



08-0158

SDMS: 214572

Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

October 1, 2004

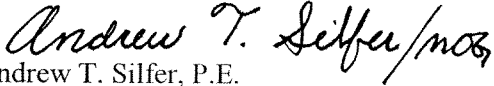
Mr. Dean Tagliaferro
US Environmental Protection Agency
c/o Weston Solutions, Inc.
One Lyman Street
Pittsfield, MA 01201

Re: Caged Mussel Study – Upper ½-Mile Reach of the Housatonic River (GECD800)

Dear Mr. Tagliaferro:

Please find attached a report that documents the results of a caged mussel study performed as part of the Upper ½-Mile Reach Removal Action of the Housatonic River. Please call me with any questions.

Yours truly,


Andrew T. Silfer, P.E.
GE Project Coordinator

TLC/dmn

Attachment

cc: Susan Steenstrup, MDEP
Robert Bell, MDEP (without attachments)
Anna Symington, MDEP (without attachments)
Holly Inglis, USEPA
Tim Conway, USEPA
Rose Howell, USEPA
K.C. Mitkevicius, USACE
R. Goff, USACE
Dale Young MA EOE
Nancy Harper, MA AG (without attachments)
~~Dawn Jamros, Roy F. Weston~~
Mayor James Ruberto, City of Pittsfield
Michael Carroll, GE (without attachments)
Rod McLaren, GE (without attachments)
Stuart Messur, BBL
Mark Graveling, BBL
James Bieke, Shea & Gardner
Public Information Repositories
GE Internal Repositories

Attachment 1 Caged Mussel Study Results

Upper ½-Mile Reach of the Housatonic River General Electric Corporation, Pittsfield, Massachusetts

1. Introduction

On behalf of the General Electric Corporation (GE), Blasland, Bouck and Lee, Inc. (BBL) conducted a caged mussel study as part of the Upper ½-Mile Reach Removal Action to assess uptake of polychlorinated biphenyls (PCBs) in the Upper ½-Mile Reach of the Housatonic River in Pittsfield, Massachusetts. The study was performed in accordance with the *Removal Action Work Plan – Upper ½-Mile Reach of the Housatonic River* (Work Plan) (BBL, 1999), and was performed in three phases: pre-removal, during-removal, and post-removal. The pre-removal phase was conducted in August and September of 1999, the during-removal phase in August through October of 2000, and the post-removal phase in August through November of 2003. Results of these phases were presented previously in the GE Monthly Reports for the Upper ½-Mile Reach Removal Action. As requested by the US Environmental Protection Agency (USEPA) this Attachment provides a summary and discussion of results of each of the phases of the caged mussel study.

2. Monitoring Program

Cage and Mussel Arrangement

As indicated above, the study was conducted in three phases: pre-, during-, and post-removal. Two-cage arrays were arranged in pairs at three different locations (a total of four cages per location) within the Upper ½-Mile Reach of the Housatonic River. The cage-arrays were situated in the vicinity of the following landmarks (see Figure 1):

- Newell Street Bridge (upstream);
- Lyman Street Bridge (downstream); and
- Dawes Avenue Bridge (further downstream).

Cage arrays were constructed of two Gee Model 40K galvanized holding cages and were suspended at the approximate mid-depth of the River (see Figure 2). Each individual cage contained 30 to 60 mussels (i.e., 60 to 120 mussels per cage-array, and as many as 240 mussels per location). The cages were positioned so that they could function as flow-through chambers, thus allowing water and particles to enter while retaining the mussels without injury.

Mussels used in the study were collected one day prior to the initiation of each study phase. The collected mussels measured between 55 and 75 millimeters (mm) long – similar to those used by USEPA in previous studies. The specific location of the source population was identified by USEPA, and was located on the Connecticut River's west bank, just north of Newton Brook at the northern Massachusetts border.

Duration

Each phase of the caged mussel study was originally intended to be conducted over a 12-week period with sampling events scheduled to occur at six and twelve weeks; however, a number of factors contributed to a change in schedule. First, the removal activities in the Upper ½-Mile Reach commenced somewhat sooner than planned, which led to the pre-removal study being shortened from 12 to 6 weeks. As a result, the sampling frequency was adjusted from once every 6 weeks to once every 2 weeks. To maintain consistency, this 2-week sampling cycle was applied to the remaining study phases. Second, during the 2003 post-removal phase, the combined effect of rainy weather and USEPA's impoundment of

the river downstream of Lyman Street Bridge (to facilitate removal activities in the 1½-Mile Reach) led to high water levels that limited access to the mussel cages. While a number of samples were collected on the planned two-week intervals, this limited access caused some of the samples to be collected at other times. Finally, high flow conditions led to the loss of three cages during the post-removal phase of the study. These complications aside, the equipment, locations, and sampling techniques used for this last phase of the study were consistent with the two previous phases.

Sampling

At the end of each sampling period the mussel cages were removed from the water, at which time four samples were collected per location. Each sample consisted of six mussels taken from one cage. The samples were sent to Northeast Analytical Inc., in Schenectady, New York for analysis. Mussel tissue (i.e., not the shell) was analyzed for PCB and lipid concentrations.

3. Monitoring Results

Pre-Removal Monitoring

A total of 38 samples (2 controls and 12 samples from each of three sampling periods) were collected during the pre-removal phase. Results of the pre-removal PCB and lipid analyses are presented in Table 1 and on Figure 3. The mean total PCB and mean lipid-normalized PCB concentrations for the maximum exposure period of 6 weeks were 0.17 milligram/kilogram (mg/kg) and 39 mg/kg-lipid at Newell Street Bridge, 1.04 mg/kg and 289 mg/kg-lipid at Lyman Street Bridge, and 1.61 mg/kg and 363 mg/kg-lipid at Dawes Avenue Bridge. PCB and lipid-normalized PCB concentrations were generally lowest in samples from Newell Street, followed by Lyman Street, and then Dawes Avenue. PCB and lipid-normalized PCB concentrations remained relatively constant throughout the 6-week sampling period at Newell Street. Samples collected at Lyman Street and Dawes Avenue showed generally increasing PCB values over the duration of this phase of the study. Patterns in lipid-normalized PCB concentrations for all three locations determined during the pre-removal phase are depicted on Figure 4.

