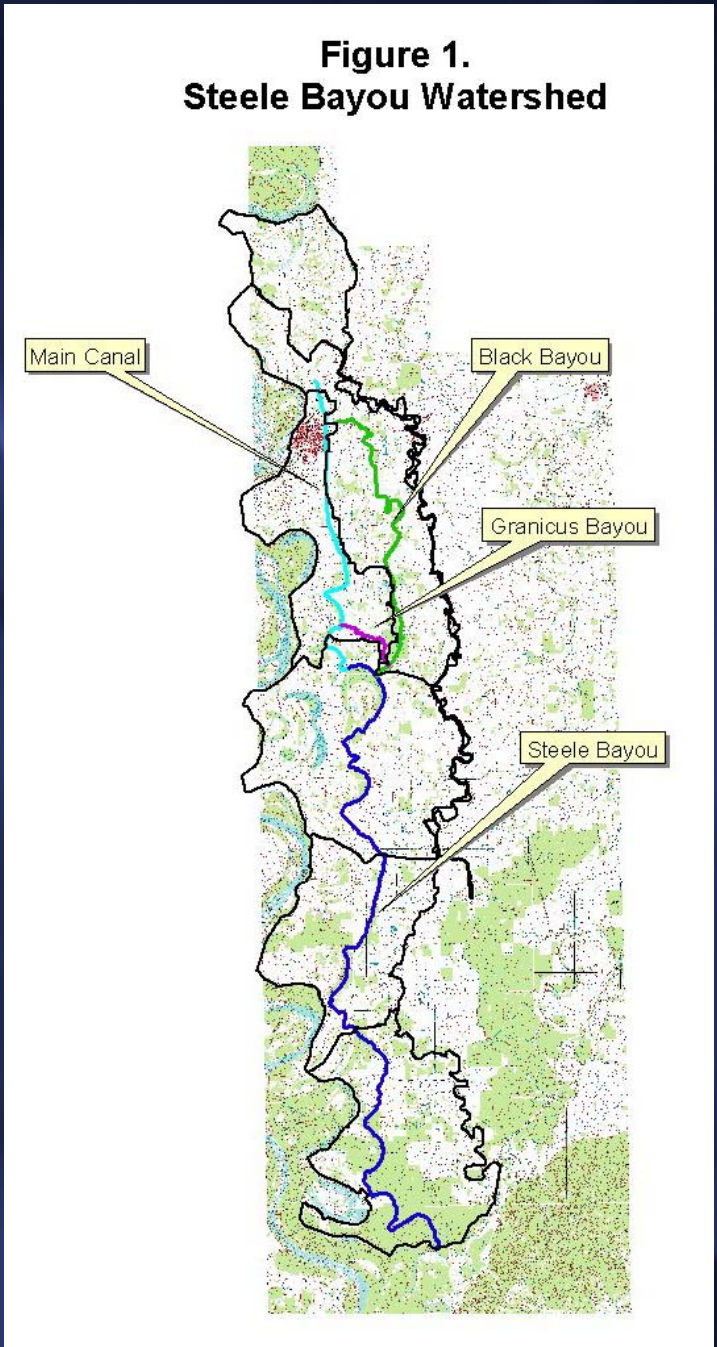
Workshop on Nitrogen Process in Large Rivers
August 23, 2005

A Comparison of Pre-and Post-Project Nutrient Data in the Steele Bayou Basin

David L. Wallace, P.E.



Steele Bayou Project Background

WATER QUALITY STUDIES

- Upper Steele Bayou Project 1990-1991
- Steele Bayou Post Project 2004-2005

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Upper Steele Bayou Project

- Commissioned pre-project Upper Steele Bayou water quality study (Ashby et al. 1991)
- USACE Project Completed in 2003
  - ✓ Channel modification
  - ✓ Removal of unconsolidated sediments
  - ✓ Construction of 72 grade / water control structures in tributaries entering Black Bayou and Main Canal
- Additional sediment control structures installed by Ducks Unlimited, Delta Wildlife and private landowners

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Steele Bayou Sediment Control Structures

