

**General Electric Company
Albany, New York**

**RESULTS OF THE GENERAL ELECTRIC 1996-97 THOMPSON
ISLAND POOL RESEARCH PROGRAM**

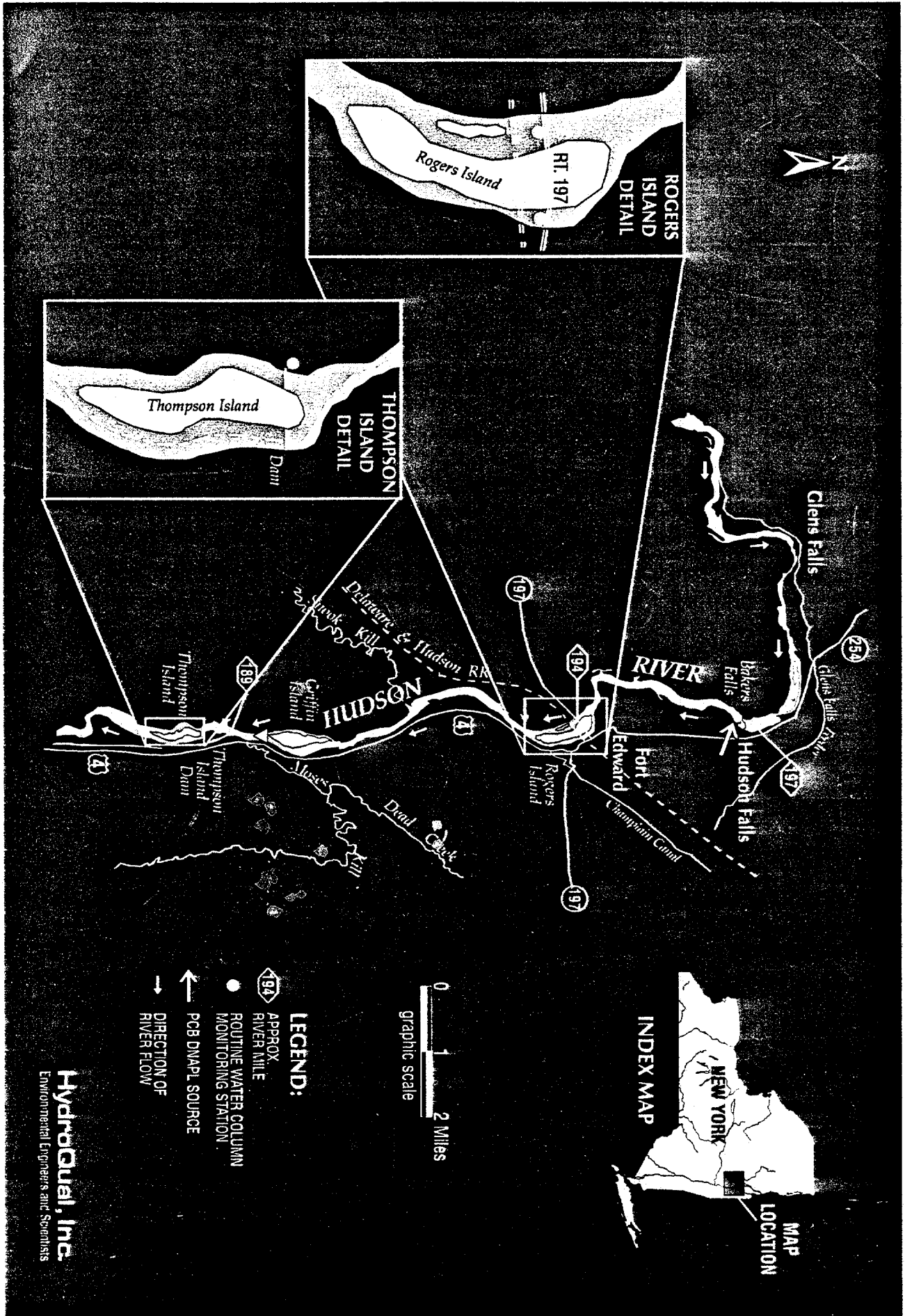
**Prepared for the NYSDEC/USEPA Meeting
October 16, 1997
Revised December 2, 1997**

HydroQual, Inc.

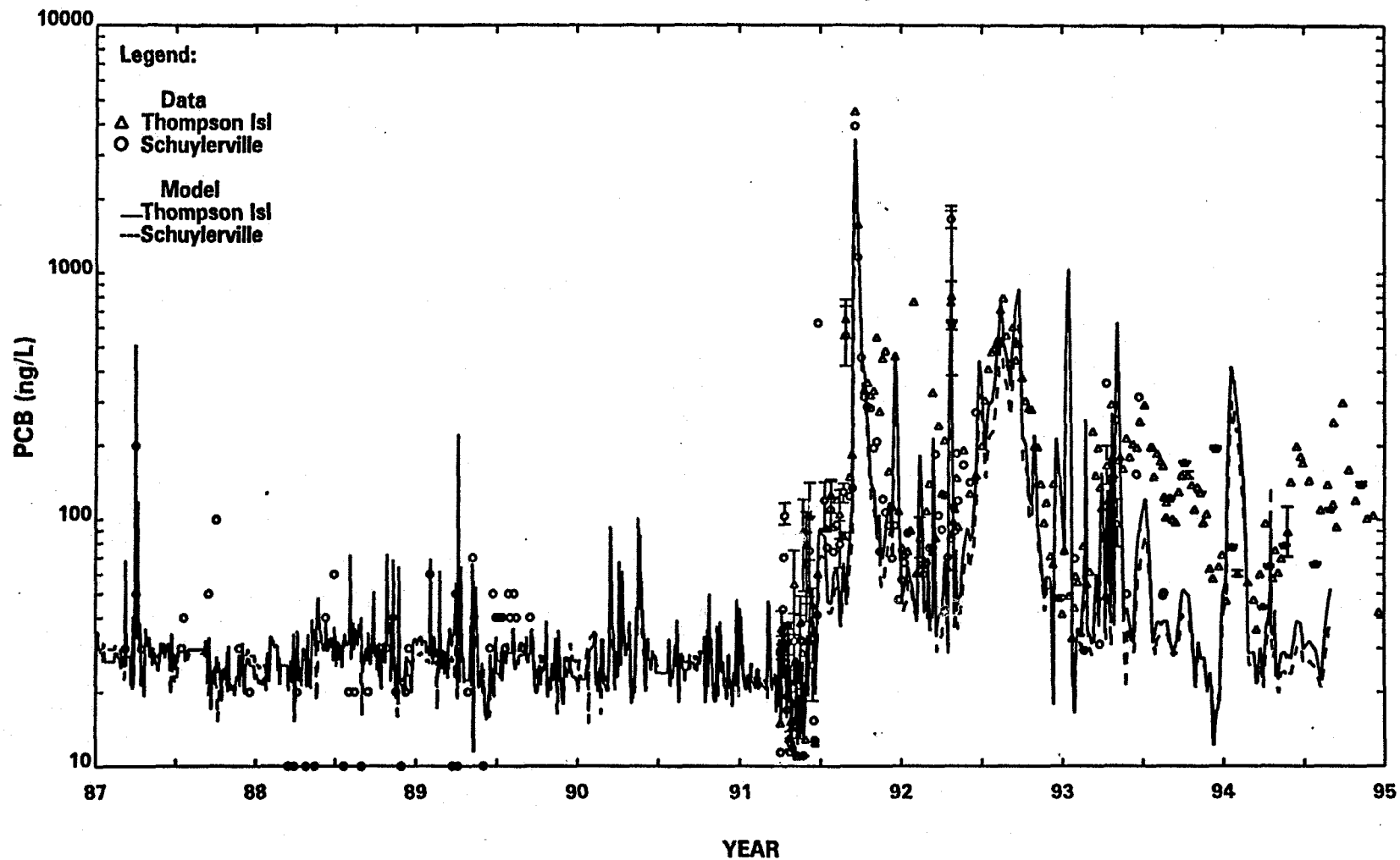
RESULTS OF THE GENERAL ELECTRIC 1996-97
THOMPSON ISLAND POOL RESEARCH PROGRAM

Background

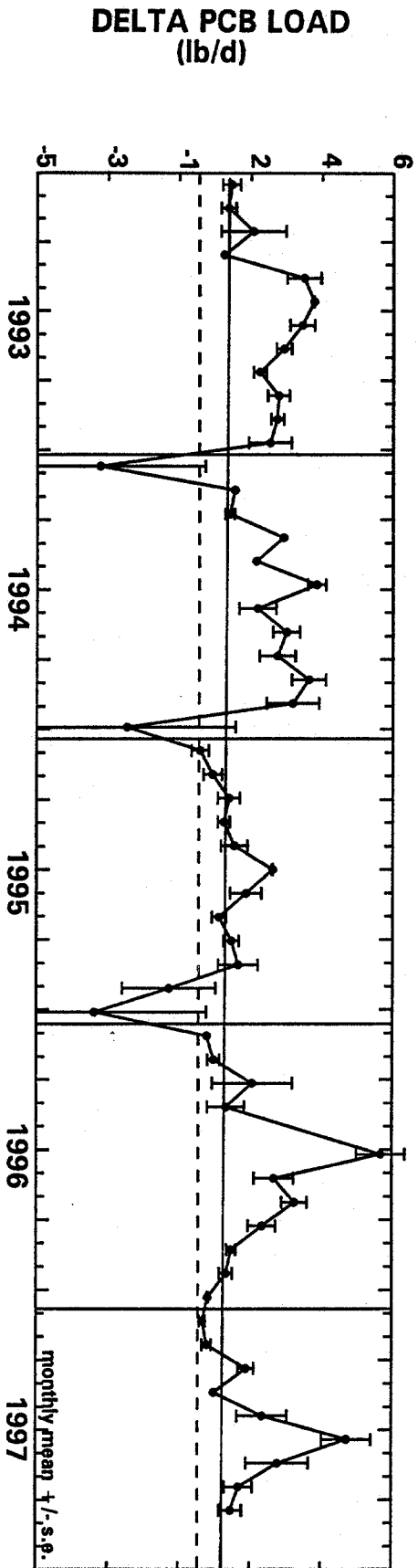
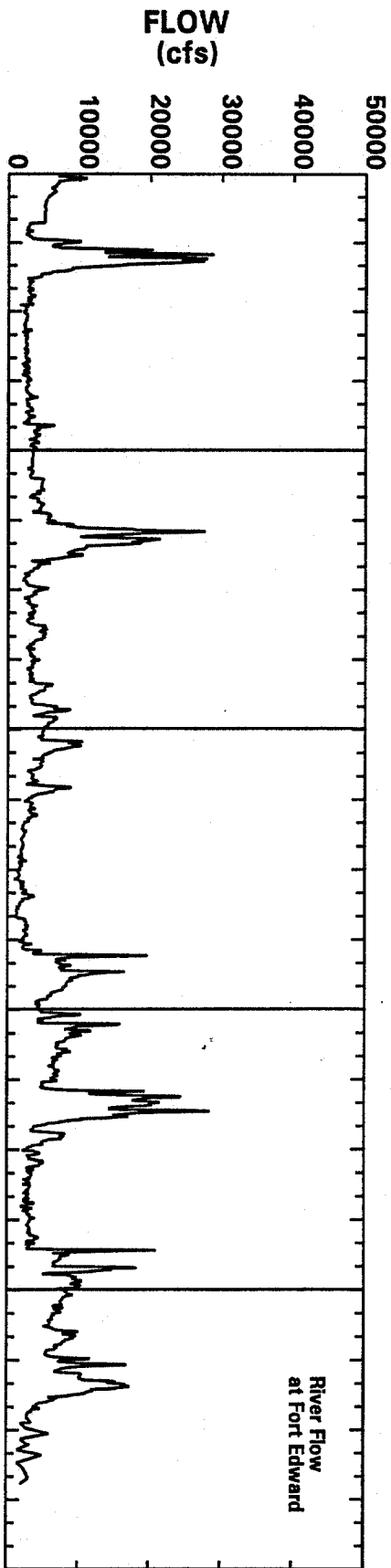
- The flux of PCBs from Thompson Island Pool (TIP) sediments has been estimated based on the increase in PCB concentration from Rogers Island to Thompson Island Dam
- The calculated flux varies seasonally and annually:
 - ☐ **excluding flood events**, the maximum occurs in early summer and the minimum occurs in winter
 - ☐ highest levels are about 5 to 6 lb/d
 - ☐ the summer average is about 2 to 3 lb/d
 - ☐ fluxes were lower in 1995, a year without a spring high flow event.
- GE has contended that the estimated flux is anomalously high, particularly during summer low flow conditions:
 - ☐ diffusion of PCBs from sediments contaminated at the levels observed in 1991 can account for, at most, 0.5 to 1 lb/d
 - ☐ water column data collected at Schuylerville in the late 1980s by the USGS suggest a flux from TIP sediments of 0.2 to 0.4 lb/d
 - ☐ the estimated flux of PCBs from sediments between the TI Dam and Schuylerville is much lower, despite similar sediment PCB levels