During-Removal Monitoring

A total of 74 samples (2 controls and 12 samples from each of six sampling periods) were collected during the during-removal phase. Results of the PCB and lipid analyses for this phase of the study are presented in Table 2 and on Figure 5. Again, total PCB and lipid-normalized PCB concentrations were generally lowest in samples from Newell Street, followed by Lyman Street, and then Dawes Avenue. The mean total PCB and mean lipid-normalized PCB concentrations for the maximum exposure period of 12-weeks were 0.41 mg/kg and 66 mg/kg-lipid at Newell Street Bridge, 2.84 mg/kg and 436 mg/kg-lipid at Lyman Street Bridge, and 3.14 mg/kg and 402 mg/kg-lipid at Dawes Avenue Bridge. There appeared to be more variability in these data than in those from the pre-removal phase, but the general trend was an increase over time with higher concentrations identified in the final 12-week samples. Patterns in lipid-normalized PCB concentrations for all three locations determined during the during-removal phase are depicted on Figure 6.

Post-Removal Monitoring

A total of 64 samples (2 control samples and between 6 and 12 samples from each of 3 sampling periods) were collected during the post-removal study. High flow events during this phase resulted in the loss of three cages, limiting the number of samples available for collection. Results of the PCB and lipid analyses for this phase of the study are presented in Table 3 and on Figure 7. Similar to the previous two phases of the study total PCB and lipid-normalized PCB concentrations generally increased from upstream to downstream. For the maximum exposure period of 13-weeks, the mean total PCB and mean lipid-normalized PCB concentrations were 0.11 mg/kg and 24 mg/kg-lipid at Newell Street Bridge, 0.25 mg/kg and 65 mg/kg-lipid at Lyman Street Bridge, and 0.43 mg/kg and 126 mg/kg-lipid at Dawes

Avenue Bridge. Also, similar to the previous two phases of the study, samples obtained during the post-removal phase showed a general increase in PCB levels over the duration of the phase. However, the mean total PCB and lipid-normalized PCB concentrations were highest during the 6- and 9-week sampling events. Patterns in lipid-normalized PCB concentrations for all three locations determined during the post-removal phase are depicted on Figure 8.

4. Summary and Discussion

BBL conducted a three-phased caged mussel study to assess the uptake of PCBs in mussels in the vicinity of the Upper ½-Mile Reach of the Housatonic River. The pre-removal phase of the caged mussel study was conducted in 1999, the during-removal phase of the study was conducted in 2000, and the post-removal phase of the study was conducted in 2003 (after the completion of sediment removal activities).

The lowest PCB concentrations were observed at the farthest upstream location (Newell Street) throughout the three phases of the study. Both total PCB and lipid-normalized PCB levels were generally highest at the most downstream location (Dawes Avenue).

Both total PCB and lipid-normalized PCB concentrations were generally highest in the during removal phase of the study. PCB concentrations during the post-removal phase were lower compared to the during-removal phase, and were generally similar to or lower than the pre-removal phase. However, the comparison between the pre- and post-removal data is somewhat limited by the shorter duration of the pre-removal phase and the associated reduced amount of data.

5. References

Blasland, Bouck & Lee, Inc. (BBL). 1999. *Removal Action Work Plan - Upper ½-Mile Reach of the Housatonic River.*

TABLE 1

**GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS**

**Housatonic River Upper 1/2-Mile Reach - 1999 Pre-Removal Caged Mussel Study
Comparison of Mean Total and Mean Lipid-Normalized PCB Concentrations [1,2]**

Sample Period Location	Number of Samples [3]	Lipid (%)	Total PCB [4,5] (mg/kg)	Lipid-Normalized PCB [5] (mg/kg-lipid)	Estimated Flow [6,7] (cfs)
Control	2	0.2 (0.01)	ND (<0.051)	NA	NA
2 - Week (8/19/99)					
Newell St.	4	0.41 (0.05)	0.16 (0.01)	40 (2.5)	17
Lyman St.	4	0.44 (0.13)	0.9 (0.10)	213 (41)	
Dawes Ave.	4	0.48 (0.17)	1.11 (0.30)	237 (32)	
4 - Week (9/2/99)					
Newell St.	4	0.46 (0.04)	0.17 (0.01)	37 (4.9)	15
Lyman St.	4	0.38 (0.02)	1.01 (0.17)	267 (54)	
Dawes Ave.	4	0.34 (0.06)	1.27 (0.24)	376 (29)	
6 - Week (9/16/99)					
Newell St.	4	0.43 (0.09)	0.17 (0.06)	39 (7.6)	21
Lyman St.	4	0.36 (0.10)	1.04 (0.26)	289 (25)	
Dawes Ave.	4	0.44 (0.10)	1.61 (0.32)	363 (15)	
Total Estimated Average Daily Flow Rate [6]					18

Notes:

- [1] Arithmetic mean concentrations (and standard deviation) for whole-body minus the shell mussel samples.
 [2] Mussels were collected from a source population in the Connecticut R. used previously by the USEPA.
 [3] Each whole-body composite sample consisted of six mussels.
 [4] Total PCBs are based on the quantification of Aroclor concentrations.
 [5] Mean total PCB and lipid-normalized PCB concentrations reported on a wet-weight basis.
 [6] Flow data was obtained from the USGS Station 01197000 in Coltsville, MA at approximately midday. (Flow data is provisional and may be subject to revision).
 [7] Estimated flow refers to average daily flow between sampling incidents
 mg/kg = milligram per kilogram (ppm - parts per million)
 mg/kg - lipid = Total PCB divided by percent lipid times 100 (ppm - parts per million)
 ND = analyte was not detected (the detection limit is in parantheses)
 NA = not applicable

TABLE 2

**GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS**

**Housatonic River Upper 1/2-Mile Reach - 2000 During-Removal Caged Mussel Study
Comparison of Mean Total and Mean Lipid-Normalized PCB Concentrations [1,2]**

