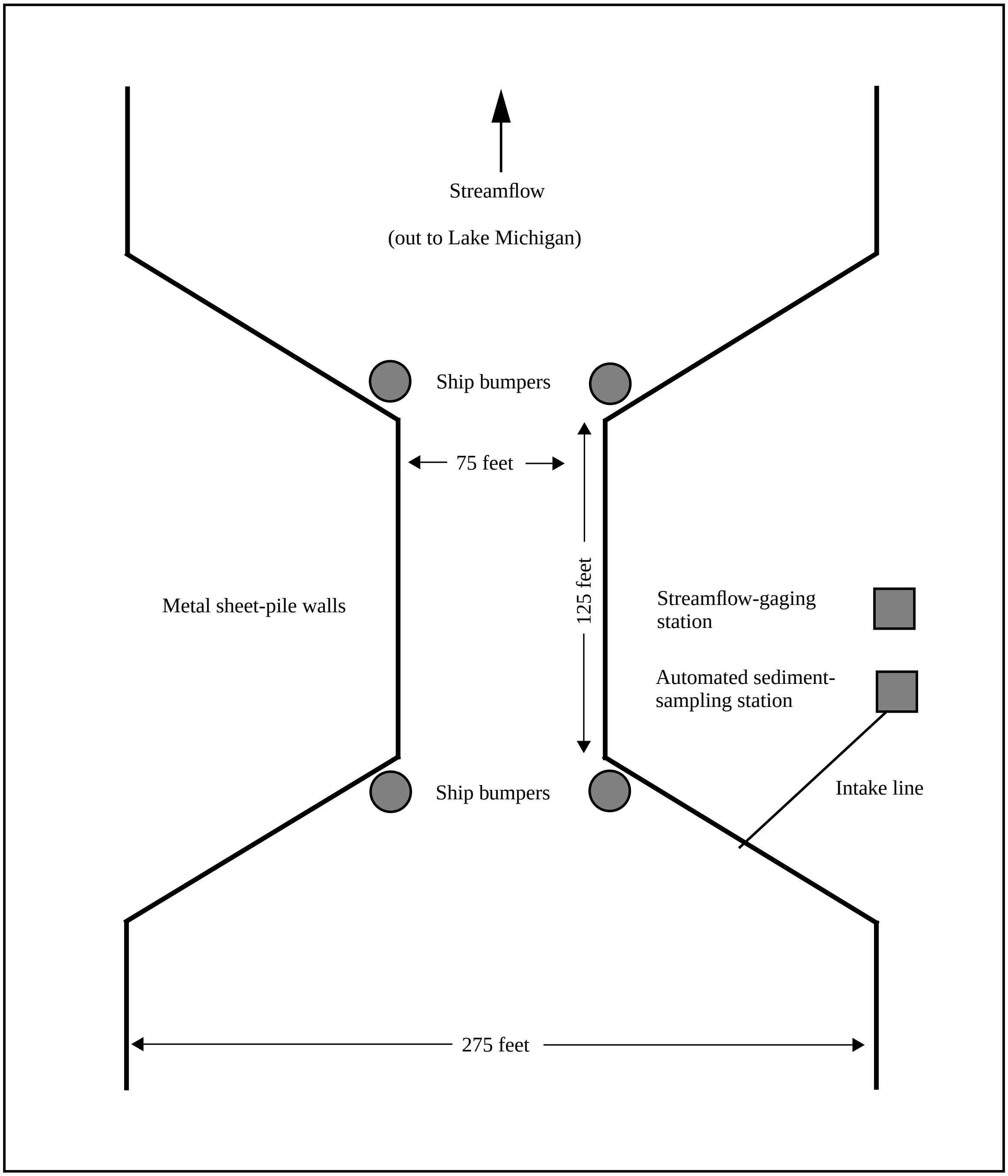


Figure 2. Diagram of the automated sediment-sampling station at the Indiana Harbor Canal at East Chicago, Indiana.

this station reverses often, varying greatly from negative to positive streamflows (negative streamflow indicates flow away from Lake Michigan). These reversals probably are a result of changes in industrial and municipal discharges and changes in the water level in Lake Michigan.

An ISCO 3700FR automated water sampler (referred to as the "automated sampler" in the remainder of this report) was installed at this site. The canal depth generally is 10 ft (feet) at the location of the intake, and the depth rapidly increases away from the wall. The intake for the automated sampler is at a depth of 6 ft and is on the east side of the canal; it is 1 ft from the sheet-pile wall that connects the wide section to the narrow section of the canal and approximately halfway between the wide and narrow sections (fig. 2). The intake was installed in this location and not in the narrow section of the canal because of the hydraulic requirements of the automated sampler (length of intake line in combination with height above water level). The location also was chosen to avoid possible damage by boat operations.

Grand Calumet River

The Grand Calumet River at Gary streamflow-gaging station (station number 04092677) (fig. 1) is located at Industrial Highway (US 12). The station is on the east branch of the river, about 5.2 river miles downstream from its source and 4.6 river miles upstream from the confluence with the Indiana Harbor Canal. At this station, the river has a U-shaped channel approximately 77 ft wide and 5 ft deep. Flow at the station is affected by changes in industrial and municipal discharges and occasional backwater from Lake Michigan; however, reversal of the direction of flow has not been observed.

The Grand Calumet River at Hammond streamflow-gaging station (station number 05536357) (fig. 1) is located at Hohman Avenue. The station is on the west branch of the river, 2.81 river miles downstream from the confluence with the Indiana Harbor Canal and 0.46 river mile upstream from the Indiana-Illinois state line. At this station, the river flows through three metal culverts that are each 4 ft in diameter. Flow at this station predominantly is effluent from municipal sewage-treatment plants. There are no observed periods of reversal of the direction of flow at this station (James Stewart, U.S. Geological Survey, oral commun., 1998).

Data Collection

Suspended-Sediment Samples

Suspended-sediment samples were collected manually instream from the Indiana Harbor Canal and from the east and west branches of the Grand Calumet River; samples also were collected from the Indiana Harbor Canal by an automated sampler. Samples were sent to the USGS Kentucky District laboratory for determination of concentrations of suspended sediment. At the laboratory, the samples were filtered through a glass-fiber filter that allows for retention of sediments that have a size of 0.0015 mm (millimeters) or larger. The 0.0015-mm size is in the sediment range for medium clay, which ranges from 0.0020 to 0.0010 mm (Guy, 1969). For sediments, clay is the finest sediment-size class. Samples were dried in an oven for 2 to 4 hours at a temperature of 103° Celsius (Sholar and Shreve, 1998). A small number of samples was collected at each station for the determination of the percentage of organic material. These samples were sent to the USGS Washington District laboratory.

Indiana Harbor Canal

Two thousand and five suspended-sediment samples were collected with the automated sampler from May 7, 1996, through June 25, 1998 (table 1, p. 30 at back of report). Samples generally were collected at 8-hour intervals. The temperature in the holding area of the sampler was maintained at 4° Celsius to minimize sample evaporation and to prevent the samples from freezing.

Suspended-sediment samples were collected manually instream periodically at the same time samples were collected by the automated sampler; this was done to evaluate any bias between concentrations of suspended sediment in samples collected manually instream and by the automated sampler. Ideally, if any bias is present and it can be determined, a correction or calibration factor can be applied to the concentrations of suspended sediment for samples collected by the automated sampler. Instream samples were collected manually with a Wildco Alpha horizontal-tube sampler that was suspended from a handline. The Wildco sampler is a point sampler that consists of a horizontal plastic-tube body with rubber end plugs that were closed by spring action when activated by a weighted messenger. Samples were collected by lowering the Wildco sampler to the sampling depth. After a minimum of 1 minute, the end plugs were closed. A depth-integrating sampler could not be used at this station because hydrostatic effects limit its use to a maximum depth of 19 ft (Edwards and Glysson, 1999); stream depth at this station is approximately 30 ft. A point-integrating sampler also could not be used because it is limited to a minimum stream velocity of 1 ft/s (foot per second) (Edwards and Glysson, 1999) and velocities at this station frequently are less than 1 ft/s (Scott Morlock, U.S. Geological Survey, oral commun., 1998).

An attempt initially was made to collect calibration samples at 10 equally spaced locations in the wide section of the canal, approximately 100 ft upstream from the narrow section of the canal. Little or no velocity was observed at most of these locations; therefore, subsequent calibration samples were collected in the narrow section of the canal where greater velocities occur. To eliminate any effects that might be caused by the sheet-pile walls or the ship bumpers (fig. 2), the calibration samples were collected in the middle of the narrow section of the canal.

Twenty-seven sets of calibration samples were collected on six different days from the narrow section of the canal (table 2, p. 51 at back of report). For the first three sample sets, samples were collected at 3-ft intervals of depth, with each interval being 10 percent of the total depth of 30 ft. Each of these three sets of 10 samples took approximately 25 minutes to collect and, during sample collection, streamflows varied greatly from negative to positive (figs. 3 and 4). The automated sampler collected samples at the same time the instream samples were collected. The average concentrations of suspended sediment for the samples collected manually instream were 147 to 177 percent greater than the average of the samples collected by the automated sampler. The instream samples showed no pattern of concentrations of suspended sediment with depth (fig. 5). Because of the large variability in streamflow during sample collection, the comparisons between samples collected manually instream and those collected by the automated sampler and the instream samples with depth are inconclusive.

To lessen the effects that the changes in streamflow might have on the comparisons of samples collected manually instream and by the automated sampler, the next 24 calibration sample sets were collected from two points—at 20 and at 80 percent of the total water depth in the canal. These depths were selected because they are used by the USGS to determine average velocities in a vertical section of a stream with depths greater than 2.5 ft (Buchanan and Somers, 1969). Equal volumes of water were collected from each point; it took approximately 2 minutes to collect each set of samples. The automated sampler collected a sample at the same time the instream samples were collected. The two instream samples collected for each of the calibration sets were analyzed separately, and the concentrations of suspended sediment were averaged for comparison with the sample collected by the automated sampler.

There was no consistent bias in concentrations of suspended sediment between the 24 calibration sample sets collected manually instream and the 24 concurrent samples collected by the automated sampler (fig. 6). Two samples collected manually instream had concentrations of suspended sediment much greater (approximately three times) than those in samples collected by the automated sampler. Both samples were collected after a ship had interrupted sampling, the first sample approximately 10 minutes afterwards and the second

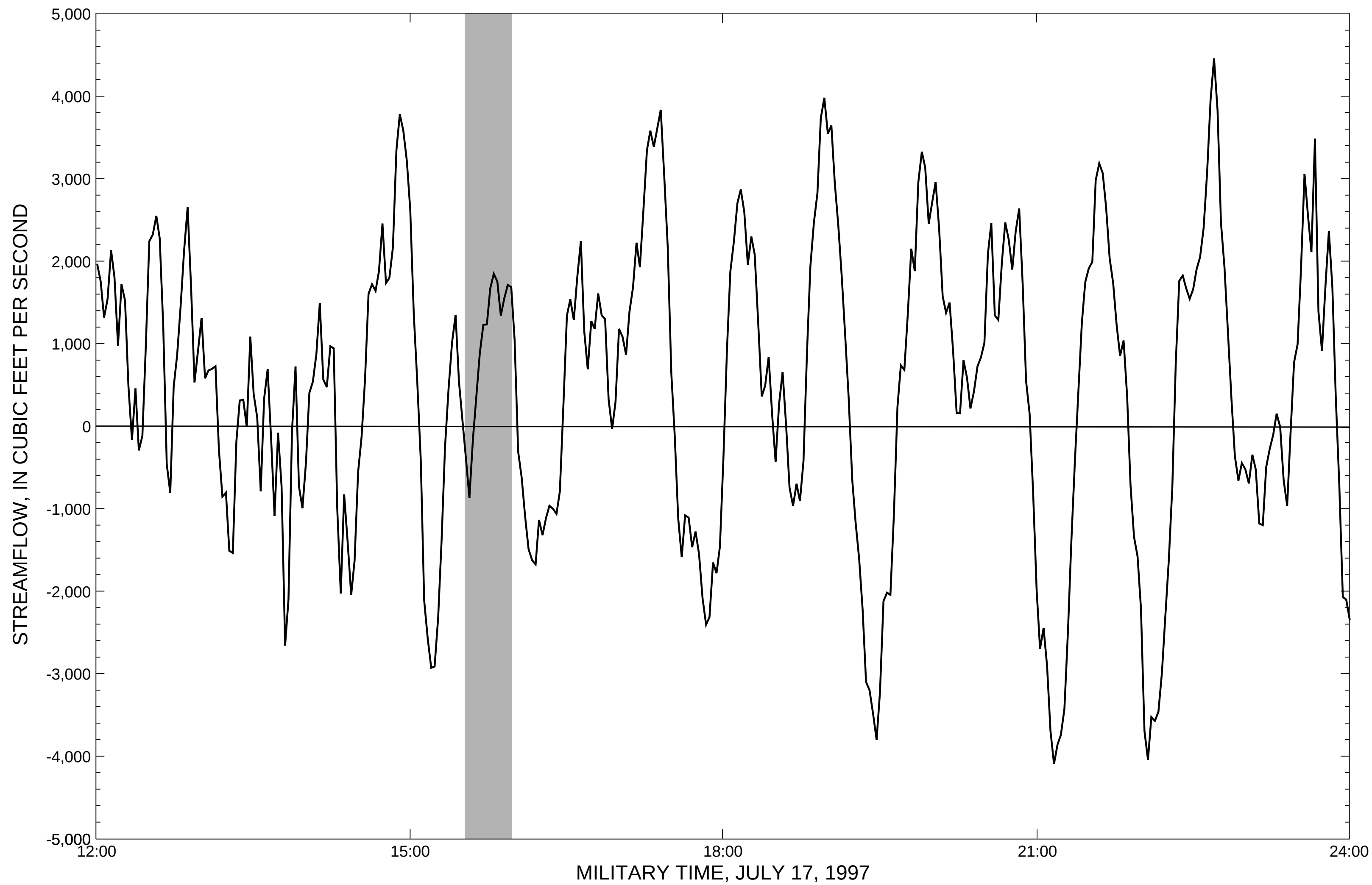


Figure 3. Changes in streamflow during collection of the first set of calibration samples from the Indiana Harbor Canal at East Chicago, Indiana. The shaded area indicates the time during which the calibration samples were collected.

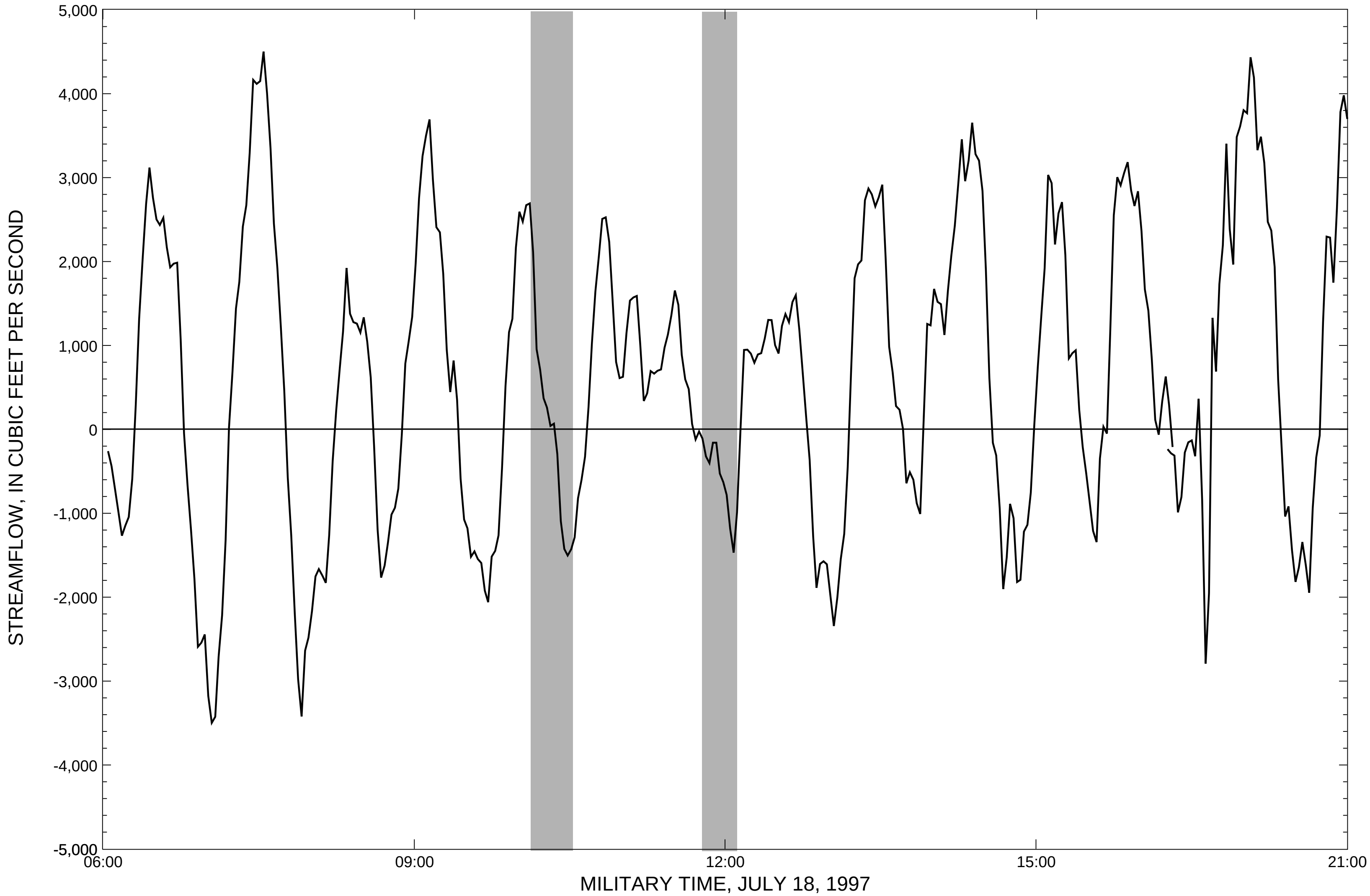


Figure 4. Changes in streamflow during collection of the second and third sets of calibration samples from the Indiana Harbor Canal at East Chicago, Indiana. The shaded area indicates the time during which the calibration samples were collected.