Thompson Island and Schuylerville



Hudson River PCB Concentration at Thompson Island and Schuylerville
 data sources: usgs, ge/obg, usepa



Max.
Δ Diffusive
Load from
TIP Sediments

Thompson Island Dam-Ft Edward PCB Load Difference
excluding FE flows > 10,000 cfs

Hypotheses

- Several hypotheses have been proposed to explain such a high flux:
 - 1) *Additional mechanisms that move PCBs from the sediments to the water column*
 - ☐ groundwater inflow
 - ☐ resuspension of sediments
 - 2) *Additional PCB Sources*
 - ☐ landfills along the river
 - ☐ PCB oil (transported from the vicinity of the GE Hudsons Falls plant site)
 - ☐ oily sediments (scoured from the Allen Mill when the gate structure failed)
 - 3) *Erroneous estimates of PCB Flux due to biased sampling*
 - ☐ the PCB levels in the center channel water sampled at Rogers Island are lower than the average level entering the pool
 - ☐ the PCB levels in the shoreline water sampled at Thompson Island Dam are higher than the average level in water passing the dam

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Summary

HYPOTHESIS	REJECTED	SUPPORTED BY DATA	TO BE EVALUATED FURTHER
1. Additional sediment/water exchange mechanisms			
a. Groundwater inflow	✓		
b. Sediment resuspension	✓		
2. Additional PCB Sources			
a. Landfills containing dredged sediments	✓		
b. PCB oils from the Hudson Falls plant site			✓
c. Oily sediments released from the Allen Mill			✓
3. Erroneous Estimates of PCB Flux Due to Biased Sampling			
a. Center channel station at RI unrepresentative	✓		
b. Shoreline station at TID unrepresentative		✓	✓

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Hypothesis 1: Additional mechanisms that move PCBs from the sediments to the water column

- ☐ estimation of the effect of long-term high flux on sediment PCB composition and inventory
- ☐ measurement of groundwater inflow rates
- ☐ measurement of water column TSS changes through the TIP for evidence of resuspension

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Program Results

Hypothesis 1: Additional mechanisms that move PCBs from the sediments to the water column

- ☐ The historical contaminated sediments (as measured in 1984) could not sustain the estimated PCB flux to the present time. The surface sediments would have been depleted of PCBs, particularly the lower chlorinated homologs.
- ☐ Measured groundwater inflow rates are at least a factor of ten too low to account for the estimated flux.
- ☐ TSS changes through the TIP show no evidence of resuspension. Levels are low and do not increase except at the locations of tributaries.

Surface Sediment PCB Reservoir Depletion Under 1993-1996 Average Thompson Island Pool Load			
Homologue	Mass of PCBs in TIP Surface Sediments in 1984 ^(1,2) (MT)	Load from TI Pool ⁽³⁾ (MT/year)	Year in Which the Sediment Reservoir is Depleted
1	0.58	0.055	1995
2	1.40	0.058	2008
3	1.00	0.057	2002
4	0.41	0.016	2009
5	0.13	0.002	2040
Sum	3.52	0.19 = 0.51 kg/day	

Notes:

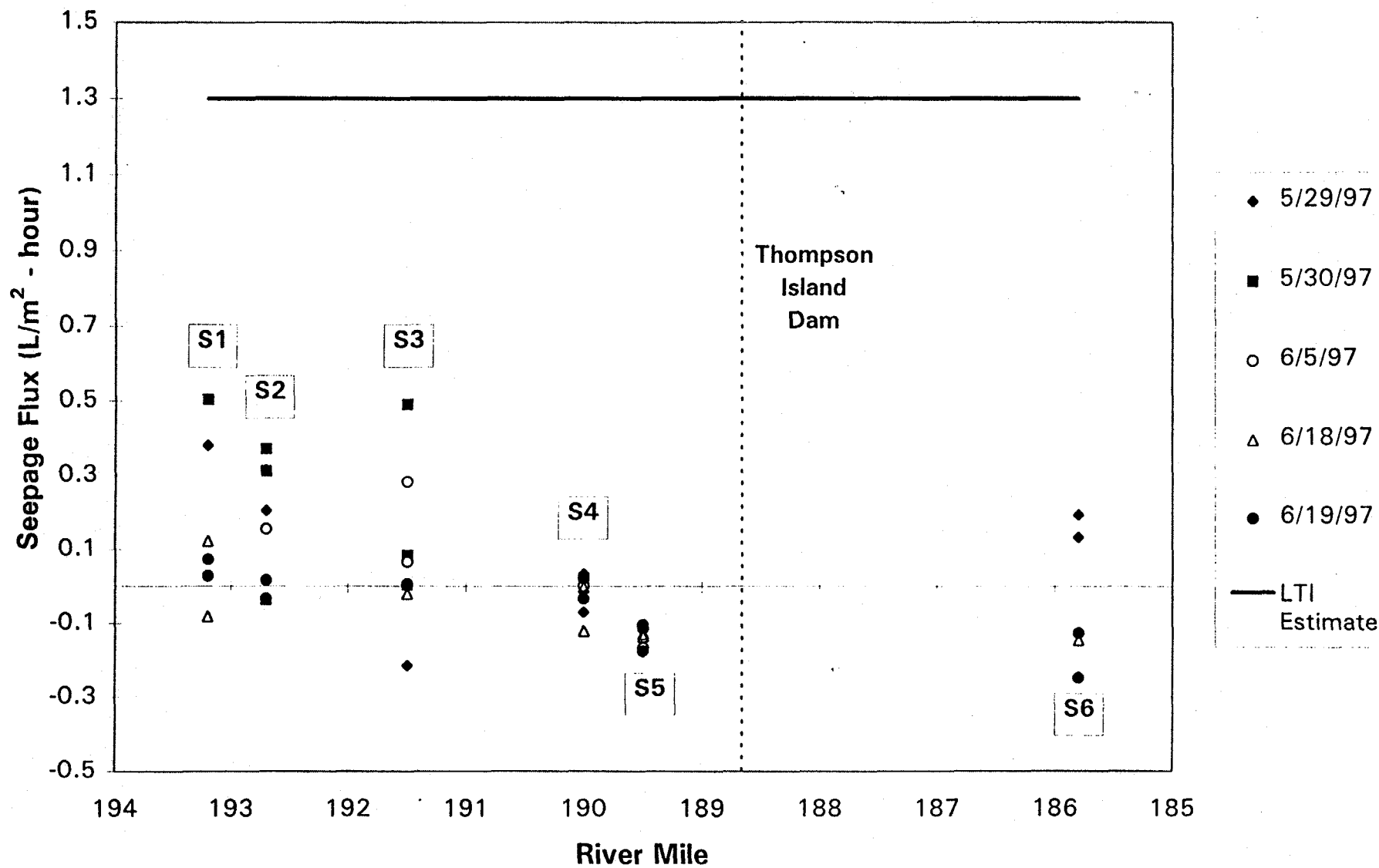
(1) Mass of total PCB in surface sediments = surface sediment concentration* x specific weight of sediments* x 8 cm depth x area of TI Pool*

* Values based on EPA analysis

(2) Homologue mass based on homologue composition of EPA low resolution cores

(3) Load from TI Pool = Load at TI Dam - load at Rogers Island; all GE data, 1993-1996

Seepage Flux Measured in Seepage Meters



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Hypothesis 2: Additional PCB Sources

- ☐ simulation of PCB oil transport from Hudsons Falls using a particulate tracer
- ☐ measurement of bed load and water column PCBs for evidence of substantive PCB transport during high flow events
- ☐ measurement of PCB transport during periodic flooding of Bakers Falls plunge pool
- ☐ measurement of PCBs throughout the TIP to search for areas of elevated flux that might indicate areas of elevated surface sediment PCBs or locations of inputs from landfills