Sample Period Location	Number of Samples [3]	Lipid (%)	Total PCB [4,5] (mg/kg)	Lipid-Normalized PCB [5] (mg/kg-lipid)	Estimated Flow [6,7] (cfs)
Control	2	0.4 (0.10)	ND (<0.052)	NA	NA
2 - Week (8/23/00)					161
Newell St.	4	0.57 (0.05)	0.13 (0.03)	23 (5.2)	
Lyman St.	4	0.52 (0.14)	0.49 (0.06)	98 (15)	
Dawes Ave.	4	0.45 (0.06)	0.88 (0.19)	196 (36)	
4 - Week (9/5/00)					99
Newell St.	4	0.49 (0.12)	0.24 (0.04)	51 (10)	
Lyman St.	4	0.41 (0.13)	1.05 (0.31)	255 (12)	
Dawes Ave.	4	0.41 (0.06)	1.82 (0.27)	452 (79)	
6 - Week (9/18/00)					121
Newell St.	4	0.48 (0.04)	0.14 (0.02)	30 (2.6)	
Lyman St.	4	0.53 (0.04)	1.72 (0.19)	325 (14)	
Dawes Ave.	4	0.48 (0.10)	2.33 (0.45)	489 (48)	
8 - Week (10/2/00)					75
Newell St.	4	0.63 (0.03)	0.09 (0.06)	14 (10)	
Lyman St.	4	0.70 (0.07)	1.13 (0.20)	162 (22)	
Dawes Ave.	4	0.48 (0.04)	1.64 (0.10)	343 (53)	
10 - Week (10/16/00)					81
Newell St.	4	0.42 (0.06)	0.20 (0.03)	49 (3.6)	
Lyman St.	4	0.42 (0.03)	1.64 (0.21)	395 (63)	
Dawes Ave.	4	0.34 (0.09)	1.90 (0.15)	579 (113)	
12 - Week (10/30/00)					94
Newell St.	4	0.73 (0.22)	0.41 (0.32)	66 (70)	
Lyman St.	4	0.70 (0.19)	2.84 (0.42)	436 (163)	
Dawes Ave.	4	0.78 (0.05)	3.14 (0.31)	402 (23)	
Total Estimated Average Daily Flow Rate [6]					105

Notes:

- [1] Arithmetic mean concentrations (and standard deviation) for whole-body minus the shell mussel samples.
 [2] Mussels were collected from a source population in the Connecticut R. used previously by the USEPA.
 [3] Each whole-body composite sample consisted of six mussels.
 [4] Total PCBs are based on the quantification of Aroclor concentrations.
 [5] Mean total PCB and lipid-normalized PCB concentrations reported on a wet-weight basis.
 [6] Flow data was obtained from the USGS Station 01197000 in Coltsville, MA at approximately midday. (Flow data is provisional and may be subject to revision).
 [7] Estimated flow refers to average daily flow between sampling incidents
- mg/kg = milligram per kilogram (ppm - parts per million)
 mg/kg - lipid = Total PCB divided by percent lipid times 100 (ppm - parts per million)
 ND = analyte was not detected (the detection limit is in parantheses)
 NA = not applicable

TABLE 3

**GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS**

**Housatonic River Upper 1/2-Mile Reach - 2003 Post-Removal Caged Mussel Study
Comparison of Mean Total and Mean Lipid-Normalized PCB Concentrations [1,2]**

Sample Period Location	Number of Samples [3]	Lipid (%)	Total PCB [4,5] (mg/kg)	Lipid-Normalized PCB [5] (mg/kg-lipid)	Estimated Flow [6,7] (cfs)
Control [a]	2	0.47 (0.04)	ND (<0.055)	NA	NA
2 - Week (8/22/03)					303
Newell St.	4	0.43 (0.09)	0.08 (0.02)	18 (1.7)	
Lyman St.	4	0.42 (0.07)	0.20 (0.02)	49 (7.3)	
Dawes Ave.	4	0.45 (0.11)	0.41 (0.11)	90 (8.8)	
5 - Week (9/12/03)					65
Newell St. [b]	4	0.39 (0.08)	0.13 (0.02)	34 (9.0)	
Lyman St.	4	0.31 (0.07)	0.21 (0.05)	67 (5.7)	
Dawes Ave.	4	0.31 (0.02)	0.44 (0.07)	142 (19)	
6 - Week (9/19/03)					57
Newell St. [c]	2	0.32 (0.11)	0.16 (0.03)	53 (9.4)	
Lyman St.	0	--	--	--	
Dawes Ave.	4	0.29 (0.03)	0.53 (0.03)	182 (7.8)	
9 - Week (10/11/03)					163
Newell St.	4	0.41 (0.17)	0.14 (0.02)	40 (22)	
Lyman St.	4	0.54 (0.07)	0.37 (0.06)	68 (10)	
Dawes Ave. [d]	4	0.49 (0.17)	0.68 (0.18)	143 (21)	
11 - Week (10/24/03)					104
Newell St.	4	0.64 (0.08)	0.06 (0.01)	10 (1.1)	
Lyman St.	4	0.61 (0.08)	0.34 (0.07)	56 (11)	
Dawes Ave.	2	0.66 (0.12)	0.50 (0.13)	75 (6.1)	
13 - Week (11/10/03)					269
Newell St.	4	0.45 (0.06)	0.11 (0.04)	24 (7.0)	
Lyman St.	4	0.38 (0.04)	0.25 (0.04)	65 (13)	
Dawes Ave.	2	0.34 (0.01)	0.43 (0.01)	126 (3.4)	
Total Estimated Average Daily Flow Rate [6]					170

Notes:

- [1] Arithmetic mean concentrations (and standard deviation) for whole-body minus the shell mussel samples.
 [2] Mussels were collected from a source population in the Connecticut R. used previously by the USEPA.
 [3] Each whole-body composite sample consisted of four mussels, except where noted.
 [4] Total PCBs are based on the quantification of Aroclor concentrations.
 [5] Mean total PCB and lipid-normalized PCB concentrations reported on a wet-weight basis.
 [6] Flow data was obtained from the USGS Station 01197000 in Coltsville, MA at approximately midday. (Flow data is provisional and may be subject to revision).
 [7] Estimated flow refers to average daily flow between sampling incidents
 [a] Both whole-body composite samples consisted of six mussels each.
 [b] One whole-body composite sample consisted of three mussels.
 [c] Both whole-body composite samples consisted of three mussels each.
 [d] One whole-body composite sample consisted of three mussels. Another whole-body composite sample consisted of two mussels.