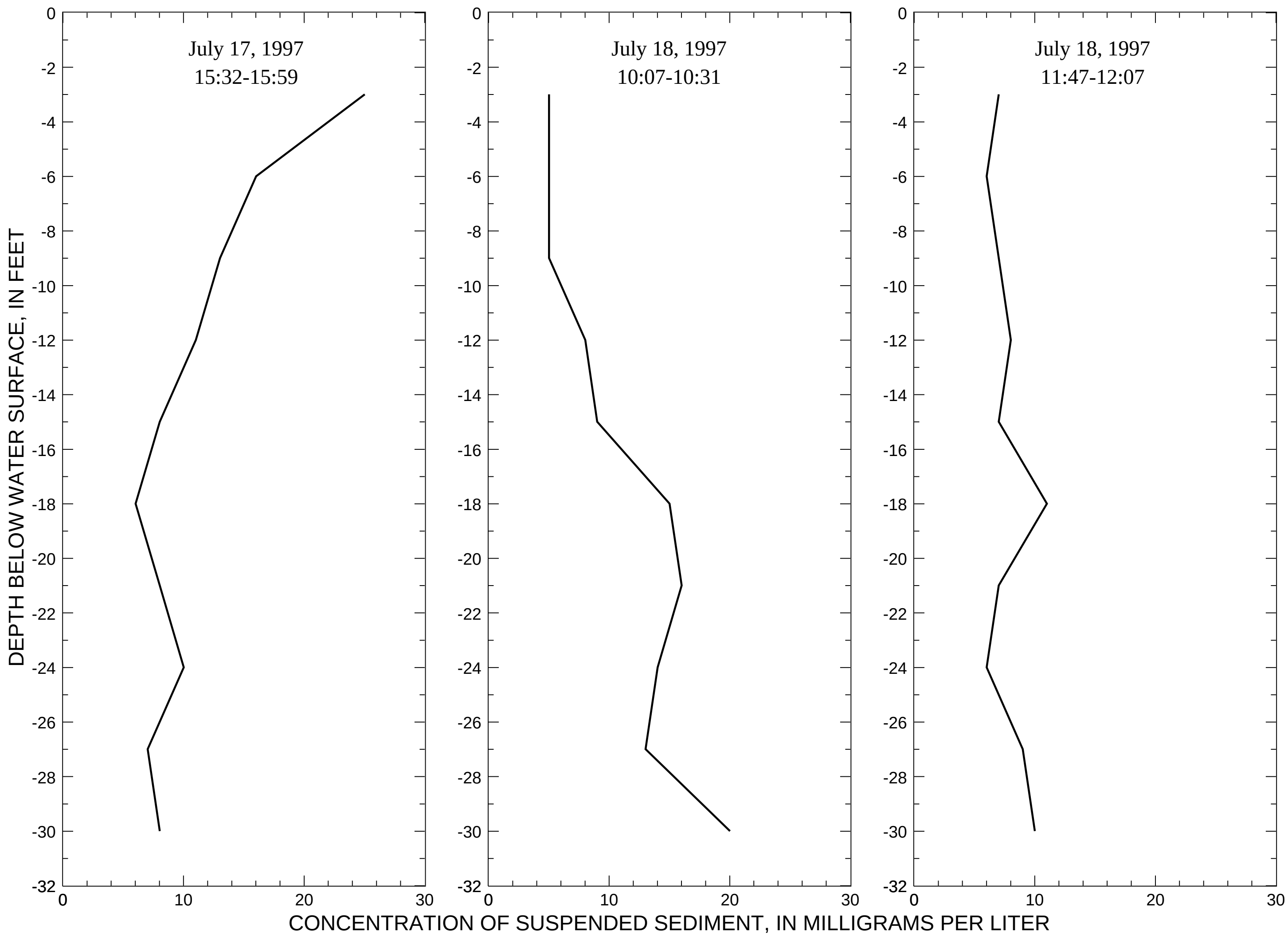


Figure 5. Concentrations of suspended sediment as a function of water depth for the three sets of calibration samples collected from the Indiana Harbor Canal at East Chicago, Indiana, at 3-foot-depth intervals.

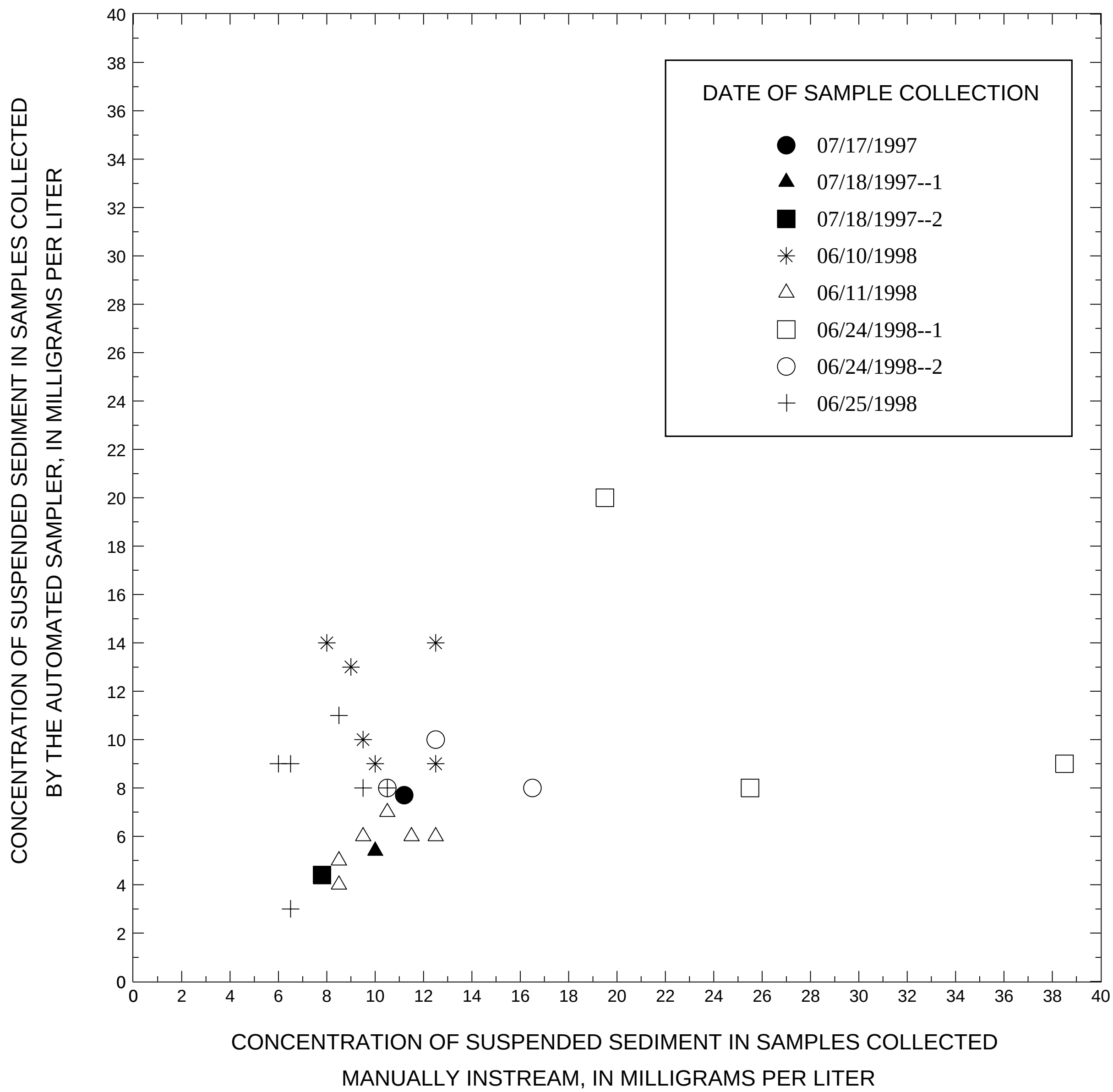


Figure 6. Concentrations of suspended sediment for samples collected from the Indiana Harbor Canal by the automated sampler compared to concentrations of suspended sediment for samples collected manually instream and used as calibration samples.

sample 8 minutes after the first sample. Most likely, the ship disturbed sediments in the narrow section of the canal and the suspended sediments did not spread from the narrow section of the canal to the intake for the automated sampler (located halfway between the wide and narrow sections of the canal). Excluding these 2 samples, 15 of the instream samples had concentrations of suspended sediment greater than those samples collected by the automated sampler; 7 of the instream samples had concentrations less than those samples collected by the automated sampler. The average concentrations of suspended sediment for the samples collected manually instream ranged from 62 to 212 percent of the concentrations of the samples collected by the automated sampler. Because there was no consistent bias in concentrations of suspended sediment between the 24 calibration sample sets collected manually instream and the 24 concurrent samples collected by the automated sampler, no correction factor was applied to the concentrations of suspended sediment for samples collected by the automated sampler.

Six sets of samples were collected on June 24, 1998, from the Indiana Harbor Canal to determine the percentage of organic material in the suspended sediment. Each of the six sets consisted of two samples collected at 20 and 80 percent of the total water depth from the middle of the narrow section of the canal.

Grand Calumet River

Suspended-sediment samples were collected seven times during July 1996 through June 1998 from the downstream side of the Industrial Highway bridge in Gary. Samples were collected at five equally spaced vertical transects by use of a Federal Interagency Sedimentation Project (FISP) DH-59 depth-integrating sampler that was suspended from a handline. Two samples were collected at each vertical transect, using the same transit rate through the water column. One sample was collected from the center of the stream during four of the seven samplings for determination of the percentage of organic material.

Suspended-sediment samples were collected seven times during July 1996 through June 1998 from the west branch of the Grand Calumet River at the downstream side of the Hohman Avenue bridge in Hammond. Samples were collected at two or three equally spaced vertical transects at each of the three culverts by use of a FISP DH-48 depth-integrating sampler that was suspended from a rod. Two samples were collected at each vertical transect, using the same transit rate through the water column. One sample was collected from the center culvert during four of the seven samplings for determination of the percentage of organic material.

Bedload-Sediment Samples

Samples of bedload sediment were collected three times in the Indiana Harbor Canal during the study to determine bedload-sediment movement. Samples were collected by use of a USGS-designed Helley-Smith bedload-sediment sampler that has a 3-in. (inch) square opening and a sample-collection bag with a mesh size of 0.25 mm. The 0.25-mm size is in the sediment range for fine sand, which ranges from 0.25 to 0.125 mm (Guy, 1969). Because of soft bottom sediments in the sampling locations, a 2-ft square plastic plate was attached to the sampler to keep the opening of the sampler from sinking into the sediments. The sampler was gently lowered to the bottom and left for 5 minutes to collect samples of the bedload.

Two sets of samples were collected on August 1, 1996. The first set of samples was collected at seven evenly spaced locations along a transect in the wide section of the canal, approximately 100 ft upstream from the narrow section of the canal. The second set was collected at three evenly spaced locations along a transect in the narrow section of the canal. Streamflow, recorded every 15 minutes during the sample collection, ranged from a positive 2,780 ft^3/s to a negative 1,020 ft^3/s. There was no rainfall during the sample collection. The third set of samples was collected on August 28, 1996. Samples were collected at three evenly spaced locations along a transect in the narrow section of the canal. Streamflow during the sample collection ranged from 58 ft^3/s to 771 ft^3/s. There was no rainfall during the sample collection. No bedload sediments were collected in the sampler for any of the streamflow conditions sampled; therefore, no additional attempts were made to collect bedload-sediment samples.

Streamflow

The USGS has collected streamflow data at the Indiana Harbor Canal at East Chicago since October 1991. Streamflow records for this site are rated fair (considered to be within 15 percent of the true streamflow) for May 1996 through September 1996, except for two periods, July 22 through 23 and August 5 through 6, that are rated poor (outside 15 percent of the true streamflow) (Stewart and others, 1997). Streamflow records for the remainder of this study are rated poor (Stewart and others, 1998 and 1999).

Streamflow data have been collected at the east branch of the Grand Calumet River at Gary and the west branch of the Grand Calumet River at Hammond since October 1991. Streamflow records for the east branch of the river are rated good (within 10 percent of the true streamflow) for the period of study, except for the period March 20 through 22, 1998, that is rated poor. Streamflow records for the west branch of the river are rated poor for the period of study (Stewart and others, 1997, 1998, and 1999).

Table 3 lists summary statistics for daily mean streamflow data collected during this study. Figures 7, 8, and 9 display the daily mean streamflows and the mean streamflow for the three stations from May 1996 through June 1998.

Concentrations of Suspended Sediment

Indiana Harbor Canal

Of the 2,005 suspended-sediment samples collected by the automated sampler, 1,856 had associated values of streamflow. Table 4 (page 18) lists summary statistics for these samples. The mean concentration of suspended sediment and the standard deviation for all samples collected and for samples that had associated streamflow were the same, 15 milligrams per liter (mg/L) and 11 mg/L, respectively. Figure 10 (page 17) shows no apparent relation between concentrations of suspended sediment and streamflow. The line through the plot is a locally weighted scatterplot smooth (LOWESS) (Helsel and Hirsch, 1992). The lack of a relation probably is because of the complexity of the hydrologic system and the source of the flow. Because almost all of the flow in the Grand Calumet River Basin is from industrial and municipal discharges and not from natural runoff, the typical pattern of larger concentrations of suspended sediment being associated with larger flows found in

Table 3. Summary statistics for daily mean streamflow data collected from May 1996 through June 1998 for the Indiana Harbor Canal at East Chicago, Indiana; the east branch of the Grand Calumet River at Gary, Indiana; and the west branch of the Grand Calumet River at Hammond, Indiana

[ft^3/s, cubic feet per second]

Statistic	Indiana Harbor Canal at East Chicago	Grand Calumet River at Gary	Grand Calumet River at Hammond
Number of observations	791	791	791
Number of estimated observations	49	3	16
Daily mean streamflow, ft^3/s	624	476	70.1
Standard deviation, ft^3/s	232	39.6	33.9
Lowest daily mean streamflow, ft^3/s	235	347	16.0
Highest daily mean streamflow, ft^3/s	1,790	601	464