Completed Structures

Proposed Structures

Typical Flash Board Riser Structure

Typical Drop Pipe Structure

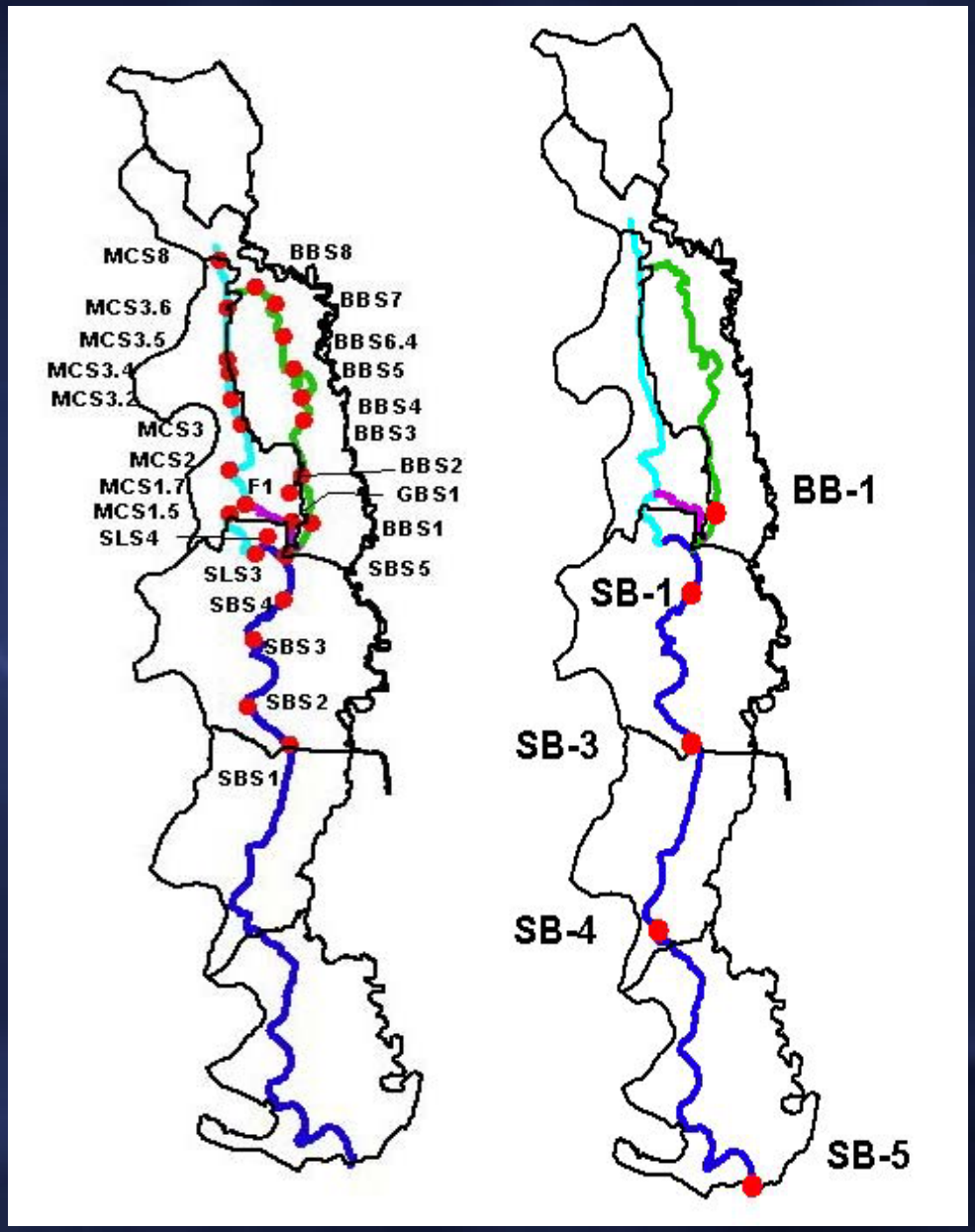
Lower Steele Bayou

Head Cuts

Vegetated Sediment Deposits

Water Quality Sampling Sites

Pre-Project



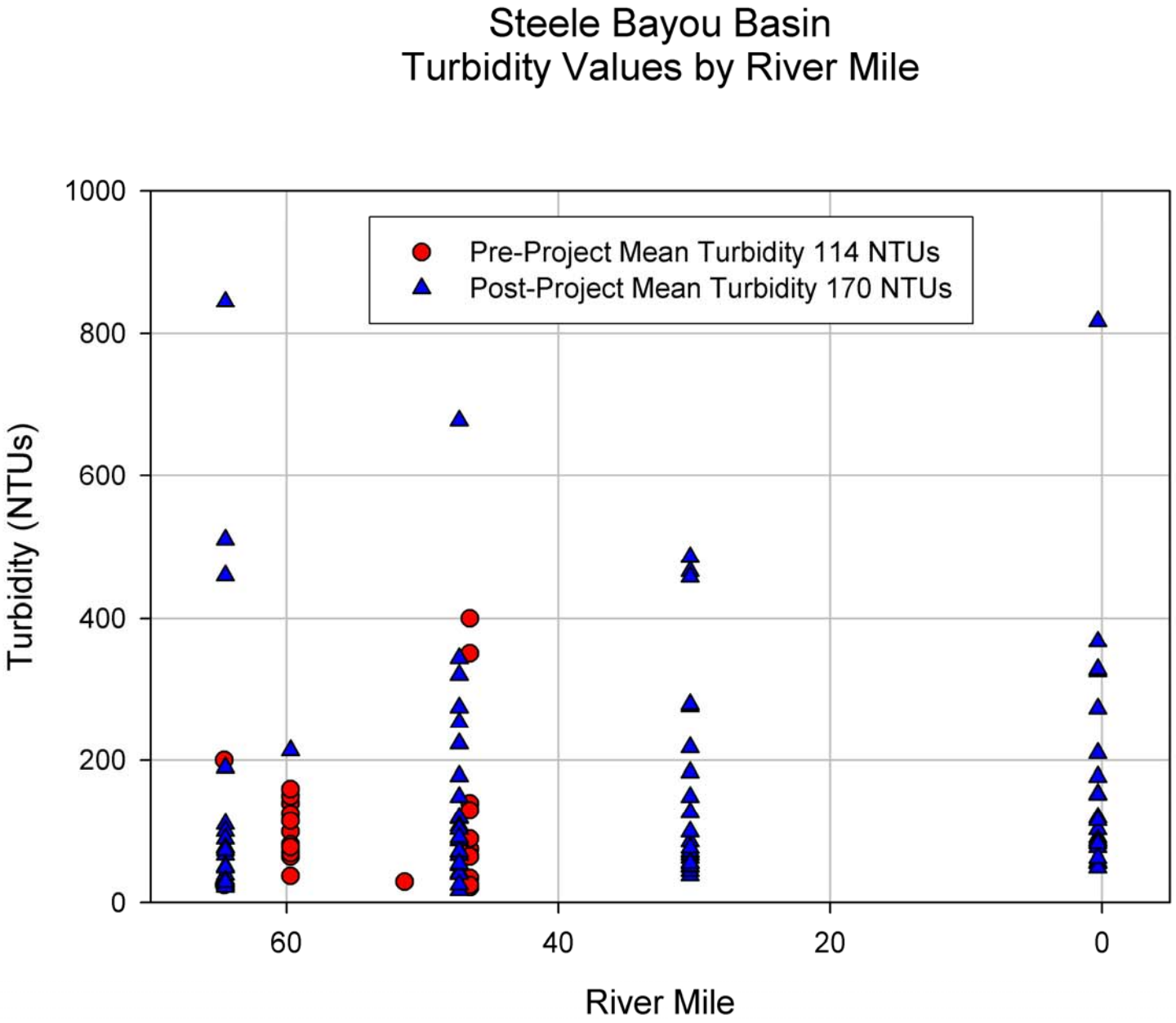
Post-Project

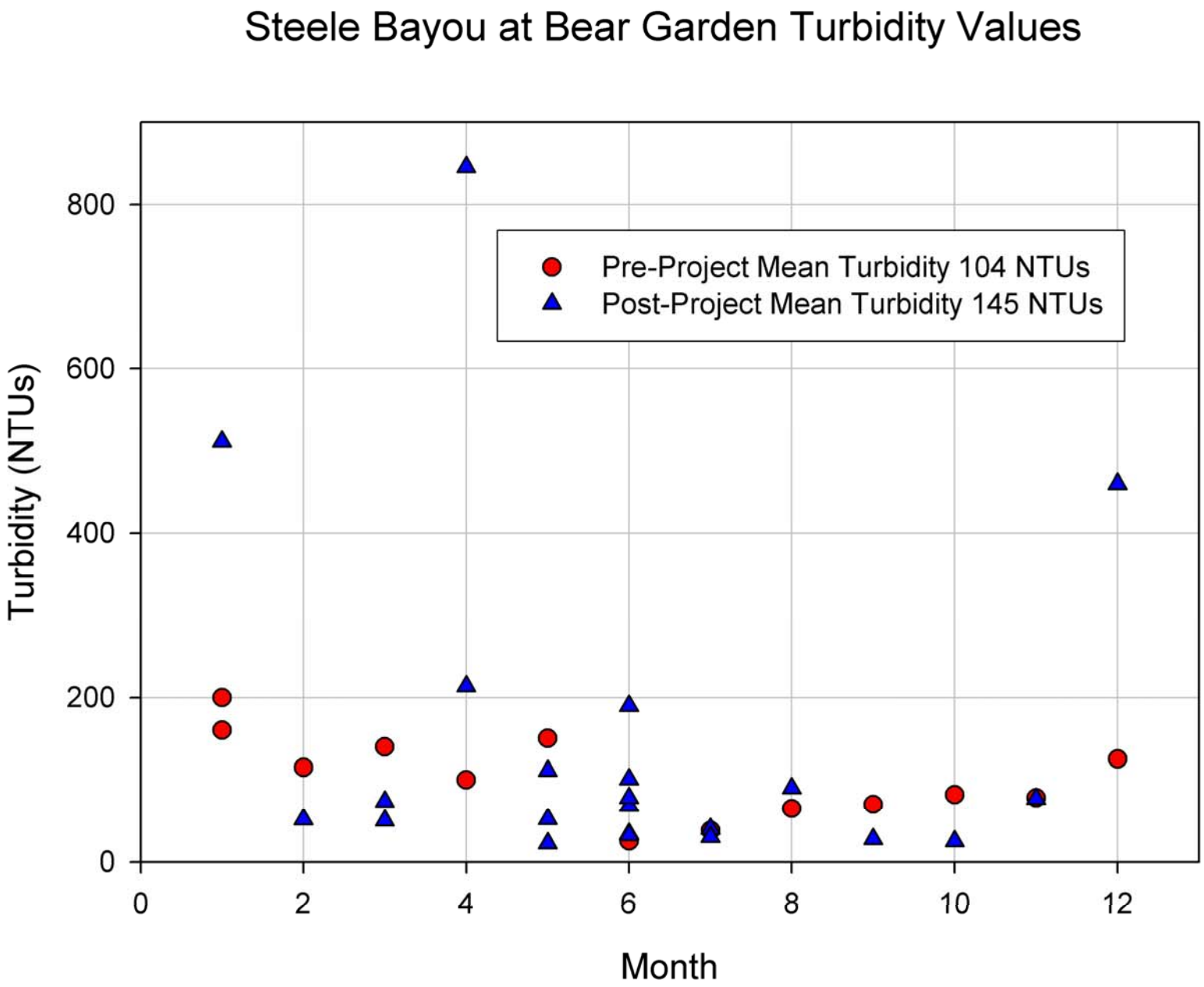
Comparison of Pre-and Post-Project Water Quality Data

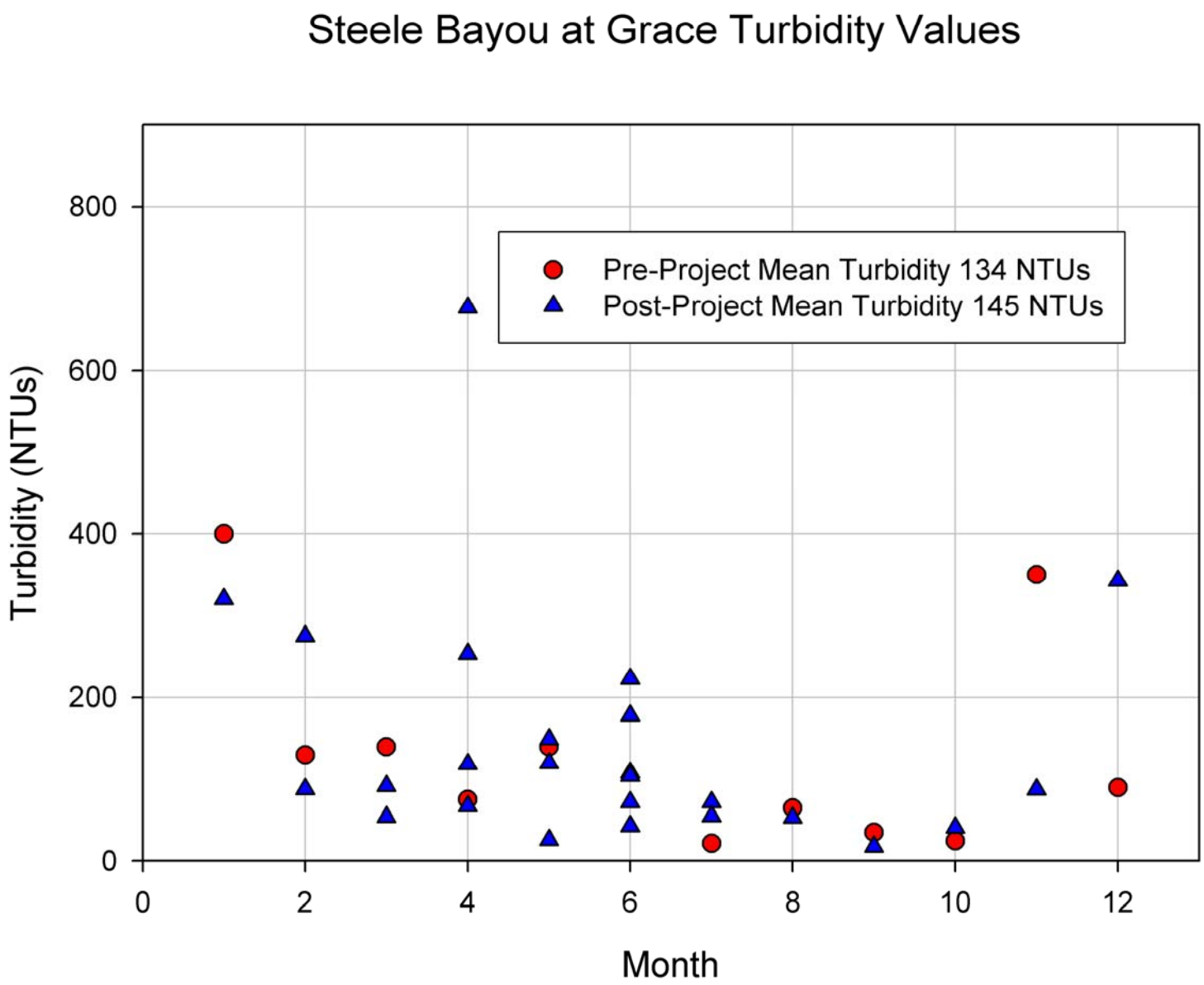
Parameter	Station	1990-1991			2004-2005			
		SB	Bear Garden	Grace	SB Mean	Bear Garden	Grace	Onward
Turbidity	Min.	22	25	22	18	23	18	39
	Mean	114	104	134	170	145	145	220
	Max.	400	200	400	1320	845	677	1320
TS	Min.	276	321	276	172	172	188	189
	Mean	462	409	537	327	305	303	373
	Max.	1444	563	1444	1228	804	738	1228
TSS	Min.	21	32	21	5	19	24	5
	Mean	197	133	282	111	95	94	145
	Max.	1300	235	1300	928	560	492	928
TDS	Min.	122	150	122	134	134	136	146
	Mean	265	276	256	221	222	210	230
	Max.	531	531	505	374	322	374	360