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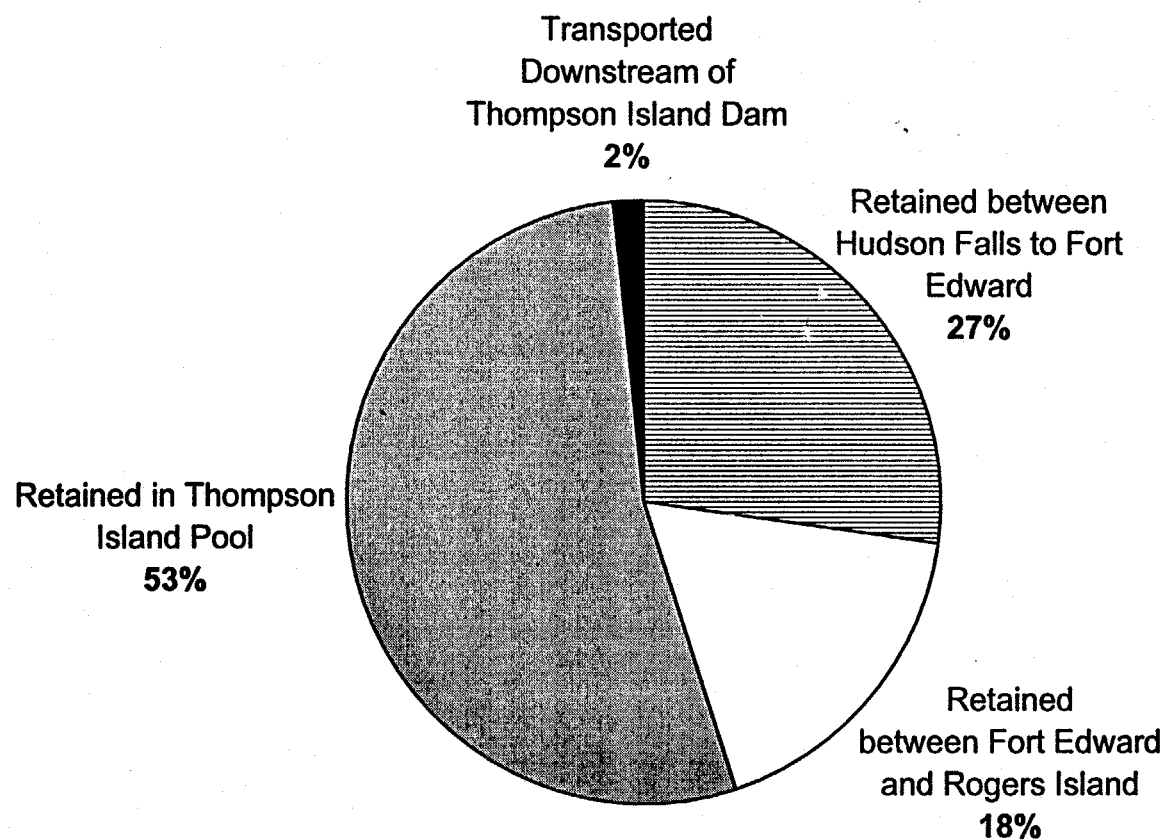
Program Results

Hypothesis 2: Additional PCB Sources

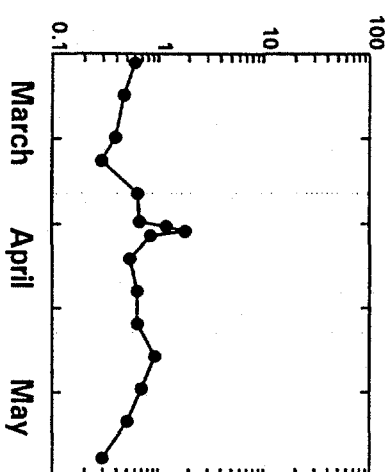
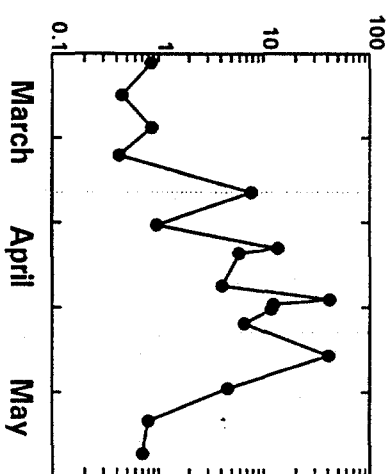
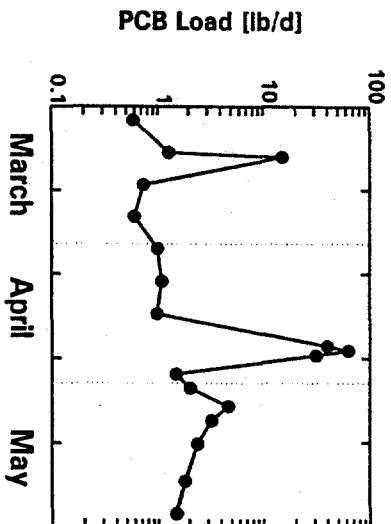
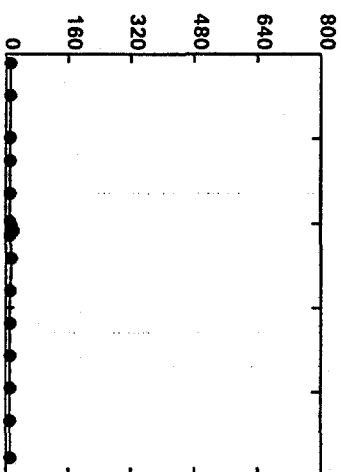
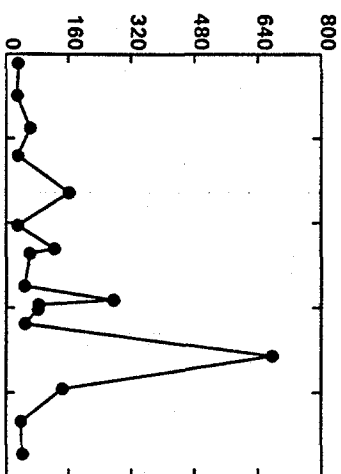
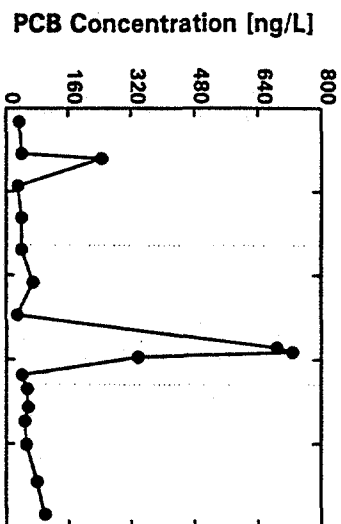
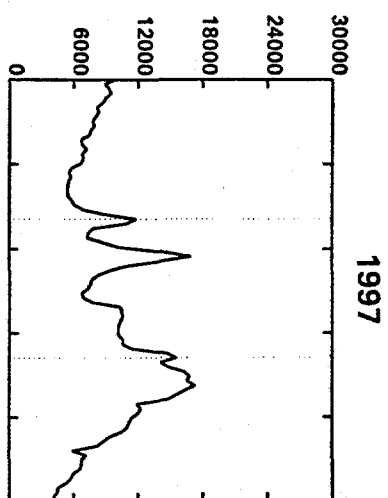
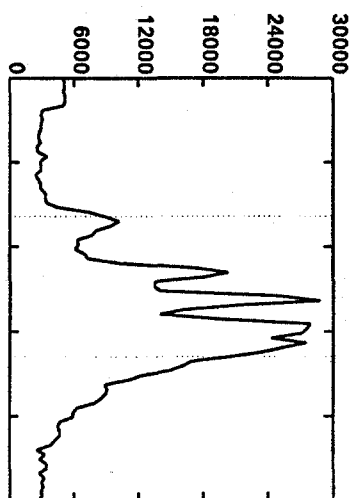
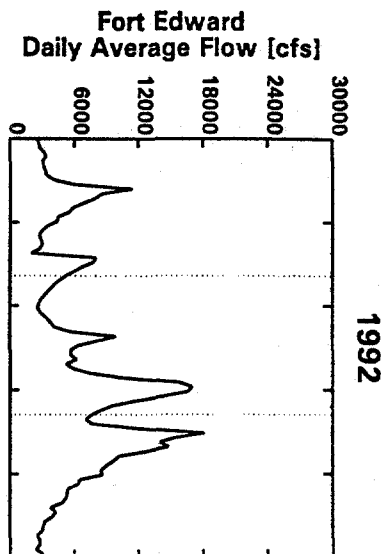
- ☐ The particle tracer study indicated a potential for PCB oil to be stored above the TIP under low flow and transported to the TIP, and trapped therein, during flood events.
- ☐ No substantive PCB flux was observed in bed load or in water passing Rogers Island during the 1997 spring high flow event. Such transport may have occurred in earlier years due to greater PCB releases from the Hudsons Falls plant site area.
- ☐ Periodic flooding of Bakers Falls plunge pool transported small quantities of PCBs downstream.
- ☐ PCB concentration changes through the TIP showed no evidence of significant localized sources, but rather a widespread flux of PCBs from sediments throughout the pool that contributed about 1 lb/d of PCBs to the water column
- ☐ The observed flux is at or above the limit of what could come from historical sediments, and may indicate some contribution from the Hudsons Falls releases
- ☐ Although localized areas of higher PCB concentration were observed, flow analyses indicated that lack of flushing in these areas was the cause rather than greater flux from sediments.