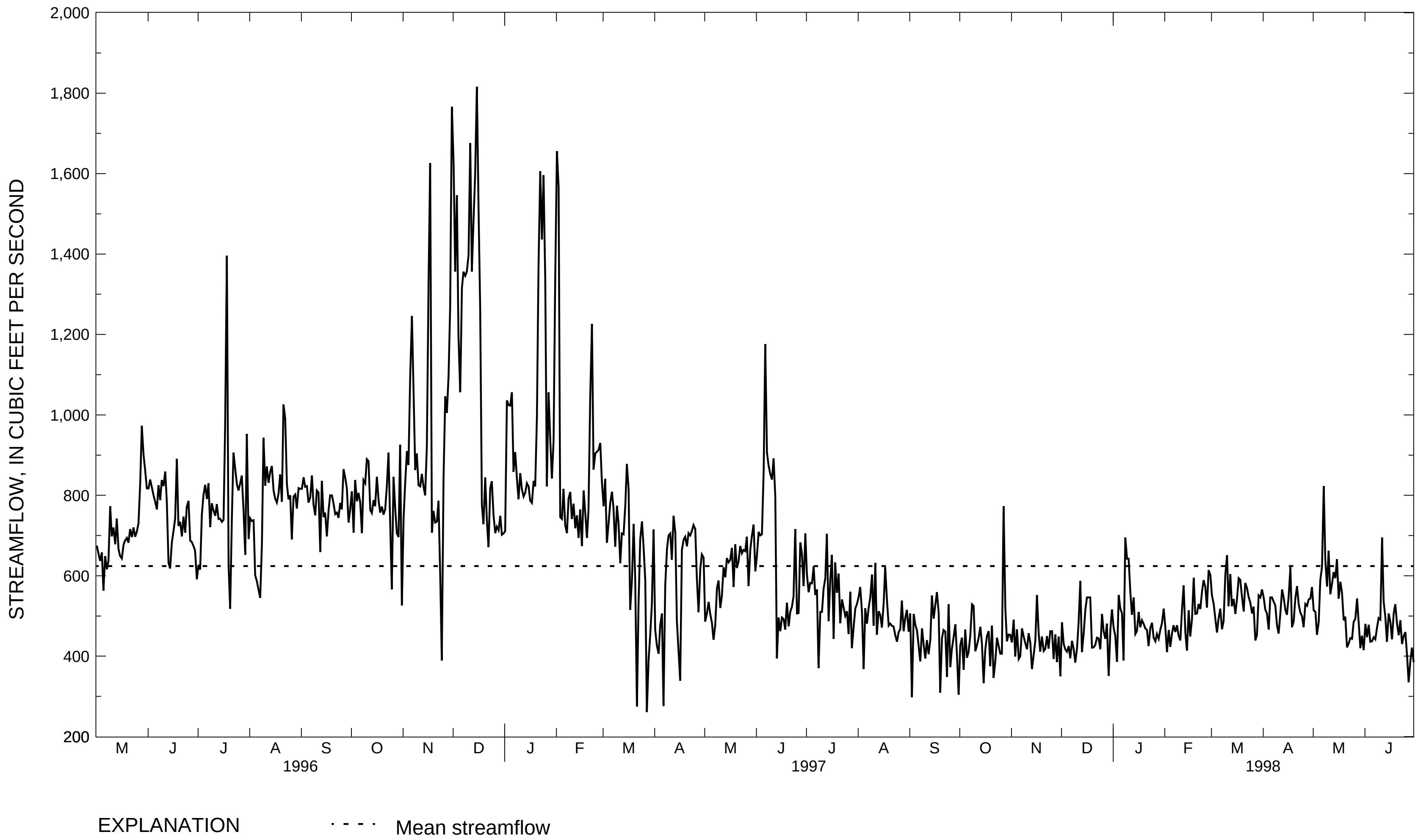
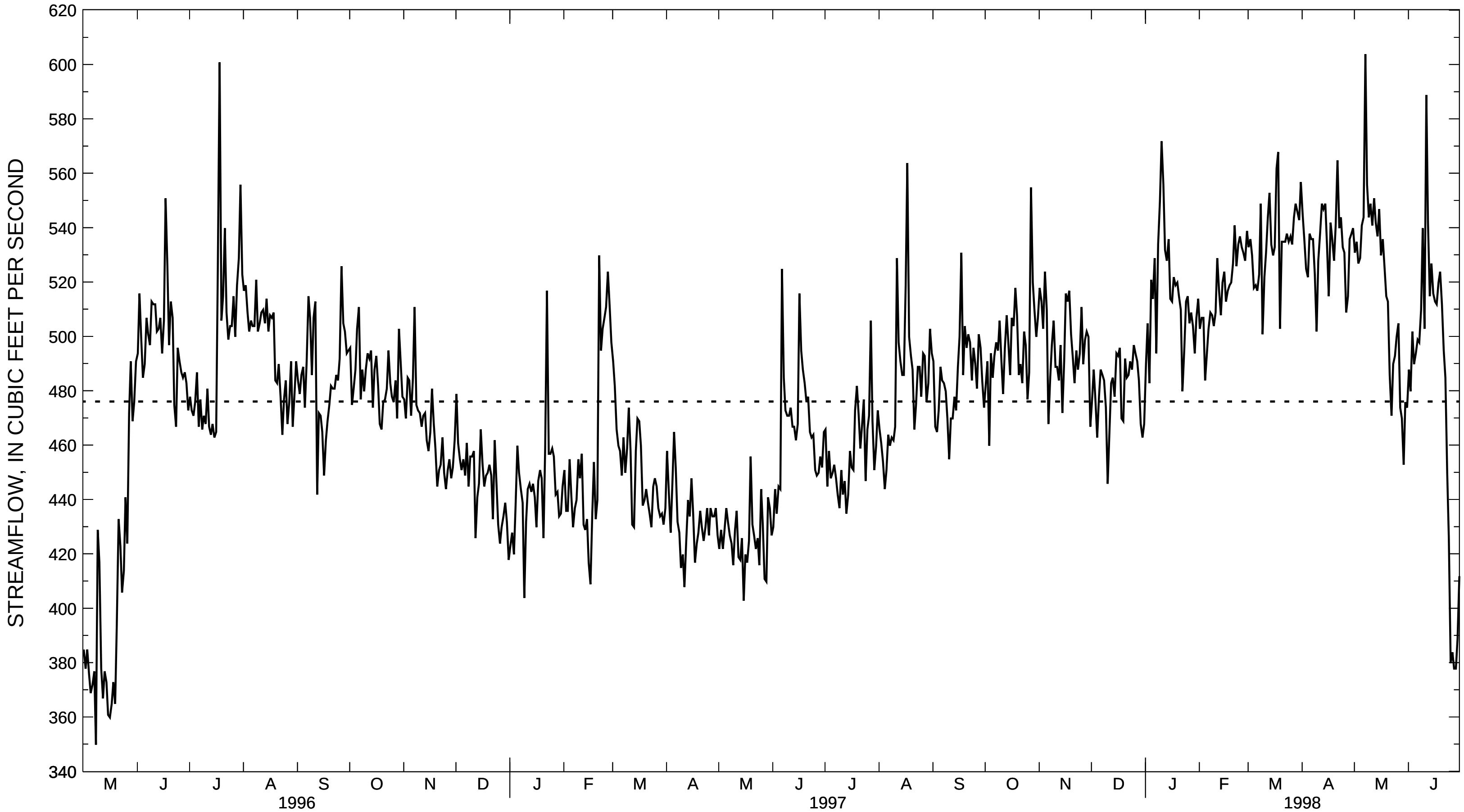


Figure 7. Daily mean streamflow and mean streamflow for the Indiana Harbor Canal at East Chicago, Indiana, from May 1996 through June 1998.



EXPLANATION

Mean streamflow

Figure 8. Daily mean streamflow and mean streamflow for the east branch of the Grand Calumet River at Gary, Indiana, from May 1996 through June 1998.

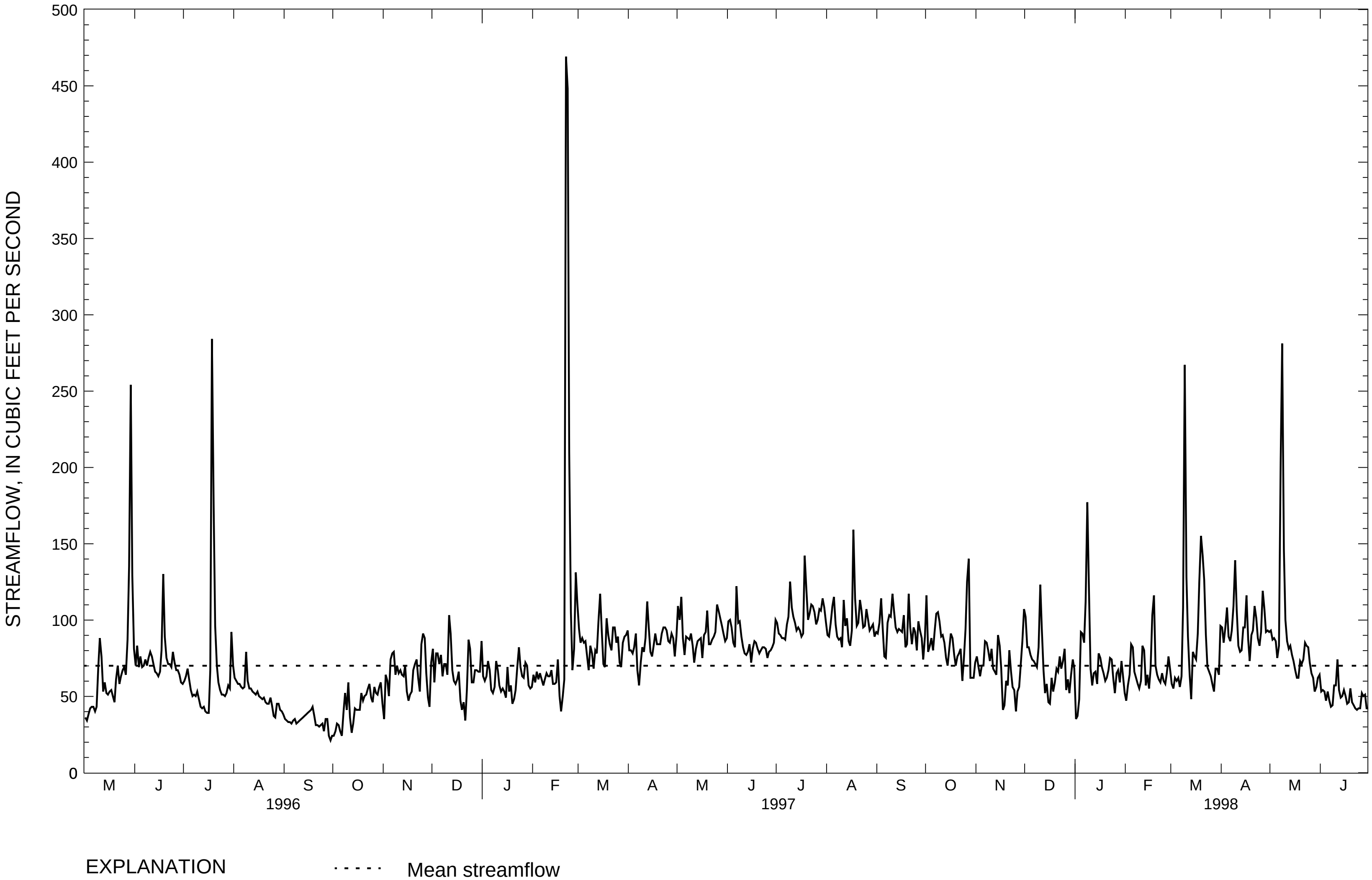


Figure 9. Daily mean streamflow and mean streamflow for the west branch of the Grand Calumet River at Hammond, Indiana, from May 1996 through June 1998.

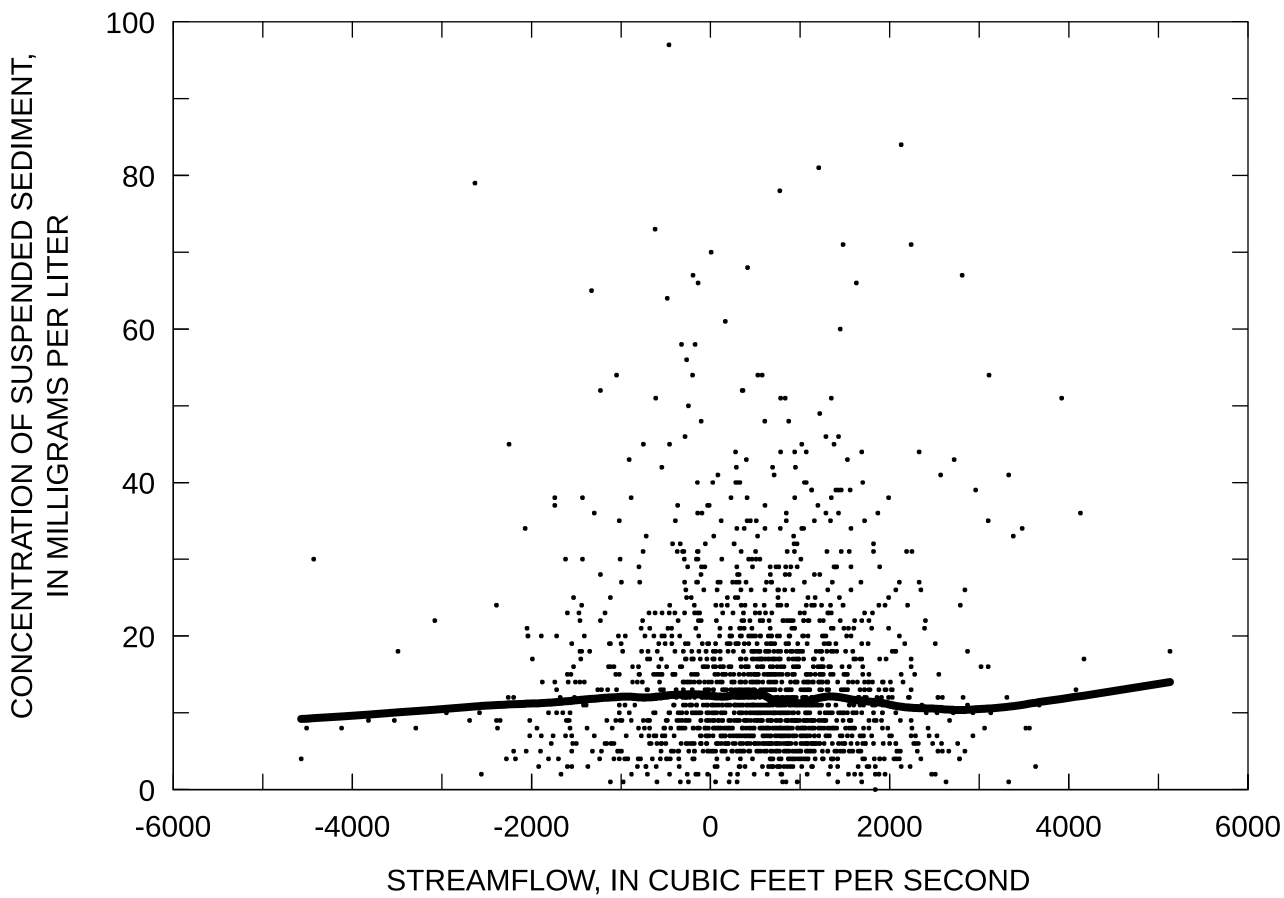


Figure 10. Relation of concentration of suspended sediment to streamflow in the Indiana Harbor Canal at East Chicago, Indiana. The solid line is a locally weighted scatterplot smooth.

Table 4. Summary statistics for suspended-sediment samples collected by the automated sampler at the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998

[mg/L, milligram per liter]

Statistic	Number of suspended-sediment samples collected	Number of suspended-sediment samples with associated values of streamflow
Number of samples collected	2,005	1,856
Mean concentration, mg/L	15	15
Median concentration, mg/L	12	12
Standard deviation, mg/L	11	11
Lowest concentration, mg/L	0	0
Highest concentration, mg/L	97	97

most natural streams does not occur. There did appear to be a seasonal trend in the concentrations of suspended sediment, however, in that the largest concentrations generally were measured during the spring (fig. 11).

During the study, four substantial rainfall events were recorded at a rainfall-data-collection station at Indiana Dunes National Lakeshore near Chesterton, Indiana, approximately 20 mi east of the study site. Daily rainfall totals were 3.68 in., June 18, 1996; 4.20 in., July 18, 1996; 1.84 in., February 21, 1997; and 2.15 in., March 9, 1998 (Hydrosphere, 1999). Suspended-sediment concentrations for samples collected by the automated sampler and associated instantaneous streamflow data for three of the rainfall events (there are no sediment data for March 9, 1998) for 5 days prior to and after the rainfall events are shown in figure 12. Only for the July 18, 1996, event was there a substantial increase in the concentrations of suspended sediment. Associated instantaneous streamflows for the three events were variable, with streamflows ranging from positive to negative.

Daily mean streamflows for the Indiana Harbor Canal and the USGS streamflow-gaging station Little Calumet River at Porter, Indiana, (station number 04094000) for 5 days prior to and after three of the rainfall events are shown in figure 13. The Little Calumet River has a drainage area of 66.2 mi^2 and is affected much less by human activities than is the Indiana Harbor Canal. Although increases in flow can be seen for each rainfall for the Indiana Harbor Canal, the canal did not show as substantial increases in flow as the Little Calumet River did; the Little Calumet River showed substantial increases for all three events. The lack of a consistent response to rainfall for the Indiana Harbor Canal may be the result of human activities in the Grand Calumet River Basin, which, along with changing Lake Michigan water levels, make the basin a complex hydrologic system.

Grand Calumet River

The concentrations of suspended sediment measured in seven samples collected from the east branch of the Grand Calumet River at Gary are listed in table 5 (page 21), along with the associated streamflows. There is no apparent relation between concentrations of suspended sediment and streamflow. The mean suspended-sediment concentration determined for samples from this station was 13 mg/L, with a standard deviation of 6 mg/L.

The concentrations of suspended sediment measured in seven samples collected from the west branch of the Grand Calumet River at Hammond are listed in table 6 (page 21), along with the associated streamflows. There is no apparent relation between concentrations of suspended sediment and streamflow. The mean suspended-sediment

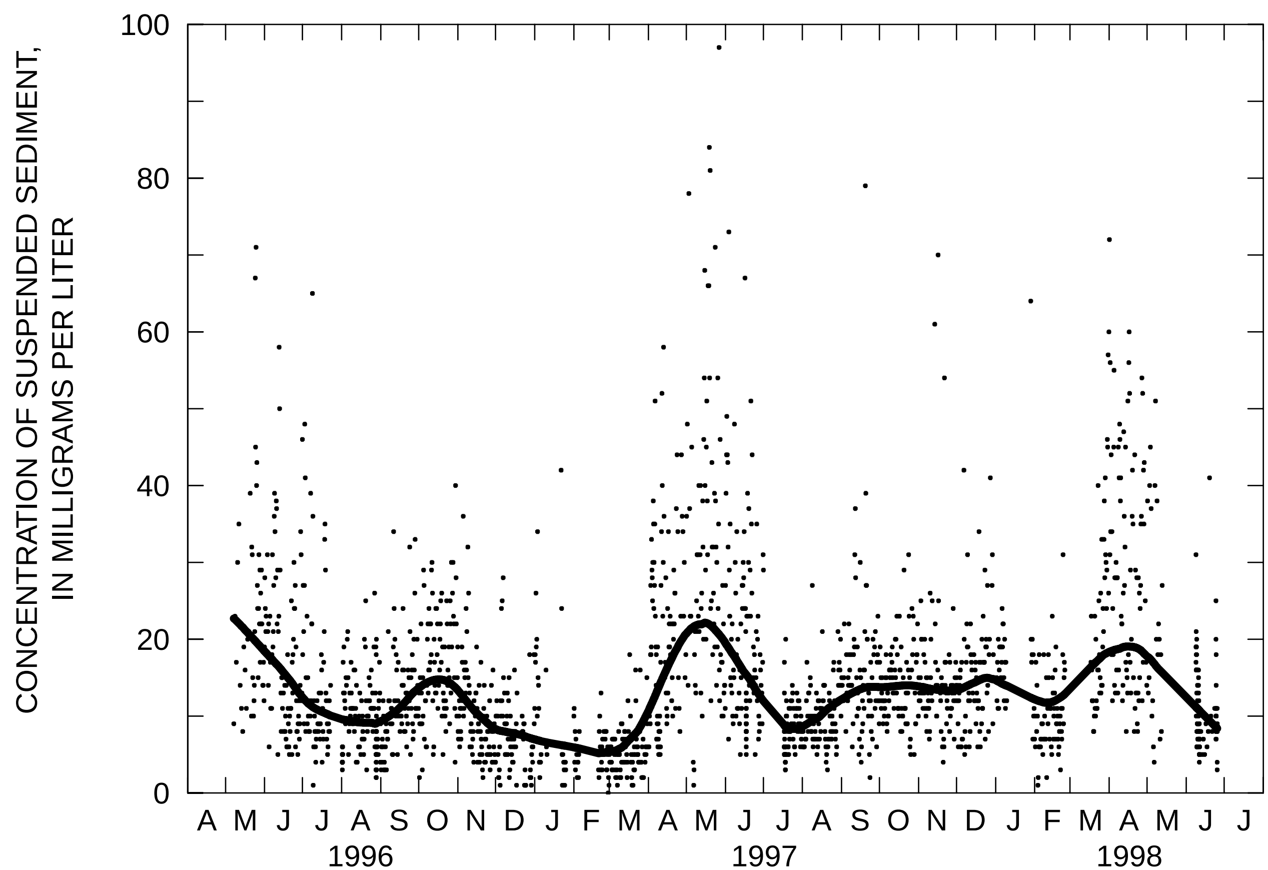


Figure 11. Relation of concentration of suspended sediment to season in the Indiana Harbor Canal at East Chicago, Indiana, for the period April 1996 to June 1998. The solid line is a locally weighted scatterplot smooth.