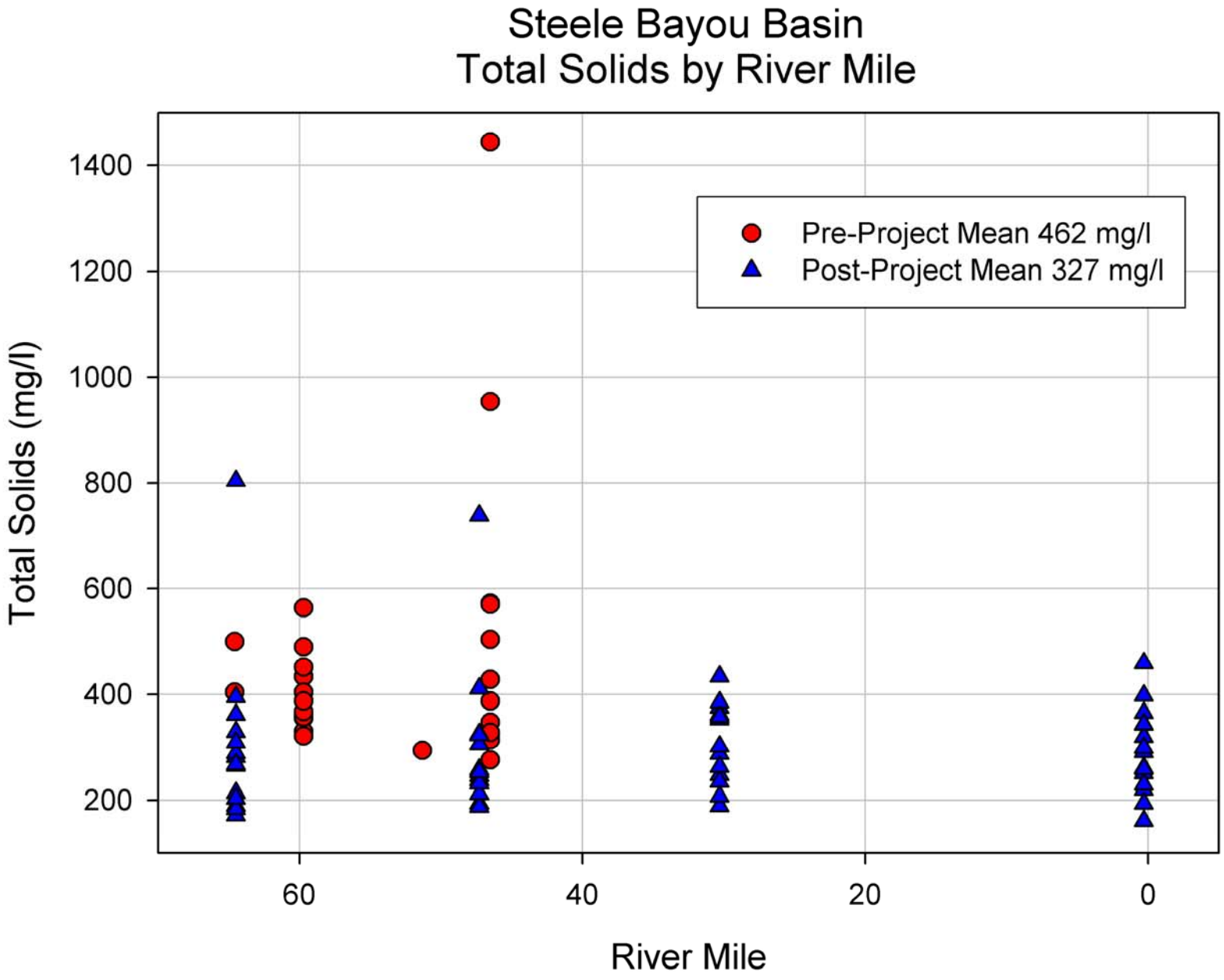
Comparison of Pre-and Post-Project Water Quality Data

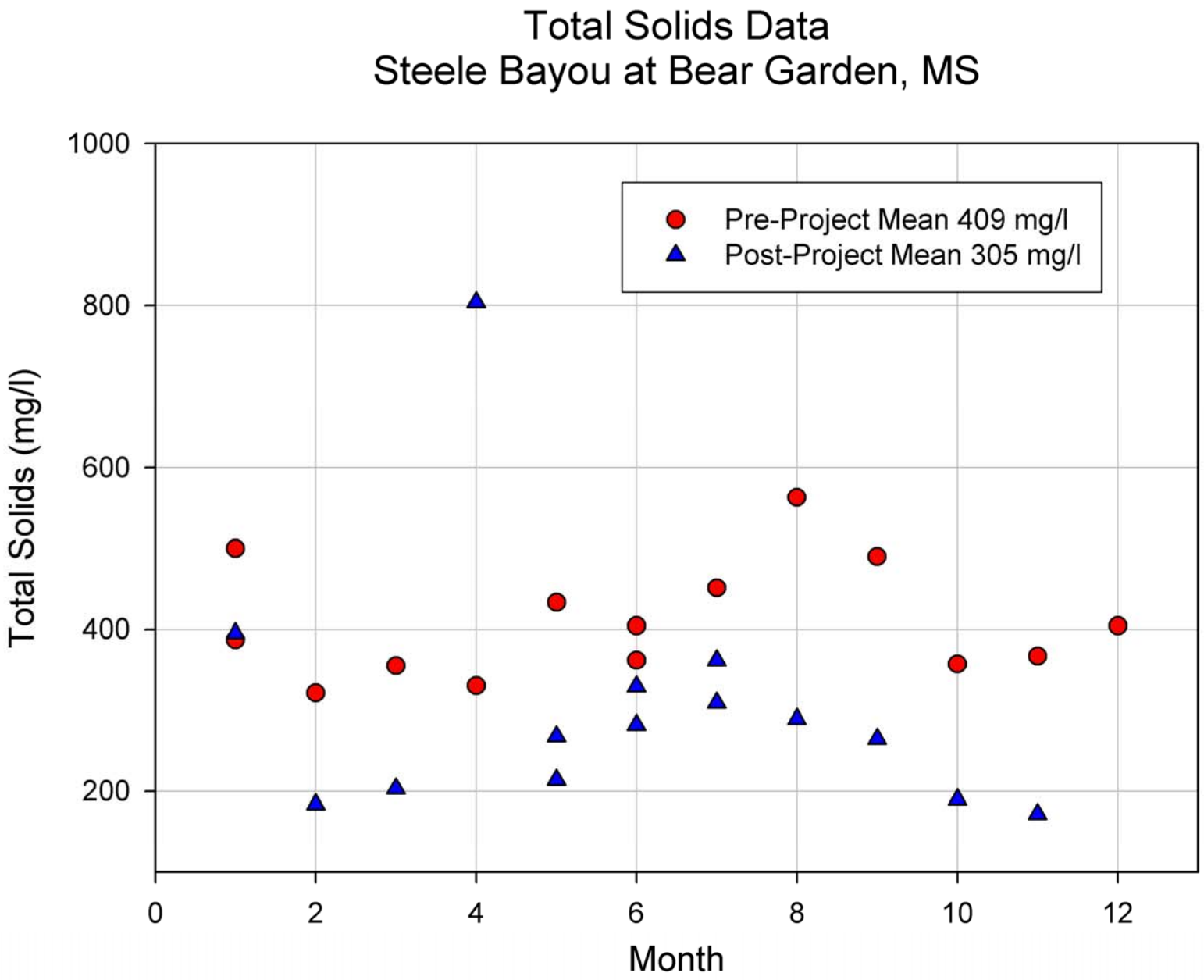
Parameter	Station	1990-1991			2004-2005			
		SB	Bear Garden	Grace	SB Mean	Bear Garden	Grace	Onward
NO2/NO3	Min.	0.02	0.02	0.02	0.10	0.10	0.10	0.10
	Mean	0.52	0.51	0.57	0.31	0.33	0.29	0.32
	Max.	2.70	1.30	2.70	1.26	1.18	0.81	1.26
TKN	Min.	1.05	1.20	1.05	0.10	0.10	0.10	0.10
	Mean	1.76	1.61	1.67	1.36	1.41	1.39	1.28
	Max.	4.59	2.59	2.80	3.29	2.86	2.80	3.29
NH3	Min.	0.01	0.01	0.01	0.10	0.10	0.10	0.10
	Mean	0.19	0.24	0.13	0.22	0.17	0.24	0.26
	Max.	0.59	0.59	0.39	1.05	0.35	0.54	1.05
TP	Min.	0.14	0.20	0.14	0.10	0.10	0.10	0.10
	Mean	0.36	0.34	0.38	0.37	0.36	0.35	0.40
	Max.	0.97	0.48	0.97	1.12	0.77	0.81	1.12
TOC	Min.	2.7	3.4	2.7	1.1	5.7	1.1	4.6
	Mean	5.7	5.7	5.3	7.7	8.4	7.3	7.5
	Max.	8.5	6.9	7.7	11.7	11.7	11.2	10.9