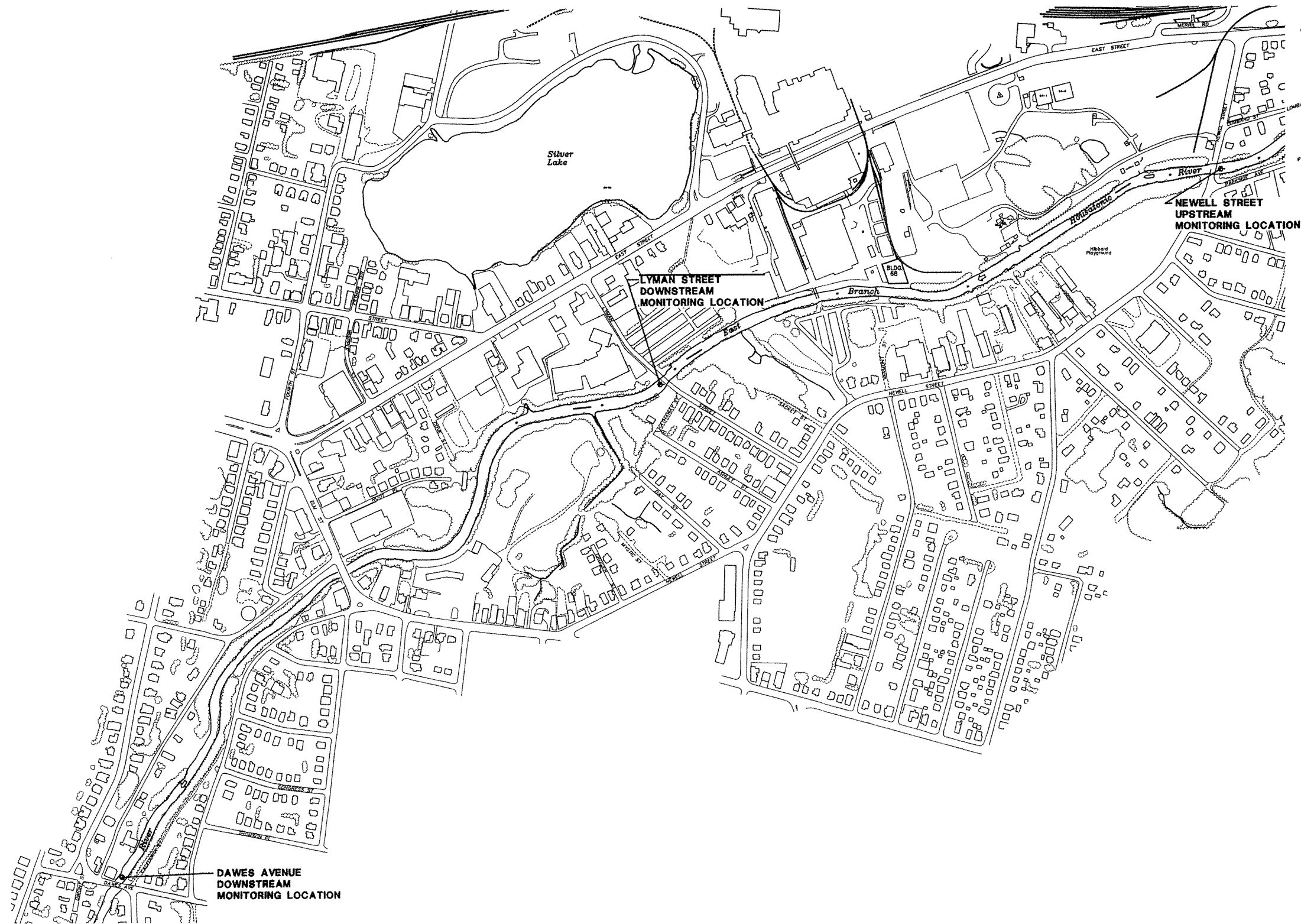
mg/kg = milligram per kilogram (ppm - parts per million)

mg/kg - lipid = Total PCB divided by percent lipid times 100 (ppm - parts per million)

ND = analyte was not detected (the detection limit is in parantheses)

NA = not applicable

-- = samples not collected due to high water (cages unreachable)

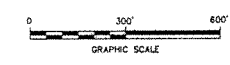


LEGEND:

- BIOTA MONITORING LOCATION
- EDGE OF WATER
- PAVED ROADWAY
- UNPAVED ROADWAY OR TRAIL
- RAILROAD
- VEGETATION

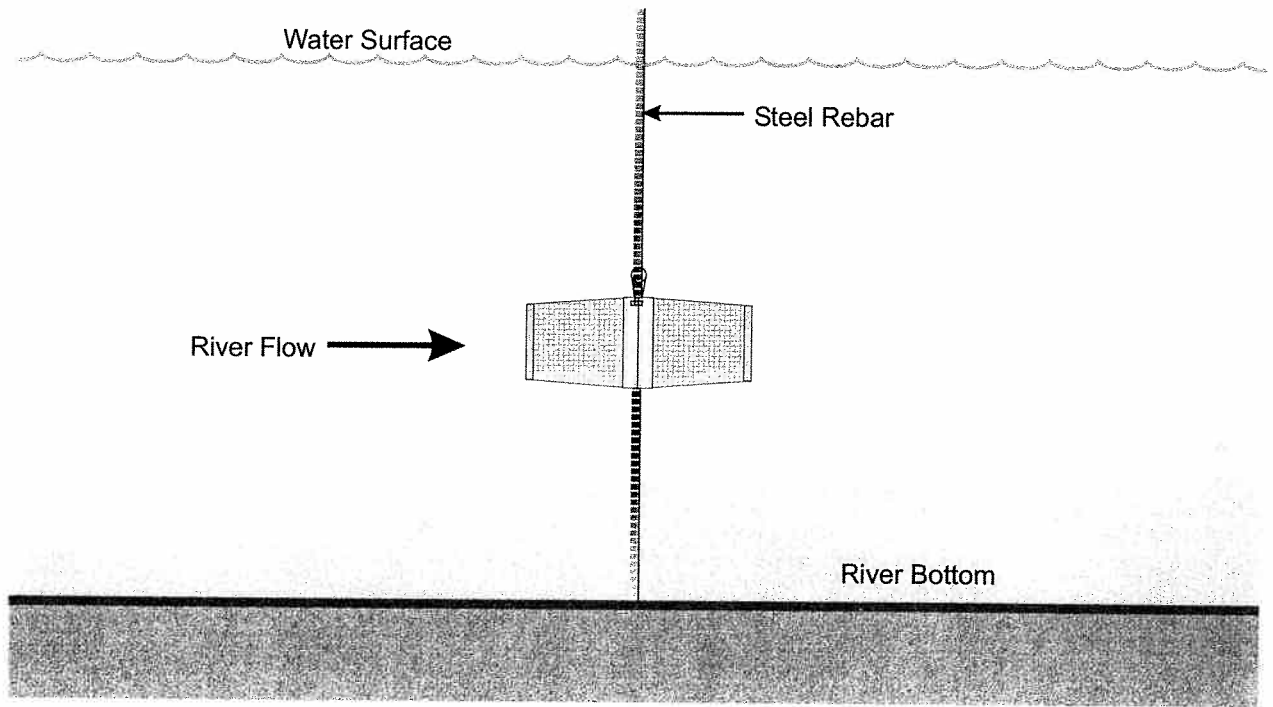
NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS, AND FROM JANUARY 1997 AND OCTOBER 1998 SURVEYS PERFORMED BY BBL.
2. MONITORING LOCATIONS ARE APPROXIMATE. MONITORING TO BE PERFORMED BEFORE, DURING AND FOLLOWING REMOVAL AND REPLACEMENT ACTIVITIES AS SPECIFIED IN THE WORK PLAN.
3. MAPPING IS BEST AVAILABLE INFORMATION AS OF 12/10/98 BASED ON MAPPING PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY; DATA PROVIDED BY GENERAL ELECTRIC; AND BLASLAND AND BOUCK, P.C. CONSTRUCTION PLANS, RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
4. COORDINATE GRID BASED ON 1927 STATE PLAN COORDINATES.