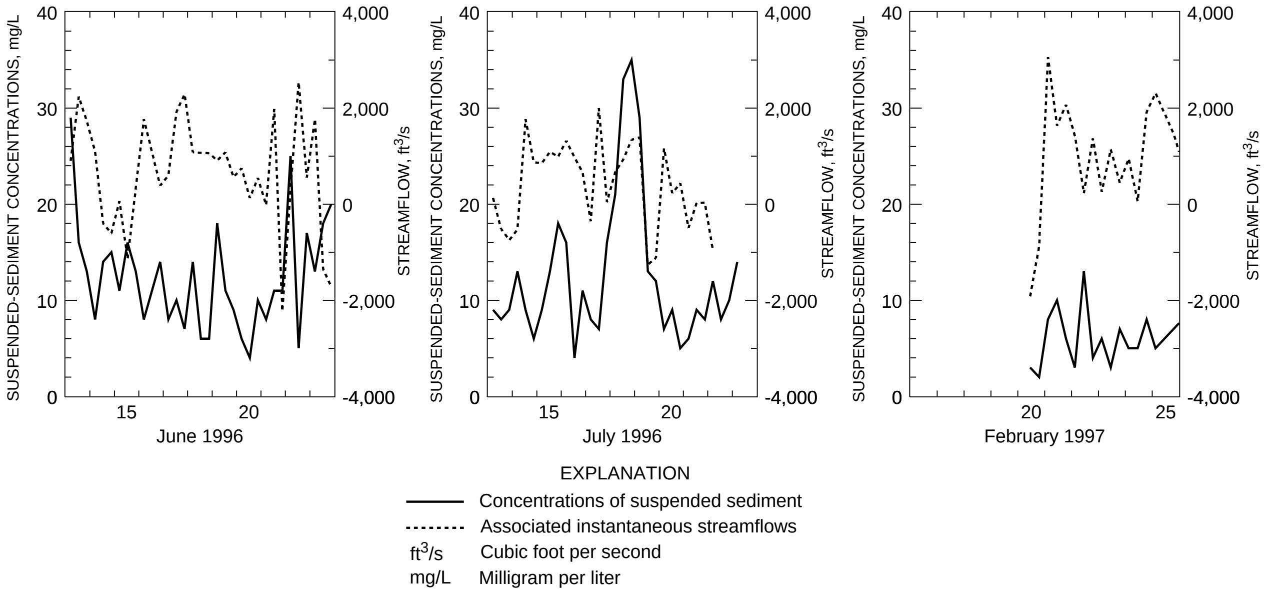


Figure 12. Relation of concentrations of suspended sediment collected by the automated sampler to associated instantaneous streamflows for the Indiana Harbor Canal at East Chicago, Indiana, for 5 days prior to and after significant rainfall events.

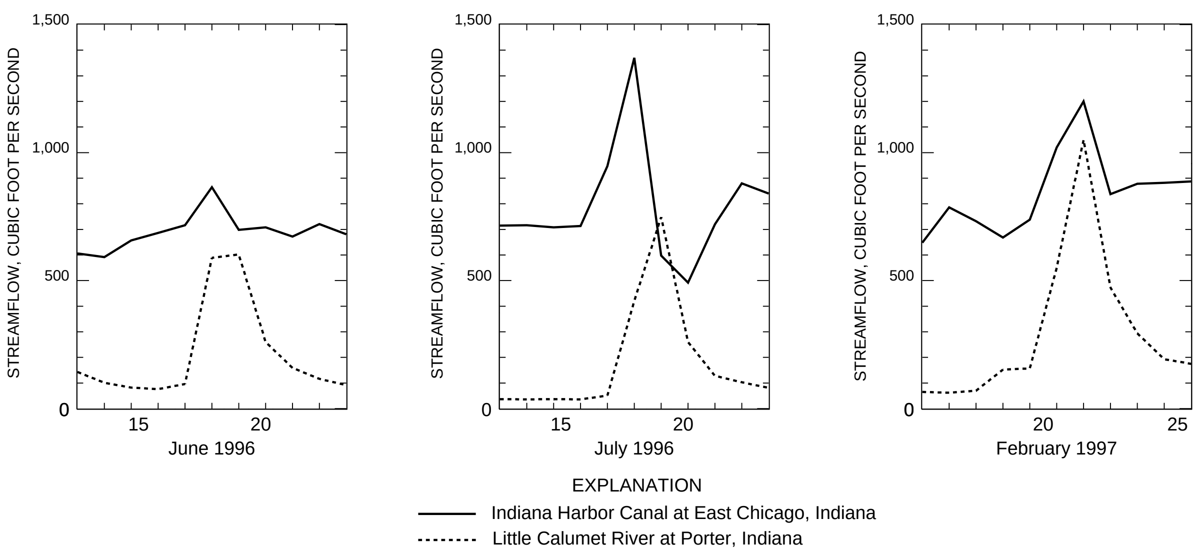


Figure 13. Daily mean streamflows for the Indiana Harbor Canal at East Chicago, Indiana, and the Little Calumet River at Porter, Indiana, for 5 days prior to and after significant rainfall events.

concentration determined for samples from this station was 6 mg/L, with a standard deviation of 2 mg/L.

Table 5. Concentrations of suspended sediment and streamflow for samples collected from the east branch of the Grand Calumet River at Gary, Indiana

[Time is in military notation; mg/L, milligrams per liter; ft^3/s, cubic feet per second]

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
07-31-1996	1535	16	503
08-27-1996	1404	11	444
01-22-1997	1305	23	507
06-09-1998	1345	15	526
06-11-1998	1445	11	582
06-24-1998	1055	10	431
06-25-1998	0835	5	419

Table 6. Concentrations of suspended sediment and streamflow for samples collected from the west branch of the Grand Calumet River at Hammond, Indiana

[Time is in military notation; mg/L, milligrams per liter; ft^3/s, cubic feet per second]

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
07-31-1996	1345	2	61.3
08-27-1996	1230	5	38.5
01-22-1997	1430	9	55.2
06-09-1998	1200	7	53.4
06-11-1998	1330	7	75.8
06-24-1998	1200	8	34.1
06-25-1998	0945	7	36.6

Comparison with Previous Studies in Indiana

Concentrations of suspended sediment measured in samples collected from the Indiana Harbor Canal and the east and west branches of the Grand Calumet River are small when compared to concentrations of suspended sediment in samples collected from other streams in northwestern Indiana or in other parts of the State (Crawford and Mansue, 1996; Crawford and Jacques, 1992). In a study completed in 1992, concentrations of suspended sediment in samples collected from Trail Creek at Michigan City during 1977 to 1981 and 1990 to 1991 ranged from a few milligrams per liter during low streamflows to almost 300 mg/L during high streamflows (Crawford and Jacques, 1992). The concentrations measured in samples collected from the Indiana Harbor Canal appear to be independent of flow and range from less than 1 mg/L to almost 97 mg/L.

Although fewer data were collected from the Grand Calumet River, the data available indicate that concentrations of suspended sediment at these stations are lower than for other streams in northern Indiana. This probably is because the primary source of water in the river system is from municipal and industrial effluents rather than runoff from rainfall.

Organic Material in Suspended Sediment

Organic material has a lower specific gravity than mineral constituents (Guy, 1969). When suspended in the water column, the organic material would have a lower settling rate than mineral constituents. The percentages of organic material in the suspended sediment determined in each sample for the six sample sets collected from the Indiana Harbor Canal and the streamflow at the time of sample collection are listed in table 7. The percentages of organic material were relatively constant and ranged from 21.9 to 29.6 percent. The mean percentage for all samples was 26.1 percent, and the standard deviation was 2.4 percent.

The low variability in the percentages of organic material may be a result of the short period during which the samples were collected.

Table 7. Percentages of organic material measured in samples, mean percentage of organic material, and streamflow for suspended-sediment samples collected from the Indiana Harbor Canal at East Chicago, Indiana

[Time is in military notation; ft, feet; ft³/s, cubic feet per second]

Date	Time	Depth (ft)		Percentage of organic material	Streamflow (ft^3/s)
6-24-98	1504	6		22.8	3,690
6-24-98	1506	24		27.1	2,686
			Mean	25.0	3,280
6-24-98	1524	6		24.8	-2,847
6-24-98	1526	24		24.1	-2,755
			Mean	24.5	-2,712
6-24-98	1534	6		21.9	-1,202
6-24-98	1536	24		27.2	-1,463
			Mean	24.6	-1,330
6-24-98	1634	6		29.6	485
6-24-98	1636	24		27.9	-317
			Mean	24.6	84
6-24-98	1644	6		29.2	-815
6-24-98	1646	24		25.4	-989
			Mean	28.8	-902
6-24-98	1654	6		25.5	1,052
6-24-98	1656	24		27.4	783
			Mean	26.5	918

The suspended-sediment samples were collected during a 2-hour period on the same day. A reversal of streamflow also was observed during the time that these samples were collected, and it is possible that virtually the same water was being sampled each time. Because of the possibility of a seasonal trend in the concentrations of suspended sediment in the Indiana Harbor Canal, additional samples collected over all seasons would be needed to determine if these six samples represent a reasonable estimate of the percentage of organic material.

The percentages of organic material determined in four suspended-sediment samples collected from the east branch of the Grand Calumet River and associated streamflows are listed in table 8. The percentages of organic material ranged from 23.8 to 44.4 percent and had a mean of 34.9 percent and a standard deviation of 9.8 percent.

Table 8. Percentages of organic material and streamflow for suspended-sediment samples collected from the east branch of the Grand Calumet River at Gary, Indiana

[Time is in military notation; ft³/s, cubic feet per second]

Date	Time	Percentage of organic material	Streamflow (ft^3/s)
6-09-98	1345	29.7	526
6-11-98	1506	44.4	582
6-24-98	1055	23.8	431
6-25-98	0835	41.9	419

The percentages of organic material determined in four suspended-sediment samples collected from the west branch of the Grand Calumet River and associated streamflows are listed in table 9. The percentages of organic material ranged from 27.1 to 39.9 percent and had a mean of 34.3 percent and a standard deviation of 5.3 percent.

Table 9. Percentages of organic material and streamflow for suspended-sediment samples collected from the west branch of the Grand Calumet River at Hammond, Indiana

[Time is in military notation; ft^3/s, cubic feet per second]

Date	Time	Percentage of organic material	Streamflow (ft^3/s)
6-09-98	1200	34.4	53.4
6-11-98	1330	39.9	75.8
6-24-98	1200	27.1	34.1
6-25-98	0945	35.9	36.6

Loads of Suspended Sediment

The mass transport or discharge of a constituent past a monitoring site in a given amount of time is referred to as the "constituent load." Ideally, the average constituent load (L_m) transported during time T can be determined as

$$L_m = \frac{1}{T}\int_0^T L\,dt \quad , \quad (1)$$

where L is the instantaneous load and dt indicates the integral is taken with respect to time. This can be approximated by

$$L_m = \frac{1}{T}\sum_{i=1}^{T/(\Delta t)} L_i \quad , \quad (2)$$

where Δt is a fixed sampling interval and L_i is the instantaneous load for the period i. The accuracy of this approximation is a function of the sampling interval. A reasonable approximation to equation (2) for the Indiana Harbor Canal is

$$L_m = \frac{1}{n}\sum_{i=1}^{n} \bar{L}_i \quad , \quad (3)$$

where $\overline{L}_i$ is the average daily load for the ith day and n is the number of days over which the average is computed. $\overline{L}_i$ can be estimated as $\overline{C}_i$ x $\overline{Q}_i$ x C (the average daily concentration, $\overline{C}_i$, times the average daily streamflow on the ith day, $\overline{Q}_i$, times a unit's conversion factor, C).

Because of malfunctions of the automated sampler and the acoustic velocity meter used to measure streamflow, concentrations of suspended sediment and streamflow data were not available for some days. Therefore, it was not possible to determine the average daily load. Sediment and streamflow data were sufficient, however, to estimate average weekly loads. By using equation (3) to estimate average weekly loads, an average load for June 1996 through May 1998 was computed.

To assess the validity of using average weekly loads to estimate annual average loads, a comparison of average monthly loads computed from equation (3)—using average daily loads (method 1) and average weekly loads (method 2)—was done for the 15 months having suspended-sediment and streamflow data for at least 23 days per month. Average monthly loads computed for the Indiana Harbor Canal, using average daily loads and average weekly loads, were comparable (fig. 14). Therefore, using estimated average weekly loads to compute the annual average load should provide a reasonable estimate.

The average daily suspended-sediment load computed for the Indiana Harbor Canal at East Chicago from June 1996 through May 1997 (the first year of the study) was 29 tons/d (tons per day). The average daily suspended-sediment load computed from June 1997 through May 1998 (the second year of the study) was 23 tons/d.

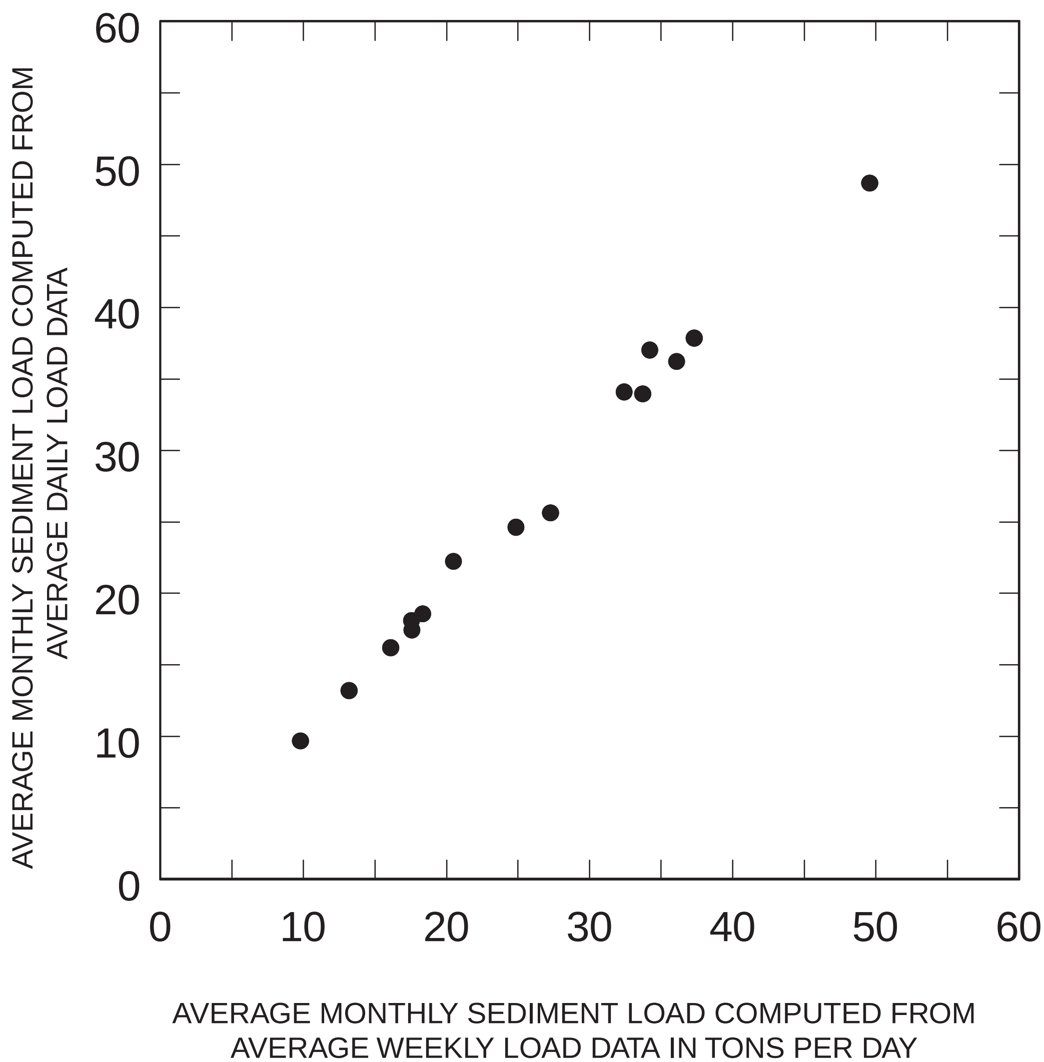


Figure 14. Comparison of monthly sediment loads computed on the basis of average daily load data and average weekly load data, Indiana Harbor Canal at East Chicago, Indiana.