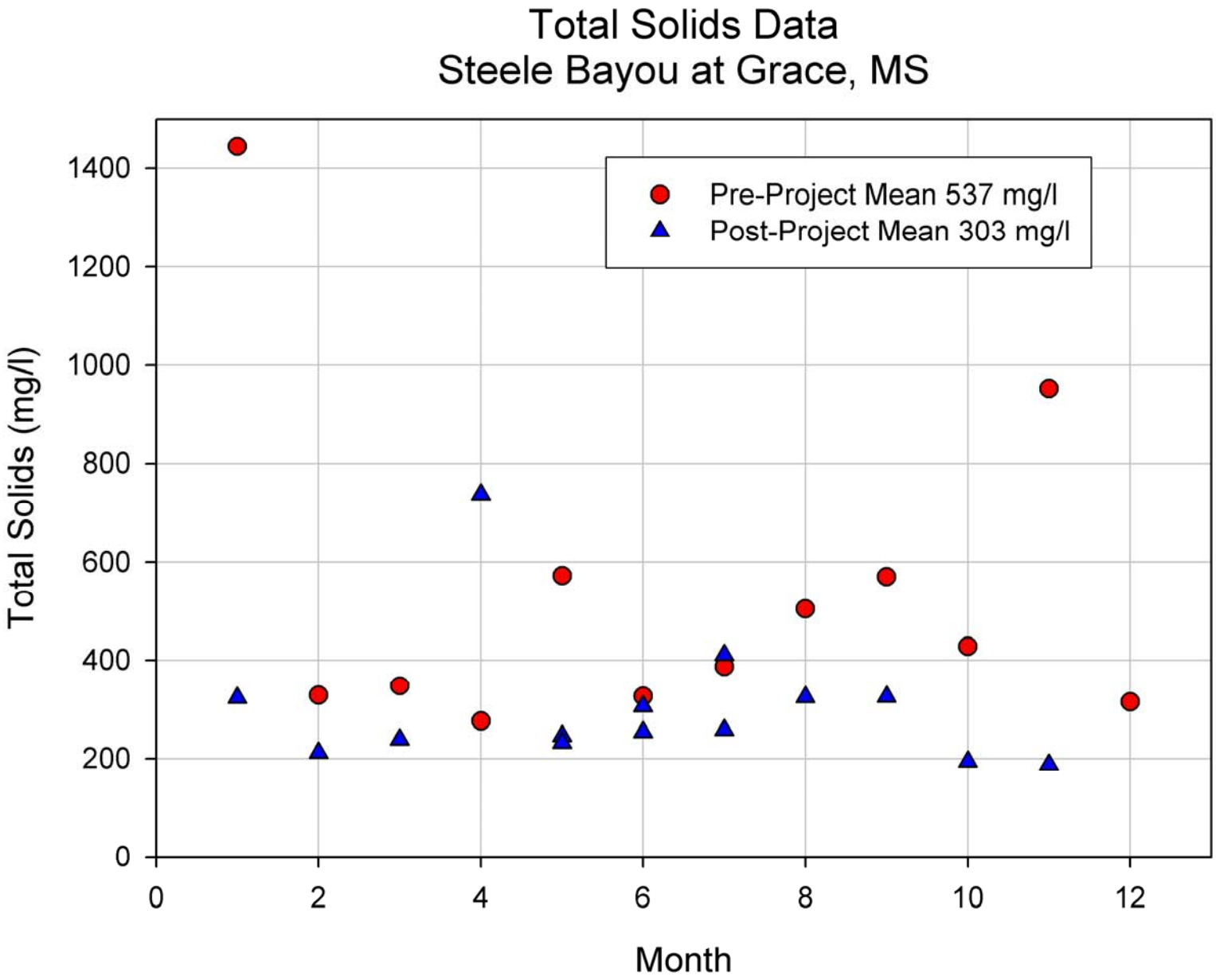

Steele Bayou Basin
Turbidity Values by River Mile
Pre-Project Mean Turbidity 114 NTUs
Post-Project Mean Turbidity 170 NTUs
Turbidity (NTUs)
1000
800
600
400
200
0
60
40
20
0
River Mile

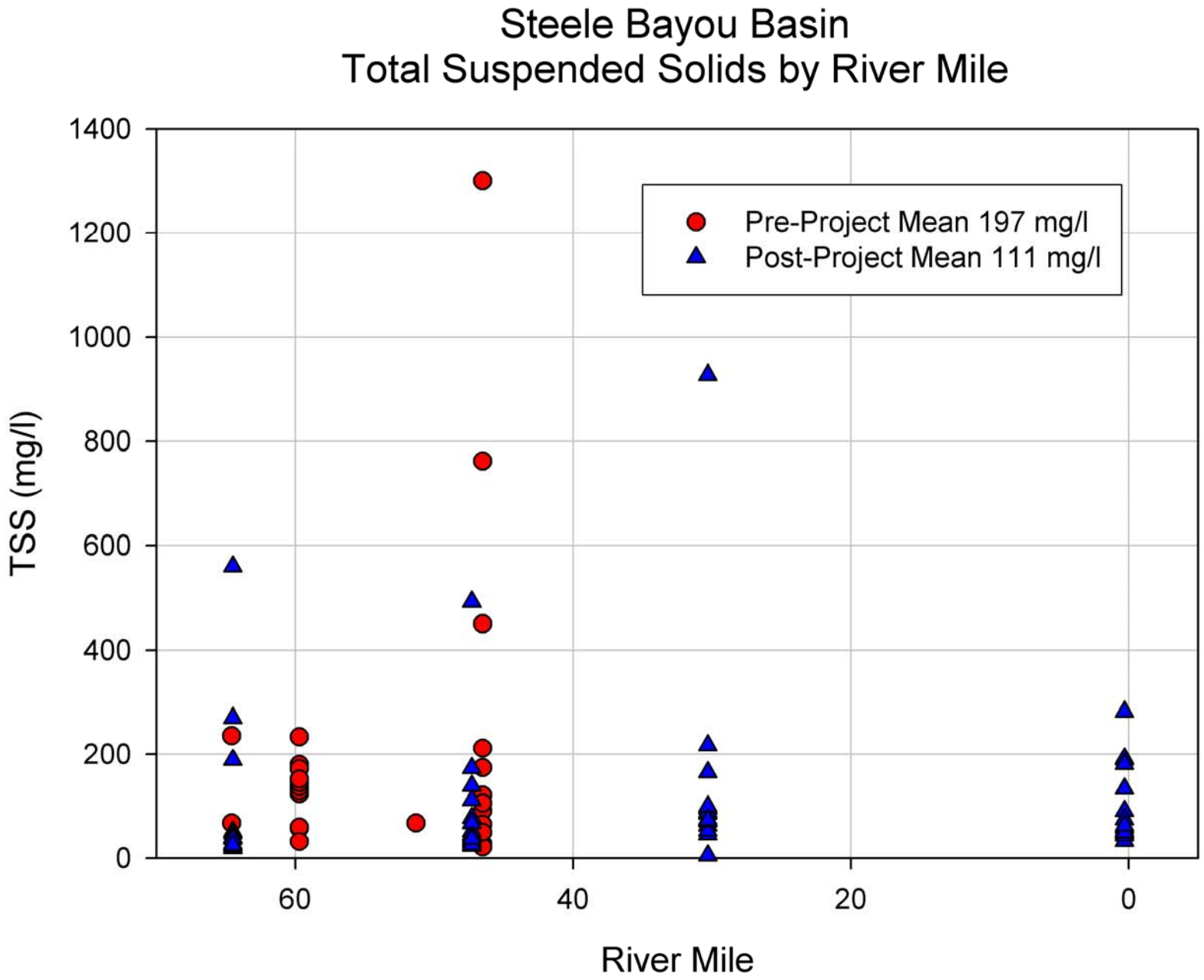

Steele Bayou at Bear Garden Turbidity Values
Pre-Project Mean Turbidity 104 NTUs
Post-Project Mean Turbidity 145 NTUs
Turbidity (NTUs)
0
200
400
600
800
0
2
4
6
8
10
12
Month

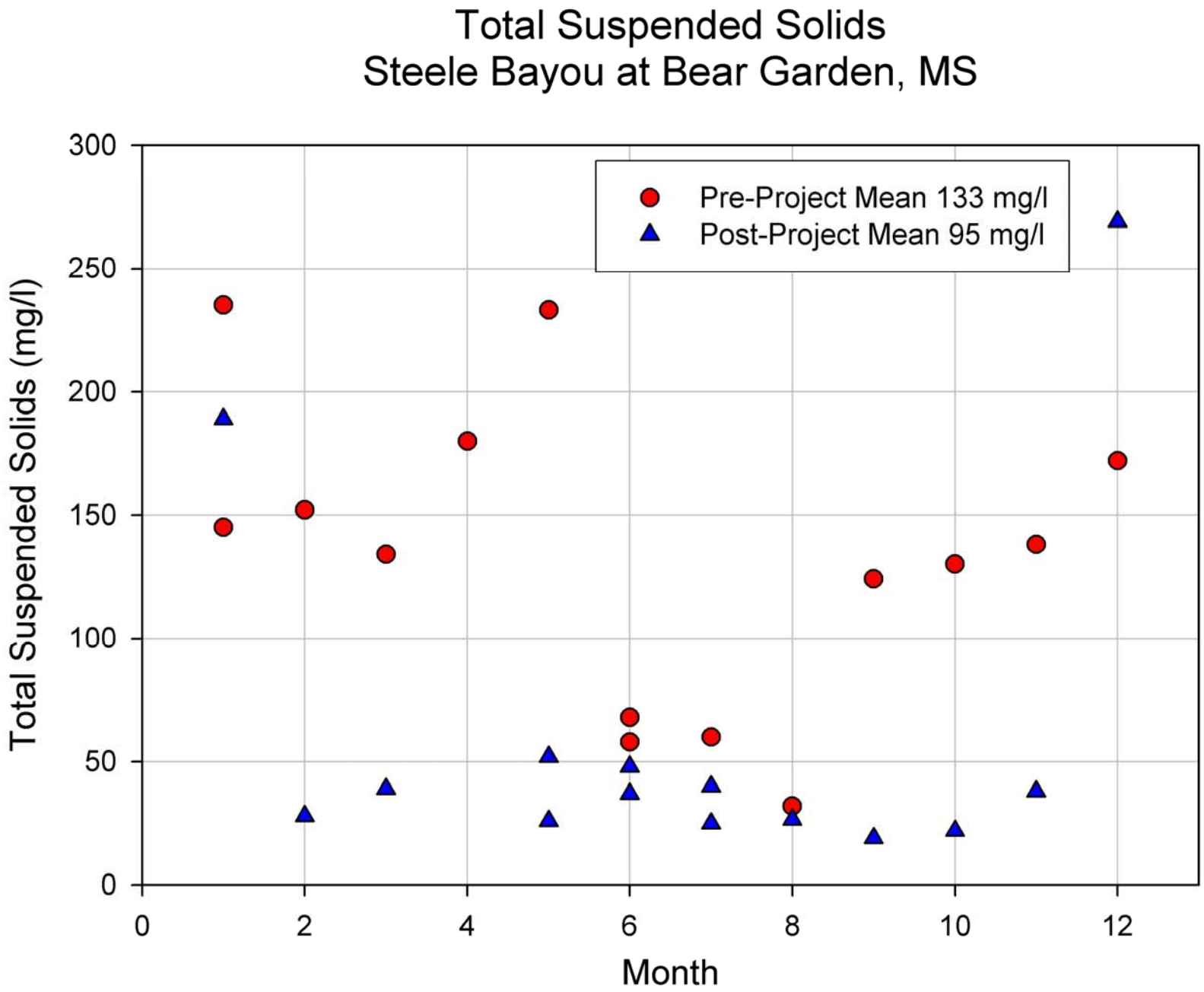

Steele Bayou at Grace Turbidity Values
Pre-Project Mean Turbidity 134 NTUs
Post-Project Mean Turbidity 145 NTUs
Turbidity (NTUs)
0
200
400
600
800
0
2
4
6
8
10
12
Month