PCB DNAPL Transport Study

Fluorescent Particle Mass Balance

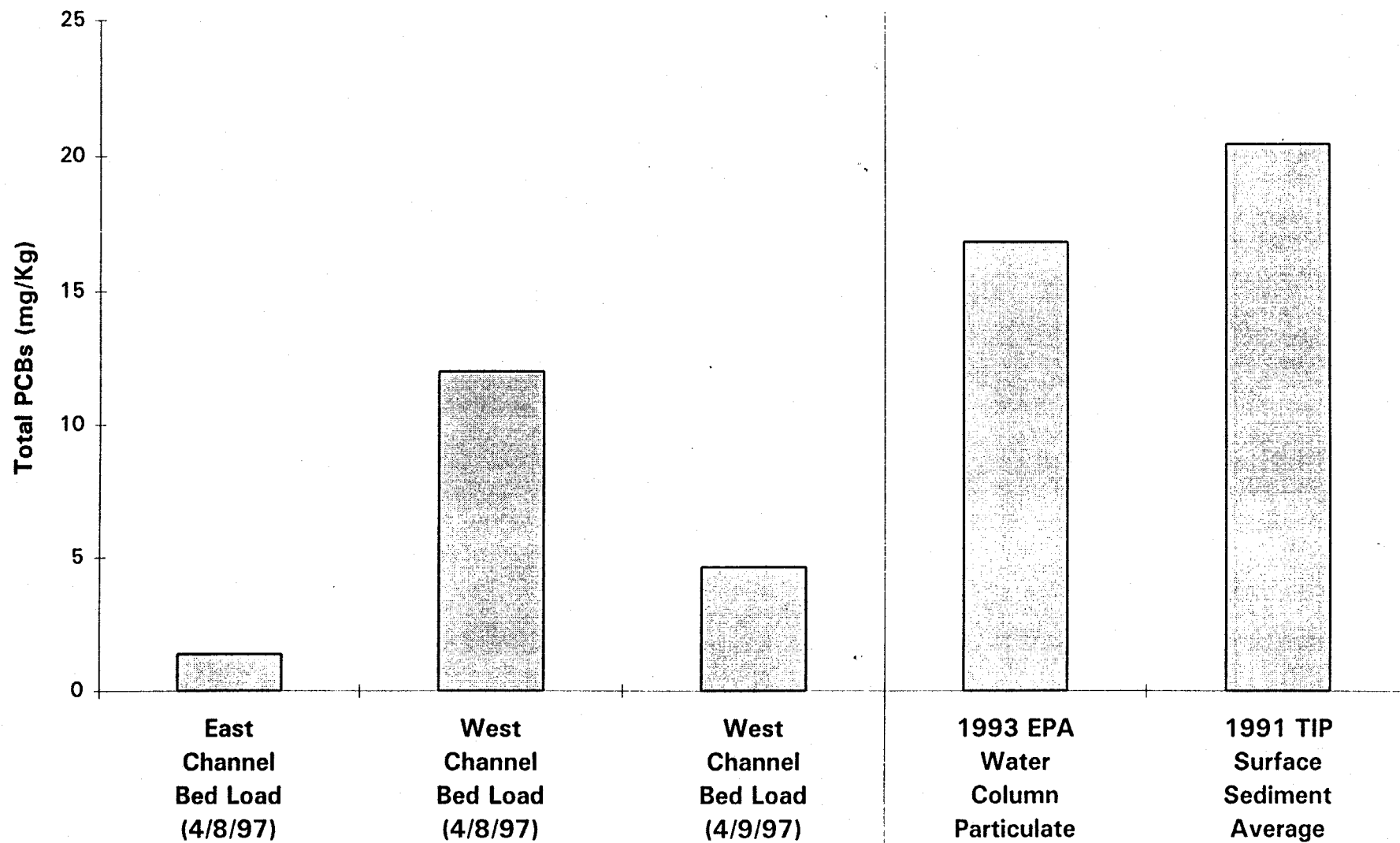


Fort Edward Station

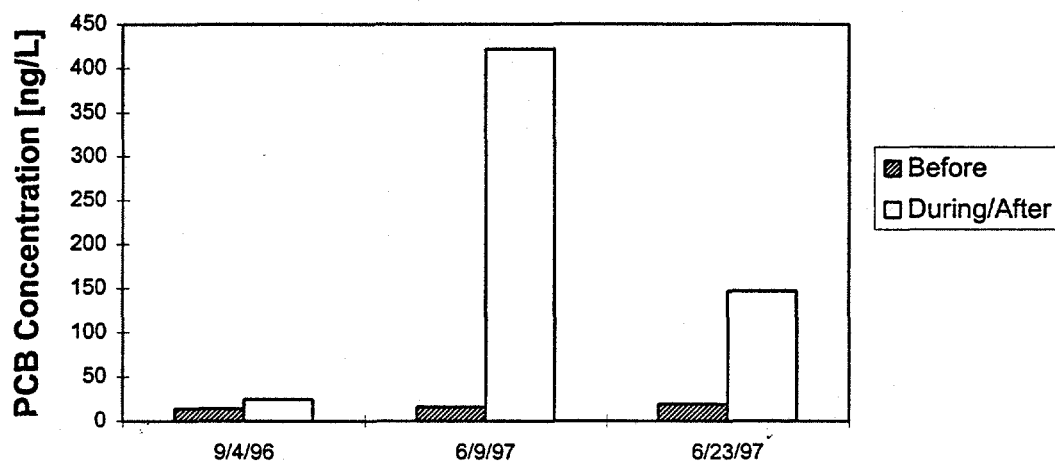


* Non-Detects Plotted at Detection Limit

Comparison of Particulate PCB Concentrations at Fort Edward

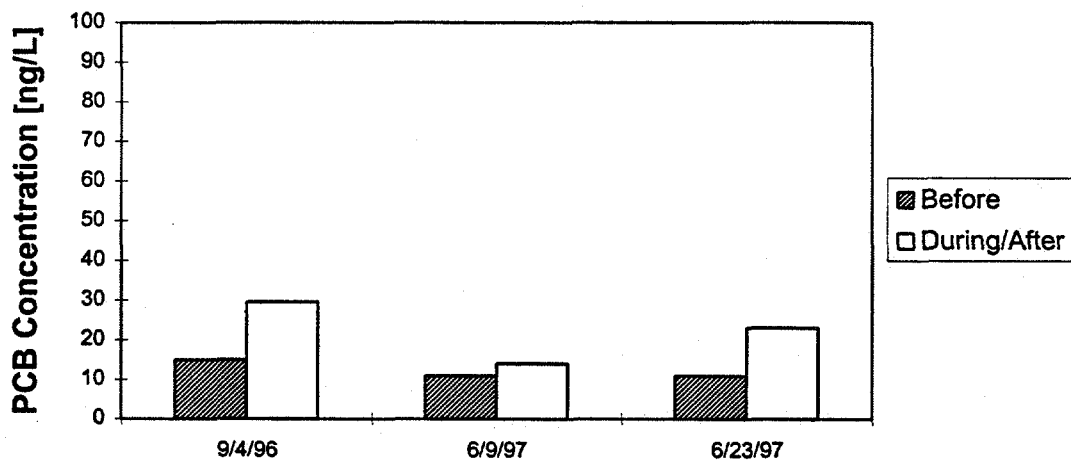


Hydrofacility Monitoring Plunge Pool



* Non-Detects Plotted at Detection Limit

Hydrofacility Monitoring Fort Edward



* Non-Detects Plotted at Detection Limit

**PCB LOAD INCREASE ACROSS THOMPSON ISLAND POOL
BASED ON CENTER CHANNEL SAMPLING**

Average Load Increase = 1.1 lb/d

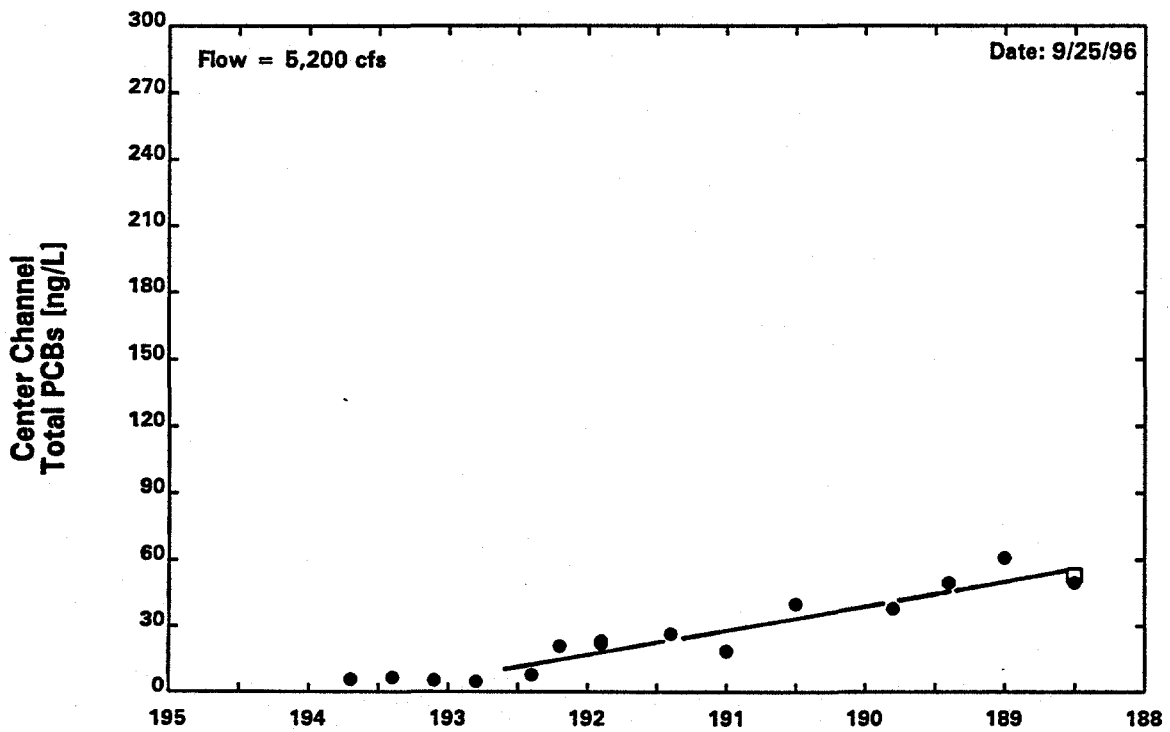
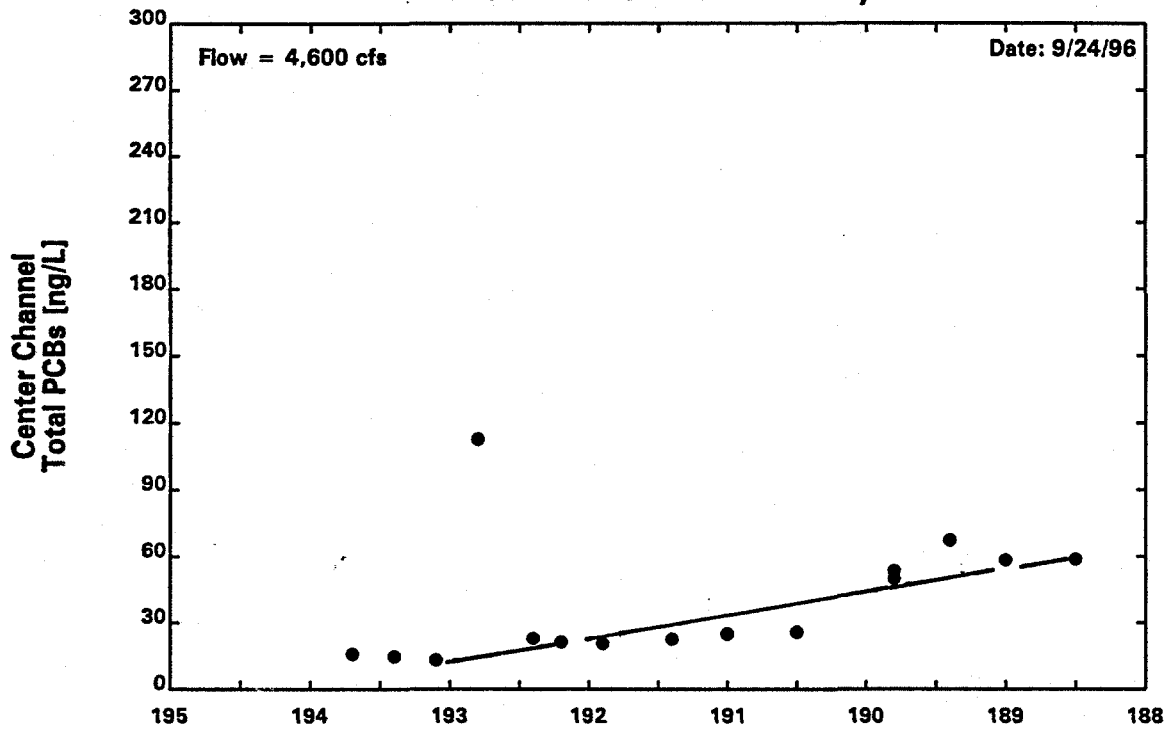
Sample Date	River Flow (cfs)	Rogers Island PCBs		TIP 18 C PCBs		Loading Change (lb/d)
		Concentration (ng/L)	Loading (lb/d)	Concentration (ng/L)	Loading (lb/d)	
09/18/96	7600	< 11	0.5	53.6	2.2	1.7
10/29/96	2200	< 11	0.1	49.7	0.6	0.5
06/04/97	4700	< 11	0.3	84.2	2.1	1.9
06/17/97	2800	31.7	0.5	105.3	1.6	1.1
06/30/97	2800	17.7	0.3	175.1	2.6	2.4
07/14/97	2000	13.7	0.1	91.8	1.0	0.8
07/28/97	1500	18.6	0.2	66.7	0.5	0.4
08/13/97	2400	-	0.1	49.6	0.6	0.5
09/09/97	3200	-	0.2	63.8	1.1	0.9
09/09/97	4000	-	0.2	69.6	1.5	1.3
09/10/97	3100	-	0.2	52.5	0.9	0.7