Loads of suspended sediment for the east branch of the Grand Calumet River and the west branch of the Grand Calumet River were estimated by the rating-curve method (Cohn and others, 1989; Crawford, 1991). The rating-curve method uses the relation between loads of suspended sediment and streamflow to estimate the average sediment load. A detailed description of this method is provided by Crawford (1996). The estimated average daily suspended-sediment load for the east branch of the Grand Calumet River from May 1996 through June 1998 was 20 tons/d, and the estimated load for the west branch of the Grand Calumet River was 2.9 tons/d. Because there is no apparent relation between concentrations of suspended sediment and streamflow—possibly because of the small number of samples—there is no apparent relation between the estimates of average daily load and streamflow (fig. 15).

Summary and Conclusions

The Grand Calumet River Basin in northwestern Indiana is a complex hydrologic system that drains one of the most industrialized areas in the United States. The basin is hydrologically complex because most of the streamflow is from industrial and municipal discharges and because streamflow is affected by changes in water levels in Lake Michigan. The Grand Calumet River Basin was identified in the Great Lakes Water Quality Agreement of 1978 as one of 43 areas of concern with one or more specific impairments to beneficial uses of Great Lakes waters. The Agreement directed that Remedial Action Plans be developed and implemented at each area of concern to restore the lakes for beneficial uses. Loads of suspended sediment for the Indiana Harbor Canal and the Grand Calumet River are needed to help determine remediation strategies for the Grand Calumet River Basin.

Suspended-sediment samples and streamflow data were collected from May 1996 through June 1998 at three USGS stations in the Grand Calumet River Basin—the Indiana Harbor Canal at East Chicago, the east branch of the Grand Calumet River at Gary, and the west branch of the Grand Calumet River at Hammond. Sample analysis allowed for retention of sediments of 0.0015 mm or larger.

At the Indiana Harbor Canal at East Chicago, an automated sampler collected 2,005 suspended-sediment samples from the canal and, of these, 1,856 had associated streamflow values. To evaluate any bias between instream concentrations of suspended sediment and samples collected by the automated sampler, 27 sets of suspended-sediment samples were collected manually instream in the canal at the same time samples were collected by the automated sampler. There was no consistent bias between the samples collected manually instream and the samples collected by the automated sampler; therefore, no correction factor was applied to the concentrations of suspended sediment for the samples collected by the automated sampler. For the 2,005 and 1,856 samples, the mean suspended-sediment concentrations were the same, 15 mg/L, and the range in suspended-sediment concentrations were the same, from less than 1 mg/L to 97 mg/L.

There was no apparent relation between the concentration of suspended-sediment measured in samples from the Indiana Harbor Canal and streamflow. This is probably because of the complexity of the hydrology in the study area, where most of the streamflow is from industrial and municipal discharges and streamflow is affected by changes in water levels in Lake Michigan. There did appear to be a seasonal trend in the concentrations of suspended sediment, however, in that the largest concentrations generally were measured during the spring.

During the study, four substantial rainfall events of 3.68 in., 4.20 in., 1.84 in., and 2.15 in. were recorded at a rainfall-data-collection station approximately 20 mi east of the Indiana Harbor Canal. Only for the rainfall event of 4.20 in. was there a substantial increase in the concentrations of suspended sediment in the Indiana Harbor Canal.

Six sets of samples were collected from the Indiana Harbor Canal to determine the percentage of organic material in the suspended sediment. The percentage of organic material for these samples

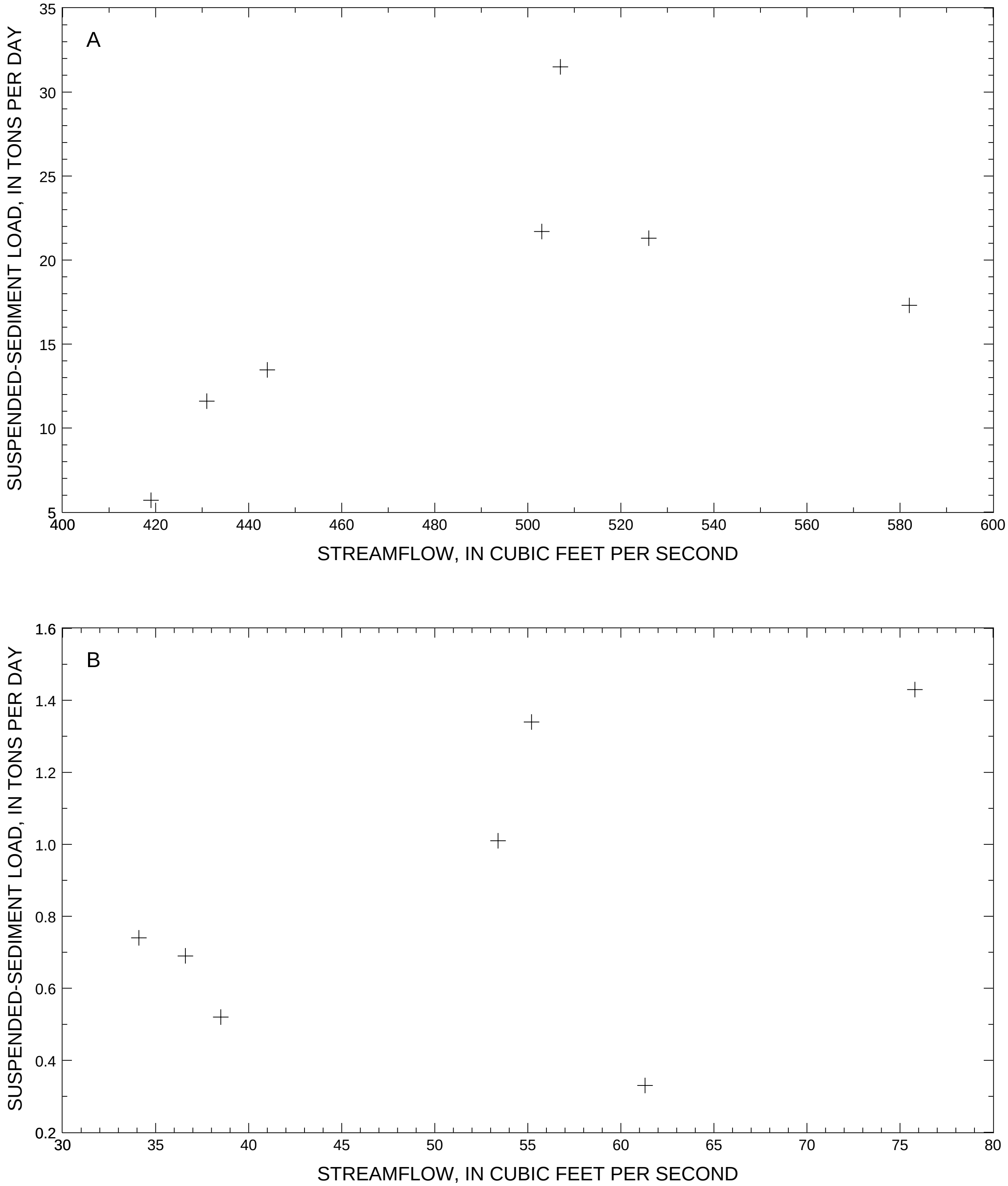


Figure 15. Loads of suspended sediment and streamflow measured in (A) the east branch of the Grand Calumet River at Gary, Indiana, and (B) the west branch of the Grand Calumet River at Hammond, Indiana.

averaged 26 percent. The samples, however, were collected over a 2-hour period on the same day and may not reflect the percentage of organic material in the suspended sediment during different seasons or streamflow conditions.

To determine bedload-sediment movement, bedload-sediment samples were collected three times in the Indiana Harbor Canal at East Chicago with a bedload-sediment sampler that had a sample-collection bag with a mesh size of 0.25 mm. During the sample collections, there was no rainfall. No bedload sediments were collected in the sampler for any of the sample collections.

Seven suspended-sediment samples were collected from the Grand Calumet River at Gary and at Hammond. The mean suspended-sediment concentration measured in samples collected at Gary was 13 mg/L, and the mean suspended-sediment concentration measured in samples collected at Hammond was 6 mg/L. For both stations, there was no apparent relation between the concentration of suspended sediment and streamflow.

Four suspended-sediment samples were collected from the Grand Calumet River at Gary and at Hammond for determination of the percentage of organic material. The percentage of organic material at Gary averaged 35 percent, and the percentage of organic material at Hammond averaged 34 percent.

The concentrations of suspended sediment determined for samples collected from the Indiana Harbor Canal and from the Grand Calumet River at Gary and at Hammond are less than concentrations of suspended sediment in samples collected from other streams in northwestern Indiana and in other parts of the State.

Loads of suspended sediment were computed as the product of the weekly mean suspended-sediment concentration and the daily average streamflow for the Indiana Harbor Canal. The average suspended-sediment load computed for the canal was 29 tons/d for the first year of the study (June 1996 through May 1997) and was 23 tons/d for the second year of the study (June 1997 through May 1998).

Loads of suspended sediment for the Grand Calumet River at Gary and at Hammond were estimated by use of the rating-curve method. The estimated average daily suspended-sediment load for the study was 20 tons/d at Gary and 2.9 tons/d at Hammond.

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Data Tables

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998

[Time is in military notation; mg/L, milligrams per liter; ft^3/s cubic feet per second; negative values of streamflow indicate flow away from Lake Michigan; --, no data]

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19960507	1415	9	-479
19960508	1415	23	1050
19960509	1415	16	646
19960510	1415	30	-1620
19960511	1415	35	1720
19960512	1415	14	472
19960513	1415	11	944
19960514	1415	8	109
19960515	1415	19	307
19960516	1415	16	-802
19960517	1415	11	3670
19960518	1415	20	348
19960519	1415	21	1990
19960520	1415	39	1400
19960521	1300	10	42
19960521	2100	32	-422
19960522	0500	31	-296
19960522	1300	15	1110
19960522	2100	10	33
19960523	0500	10	2530
19960523	1300	12	1350
19960523	2100	14	-296
19960524	0500	21	-161
19960524	1300	67	2810
19960524	2100	45	-748
19960525	0500	71	2240
19960525	1300	40	283
19960525	2100	43	2720
19960526	0500	27	2330
19960526	1300	24	1480
19960526	2100	15	151
19960527	0500	24	-452
19960527	1300	31	-751
19960527	2100	22	-3080
19960528	0500	29	733
19960528	1300	17	2240
19960528	2100	26	2070
19960529	0500	22	809
19960529	1300	29	-63
19960529	2100	22	818
19960530	0500	19	220
19960530	1300	14	1720
19960530	2100	14	-237
19960531	0500	17	568
19960531	1300	12	1650
19960531	2100	19	2170
19960601	0500	28	1220
19960601	1300	24	-178
19960601	2100	21	940
19960602	0500	23	1350
19960602	1300	18	370
19960602	2100	18	1240
19960603	0500	31	1550
19960603	1300	21	1800
19960603	2100	14	344
19960604	0500	22	-359
19960604	1300	6	1500
19960604	2100	18	1370
19960605	0500	23	-119
19960605	1300	17	614
19960605	2100	11	220
19960606	0500	18	198
19960606	1300	10	483
19960606	2100	18	109
19960607	0500	30	2190
19960607	1300	19	429
19960607	2100	21	1540
19960608	0500	27	85
19960608	1300	36	-143
19960608	2100	9	1130
19960609	0500	34	1020
19960609	1300	17	467
19960609	2100	28	-106
19960610	0500	38	1990
19960610	1300	37	611
19960610	2100	22	585
19960611	0500	29	-797
19960611	1300	5	864
19960611	2100	21	1350
19960612	0500	23	139
19960612	1300	8	-169
19960612	2100	50	-245
19960613	0500	29	898
19960613	1300	16	2240
19960613	2100	13	1720
19960614	0500	8	1100
19960614	1300	14	-402
19960614	2100	15	-607
19960615	0500	11	63
19960615	1300	16	-1140
19960615	2100	13	332
19960616	0500	8	1770
19960616	2100	14	387
19960617	0500	8	594

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19960617	1300	10	1920
19960617	2100	7	2290
19960618	0500	14	1080
19960618	1300	6	--
19960618	2100	6	1060
19960619	0500	18	910
19960619	1300	11	1080
19960619	2100	9	564
19960620	0500	6	746
19960620	1300	4	127
19960620	2100	10	548
19960621	0500	8	-21
19960621	1300	11	1980
19960621	2100	11	-2230
19960622	0500	25	307
19960622	1300	5	2540
19960622	2100	17	555
19960623	0500	13	1770
19960623	1300	18	-1350
19960623	2100	20	-1720
19960624	0500	30	-4430
19960624	1300	24	344
19960624	2100	24	1480
19960625	0500	27	1050
19960625	1300	6	513
19960625	2100	19	-431
19960626	0500	12	2030
19960626	1300	8	-802
19960626	2100	8	198
19960627	0500	5	2840
19960627	1300	9	1570
19960627	2100	10	847
19960628	0500	12	-1040
19960628	1300	7	631
19960628	2100	9	92
19960629	0500	14	1240
19960629	1300	34	611
19960629	2100	31	344
19960630	0500	12	552
19960630	1300	13	279
19960630	2100	46	-283
19960701	0500	18	33
19960701	1300	27	1360
19960701	2100	21	337
19960702	0500	9	935
19960702	1300	27	287
19960702	2100	48	607
19960703	0500	41	2570
19960703	1300	8	640
19960703	2100	15	674
19960704	0500	15	1490
19960704	1300	23	1720
19960704	2100	9	1240
19960705	0500	15	918
19960705	1300	10	357
19960705	2100	8	-194
19960706	0500	12	505
19960706	1300	8	396
19960706	2100	12	-.25
19960707	0500	10	513
19960707	1300	39	1560
19960707	2100	12	1200
19960708	0500	22	-102
19960708	1300	22	-1460
19960708	2100	65	-1330
19960709	0500	36	-1300
19960709	1300	1	-975
19960709	2100	6	953
19960710	0500	12	1860
19960710	1300	10	-110
19960710	2100	8	88
19960711	0500	6	332
19960711	1300	4	1070
19960711	2100	7	746
19960712	0500	8	357
19960712	1300	12	2220
19960712	2100	11	910
19960713	0500	9	127
19960713	1300	8	-519
19960713	2100	9	-748
19960714	0500	13	-524
19960714	1300	9	1770
19960714	2100	6	872
19960715	0500	9	855
19960715	1300	13	1090
19960715	2100	18	986
19960716	0500	16	1320
19960716	1300	4	977
19960716	2100	11	661
19960717	0500	8	-354
19960717	1300	7	2000
19960717	2100	16	42
19960718	0500	21	668
19960718	1300	33	929
19960718	2100	35	1340
19960719	0500	29	1390

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19960719	1300	13	-1260
19960719	2100	12	-1120
19960720	0500	7	1160
19960720	1300	9	227
19960720	2100	5	436
19960721	0500	6	-497
19960721	1300	9	25
19960721	2100	8	33
19960722	0500	12	-956
19960722	1300	8	--
19960722	2100	10	--
19960723	0500	14	--
19960801	1315	4	1420
19960801	1330	4	768
19960801	1345	4	1170
19960801	1400	3	1130
19960801	1415	4	-181
19960801	1430	5	-1020
19960801	1445	4	532
19960801	1500	4	1830
19960801	1515	6	-101
19960801	1530	4	-647
19960801	1545	5	2090
19960801	1600	4	2780
19960801	1615	6	-109
19960801	1630	4	-958
19960801	1645	5	742
19960801	1700	5	1390
19960801	1715	5	1250
19960801	1900	6	1160
19960802	0300	17	985
19960802	1100	13	903
19960802	1900	19	717
19960803	0300	12	902
19960803	1100	12	1360
19960803	1900	11	1240
19960804	0300	9	562
19960804	1100	15	-790
19960804	1900	14	-260
19960805	0300	15	-420
19960805	1100	20	--
19960805	1900	21	--
19960806	0300	15	--
19960806	1100	5	--
19960806	1900	8	--
19960807	0300	9	1120
19960807	1100	13	1880
19960807	1900	10	-633
19960808	0300	11	-1390
19960808	1100	17	-190
19960808	1900	13	156
19960809	0300	11	696
19960809	1100	9	864
19960809	1900	11	1400
19960810	0300	10	586
19960810	1100	9	784
19960810	1900	16	926
19960811	0300	8	755
19960811	1100	16	411
19960811	1900	10	930
19960812	0300	11	33
19960812	1100	4	1020
19960812	1900	14	1050
19960813	0300	9	1480
19960813	1100	4	1360
19960813	1900	9	784
19960814	0300	9	864
19960814	1100	6	405
19960814	1900	10	814
19960815	0300	6	687
19960815	1100	13	561
19960815	1900	9	1060
19960816	0300	5	1650
19960816	1100	9	1210
19960816	1900	12	637
19960817	0300	7	775
19960817	1100	10	-131
19960817	1900	8	729
19960818	0300	7	121
19960818	1100	5	838
19960818	1900	7	880
19960819	0300	20	-512
19960819	1100	9	--
19960819	1900	19	--
19960820	0300	25	--
19960820	1100	12	--
19960820	1900	3	--
19960821	0300	10	-168
19960821	1100	8	1310
19960821	1900	10	1490
19960822	0300	10	510
19960822	1100	12	868
19960822	1900	15	2280
19960823	0300	12	1720
19960823	1100	14	-22
19960823	1900	9	-8.4
19960824	0300	11	596
19960824	1100	16	1220
19960824	1900	11	1210
19960825	0300	11	550