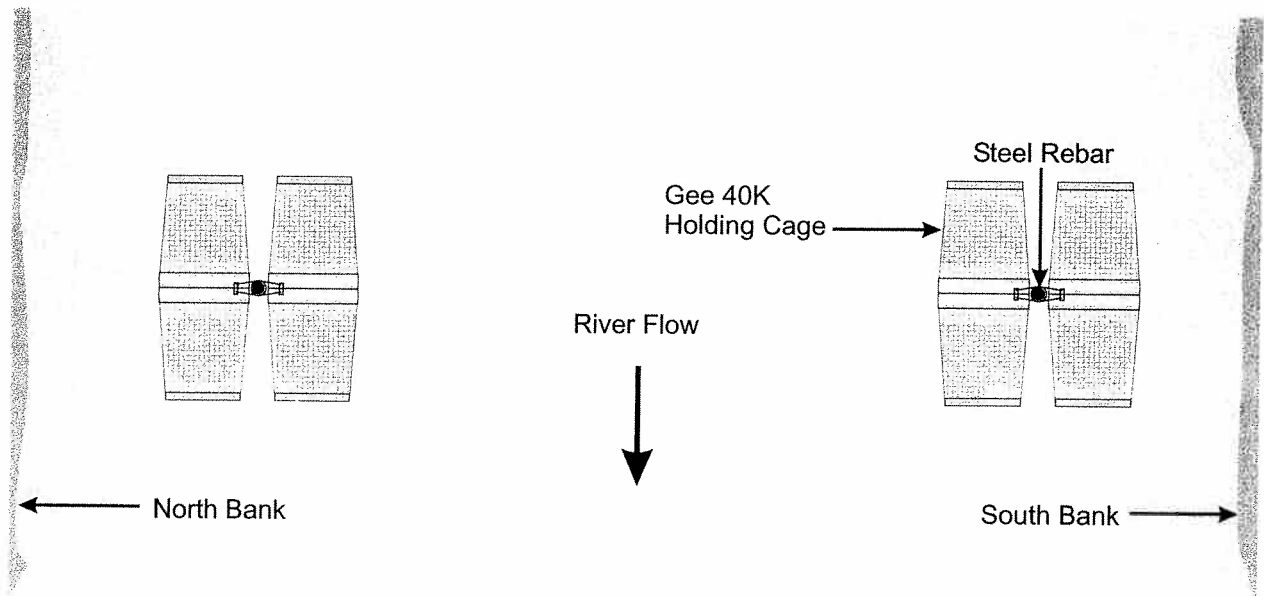


<p>GENERAL ELECTRIC COMPANY PITTSFIELD, MASSACHUSETTS UPPER 1/2-MILE REACH OF HOUSATONIC RIVER</p>	
<p>BIOTA MONITORING LOCATIONS</p>	
	<p>FIGURE 1</p>

X: 20197X1A.DWG, 20197X1C.DWG
 L: ON = *, OFF = *REF*, X1A:NAME-ST, SHD-131,
 X1C:NAME-ST
 P: SYR-DL DL2B1
 B/28/04 SYR-85-RLP DMJ NES
 C/20197020/20197001.DWG