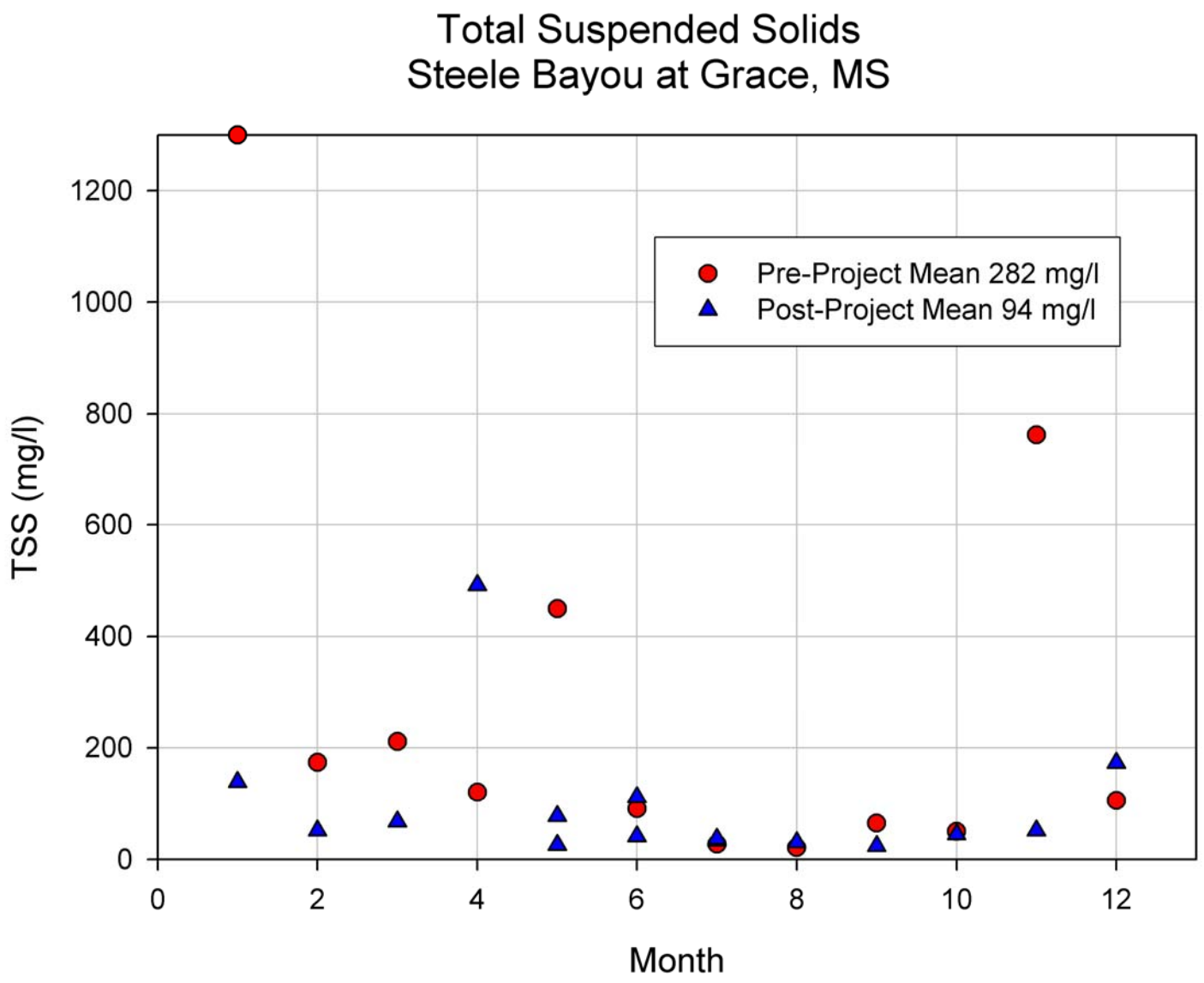

Steele Bayou Basin
Total Solids by River Mile
Pre-Project Mean 462 mg/l
Post-Project Mean 327 mg/l
Total Solids (mg/l)
1400
1200
1000
800
600
400
200
60
40
20
0
River Mile

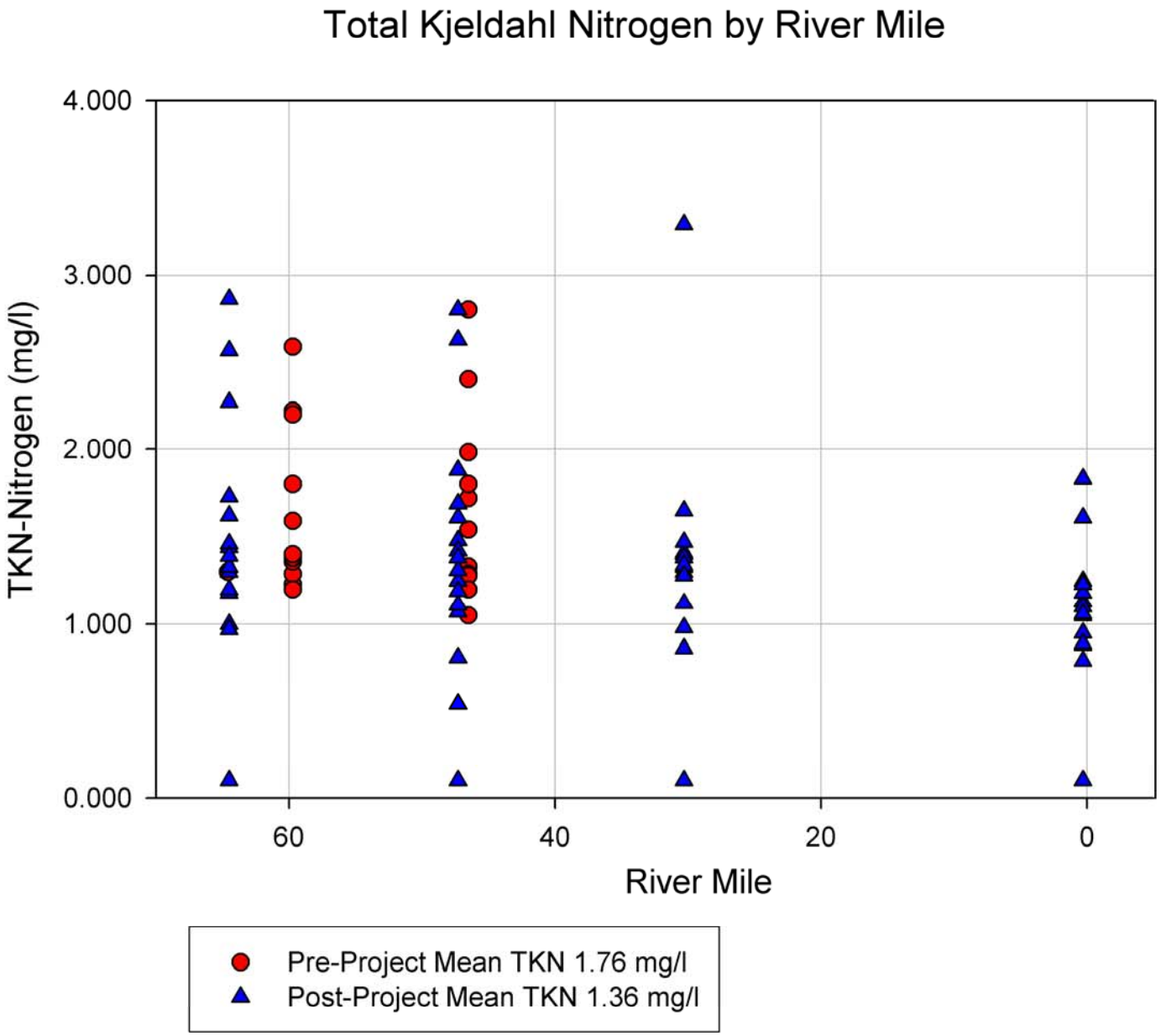

Total Solids Data
Steele Bayou at Bear Garden, MS
Pre-Project Mean 409 mg/l
Post-Project Mean 305 mg/l
Total Solids (mg/l)
1000
800
600
400
200
0
2
4
6
8
10
12
Month