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19960825	1100	13	616
19960825	1900	8	1240
19960826	0300	11	1600
19960826	1100	19	-89
19960826	1900	11	1310
19960827	0300	26	2350
19960827	1100	6	821
19960827	1900	13	-381
19960828	0300	19	871
19960828	0910	18	1410
19960828	0915	4	931
19960828	0920	6	1130
19960828	0925	3	746
19960828	0930	5	370
19960828	0935	7	406
19960828	0940	3	76
19960828	0945	6	-256
19960828	0950	5	317
19960828	0955	2	304
19960828	1000	2	1540
19960828	1005	5	1410
19960828	1010	3	1770
19960828	1015	6	666
19960828	1020	3	922
19960828	1025	4	699
19960828	1030	9	451
19960828	1035	3	694
19960828	1040	5	771
19960828	1045	8	58
19960828	1200	10	648
19960828	1205	20	447
19960828	1210	8	430
19960828	1215	8	978
19960828	1220	8	1210
19960828	1225	7	1800
19960828	1230	9	1410
19960828	1400	5	731
19960828	2200	6	362
19960829	0600	6	1220
19960829	1400	7	-36
19960829	2200	5	1010
19960830	0600	11	405
19960830	1400	12	182
19960830	2200	17	574
19960831	0600	13	134
19960831	1400	4	925
19960831	2200	9	1290
19960901	0600	3	1020
19960901	1400	6	604
19960901	2200	4	675
19960902	0600	7	137
19960902	1400	6	494
19960902	2200	12	1070
19960903	0600	10	918
19960903	1400	3	699
19960903	2200	4	1890
19960904	0600	3	677
19960904	1400	6	172
19960904	2200	8	66
19960905	0600	9	490
19960905	1400	3	1340
19960905	2200	8	570
19960906	0600	7	217
19960906	1400	7	928
19960906	2200	21	327
19960907	0600	12	958
19960907	1400	12	322
19960907	2200	12	300
19960908	0600	10	670
19960908	1400	9	390
19960908	2200	10	1530
19960909	0600	11	766
19960909	1400	11	769
19960909	2200	9	1140
19960910	0600	5	347
19960910	1400	5	1070
19960910	2200	19	1080
19960911	0600	34	-2070
19960911	1400	24	1950
19960911	2200	12	-32
19960912	0600	20	748
19960912	1400	12	1910
19960912	2200	10	1310
19960913	0600	18	710
19960913	1400	16	391
19960913	2200	10	573
19960914	0600	5	846
19960914	1400	12	380
19960914	2200	17	569
19960915	0600	10	72
19960915	1400	11	753
19960915	2200	10	1490
19960916	0600	8	975
19960916	1400	11	662
19960916	2200	10	1080
19960917	0600	10	980

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19960917	1400	9	45
19960917	2200	14	969
19960918	0600	16	1330
19960918	1400	24	1240
19960918	2200	14	711
19960919	0600	16	958
19960919	1400	8	490
19960919	2200	11	365
19960920	0600	8	-350
19960920	1400	12	353
19960920	2200	13	483
19960921	0600	10	44
19960921	1400	6	1430
19960921	2200	13	415
19960922	0600	9	-317
19960922	1400	16	-335
19960922	2200	11	984
19960923	0600	15	1120
19960923	1400	12	200
19960923	2200	32	1820
19960924	0600	21	378
19960924	1400	5	-361
19960924	2200	15	939
19960925	0600	11	640
19960925	1400	16	786
19960925	2200	18	848
19960926	0600	9	1130
19960926	1400	7	1700
19960926	2200	8	-40
19960927	0600	20	1520
19960927	1400	16	524
19960927	2200	26	2840
19960928	0600	32	3380
19960928	1400	11	179
19960928	2200	10	397
19960929	0600	11	-153
19960929	1400	10	1080
19960929	2200	20	684
19960930	0600	14	-1740
19960930	1400	10	-1720
19960930	2200	11	1670
19961001	0600	13	600
19961001	1400	2	1840
19961001	2200	9	304
19961002	0600	14	867
19961002	1400	9	-1590
19961002	2200	22	66
19961003	0600	13	2020
19961003	1400	9	842
19961003	2200	3	580
19961004	0600	15	635
19961004	1400	10	792
19961004	2200	29	471
19961005	0600	27	2110
19961005	1400	7	592
19961005	2200	14	1040
19961006	0600	12	1300
19961006	1400	12	173
19961006	2200	6	-179
19961007	0600	6	847
19961007	1400	14	1310
19961007	2200	20	888
19961008	0600	22	1690
19961008	1400	13	-1050
19961008	2200	16	1550
19961009	0600	24	1340
19961009	1400	16	1200
19961009	2200	22	1260
19961010	0600	17	1150
19961010	1400	22	554
19961010	2200	18	460
19961011	0600	29	764
19961011	1400	30	511
19961011	2200	26	74
19961012	0600	12	-280
19961012	1400	5	364
19961012	2200	6	1930
19961013	0600	20	1290
19961013	1400	17	1040
19961013	2200	14	944
19961014	0600	13	1110
19961014	1400	24	752
19961014	2200	13	1240
19961015	0600	24	191
19961015	1400	18	541
19961015	2200	22	2400
19961016	0600	11	-31
19961016	1400	15	691
19961016	2200	14	-179
19961017	0600	15	1770
19961017	1400	16	3020
19961017	2200	20	1270
19961018	0600	22	-132
19961018	1400	25	190
19961018	2200	17	110
19961019	0600	26	-274
19961019	1400	10	-145
19961019	2200	19	1310
19961020	0600	5	2660
19961020	1400	13	1090

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19961020	2200	12	755
19961021	0600	11	1120
19961021	1400	19	--
19961021	2200	10	--
19961022	0600	12	--
19961022	1400	8	--
19961022	2200	11	--
19961023	0600	24	--
19961023	1400	22	--
19961023	2200	14	--
19961024	0600	16	--
19961024	1400	14	--
19961024	2200	19	--
19961025	0600	15	--
19961025	1400	9	--
19961025	2200	25	--
19961026	0600	22	--
19961026	1400	13	--
19961026	2200	30	--
19961027	0600	19	--
19961027	1400	14	--
19961027	2200	26	--
19961028	0600	30	--
19961028	1400	23	--
19961028	2200	22	--
19961029	0600	15	170
19961029	1400	11	--
19961029	2200	4	--
19961030	0600	40	--
19961030	1400	28	--
19961030	2200	22	1770
19961031	0600	10	2930
19961031	1400	15	423
19961031	2200	19	--
19961101	0600	8	--
19961101	1400	7	-112
19961101	2200	10	631
19961102	0600	12	322
19961102	1400	6	122
19961102	2200	10	1920
19961103	0600	8	972
19961103	1400	7	457
19961103	2200	11	470
19961104	0600	19	520
19961104	1400	17	-113
19961104	2200	12	-2200
19961105	0600	36	1430
19961105	1400	10	1480

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19961105	2200	11	-1020
19961106	0600	16	986
19961106	1400	15	-580
19961106	2200	17	950
19961107	0600	13	-203
19961107	1400	24	502
19961107	2200	16	1250
19961108	0600	21	-773
19961108	1400	12	93
19961108	2200	32	934
19961109	0600	15	534
19961109	1400	26	761
19961109	2200	14	1420
19961110	0600	12	1220
19961110	1400	6	1190
19961110	2200	11	1150
19961111	0600	8	806
19961111	1400	9	268
19961111	2200	6	278
19961112	0600	11	742
19961112	1400	5	517
19961112	2200	7	388
19961113	0600	8	1330
19961113	1400	4	1090
19961113	2200	12	460
19961114	0600	11	884
19961114	1400	11	1190
19961114	2200	10	1220
19961115	0600	13	1090
19961115	1400	13	326
19961115	2200	19	379
19961116	0600	11	457
19961116	1400	4	470
19961116	2200	8	1020
19961117	0600	9	1270
19961117	1400	9	-680
19961117	2200	14	-118
19961118	0600	4	668
19961118	1400	5	622
19961118	2200	8	1060
19961119	0600	17	336
19961119	1400	7	881
19961119	2200	6	753
19961120	0600	5	167
19961120	1400	3	-347
19961120	2200	2	-31
19961121	0600	10	570
19961121	1400	11	1320

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)	Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19961121	2200	14	1810	19961208	2200	9	296
19961122	0600	4	900	19961209	0600	5	1120
19961122	1400	6	665	19961209	1400	9	-44
19961122	2200	4	2110	19961209	2200	10	471
19961123	0600	6	1330	19961210	0600	13	1960
19961123	1400	9	1850	19961210	1400	5	1400
19961123	2200	10	2710	19961210	2200	7	804
19961124	0600	5	1080	19961211	0600	12	35
19961124	1400	8	-678	19961211	1400	15	720
19961124	2200	8	-236	19961211	2200	2	-1670
19961125	0600	8	354	19961212	0600	3	-718
19961125	1400	4	1550	19961212	1400	10	138
19961125	2200	6	-663	19961212	2200	6	642
19961126	0600	12	689	19961213	0600	7	919
19961126	1400	3	2130	19961213	1400	5	997
19961126	2200	5	1590	19961213	2200	7	1080
19961127	1400	14	132	19961214	0600	4	-1080
19961127	2200	8	-140	19961214	1400	8	176
19961128	0600	4	1000	19961214	2200	4	2080
19961128	1400	4	1940	19961215	0600	6	782
19961128	2200	16	1260	19961215	1400	7	-607
19961129	0600	8	1580	19961215	2200	16	-82
19961129	1400	6	1700	19961216	0600	8	553
19961129	2200	9	2240	19961216	1400	8	215
19961130	0600	5	693	19961216	2200	6	163
19961130	1400	4	1250	19961217	0600	9	379
19961130	2200	4	-483	19961217	1400	1	1690
19961201	0600	10	2410	19961217	2200	13	1490
19961201	1400	10	3130	19961221	2200	10	-1810
19961201	2200	12	2820	19961222	0600	8	-122
19961202	0600	8	-283	19961222	1400	8	1980
19961202	1400	10	164	19961222	2200	7	--
19961202	2200	5	822	19961223	0600	9	--
19961203	0600	2	-456	19961223	1400	9	--
19961203	1400	2	798	19961223	2200	1	969
19961203	2200	3	893	19961224	0600	3	777
19961204	0600	6	88	19961224	1400	1	211
19961204	1400	1	-335	19961224	2200	1	-1120
19961204	2200	12	492	19961227	2200	18	-3490
19961205	0600	10	-1020	19961228	0600	2	-2560
19961205	1400	24	601	19961228	1400	3	1650
19961205	2200	12	305	19961228	2200	2	1080
19961206	0600	25	1440	19961229	0600	1	297
19961206	1400	10	119	19961229	1400	5	1080
19961206	2200	28	321	19961229	2200	6	2000
19961207	0600	15	-393	19961230	0600	4	-1810
19961207	1400	8	248	19961230	1400	6	-1160
19961207	2200	13	1950	19961230	2200	7	437
19961208	0600	8	-1060	19961231	0600	18	5130
19961208	1400	4	-31	19961231	1400	9	-1580

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)	Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19961231	2200	11	838	19970221	1100	10	1630
19970101	0600	18	1590	19970221	1900	6	2070
19970101	1400	17	4170	19970222	0300	3	1420
19970101	2200	26	922	19970222	1100	13	227
19970102	0600	19	-577	19970222	1900	4	1370
19970102	1400	20	-2040	19970223	0300	6	255
19970102	2200	10	1820	19970223	1100	3	1140
19970103	0600	34	3480	19970223	1900	7	446
19970103	1400	15	-1020	19970224	0300	5	949
19970103	2200	14	1770	19970224	1100	5	58
19970104	0600	10	779	19970224	1900	8	1920
19970104	1400	4	1090	19970225	0300	5	2310
19970104	2200	2	1610	19970225	1900	7	1470
19970105	0600	4	-779	19970226	0300	8	864
19970105	1400	4	-1700	19970226	1100	8	-321
19970105	2200	5	762	19970226	1900	2	388
19970109	2200	16	-869	19970227	0300	3	-1370
19970110	0600	6	336	19970227	1100	5	-433
19970110	1400	5	1310	19970227	1900	6	2290
19970121	2200	42	949	19970228	0300	0	1840
19970122	0600	24	1130	19970228	1100	2	1950
19970122	1400	5	982	19970228	1900	1	3330
19970122	2200	1	57	19970301	0300	5	-81
19970123	0600	5	743	19970301	1100	4	-805
19970123	1400	6	-271	19970301	1900	6	2760
19970123	2200	4	2350	19970302	0300	4	1720
19970124	0600	3	-1600	19970302	1100	6	2320
19970124	1400	1	806	19970302	1900	4	1890
19970124	2200	4	680	19970303	0300	3	322
19970125	0600	4	1350	19970303	1100	7	1050
19970125	1400	3	765	19970303	1900	3	649
19970131	2200	10	2070	19970304	0300	7	2020
19970201	0600	11	1550	19970304	1100	7	1680
19970201	1400	4	688	19970304	1900	7	1160
19970201	2200	8	360	19970305	0300	5	-996
19970202	0600	3	-604	19970305	1100	6	1210
19970202	1400	7	304	19970305	1900	3	3630
19970202	2200	6	1500	19970306	0300	2	1880
19970203	0600	5	1670	19970306	1100	5	374
19970203	1400	2	787	19970306	1900	2	1320
19970203	2200	4	1050	19970307	0300	3	823
19970204	0600	4	-2180	19970307	1100	1	-595
19970204	1400	2	2510	19970307	1900	5	1480
19970204	2200	5	297	19970308	0300	5	674
19970205	0600	8	734	19970308	1100	8	238
19970220	1100	3	-1920	19970308	1900	5	871
19970220	1900	2	-882	19970309	0300	5	2120
19970221	0300	8	3060	19970309	1100	2	2470

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)	Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970309	1900	3	1750	19970327	0300	6	579
19970310	0300	2	-163	19970327	1100	2	-258
19970310	1100	9	1550	19970327	1900	7	-535
19970310	1900	4	-353	19970328	0300	2	491
19970311	0300	9	1270	19970328	1100	9	398
19970311	1100	7	-1300	19970328	1900	10	1920
19970311	1900	6	1270	19970329	0300	5	-1550
19970312	0300	4	-196	19970329	1100	4	-491
19970312	1100	6	141	19970329	1900	6	542
19970312	1900	4	72	19970330	0300	5	559
19970313	0300	8	584	19970330	1100	6	2270
19970313	1100	8	-63	19970330	1900	15	855
19970313	1900	6	879	19970331	0300	9	-702
19970314	0300	4	-939	19970331	1100	10	702
19970314	1100	7	-32	19970331	1900	6	1070
19970314	1900	5	-175	19970401	0300	11	1060
19970315	0300	2	634	19970401	1100	6	1170
19970315	1100	4	1260	19970401	1900	10	266
19970315	1900	12	894	19970402	0300	11	640
19970316	0300	8	1030	19970402	1100	9	-684
19970317	0300	18	638	19970402	1300	18	-395
19970317	1100	7	1310	19970402	1900	27	110
19970317	1900	10	712	19970403	0100	18	754
19970318	0300	4	1700	19970403	0700	19	58
19970318	1100	5	1160	19970403	1300	32	-717
19970318	1900	2	-135	19970403	1900	28	296
19970319	0300	1	2630	19970404	0100	28	-1230
19970319	1100	4	-924	19970404	0700	25	1990
19970319	1900	1	-246	19970404	1300	30	-290
19970320	0300	5	-179	19970404	1900	38	-1430
19970320	1100	3	331	19970405	0100	35	410
19970320	1900	6	865	19970405	0700	24	125
19970321	0300	2	-1550	19970405	1300	30	-139
19970321	1100	5	-2060	19970405	1900	27	-142
19970321	1900	16	669	19970406	0100	35	847
19970322	0300	12	2210	19970406	0700	51	3920
19970322	1100	7	1290	19970406	1300	23	-617
19970322	1900	6	638	19970406	1900	19	1690
19970323	0300	5	138	19970407	0100	14	-816
19970323	1100	6	604	19970407	0700	18	476
19970323	1900	5	427	19970407	1200	7	-685
19970324	0300	4	336	19970407	1600	7	-49
19970324	1100	4	2050	19970407	2000	14	1210
19970324	1900	4	943	19970407	2400	8	-107
19970325	0300	8	-3290	19970408	0400	10	327
19970325	1100	16	-64	19970408	0800	19	1330
19970325	1900	9	2120	19970408	1200	6	1080
19970326	0300	4	2780	19970408	1600	9	1910
19970326	1100	4	790	19970408	2000	7	1450
19970326	1900	2	-703	19970408	2400	6	195