Cross-Section



NOT-TO-SCALE

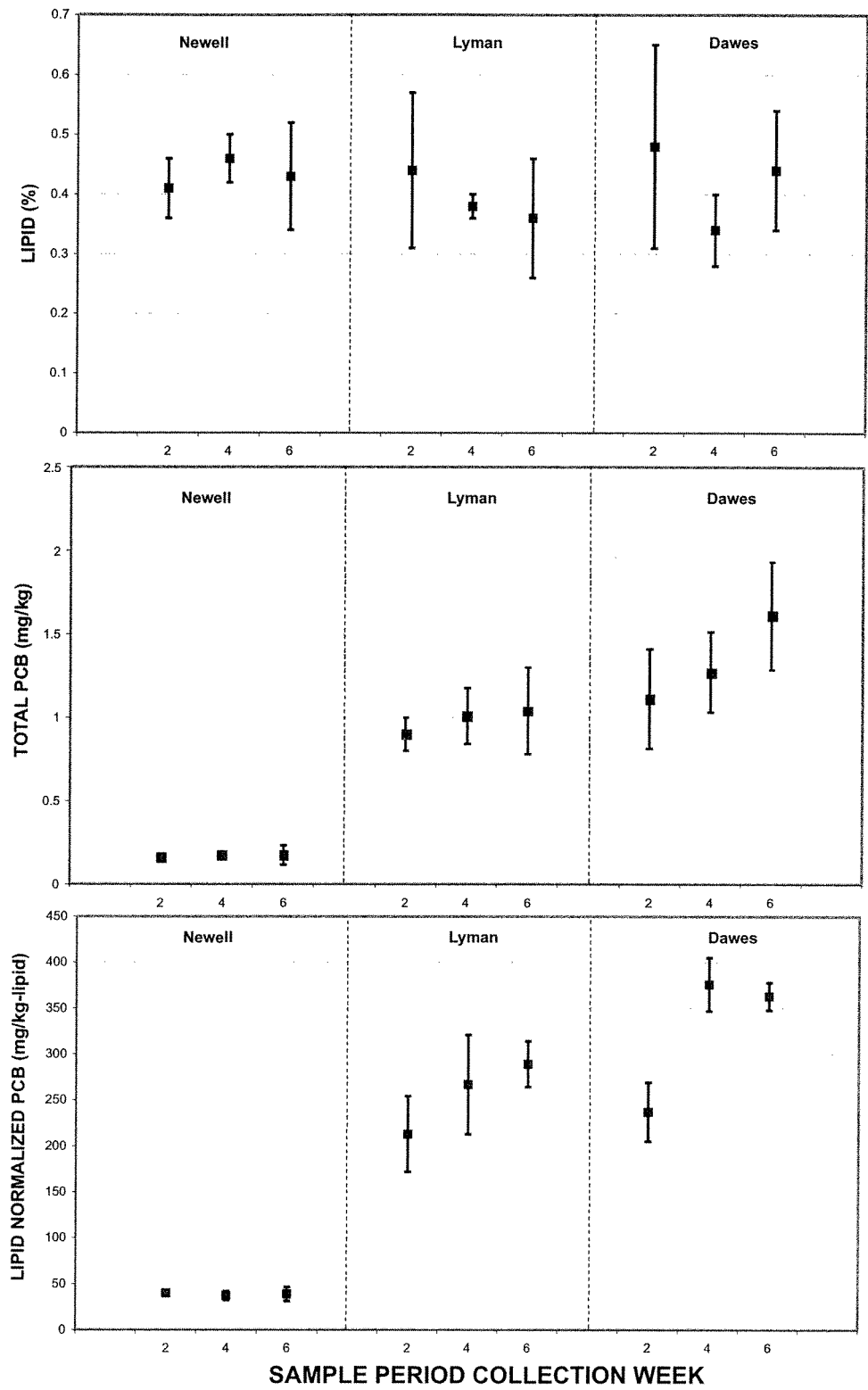
Plan View

GENERAL ELECTRIC COMPANY
 PITTSFIELD, MASSACHUSETTS
 UPPER 1/2-MILE REACH OF HOUSATONIC RIVER


MUSSEL CAGE ARRAY

BBL[®]
 BLASLAND, BOUCK & LEE, INC.
 engineers, scientists, economists

FIGURE
2



KEY:

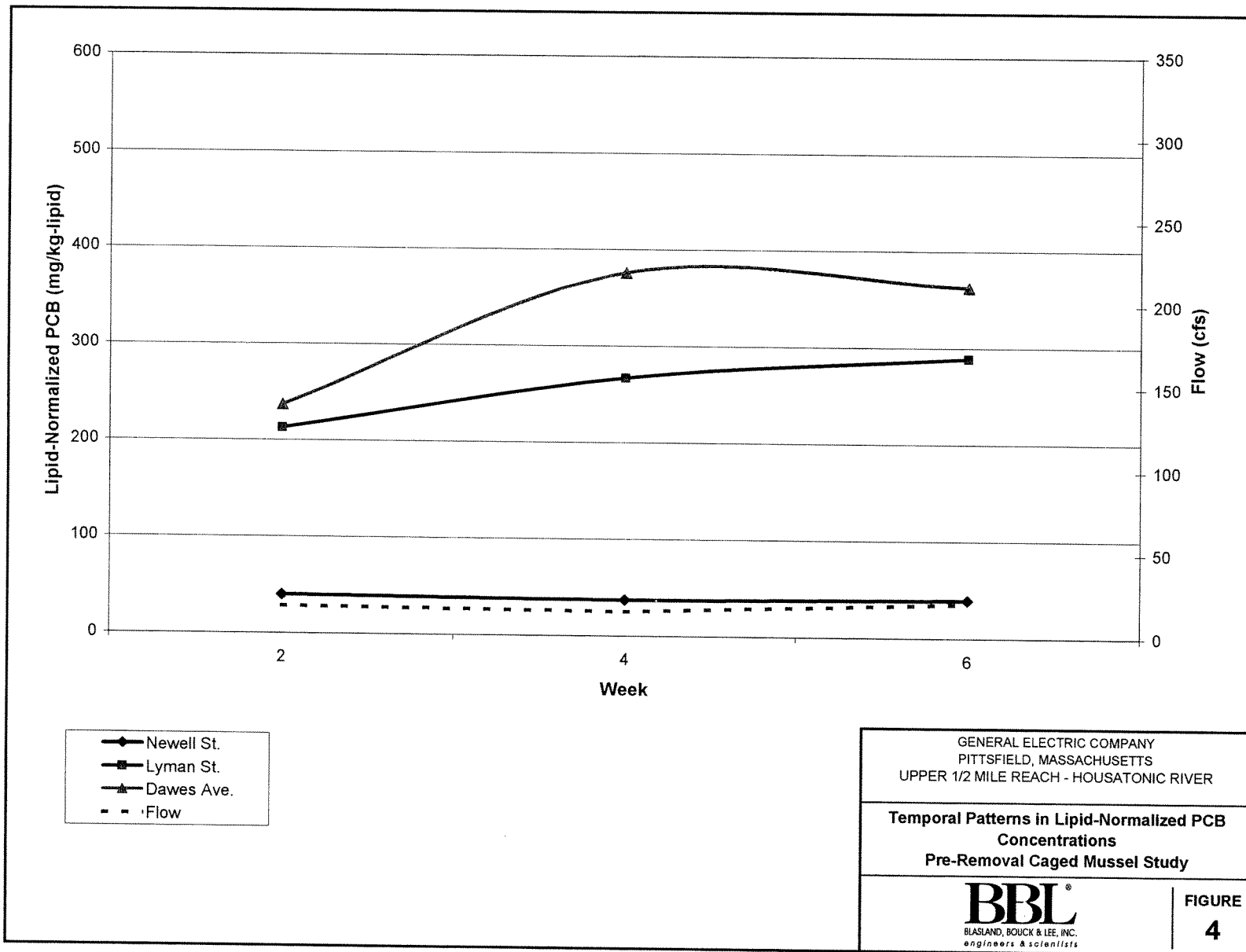
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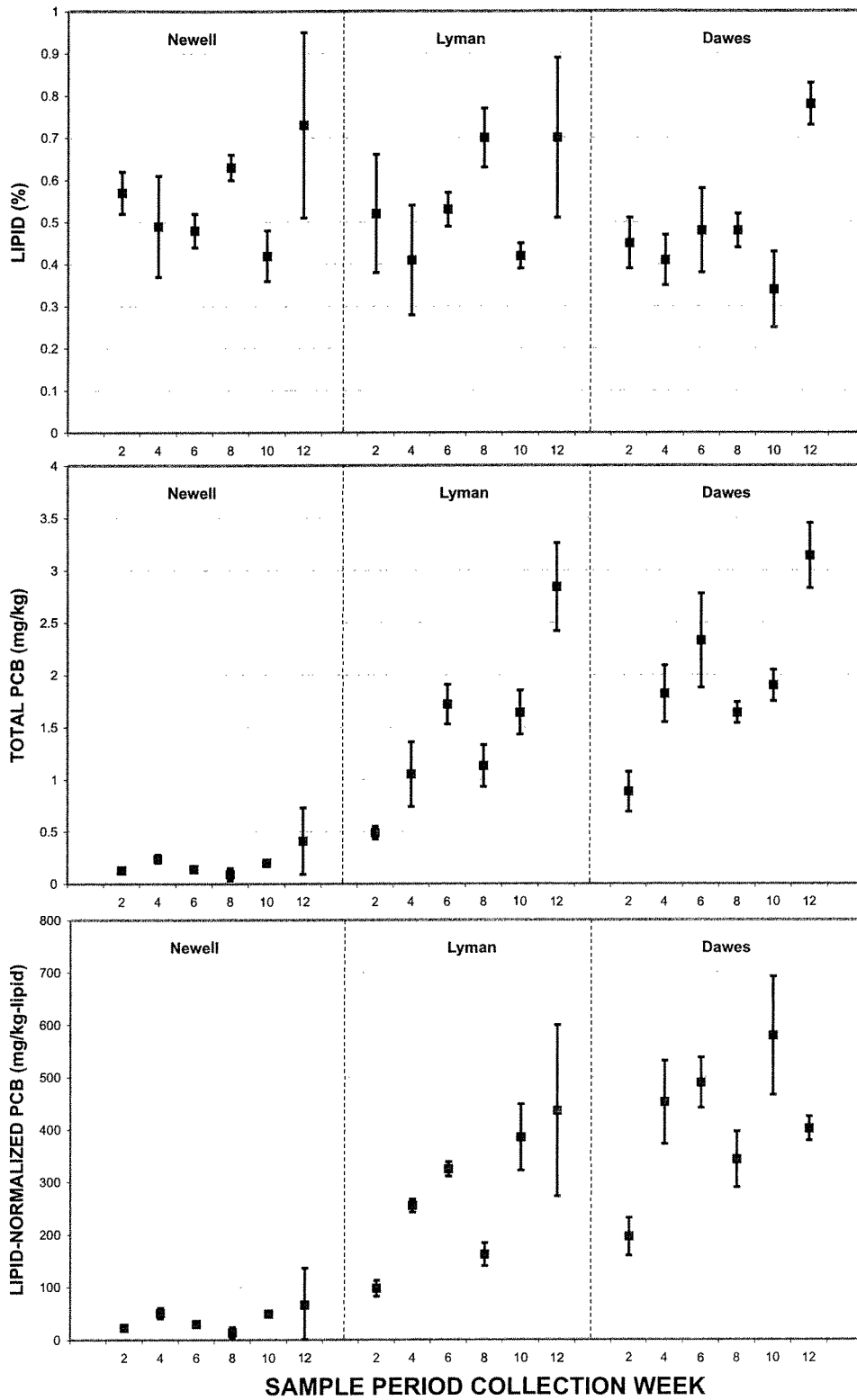
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

**1999 PRE-REMOVAL CAGED
MUSSEL PCB AND LIPID CONCENTRATIONS**


BBL[®]
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
3





KEY:

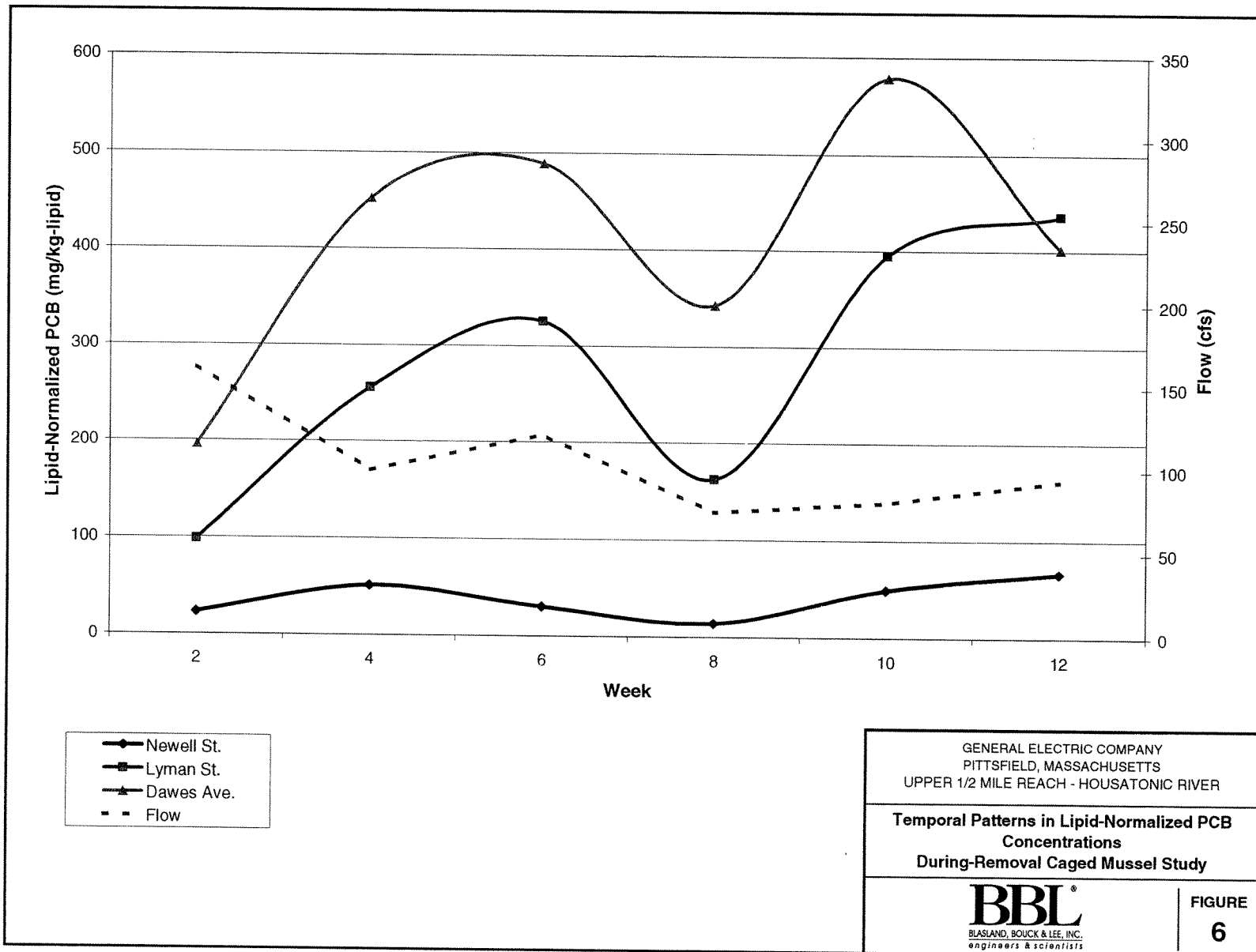
 = Average value with standard deviation