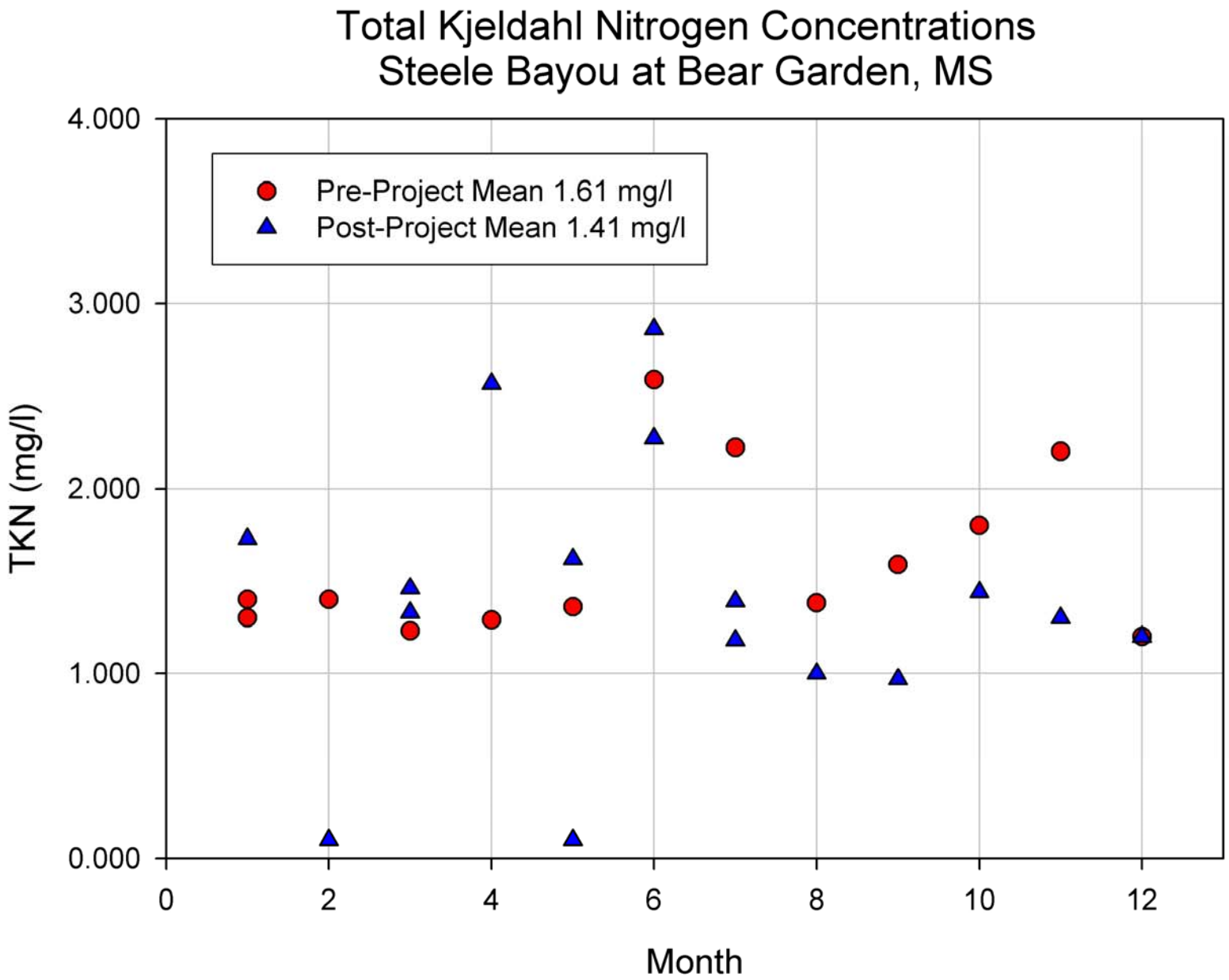

Total Solids Data
Steele Bayou at Grace, MS
Pre-Project Mean 537 mg/l
Post-Project Mean 303 mg/l
Total Solids (mg/l)
0
200
400
600
800
1000
1200
1400
0
2
4
6
8
10
12
Month

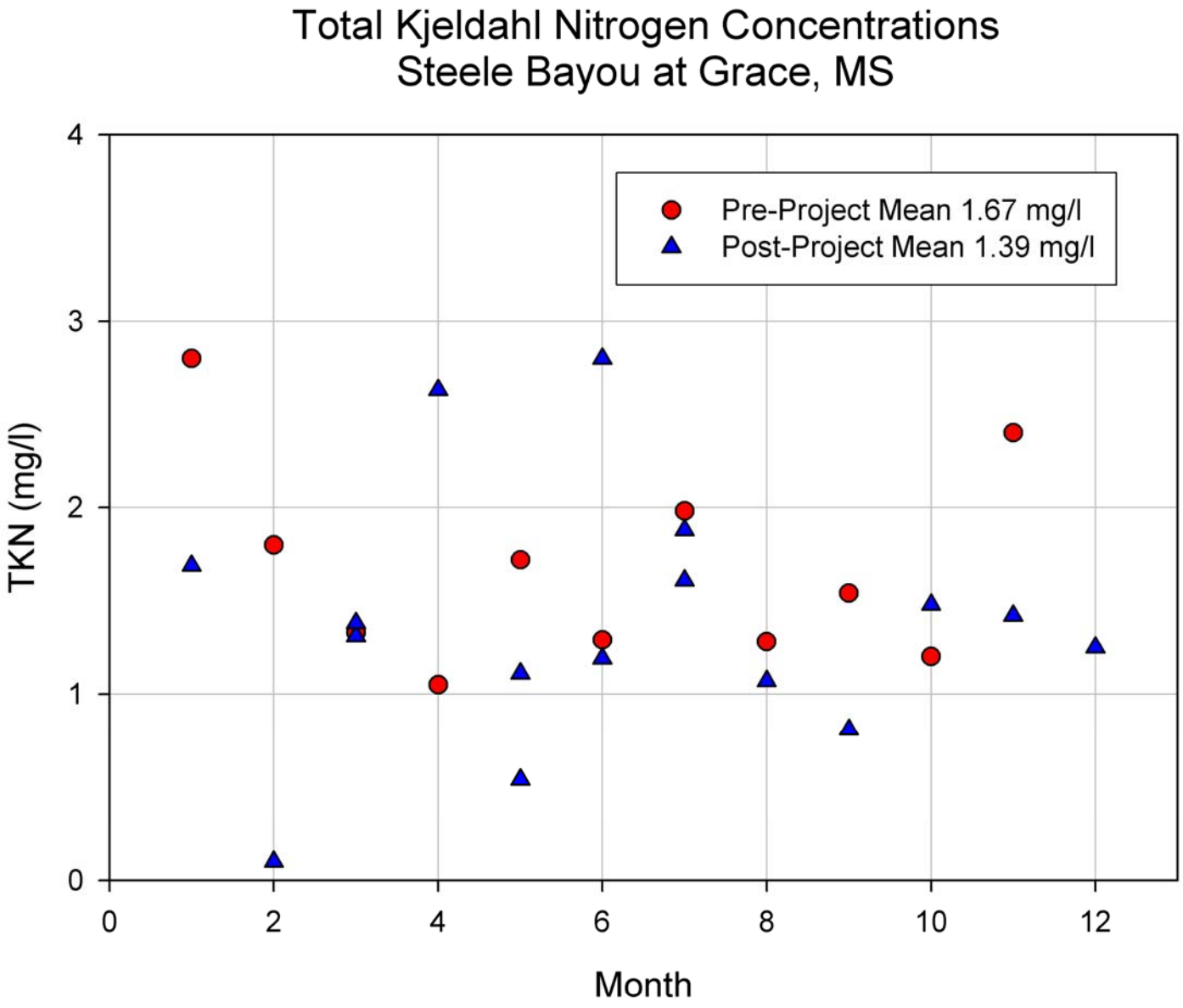

Steele Bayou Basin
Total Suspended Solids by River Mile
Pre-Project Mean 197 mg/l
Post-Project Mean 111 mg/l
TSS (mg/l)
1400
1200
1000
800
600
400
200
0
60
40
20
0
River Mile

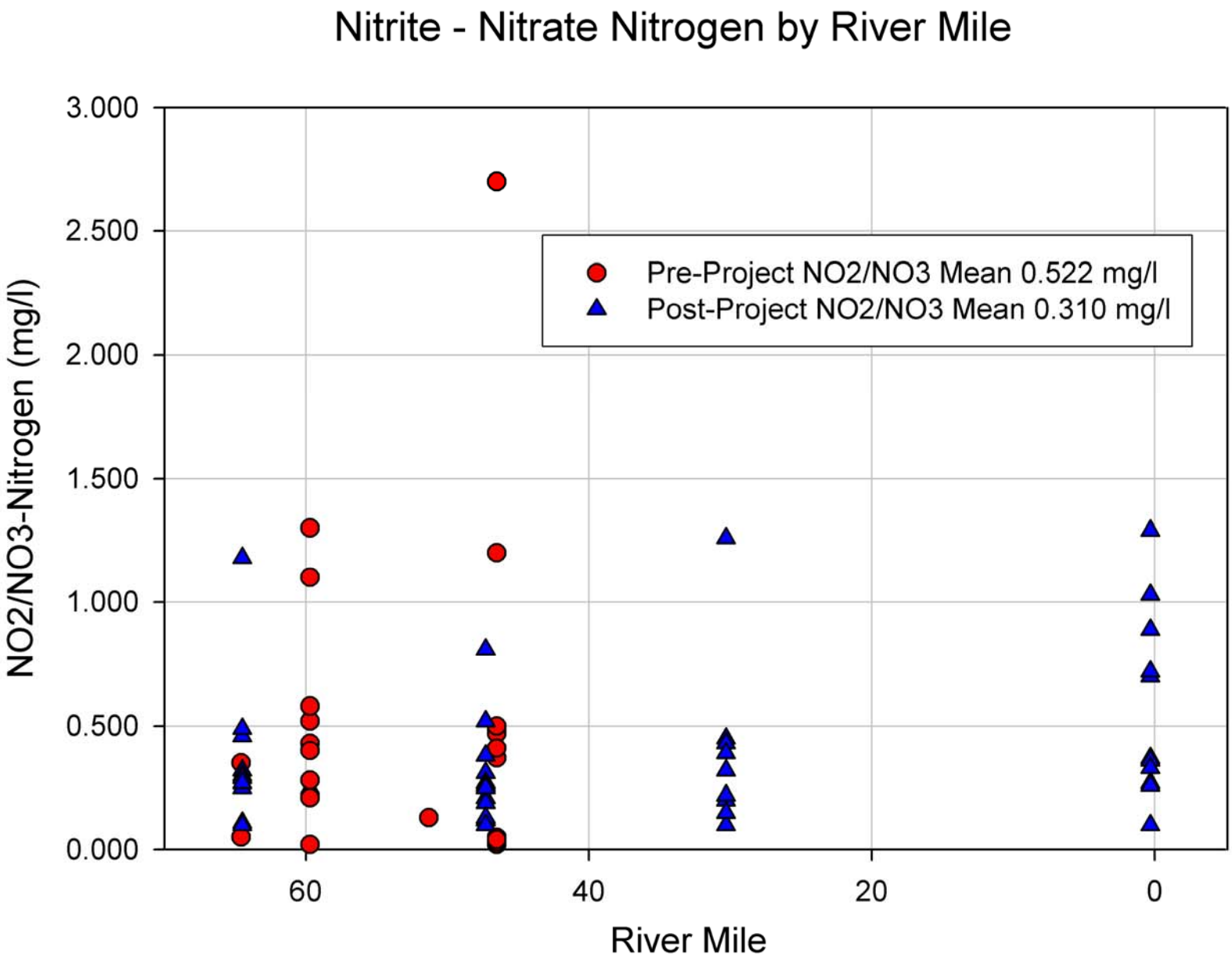

Total Suspended Solids
Steele Bayou at Bear Garden, MS
Pre-Project Mean 133 mg/l
Post-Project Mean 95 mg/l
Total Suspended Solids (mg/l)
Month
0
50
100
150
200
250
300
0
2
4
6
8
10
12