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970409	0400	5	1580
19970409	0800	8	645
19970409	1200	5	333
19970409	1600	8	1360
19970409	2000	6	444
19970409	2400	10	608
19970410	0400	8	1370
19970410	0800	5	1100
19970410	1200	6	-40
19970410	1700	17	1670
19970411	0100	27	399
19970411	0900	34	296
19970411	1700	52	355
19970412	0100	40	1050
19970412	0900	23	-397
19970412	1700	30	1010
19970413	0100	58	-323
19970413	0900	36	848
19970413	1700	15	1700
19970414	0100	15	492
19970414	0900	17	-40
19970414	1700	28	882
19970415	0100	13	1500
19970415	0900	11	128
19970415	1230	9	902
19970415	2030	10	1100
19970416	0430	24	62
19970416	1230	13	707
19970416	2030	34	379
19970417	0430	19	873
19970417	1230	22	373
19970417	2030	19	283
19970418	0430	23	686
19970418	1230	18	537
19970418	2030	17	1690
19970419	0430	22	1610
19970419	1230	12	267
19970419	2030	15	491
19970420	0430	10	441
19970420	1230	22	1450
19970420	2030	20	103
19970421	0430	29	1410
19970421	1230	22	876
19970421	2030	26	609
19970422	0430	26	752
19970422	1200	11	1160
19970423	0200	37	-14
19970423	1600	44	281
19970424	0600	34	782
19970424	2000	15	647
19970425	1000	11	533
19970425	2400	8	1160
19970426	1400	23	-176
19970427	0400	44	941
19970427	1800	36	1870
19970428	0800	34	1570
19970428	2200	23	-459
19970429	1200	30	428
19970430	0200	15	1230
19970430	1600	18	1510
19970501	0600	36	4130
19970501	2000	48	-103
19970502	1000	14	331
19970502	2400	78	775
19970503	1400	36	1200
19970504	0400	23	253
19970504	1800	23	-143
19970505	0800	45	1380
19970506	1315	4	-2280
19970506	2115	1	1420
19970507	0515	3	-719
19970507	1315	18	503
19970507	2115	21	910
19970508	0515	14	1100
19970508	1315	13	2030
19970508	2115	21	-432
19970509	0515	25	1170
19970509	1315	31	939
19970509	2115	21	2390
19970510	0515	31	505
19970510	1315	23	371
19970510	2115	40	308
19970511	0515	21	1490
19970511	1315	22	-757
19970511	2115	31	1820
19970512	0515	40	27
19970512	1315	12	--
19970512	2115	24	--
19970513	0515	26	-72
19970513	1400	10	-908
19970513	2200	38	-888
19970514	0600	32	968
19970514	1400	20	1030
19970514	2200	46	1430
19970515	0600	54	531
19970515	1400	68	414

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970515	2200	40	330
19970516	0600	29	971
19970516	1400	20	-953
19970516	2200	45	-2250
19970517	0600	51	785
19970517	1400	38	942
19970517	2200	31	2250
19970518	0600	66	1630
19970518	1400	22	-1230
19970518	2200	66	-137
19970519	0600	84	2130
19970519	1400	54	3110
19970519	2200	81	1210
19970520	0600	24	1880
19970520	1400	12	-481
19970520	2200	25	-1120
19970521	0600	43	1530
19970521	1400	32	-337
19970521	2200	18	-695
19970522	0600	32	266
19970522	1400	26	--
19970522	2200	22	--
19970523	0600	39	1430
19970523	1400	19	187
19970523	2200	71	1480
19970524	0600	38	1350
19970524	1400	32	264
19970524	2200	14	1250
19970525	0600	30	553
19970525	1400	18	666
19970525	2200	54	-1050
19970526	0600	24	1160
19970526	1400	35	512
19970526	2200	97	-461
19970527	0600	16	398
19970527	1200	12	923
19970527	2000	46	1290
19970528	0400	18	1300
19970528	1200	20	-430
19970528	2000	17	875
19970529	0400	10	-23
19970529	1200	17	397
19970529	2000	26	685
19970530	0400	10	735
19970530	1200	22	1040
19970530	2000	12	641
19970531	0400	14	449
19970531	1200	14	-215
19970531	2000	11	288
19970601	0400	27	-147
19970601	1200	39	1130
19970601	2000	44	784
19970602	0400	48	1220
19970602	1200	44	2330
19970602	2000	43	-910
19970603	0400	32	-55
19970603	1000	7	118
19970603	1800	72	-617
19970604	0200	29	842
19970604	1000	22	1320
19970604	1800	35	1160
19970605	0200	15	1070
19970605	1000	14	797
19970605	1800	20	223
19970606	0200	12	1670
19970606	1000	22	1090
19970606	1800	10	1280
19970607	0200	9	682
19970607	1000	16	344
19970607	1800	14	1240
19970608	0200	48	875
19970608	1000	18	553
19970608	1800	30	-1010
19970609	0200	26	1570
19970609	1000	10	--
19970609	1800	18	--
19970610	0200	34	--
19970610	1200	11	--
19970610	2000	20	--
19970611	0400	11	--
19970611	1200	17	--
19970611	2000	13	--
19970612	0400	9	--
19970612	1200	16	--
19970612	2000	4	1450
19970613	0400	22	923
19970613	1200	15	455
19970613	2000	11	2360
19970614	0400	27	1680
19970614	1200	24	852
19970614	2000	27	-153
19970615	0400	30	128
19970615	1200	28	671
19970615	2000	34	1040
19970616	0400	24	-2390
19970616	1200	67	-194
19970616	2000	24	-1440
19970617	0400	21	1370
19970617	1105	9	-493
19970617	1110	9	-1010

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970617	1115	12	-996
19970617	1120	6	-595
19970617	1125	10	-22
19970617	1130	8	659
19970617	1135	9	667
19970617	1140	8	157
19970617	1145	10	492
19970617	1150	12	844
19970617	1155	11	514
19970617	1200	6	587
19970617	1205	11	1200
19970617	1210	9	540
19970617	1215	13	873
19970617	1220	10	1590
19970617	1225	9	780
19970617	1230	8	699
19970617	1235	5	1000
19970617	1240	10	-203
19970617	1400	8	1610
19970617	2200	23	1310
19970618	0600	15	322
19970618	1400	39	1460
19970618	2200	23	-1600
19970619	0600	30	-1430
19970619	1400	37	-1740
19970619	2200	14	1760
19970620	0600	12	844
19970620	1400	29	1400
19970620	2200	23	-684
19970621	0600	51	1350
19970621	1400	35	3100
19970621	2200	26	829
19970622	0600	44	1690
19970622	1400	15	-1560
19970622	2200	15	922
19970623	0600	19	-18
19970623	1400	13	1720
19970623	2200	18	2030
19970624	0600	16	-488
19970624	1200	5	599
19970624	2000	14	-257
19970625	0400	15	674
19970625	1200	21	-2050
19970625	2000	34	-391
19970626	0400	12	-2260
19970626	1200	20	881
19970626	2000	23	-1470
19970627	0400	7	1010
19970627	1200	10	684
19970627	2000	8	776
19970628	0400	8	958
19970628	1200	18	1030
19970628	2000	16	821
19970629	0400	14	-306
19970629	1200	13	1300
19970629	2000	13	-1220
19970630	0400	9	936
19970630	1200	17	573
19970630	2000	31	1460
19970701	0400	29	1570
19970717	1515	9	-2350
19970717	1520	9	-280
19970717	1525	13	1320
19970717	1530	17	37
19970717	1535	8	-187
19970717	1540	6	859
19970717	1545	6	1640
19970717	1550	6	1730
19970717	1555	5	1680
19970717	1600	6	1010
19970717	1605	6	-1110
19970717	1700	5	1150
19970717	1900	8	3520
19970717	2100	6	-2020
19970717	2300	6	-549
19970718	0100	6	1730
19970718	0300	6	2580
19970718	0500	6	-678
19970718	0700	9	-3530
19970718	1005	5	2080
19970718	1010	6	682
19970718	1015	5	9.7
19970718	1020	6	-327
19970718	1025	6	-1540
19970718	1030	5	-1320
19970718	1035	5	-357
19970718	1145	5	-354
19970718	1148	5	-435
19970718	1151	4	-191
19970718	1154	4	-558
19970718	1157	3	-814
19970718	1200	5	-1220
19970718	1203	4	-1020
19970718	1206	5	-27
19970718	1209	5	919
19970718	1212	4	871

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970718	1215	3	861
19970718	1400	5	1490
19970718	2000	20	877
19970719	0200	10	836
19970719	0800	12	1740
19970719	1400	10	1110
19970719	2000	9	516
19970720	0200	8	88
19970720	0800	5	1310
19970720	1400	6	1570
19970720	2000	6	493
19970721	0200	5	974
19970721	0800	11	-1420
19970721	1400	8	2430
19970721	2000	7	-769
19970722	0200	8	777
19970722	0800	8	3560
19970722	1400	10	-219
19970722	2200	12	417
19970723	0600	9	996
19970723	1400	12	-519
19970723	2200	14	1210
19970724	0600	13	718
19970724	1400	7	-628
19970724	2200	11	1840
19970725	0600	9	36
19970725	1400	6	2480
19970725	2200	6	-44
19970726	0600	5	-2200
19970726	1400	10	-616
19970726	2200	11	1060
19970727	0600	10	1360
19970727	1400	13	2240
19970727	2200	11	435
19970728	0600	8	-1940
19970728	1400	12	807
19970728	2200	9	-885
19970729	0600	12	223
19970729	1200	11	-410
19970729	2000	8	1270
19970730	0400	9	573
19970730	1200	6	--
19970730	2000	10	856
19970731	0400	7	1030
19970731	1200	8	41
19970731	2000	8	1380
19970801	0400	6	-1780
19970801	1200	8	-509
19970801	2000	6	1080
19970802	0400	6	1130
19970802	1200	6	1220
19970802	2000	9	1040
19970803	0400	7	349
19970803	1200	7	1010
19970803	2000	7	790
19970804	0400	12	-807
19970804	1200	17	-208
19970805	0400	10	1060
19970805	1200	8	887
19970805	2000	13	32
19970806	0400	13	476
19970806	1200	9	962
19970806	2000	10	338
19970807	0400	15	50
19970807	1200	14	267
19970807	2000	8	1010
19970808	0400	8	774
19970808	1200	10	320
19970808	2000	27	-287
19970809	0400	7	117
19970809	1200	6	724
19970809	2000	9	1150
19970810	0400	10	59
19970810	1200	7	678
19970810	2000	7	644
19970811	0400	8	1050
19970811	1200	10	715
19970811	2000	11	1120
19970812	0400	13	862
19970812	1200	5	880
19970812	2000	7	382
19970813	0400	6	1470
19970813	1200	12	-308
19970813	2000	8	-261
19970814	0400	12	1130
19970814	1200	7	1580
19970814	2000	11	-301
19970815	0400	11	639
19970815	1200	8	-1570
19970815	2000	10	126
19970816	0400	10	1600
19970816	1200	10	-80
19970816	2000	20	-474
19970817	0400	12	1510
19970817	1200	12	2590
19970817	2000	14	-1880
19970818	0400	14	1930
19970818	1200	14	-130
19970818	2000	8	1020
19970819	0400	7	2440

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970819	1200	6	-1110
19970819	2000	4	-1240
19970820	0400	5	-1040
19970820	1200	6	869
19970820	2000	3	1840
19970821	0400	6	1090
19970821	1200	6	160
19970821	2000	7	812
19970822	0400	13	-703
19970822	1200	12	-671
19970822	2000	10	551
19970823	0400	10	528
19970823	1200	8	1060
19970823	2000	7	607
19970824	0400	7	-1760
19970824	1200	10	528
19970824	2000	8	977
19970825	0400	8	-1100
19970825	1200	16	1700
19970825	2000	17	1960
19970826	0400	11	803
19970826	1200	12	-678
19970826	2000	9	1080
19970827	0400	7	-14
19970827	1200	8	770
19970827	2000	5	-551
19970828	0400	6	655
19970828	1200	12	797
19970828	2000	12	-272
19970829	0400	21	225
19970829	1200	14	1540
19970829	2000	16	579
19970830	0400	17	--
19970830	1200	14	-66
19970830	2000	16	1340
19970831	0400	20	217
19970831	1200	10	448
19970831	2000	14	947
19970901	0400	15	1370
19970901	1200	14	518
19970901	2000	12	1280
19970902	0400	15	716
19970902	1200	12	-1680
19970902	2000	15	-418
19970903	0400	22	1220
19970904	1200	8	-56
19970904	2000	18	-48
19970905	0400	13	36
19970905	1200	13	495
19970905	2000	12	-96
19970906	0400	15	-633
19970906	1200	14	650
19970906	2000	22	656
19970907	0400	18	654
19970907	1200	16	-319
19970907	2000	14	1080
19970908	0400	14	895
19970908	1200	18	784
19970908	2000	14	678
19970909	0400	14	-759
19970909	1200	6	-220
19970909	2000	13	353
19970910	0400	9	88
19970910	1200	18	60
19970910	2000	20	-542
19970911	0400	19	688
19970911	1200	31	-369
19970911	2000	37	-30
19970912	0400	28	--
19970912	1200	13	1060
19970912	2000	15	86
19970913	0400	10	765
19970913	1200	19	-504
19970913	2000	12	672
19970914	0400	11	329
19970914	1200	11	652
19970914	2000	5	239
19970915	0400	7	840
19970915	1200	16	966
19970915	2000	30	-157
19970916	0400	15	514
19970916	1200	4	-448
19970916	2000	6	--
19970917	0400	8	122
19970917	1200	12	-379
19970917	2000	9	-2690
19970918	0400	14	238
19970918	1200	16	208
19970918	2000	11	564
19970919	0400	16	-1530
19970919	1200	21	465
19970919	2000	79	-2630
19970920	0400	39	2960
19970920	1200	27	-788
19970920	2000	27	-997
19970921	0400	20	562

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19970921	1200	20	-731
19970921	2000	14	1920
19970922	0400	10	-163
19970922	1200	13	-1720
19970922	2000	12	-640
19970923	0400	5	35
19970923	1200	2	224
19970923	2000	12	-265
19970924	0400	17	702
19970924	1200	8	1140
19970924	2000	10	542
19970925	0400	15	-1060
19970925	1200	7	-405
19970925	2000	20	476
19970926	0400	14	512
19970926	1200	18	895
19970926	2000	14	1300
19970927	0400	19	-1000
19970927	1200	11	802
19970927	2000	21	1600
19970928	0400	12	-229
19970928	1200	14	-1510
19970928	2000	6	-1080
19970929	0400	17	986
19970929	1200	18	-593
19970929	2000	23	615
19970930	0400	12	1150
19970930	1200	12	1340
19970930	2000	9	-372
19971001	0400	17	--
19971001	1200	19	--
19971001	2000	12	--
19971002	0400	15	--
19971002	1200	11	--
19971002	2000	13	--
19971003	0400	15	--
19971003	1200	12	--
19971003	2000	9	--
19971004	0400	12	--
19971004	1200	12	--
19971004	2000	10	--
19971005	0400	10	--
19971005	1200	12	--
19971005	2000	15	--
19971006	0400	18	473
19971006	1200	15	-211
19971006	2000	9	209
19971007	0400	8	1380
19971007	1200	13	720
19971007	2000	10	878
19971008	0400	10	716
19971008	1200	12	431
19971008	2000	16	746
19971009	0400	16	424
19971009	1200	15	738
19971009	2000	18	1350
19971010	0400	16	58
19971010	1200	16	-61
19971010	2000	17	577
19971011	0400	19	-247
19971011	1200	15	599
19971011	2000	13	1060
19971012	0400	13	312
19971012	1200	11	473
19971012	2000	14	393
19971013	0400	16	588
19971013	1200	20	677
19971013	2000	15	2130
19971014	0400	20	-2040
19971014	1200	13	1480
19971014	2000	23	500
19971015	0400	18	-47
19971015	1200	11	-47
19971015	2000	11	13
19971016	0400	11	882
19971016	1200	10	18
19971016	2000	23	550
19971017	0400	16	-30
19971017	1200	16	142
19971017	2000	8	-736
19971018	0400	19	975
19971018	1200	11	485
19971018	2000	8	619
19971019	0400	10	-347
19971019	1200	10	-38
19971019	2000	15	646
19971020	0400	14	1150
19971020	1200	29	668
19971020	2000	11	137
19971021	0400	11	-276
19971021	1200	11	1100
19971021	2000	9	910
19971022	0400	13	1460
19971022	1200	17	--
19971022	2000	9	--
19971023	0400	9	--
19971023	1200	13	--
19971023	2000	16	--
19971024	0400	30	--
19971024	1200	23	--