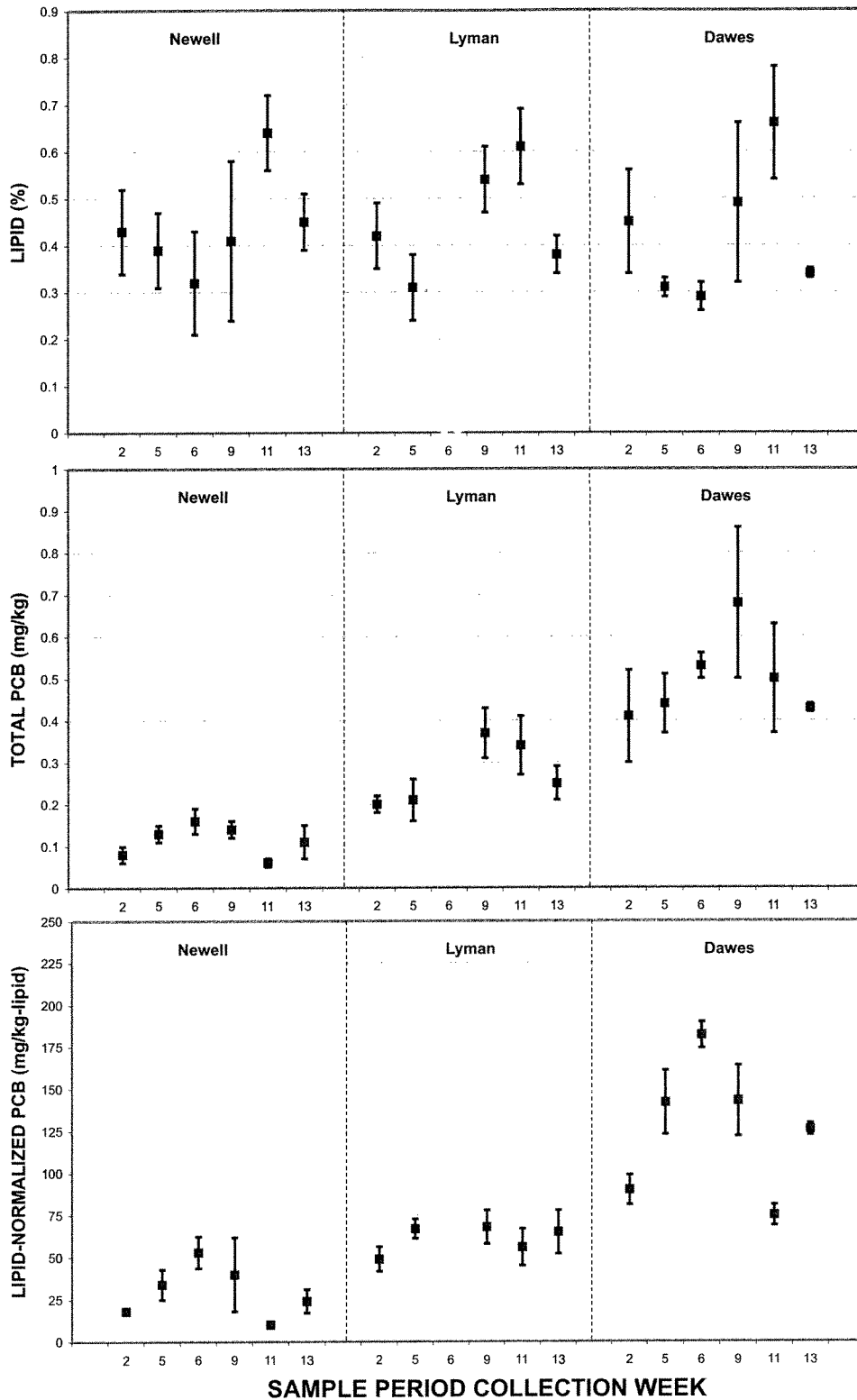
GENERAL ELECTRIC COMPANY
 PITTSFIELD, MASSACHUSETTS
 UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

2000 DURING-REMOVAL CAGED
 MUSSEL PCB AND LIPID CONCENTRATIONS


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 engineers, scientists, economists

FIGURE
5





KEY:

 = Average value with standard deviation

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UPPER 1/2-MILE REACH OF HOUSATONIC RIVER

2000 POST-REMOVAL CAGED
MUSSEL PCB AND LIPID CONCENTRATIONS

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FIGURE
7