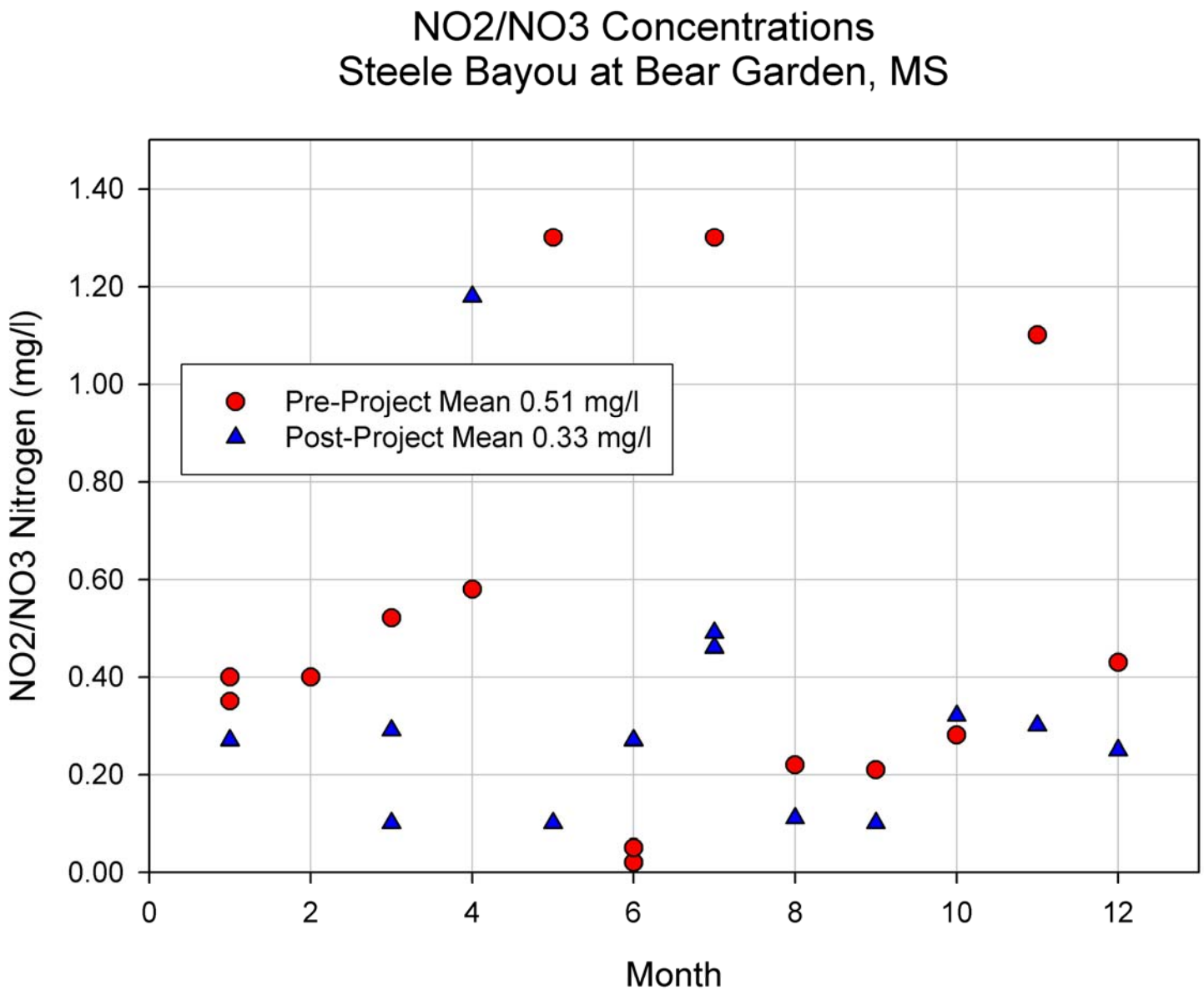

Total Suspended Solids
Steele Bayou at Grace, MS
Pre-Project Mean 282 mg/l
Post-Project Mean 94 mg/l
TSS (mg/l)
Month
0
200
400
600
800
1000
1200
0
2
4
6
8
10
12

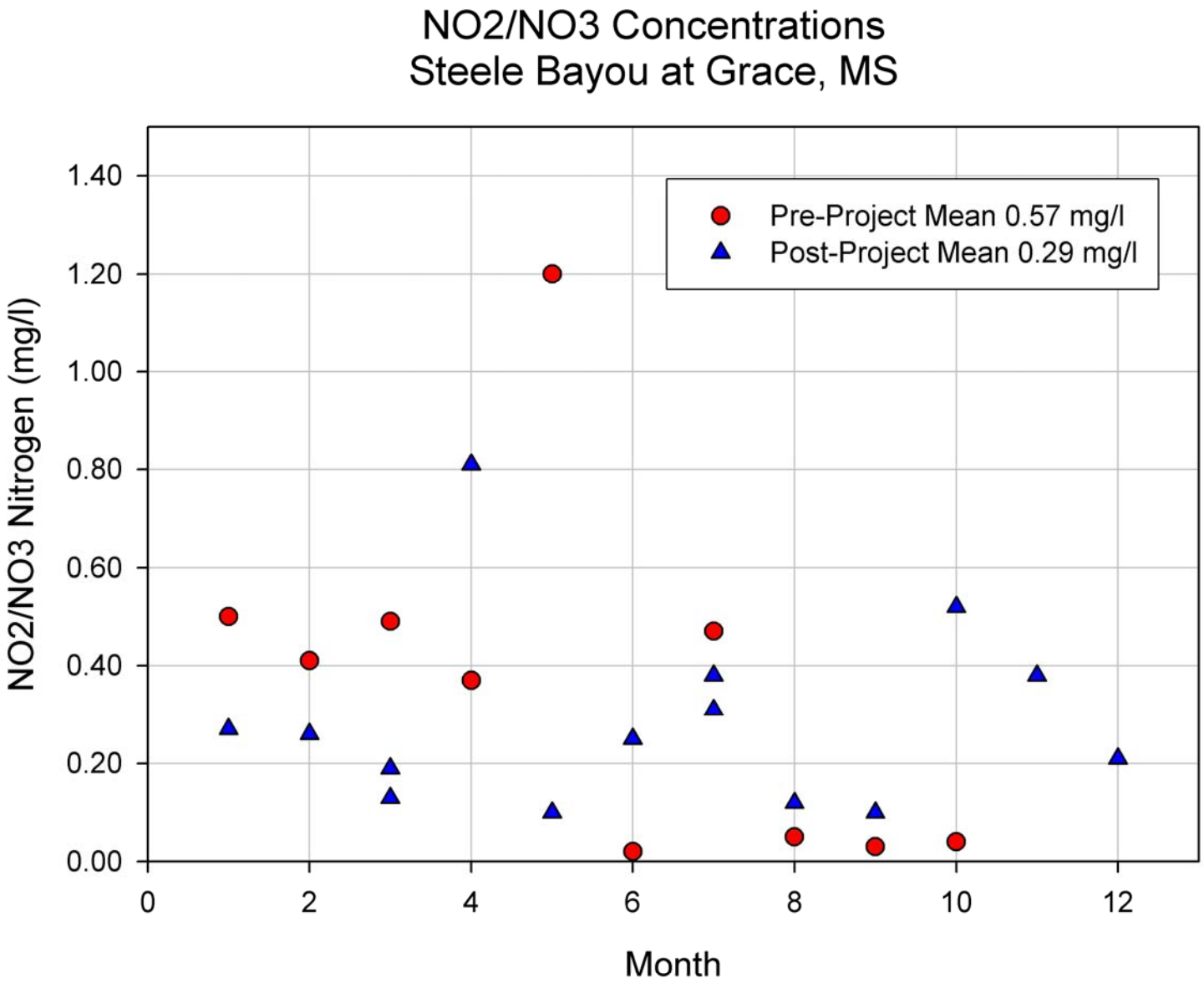

Total Kjeldahl Nitrogen by River Mile
4.000
3.000
2.000
1.000
0.000
TKN-Nitrogen (mg/l)
60
40
20
0
River Mile
Pre-Project Mean TKN 1.76 mg/l
Post-Project Mean TKN 1.36 mg/l