Notes:

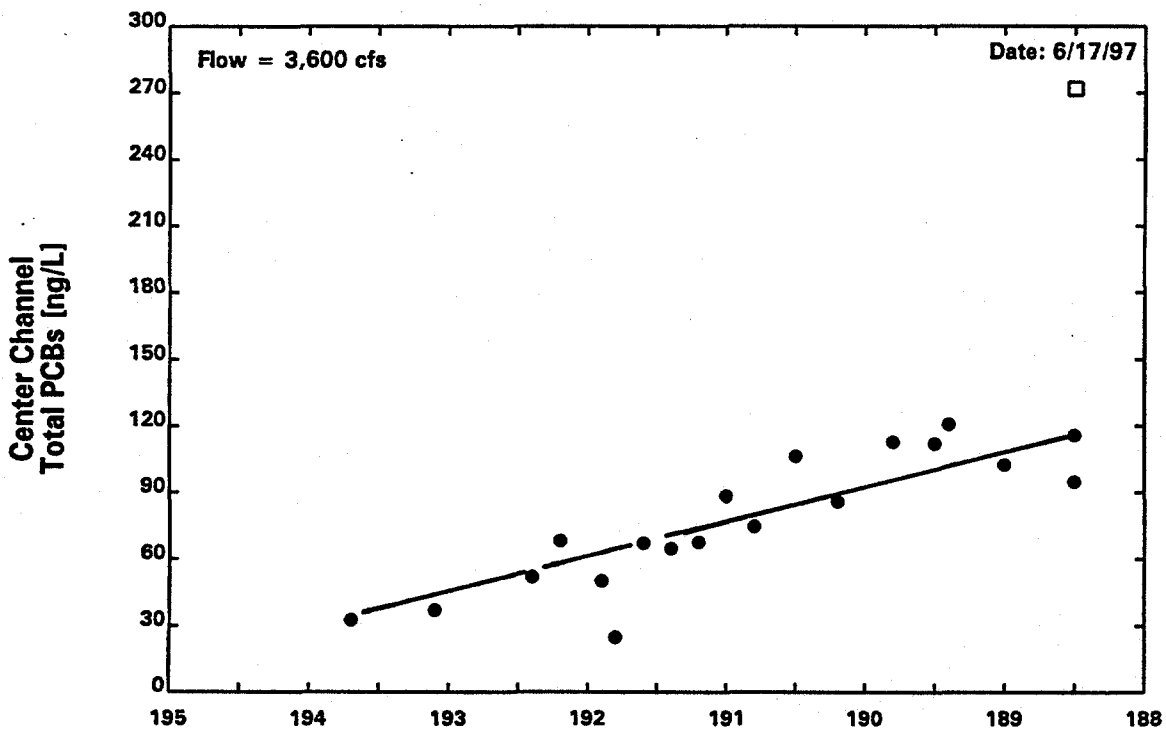
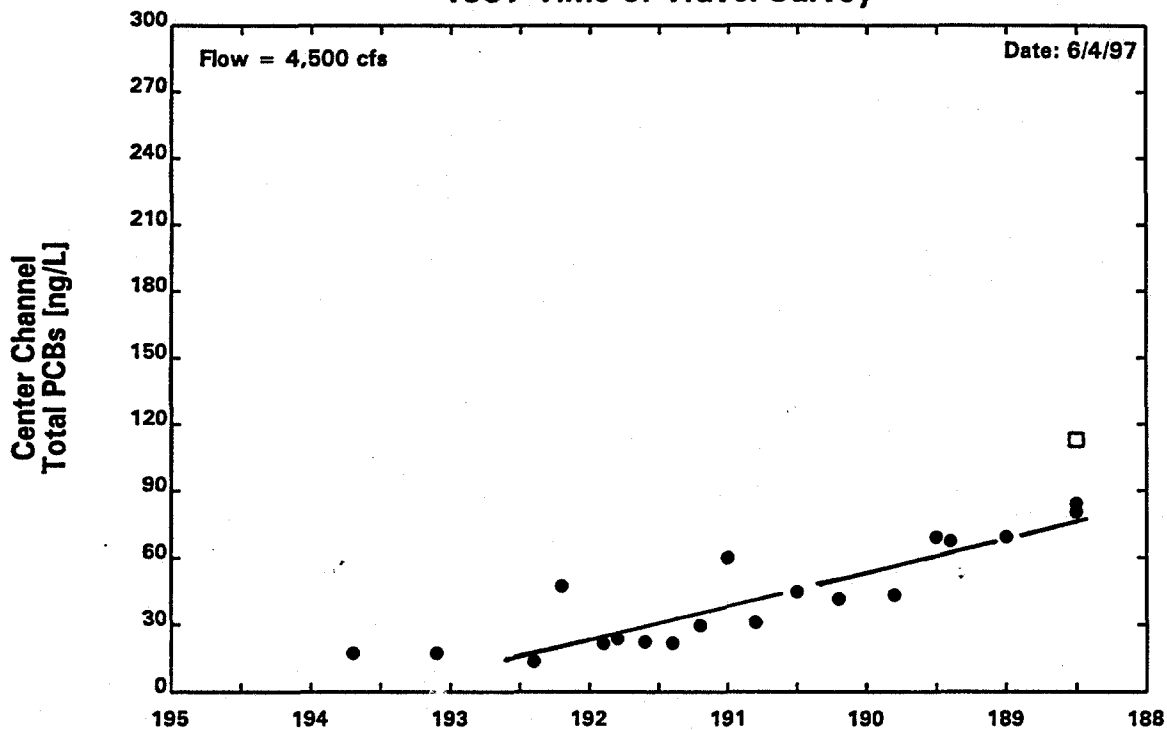
MDL of 11 ng/L used in loading calculations for samples below detection limit

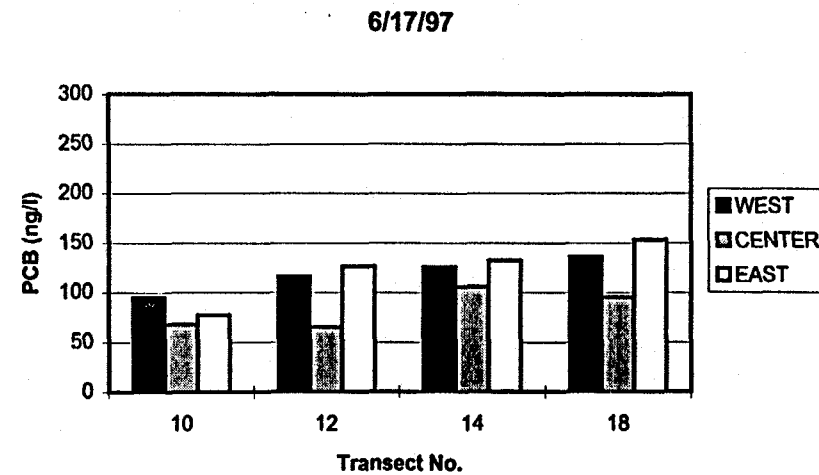
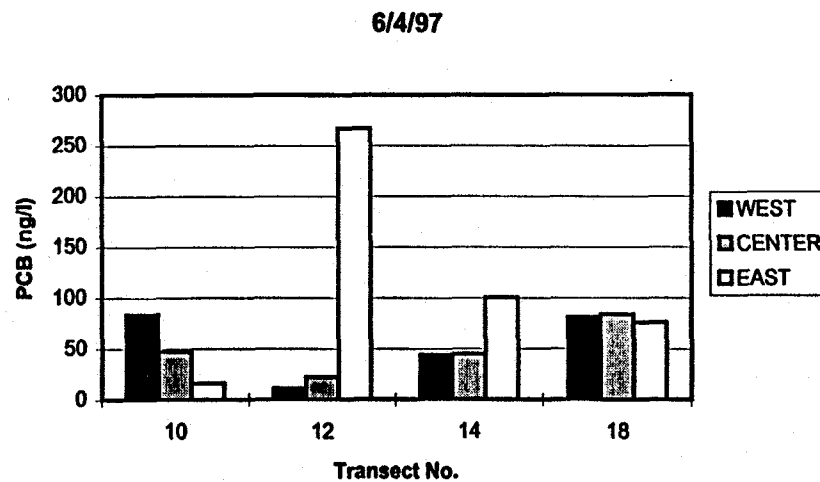
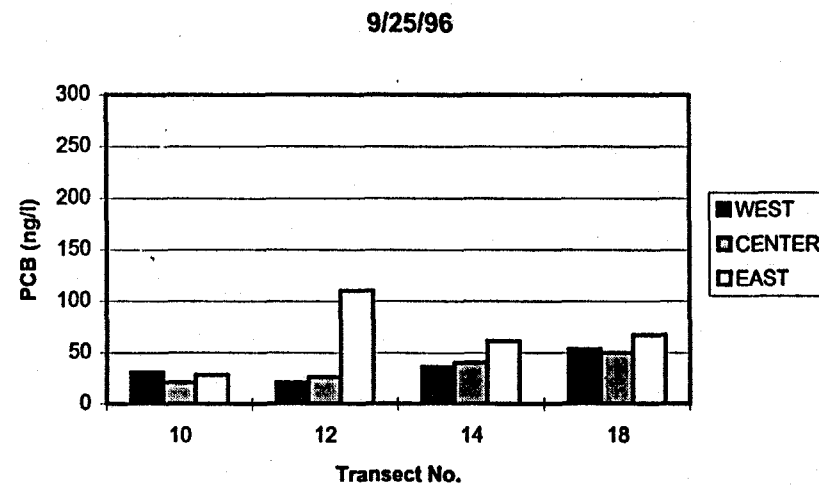
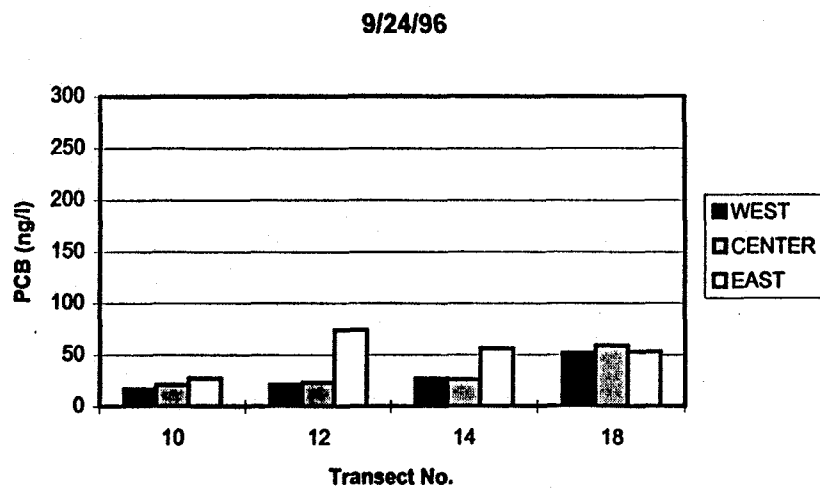
Fort Edward PCB concentrations after 7/28/97 were not available. MDL of 11 ng/L was used for load calculations.