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19971024	2000	15	--
19971025	0400	6	--
19971025	1200	7	--
19971025	2000	5	--
19971026	0400	14	--
19971026	1200	16	--
19971026	2000	24	--
19971027	0400	18	2070
19971027	1200	14	1640
19971027	2000	23	1810
19971028	0400	20	237
19971028	1200	5	-241
19971028	2000	14	13
19971029	0400	12	157
19971029	1200	8	863
19971029	2000	9	324
19971030	0400	17	-703
19971030	1200	18	957
19971030	2000	18	915
19971031	0400	22	1040
19971031	1200	14	1090
19971031	2000	10	1690
19971101	0400	15	800
19971101	1200	12	-78
19971101	2000	12	-22
19971102	0400	12	1660
19971102	1200	14	1260
19971102	2000	25	279
19971103	0400	20	333
19971103	1200	20	-629
19971103	2000	13	725
19971104	0400	13	781
19971104	1200	11	1140
19971104	2000	14	539
19971105	0400	18	979
19971105	1200	12	-17
19971105	2000	20	-1410
19971106	0400	17	-269
19971106	1200	11	956
19971106	2000	10	710
19971107	0400	14	-145
19971107	1200	8	637
19971107	2000	15	-538
19971108	0400	11	411
19971108	1200	13	155
19971108	2000	12	1030
19971109	0400	11	1710
19971109	1200	7	2240
19971109	2000	8	479
19971110	0400	26	340
19971110	1200	15	1080
19971110	2000	20	427
19971111	0400	13	1310
19971111	1200	12	-51
19971111	2000	24	-265
19971113	2000	61	167
19971114	0400	22	1100
19971114	1200	17	-280
19971114	2000	14	107
19971115	0400	10	348
19971115	1200	10	1430
19971115	2000	14	584
19971116	0400	16	698
19971116	1200	70	9.3
19971116	2000	25	-212
19971118	0400	13	-59
19971118	1200	12	659
19971118	2000	8	700
19971119	0400	15	135
19971119	1200	14	481
19971119	2000	6	1360
19971120	0400	14	1590
19971120	1200	4	194
19971120	2000	7	1710
19971121	0400	6	679
19971121	1200	54	577
19971121	2000	17	40
19971122	0400	14	1140
19971122	1200	16	-1990
19971122	2000	13	239
19971123	0400	9	1130
19971123	1200	12	-176
19971123	2000	11	-845
19971124	0400	13	879
19971124	2000	12	1530
19971125	0400	18	-1440
19971125	1200	8	-1380
19971125	2000	16	544
19971126	0400	10	400
19971126	1200	11	1810
19971126	2000	14	-870
19971127	0400	11	281
19971127	1200	13	-1150
19971127	2000	13	4080
19971128	0400	14	-1590
19971128	1200	24	388

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19971128	2000	12	-1520
19971129	0400	7	-1620
19971129	1200	13	-556
19971129	2000	15	1220
19971130	0400	12	731
19971130	1200	17	711
19971130	2000	14	72
19971201	0400	14	-1600
19971201	1200	14	964
19971201	2000	12	1130
19971202	0400	9	1280
19971202	1200	6	739
19971202	2000	12	1060
19971203	0400	13	1030
19971203	1200	14	1310
19971203	2000	14	769
19971204	0400	16	-1120
19971204	1200	6	-542
19971204	2000	6	1160
19971205	0400	17	-547
19971205	1200	6	672
19971205	2000	7	1530
19971206	2000	42	-543
19971207	0400	20	1090
19971207	1200	5	248
19971207	2000	8	-308
19971208	0400	10	-184
19971208	1200	6	2070
19971208	2000	17	690
19971209	0400	22	442
19971209	1200	19	312
19971209	2000	31	-135
19971210	0400	19	674
19971210	1200	12	-652
19971210	2000	13	691
19971211	0400	6	1140
19971211	1200	12	755
19971211	2000	8	1130
19971212	0400	22	854
19971212	1200	18	2060
19971212	2000	17	1600
19971213	0400	16	1550
19971213	2000	13	-703
19971214	2000	18	-767
19971215	0400	12	-1260
19971215	1200	12	--
19971215	2000	16	--
19971216	0400	16	--
19971216	1200	9	--
19971216	2000	15	--
19971217	0400	13	--
19971217	1200	12	--
19971217	2000	6	--
19971218	0400	10	--
19971218	1200	12	--
19971218	2000	34	--
19971219	0400	17	1890
19971219	1200	8	1510
19971219	2000	6	201
19971220	0400	15	-175
19971220	1200	17	-198
19971220	2000	9	641
19971221	0400	20	647
19971221	1200	11	-230
19971221	2000	11	982
19971222	0400	23	-538
19971222	1200	17	26
19971222	2000	17	-1450
19971223	0400	17	-676
19971223	1200	29	1890
19971223	2000	6	-943
19971224	0400	19	-1120
19971224	1200	20	-1890
19971224	2000	19	1760
19971225	0400	13	1010
19971225	1200	27	249
19971225	2000	14	-296
19971226	0400	15	222
19971226	1200	8	853
19971226	2000	18	614
19971227	0400	20	1040
19971227	2000	41	83
19971229	0400	27	677
19971229	1200	30	-309
19971229	2000	9	683
19971230	0400	18	552
19980101	2000	15	261
19980102	0400	12	2540
19980102	1200	17	1620
19980102	2000	11	1020
19980103	0400	20	-130
19980103	1200	11	273
19980103	2000	16	230
19980104	0400	19	290
19980104	2000	19	-1550
19980105	0400	15	1530
19980105	1200	19	2510
19980105	2000	17	1250
19980106	0400	24	1070
19980106	1200	19	-1130

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19980106	2000	22	353
19980107	0400	22	897
19980107	1200	15	531
19980107	2000	12	122
19980108	0400	20	-1030
19980108	1200	17	1160
19980108	2000	11	626
19980109	0400	17	971
19980109	1200	14	253
19980109	2000	12	-775
19980128	2000	64	-481
19980129	0400	20	-341
19980129	1200	17	731
19980129	2000	18	1240
19980130	0400	20	2110
19980130	1200	7	725
19980130	2000	18	-208
19980131	0400	10	601
19980131	1200	11	1190
19980131	2000	6	-104
19980201	0400	10	818
19980201	1200	6	866
19980201	2000	17	765
19980202	0400	12	-951
19980202	1200	8	-442
19980202	2000	14	-1410
19980203	0400	10	-452
19980203	1200	1	844
19980203	2000	2	1880
19980204	0400	6	-106
19980204	1200	18	1180
19980204	2000	6	900
19980205	0400	12	319
19980205	1200	6	418
19980205	2000	7	30
19980206	0400	7	286
19980206	1200	9	731
19980206	2000	12	632
19980207	0400	9	522
19980207	1200	5	-410
19980207	2000	7	482
19980208	0400	18	984
19980208	1200	7	253
19980208	2000	10	-203
19980209	0400	7	829
19980209	2000	7	-507
19980210	0400	15	1170
19980210	1200	2	1680

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19980210	2000	12	343
19980211	0400	11	314
19980211	1200	9	1060
19980211	2000	18	2870
19980212	0400	15	511
19980212	1200	12	375
19980212	2000	7	418
19980213	0400	11	-156
19980213	2000	11	270
19980214	0400	6	1080
19980214	1200	5	628
19980214	2000	23	-1180
19980215	0400	15	-554
19980215	1200	13	-36
19980215	2000	7	1670
19980216	0400	10	1070
19980216	1200	11	951
19980216	2000	12	420
19980217	0400	16	213
19980217	1200	7	955
19980217	2000	19	1270
19980218	0400	9	580
19980218	1200	9	749
19980218	2000	11	358
19980219	0400	10	-106
19980219	1200	7	155
19980219	2000	5	-17
19980220	0400	6	1130
19980220	1200	8	839
19980220	2000	9	1090
19980221	0400	10	-119
19980221	1200	3	52
19980221	2000	11	-208
19980222	0400	8	454
19980222	1200	7	595
19980222	2000	11	769
19980223	0400	18	1220
19980223	1200	31	-144
19980223	2000	9	-25
19980224	0400	15	1510
19980224	1200	17	484
19980224	2000	16	34
19980317	1200	17	656
19980317	2000	23	1000
19980318	0400	16	-576
19980318	1200	12	681
19980318	2000	12	229
19980319	0400	12	614

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)	Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19980319	1200	8	1410	19980405	0400	14	--
19980319	2000	8	914	19980405	1200	28	--
19980320	0400	10	-1650	19980405	2000	13	--
19980320	1200	22	-288	19980406	0400	28	--
19980320	2000	11	476	19980406	1200	30	--
19980321	0400	10	788	19980406	2000	16	--
19980321	1200	20	554	19980407	0400	28	--
19980321	2000	12	729	19980407	1200	28	--
19980322	0400	10	193	19980407	2000	13	--
19980322	1200	11	640	19980408	0400	45	--
19980322	2000	16	566	19980408	1200	16	--
19980323	0400	40	-144	19980408	2000	41	--
19980323	1200	16	111	19980409	0400	48	--
19980323	2000	25	756	19980409	1200	46	--
19980324	0400	18	1010	19980409	2000	38	--
19980324	1200	13	387	19980410	0400	41	--
19980324	2000	14	1070	19980410	1200	23	--
19980325	0400	26	1310	19980410	2000	22	--
19980325	1200	13	583	19980411	0400	22	--
19980325	2000	14	-1460	19980411	1200	12	--
19980326	0400	33	38	19980411	2000	14	--
19980326	1200	14	2010	19980412	0400	26	--
19980326	2000	19	843	19980412	1200	47	--
19980327	0400	24	2200	19980412	2000	36	--
19980327	1200	20	106	19980413	0400	27	--
19980327	2000	33	527	19980413	1200	32	--
19980328	0400	38	-1740	19980413	2000	45	1020
19980328	1200	28	1160	19980414	0400	16	769
19980328	2000	41	3330	19980414	1200	8	977
19980329	0400	31	857	19980414	2000	16	1470
19980329	1200	30	465	19980415	0400	15	-795
19980329	2000	24	2790	19980415	1200	13	1780
19980330	0400	29	1380	19980415	2000	51	-610
19980330	1200	46	--	19980416	0400	18	-302
19980330	2000	45	--	19980416	1200	56	-264
19980331	0400	57	--	19980416	2000	60	1450
19980331	1200	26	--	19980417	0400	52	364
19980331	2000	60	--	19980417	1200	17	780
19980401	0400	72	--	19980417	2000	29	-99
19980401	1200	31	--	19980418	0400	13	671
19980401	2000	56	--	19980418	1200	20	1250
19980402	0400	34	--	19980418	2000	19	1400
19980402	1200	44	--	19980419	0400	36	1290
19980402	2000	18	--	19980419	1200	42	695
19980403	0400	34	--	19980419	2000	35	447
19980403	1200	12	--	19980420	0400	15	1340
19980403	2000	24	--	19980420	1200	19	205
19980404	0400	18	--	19980420	2000	8	827
19980404	1200	45	--	19980421	0400	44	1070
19980404	2000	55	--	19980421	1200	11	794

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19980421	2000	29	-254
19980422	0400	13	179
19980422	1200	12	441
19980422	2000	28	303
19980423	0400	9	944
19980423	1200	8	620
19980423	2000	13	875
19980424	0400	28	836
19980424	1200	12	929
19980424	2000	26	455
19980425	0400	15	1510
19980425	1200	24	786
19980425	2000	27	320
19980426	0400	35	122
19980426	1200	36	-94
19980426	2000	54	-200
19980427	0400	12	648
19980427	1200	52	-1230
19980427	2000	17	920
19980428	0400	42	291
19980428	1200	35	-1020
19980428	2000	43	402
19980429	1400	25	1090
19980430	0400	17	520
19980430	1800	14	1300
19980501	0800	38	409
19980501	2200	13	-708
19980502	1200	15	373
19980503	0200	40	1700
19980503	1600	44	-456
19980504	0600	37	-366
19980504	2000	10	771
19980505	1000	12	1520
19980505	2400	6	1030
19980506	1400	4	1360
19980507	0400	40	1070
19980507	1800	51	836
19980508	0800	20	1570
19980508	2200	38	231
19980509	1200	18	257
19980510	0200	22	581
19980510	1600	20	504
19980511	0600	7	475
19980511	2000	18	487
19980512	1000	8	785
19980512	2400	27	626
19980608	1700	19	-280
19980608	1800	30	1300
19980608	1900	17	343
19980608	2000	21	-675
19980608	2100	16	146
19980608	2200	18	-30
19980608	2300	10	-266
19980608	2400	18	-981
19980609	0100	11	1030
19980609	0200	16	-1080
19980609	0300	16	1150
19980609	0400	18	628
19980609	0500	16	1240
19980609	0600	20	773
19980609	0700	18	-127
19980609	0800	13	-303
19980609	1100	6	856
19980609	1200	6	1820
19980609	1300	8	1040
19980609	1400	8	206
19980609	1500	6	67
19980609	1600	9	139
19980609	1700	11	31
19980609	1800	11	-2550
19980609	1900	10	-1570
19980609	2000	10	1450
19980609	2100	14	2150
19980609	2200	12	-614
19980609	2300	10	-2950
19980609	2400	9	-349
19980610	0100	9	414
19980610	0200	6	77
19980610	0300	7	1070
19980610	0400	16	1240
19980610	0500	12	3310
19980610	0600	12	2540
19980610	0700	12	1050
19980610	0800	7	167
19980610	0900	11	--
19980610	1650	16	3100
19980610	1655	14	2550
19980610	1700	13	1530
19980610	1705	14	732
19980610	1710	10	-360
19980610	1715	9	-2390
19980610	1720	9	-1610
19980610	1725	10	-955
19980610	1900	9	1830
19980610	2100	7	2530
19980610	2300	12	1990

Table 1. Concentrations of suspended sediment and associated streamflows for samples collected by the automated sampler from the Indiana Harbor Canal at East Chicago, Indiana, from May 7, 1996, through June 25, 1998—Continued

Date	Time	Suspended-sediment concentration (mg/L)	Streamflow (ft^3/s)
19980611	0100	8	568
19980611	0300	8	-141
19980611	0500	8	1550
19980611	0700	5	1120
19980611	0900	9	-106
19980611	1040	6	481
19980611	1045	6	1110
19980611	1050	4	874
19980611	1055	5	-1900
19980611	1100	6	-1180
19980611	1105	7	-1890
19980611	1110	6	-1500
19980611	1115	5	2540
19980611	1300	7	2930
19980612	1300	8	1710
19980613	1300	5	440
19980614	1300	7	-1550
19980615	1300	5	2590
19980616	1300	9	1160
19980617	1300	6	-197
19980618	1300	8	1600
19980619	1300	41	712
19980620	1300	10	-462
19980621	1300	8	1210
19980622	1300	8	1560
19980623	1300	11	90
19980624	1300	25	-1530
19980624	1500	20	--
19980624	1505	11	2870
19980624	1510	7	319
19980624	1515	11	-405
19980624	1520	9	-2020
19980624	1525	10	-2580
19980624	1530	8	-2380
19980624	1535	18	-1460
19980624	1540	14	-568
19980624	1630	10	1340
19980624	1635	10	-317
19980624	1640	8	-1160
19980624	1645	9	-989
19980624	1650	8	206
19980624	1655	7	783
19980624	1700	8	869
19980625	1125	8	2250
19980625	1130	9	2670
19980625	1135	3	2230
19980625	1140	11	488
19980625	1145	9	-3820
19980625	1150	8	-4510
19980625	1155	8	-4120
19980625	1200	4	-4570

Table 2. Depth, concentration of suspended sediment, and mean concentration of suspended sediment for samples collected in the Indiana Harbor Canal at East Chicago, Indiana, for calibration

[Time is in military notation; ft, feet; mg/L, milligrams per liter]

Sample	Date	Time	Depth (ft)	Concentration (mg/L)	Mean concentration (mg/L)
1	19970717	1532	3	25	11.2
	19970717	1534	6	16	
	19970717	1538	9	13	
	19970717	1541	12	11	
	19970717	1544	15	8	
	19970717	1547	18	6	
	19970717	1551	21	8	
	19970717	1554	24	10	
	19970717	1556	27	7	
	19970717	1559	30	8	
2	19970718	1007	3	5	10.0
	19970718	1009	6	5	
	19970718	1013	9	5	
	19970718	1014	12	8	
	19970718	1017	15	9	
	19970718	1019	18	15	
	19970718	1022	21	16	
	19970718	1026	24	14	
	19970718	1028	27	13	
	19970718	1031	30	10	
3	19970718	1147	3	7	7.8
	19970718	1150	6	6	
	19970718	1152	9	7	
	19970718	1153	12	8	
	19970718	1156	15	7	
	19970718	1159	18	11	
	19970718	1201	21	7	
	19970718	1202	24	6	
	19970718	1205	27	9	
	19970718	1207	30	10	
4	19980610	1654	6	15	12.5
	19980610	1656	24	10	
5	19980610	1659	6	8	9.0
	19980610	1701	24	10	
6	19980610	1704	6	7	8.0
	19980610	1706	24	9	
7	19980610	1709	6	10	9.5
	19980610	1711	24	9	
8	19980610	1714	6	10	10.0
	19980610	1716	24	10	
9	19980610	1719	6	12	12.5
	19980610	1721	24	13	

Table 2. Depth, concentration of suspended sediment, and mean concentration of suspended sediment for samples collected in the Indiana Harbor Canal at East Chicago, Indiana, for calibration—Continued

Sample	Date	Time	Depth (ft)	Concentration (mg/L)	Mean concentration (mg/L)
10	19980611	1044	6	9	11.5
	19980611	1046	24	14	
11	19980611	1049	6	8	8.5
	19980611	1051	24	9	
12	19980611	1054	6	8	8.5
	19980611	1056	24	9	
13	19980611	1059	6	9	9.5
	19980611	1101	24	10	
14	19980611	1104	6	10	10.5
	19980611	1106	24	11	
15	19980611	1109	6	14	12.5
	19980611	1111	24	11	
16	19980624	1459	6	16	19.5
	19980624	1501	24	23	
17	19980624	1519	6	37	38.5
	19980624	1521	24	40	
18	19980624	1529	6	30	25.5
	19980624	1531	24	21	
19	19980624	1629	6	13	12.5
	19980624	1631	24	12	
20	19980624	1639	6	12	10.5
	19980624	1641	24	9	
21	19980624	1649	6	13	16.5
	19980624	1651	24	20	
22	19980625	1129	6	6	6.0
	19980625	1131	24	6	
23	19980625	1134	6	6	6.5
	19980625	1136	24	7	
24	19980625	1139	6	10	8.5
	19980625	1141	24	7	
25	19980625	1144	6	7	6.5
	19980625	1146	24	6	
26	19980625	1149	6	10	10.5
	19980625	1151	24	11	
27	19980625	1154	6	10	9.5
	19980625	1156	24	9	