HUDSON RIVER PROJECT 1996 Time of Travel Survey



HUDSON RIVER PROJECT 1997 Time of Travel Survey





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Hypothesis 3: Erroneous estimates of PCB Flux due to biased sampling
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- ☐ sample at 6 stations along a transect just upstream of the Rogers Island station
- ☐ sample at opposite shoreline at the dam for comparison to routine sampling location
- ☐ sample at transect in the river immediately upstream of the dam for comparison to the shoreline sampling location
- ☐ sample in the main flow of the river immediately downstream of the shoreline sampling location for comparison to the shoreline sampling location and the transect upstream of the dam

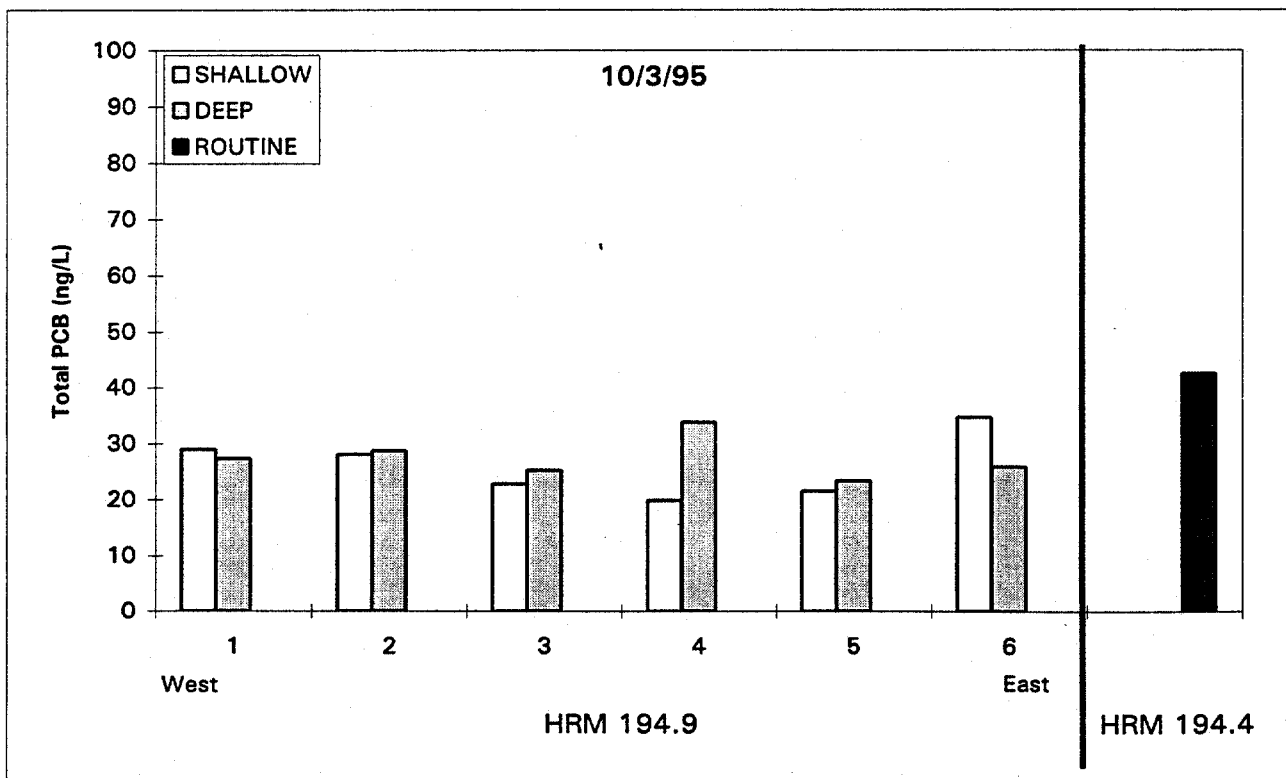
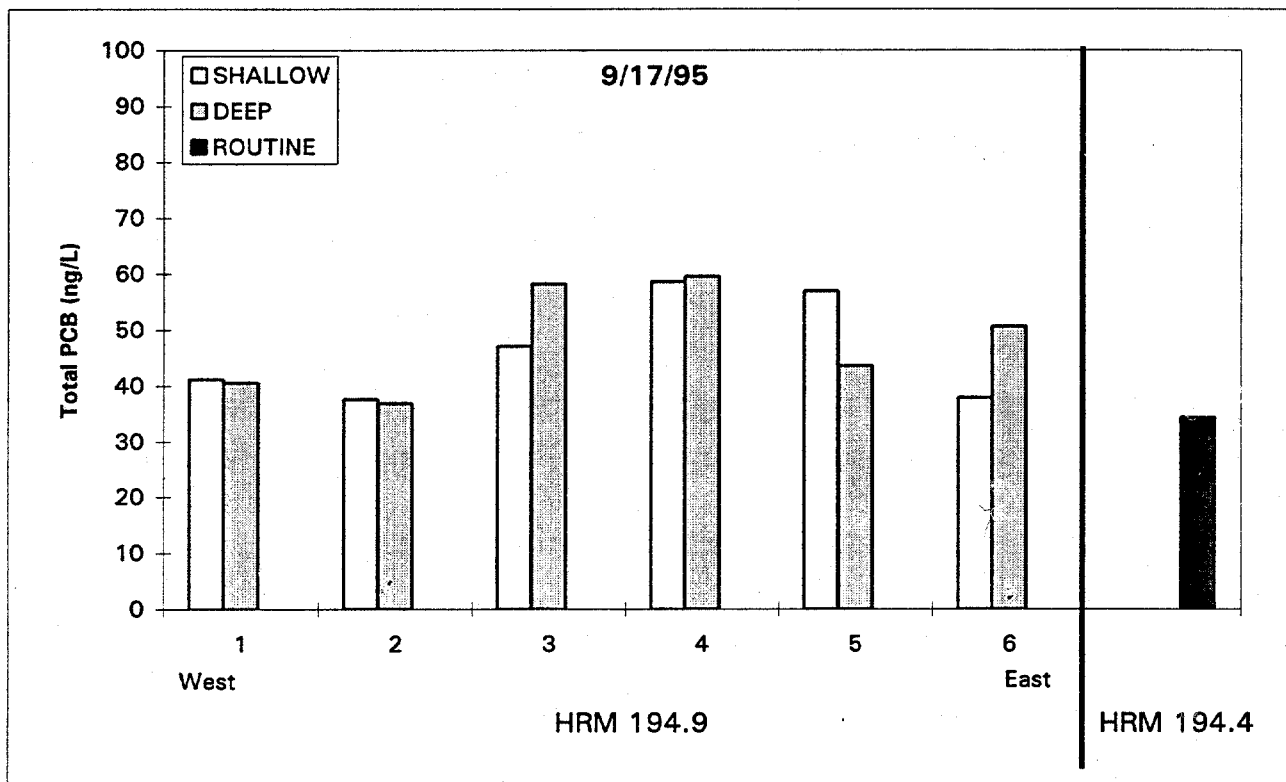
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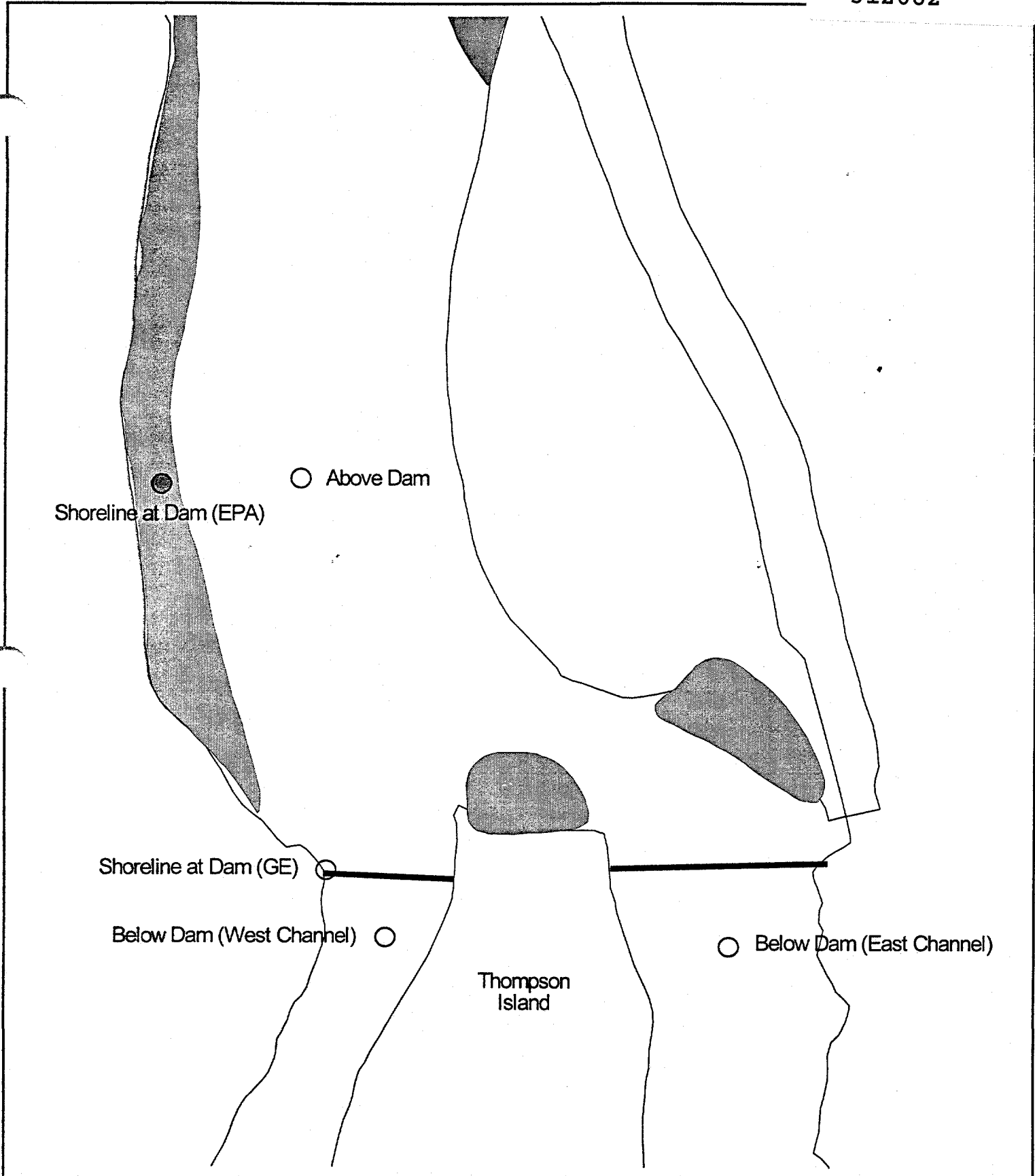
Program Results

Hypothesis 3: Erroneous estimates of PCB Flux due to biased sampling

- ☐ samples at the transect upstream of Rogers Island have levels similar to samples from the Rogers Island station
- ☐ samples at the opposite shoreline had PCB levels similar to those at the TI Dam routine sampling location
- ☐ samples from a transect about 1000 ft. upstream of the dam had PCB concentrations significantly lower than samples taken at the routine sampling location
- ☐ samples in the main flow of the river immediately downstream of the shoreline sampling location had concentrations similar to those measured at the transect upstream of the dam
- ☐ samples from Schuylerville indicate the bias at the dam masked sediment PCB loadings occurring between the TI Dam and Schuylerville that are similar to those from TIP sediments

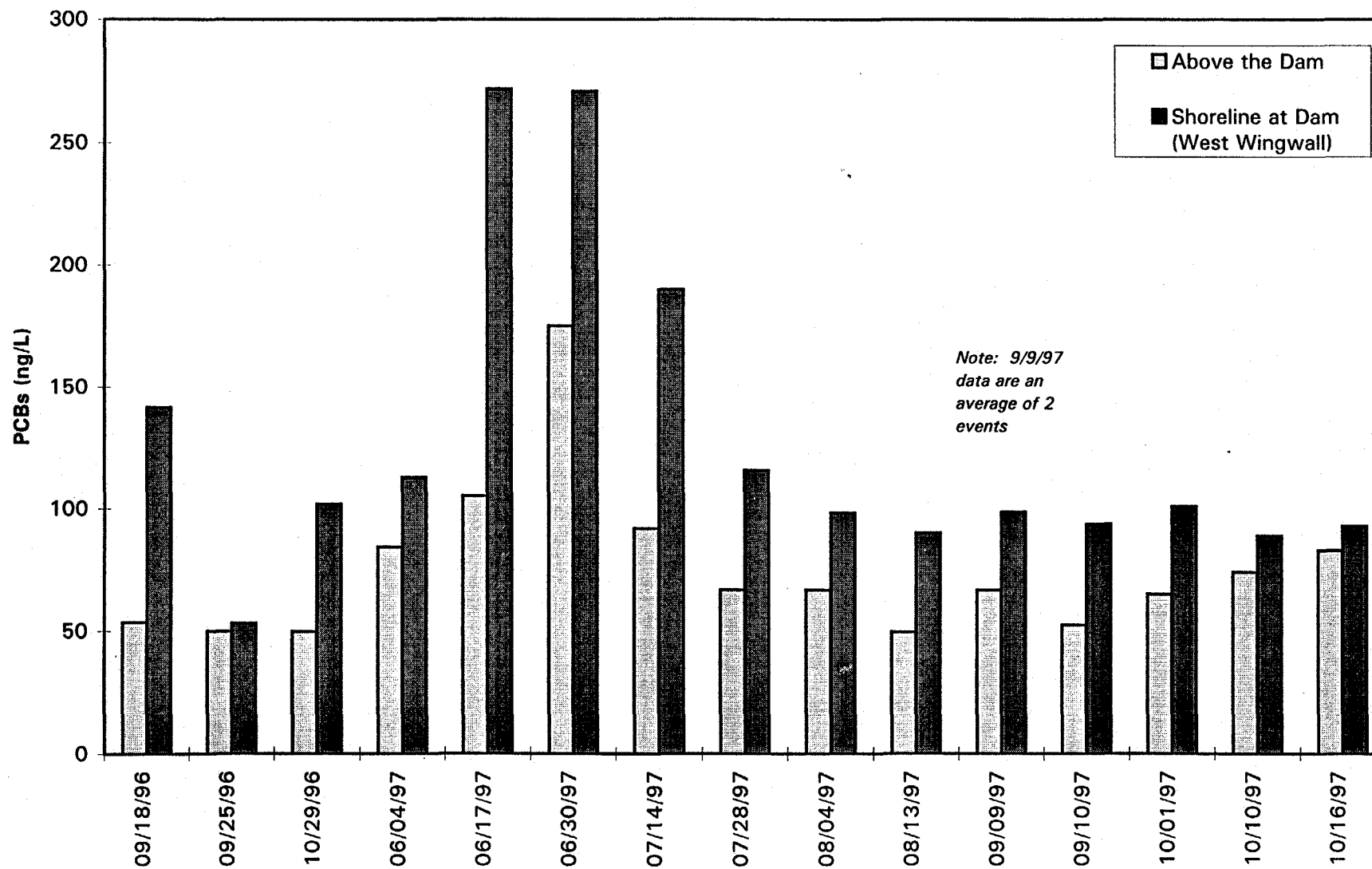
THE GENERAL ELECTRIC COMPANY - Hudson River Project
River Monitoring Test Data: Representativeness of Routine (HRM 194.4) Monitoring Station



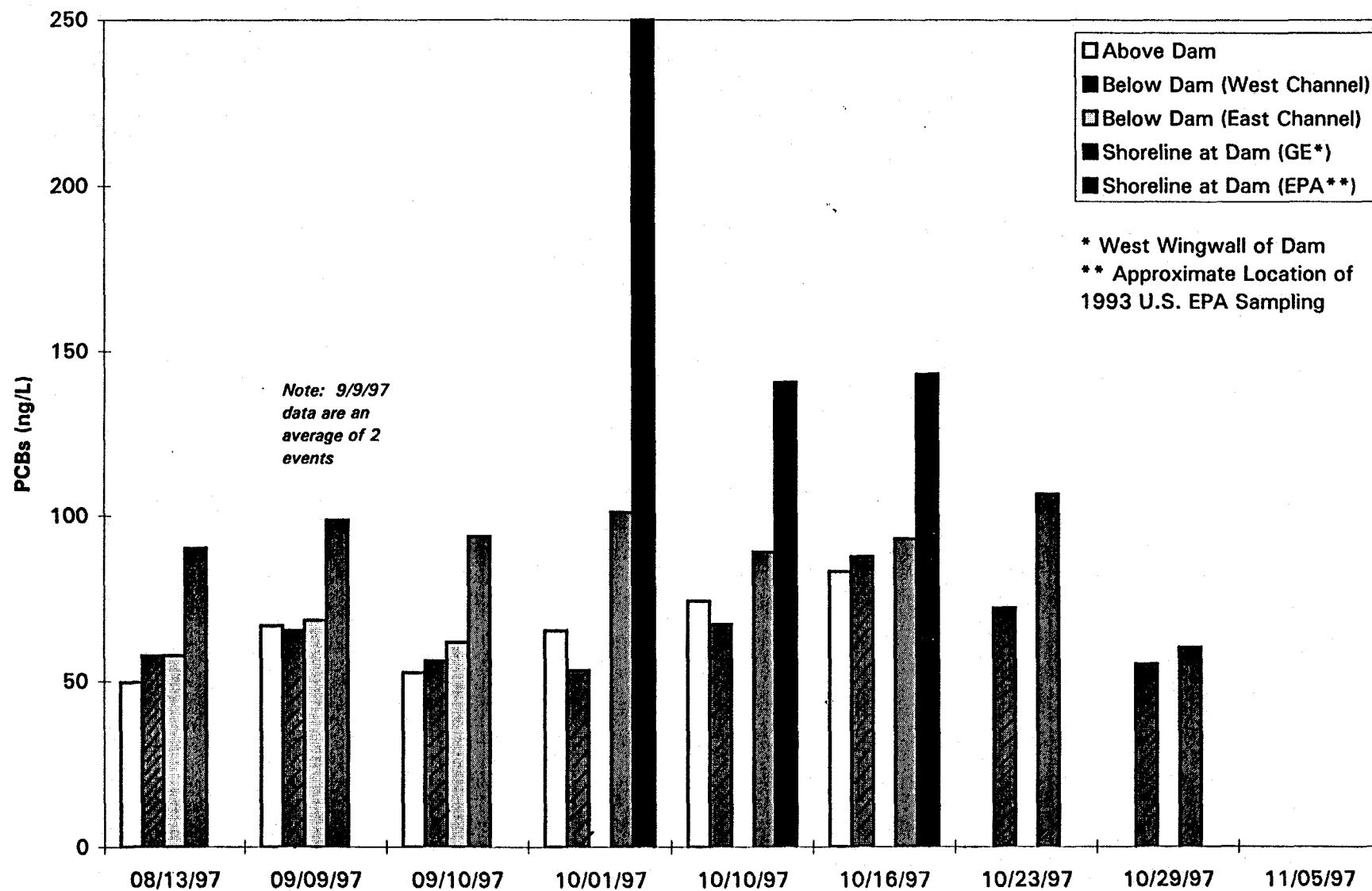


 	New York State	Upper Hudson	The General Electric Company Thompson Island Dam Monitoring Study Sample Locations Near Thompson Island Dam HydroQual, Inc. November, 1997
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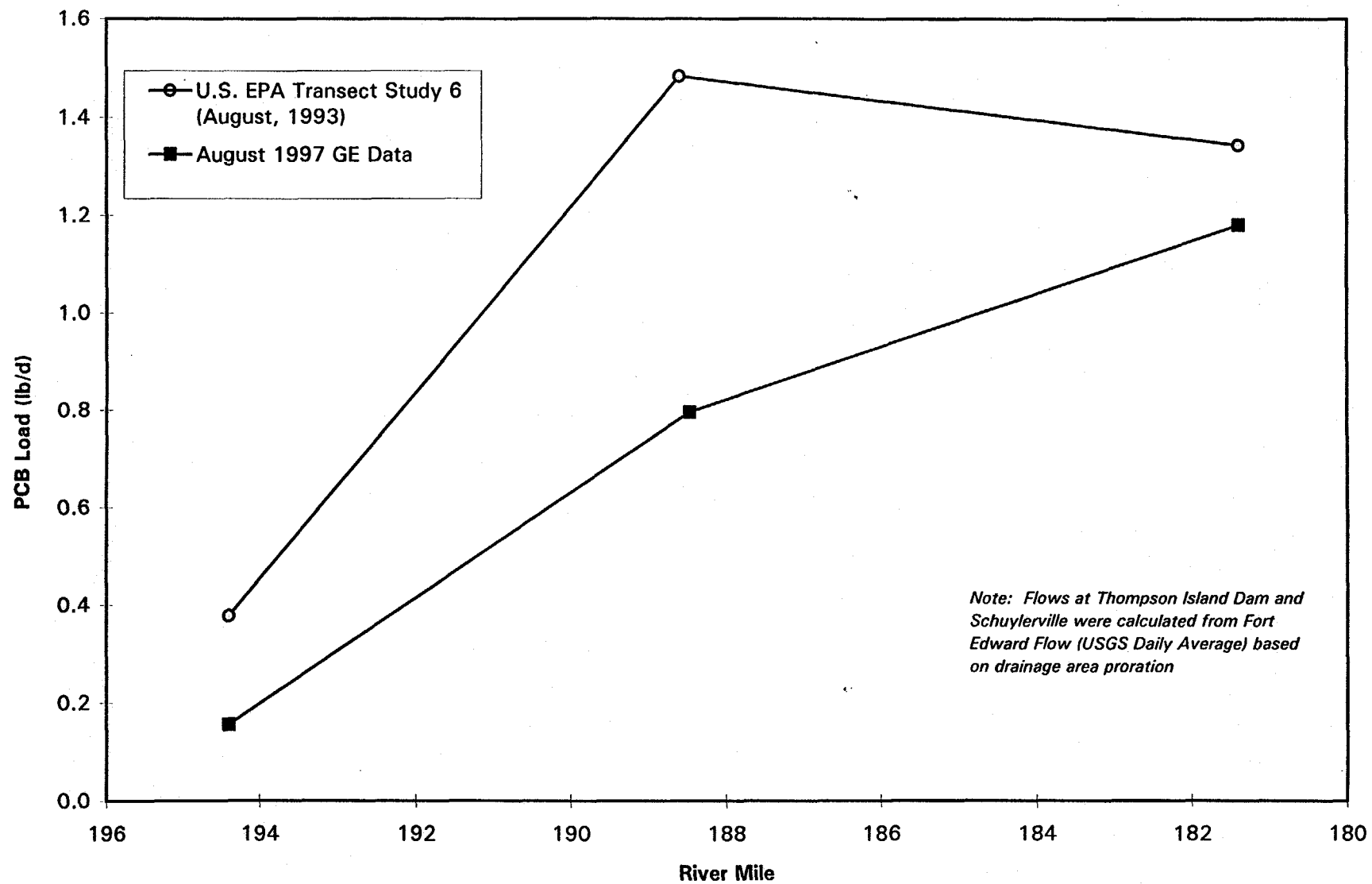
Comparison of PCB Concentrations from
Above Thompson Island Dam and at the West Wingwall



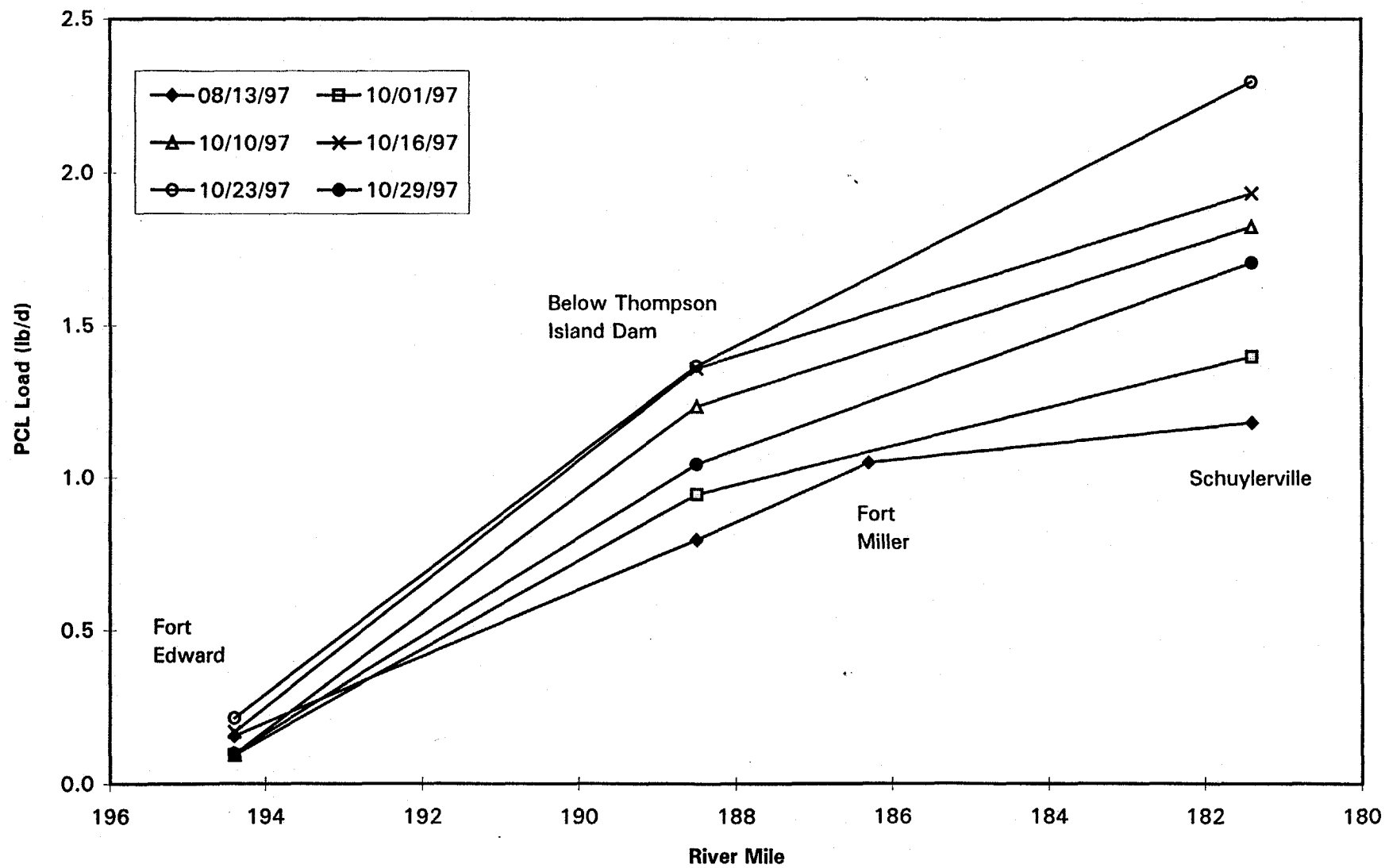
Comparison of PCB Concentrations Near Thompson Island Dam



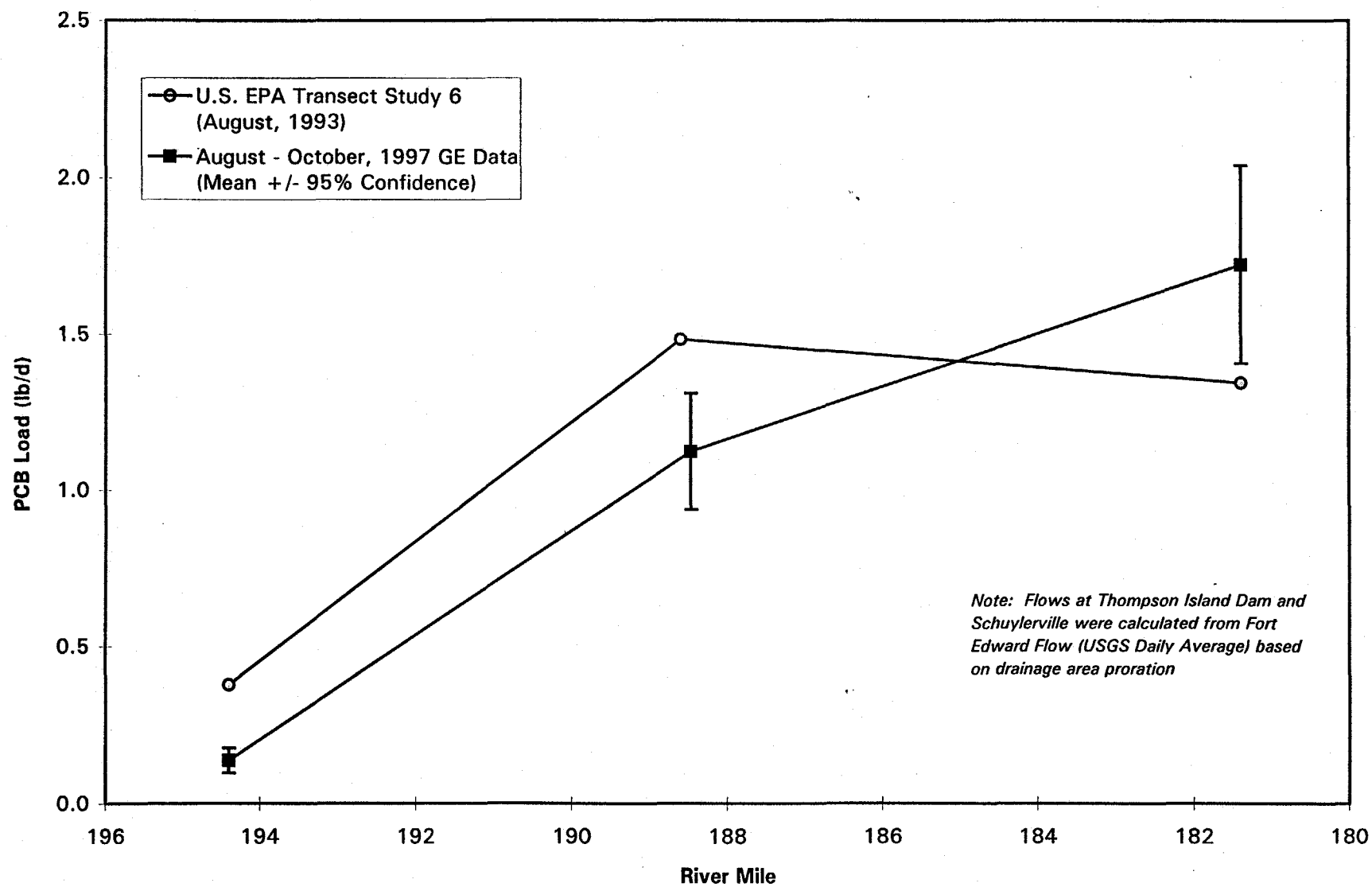
Spatial Profile of Average Low Flow PCB Loading for 1993 EPA Data and 1997 GE Data



Spatial Profile of Upper Hudson River PCB Loading



Spatial Profile of Average Low Flow PCB Loading for 1993 EPA Data and 1997 GE Data



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Main Conclusions

- Current estimates of PCB load from TIP sediments (2 to 3 lb/d with maxima of 5 to 6 lb/d) are erroneous due to a sampling bias at the Thompson Island Dam
- The summer average low flow PCB load from TIP sediments is probably on the order of about 1 lb/d; additional loading measured at downstream stations comes from downstream sediments
- The TIP PCB load is derived from surface sediments throughout the TIP
- The PCB load derived from surface sediments between the TI Dam and Schuylerville is similar to that derived from TIP surface sediments

Ancillary Conclusions

- The PCB flux from TIP sediments results in a gradual increase in PCB levels through the TIP
- Water column PCB concentrations tend to be highest in backwater areas
- Little PCB oil or oily sediment entered the TIP in 1997

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Next Steps

- Determine the cause of the sampling bias at the TI Dam
 - ☐ test hypothesis that water from shoreline backwater areas is carried alongshore to the sampling location
 - ☐ sample at the following locations:
 - main channel upstream of the Dam
 - backwater area along the shore
 - routine station at the Dam
 - downstream of the Dam
- Investigate whether the TI Dam data can be corrected
 - ☐ do the new data indicate a systematic bias?
- Use PCB fate model to evaluate whether 1 lb/d flux from TIP sediments is consistent with 1991 PCB levels