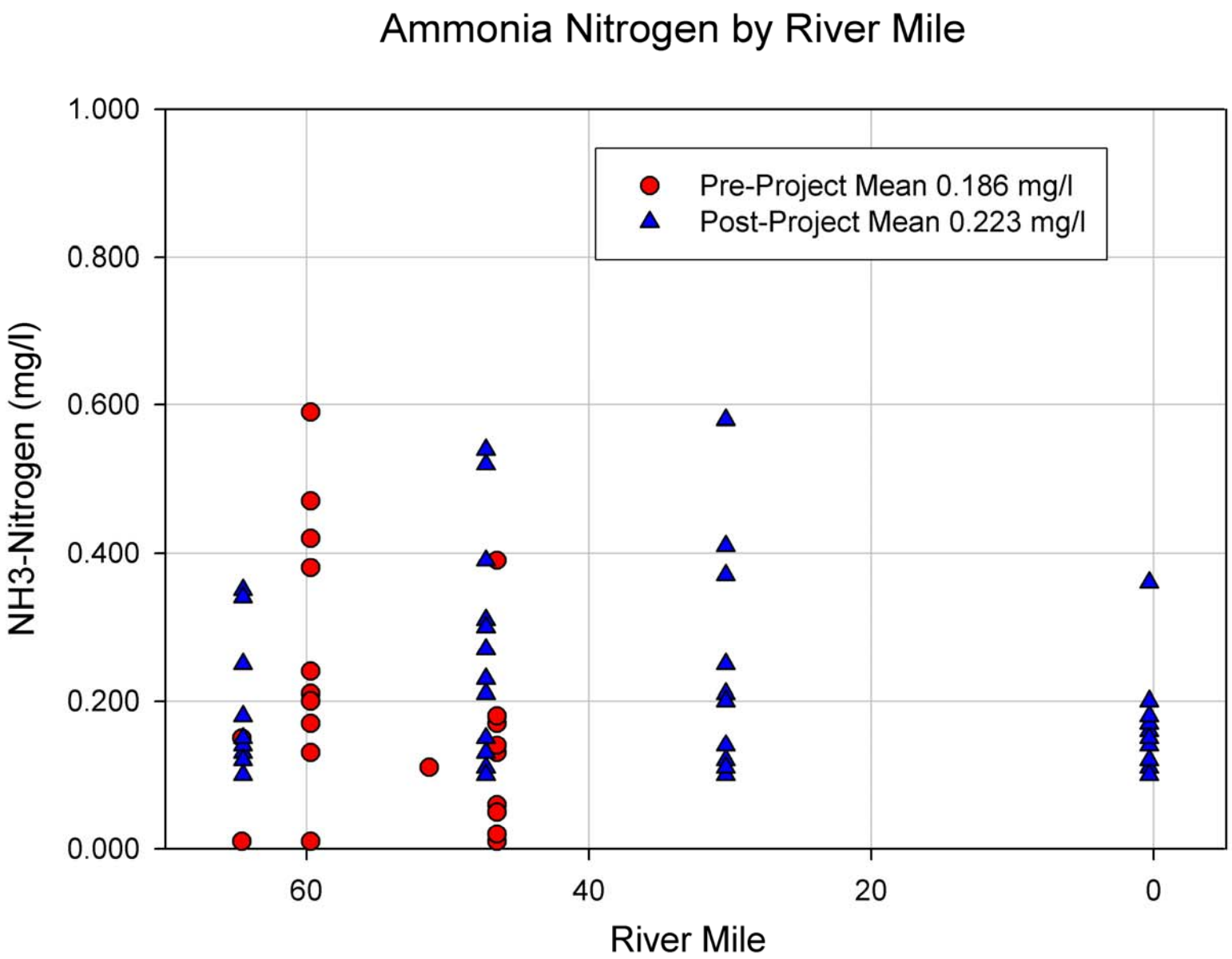

Total Kjeldahl Nitrogen Concentrations
Steele Bayou at Bear Garden, MS
Pre-Project Mean 1.61 mg/l
Post-Project Mean 1.41 mg/l
TKN (mg/l)
4.000
3.000
2.000
1.000
0.000
0
2
4
6
8
10
12
Month

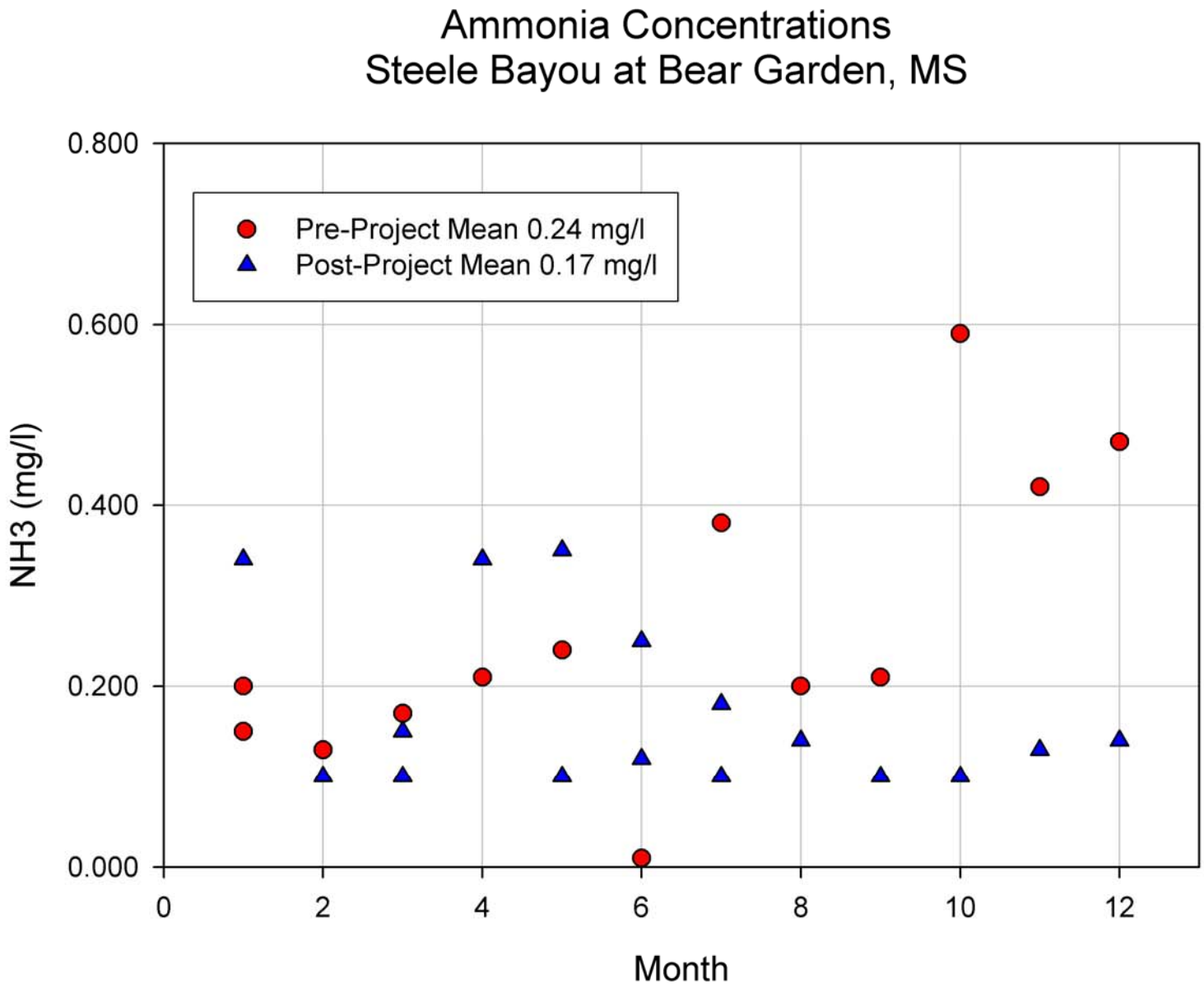

Total Kjeldahl Nitrogen Concentrations
Steele Bayou at Grace, MS
Pre-Project Mean 1.67 mg/l
Post-Project Mean 1.39 mg/l
TKN (mg/l)
Month
0
1
2
3
4
0
2
4
6
8
10
12

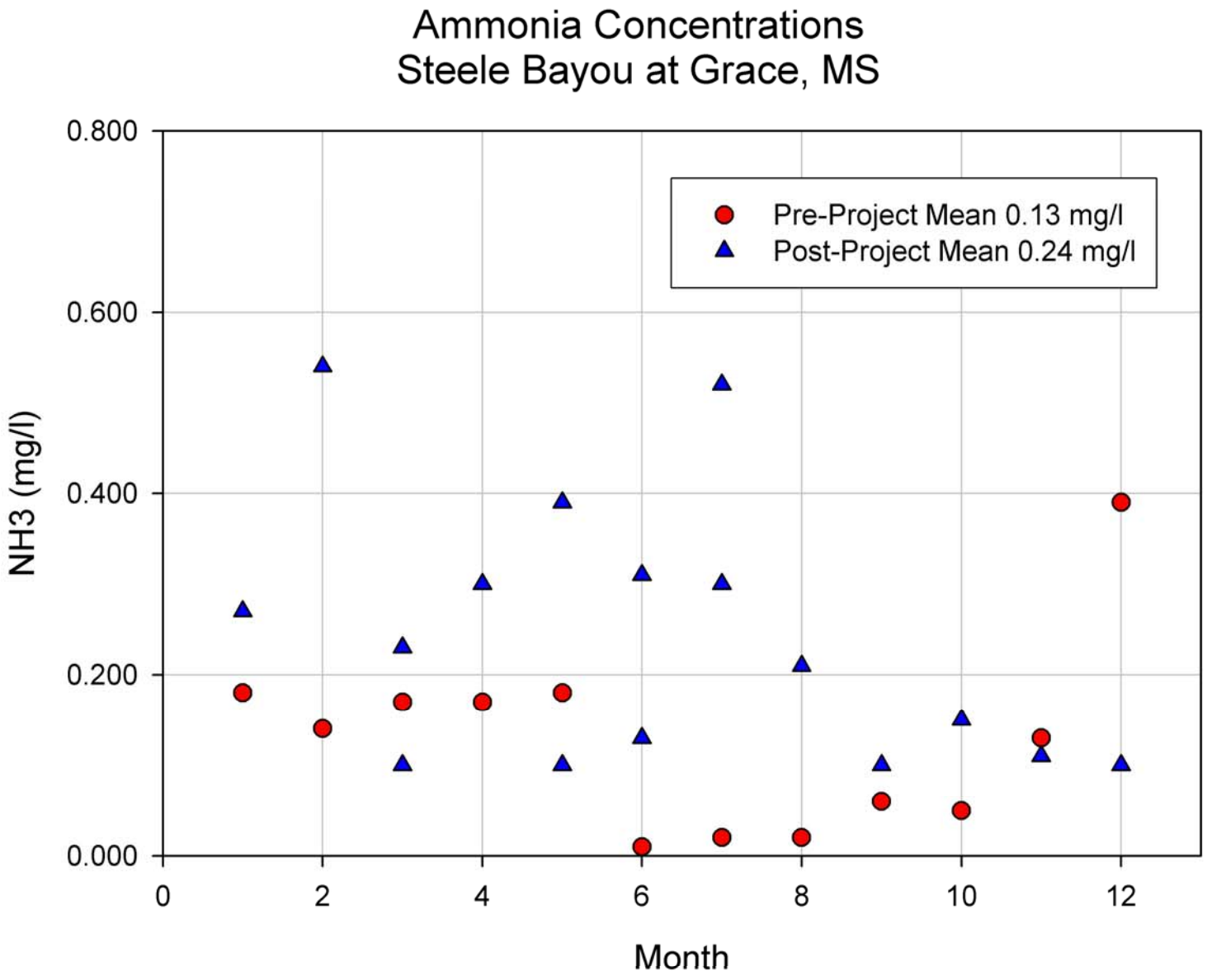

Nitrite - Nitrate Nitrogen by River Mile
3.000
2.500
2.000
1.500
1.000
0.500
0.000
NO2/NO3-Nitrogen (mg/l)
Pre-Project NO2/NO3 Mean 0.522 mg/l
Post-Project NO2/NO3 Mean 0.310 mg/l
60
40
20
0
River Mile

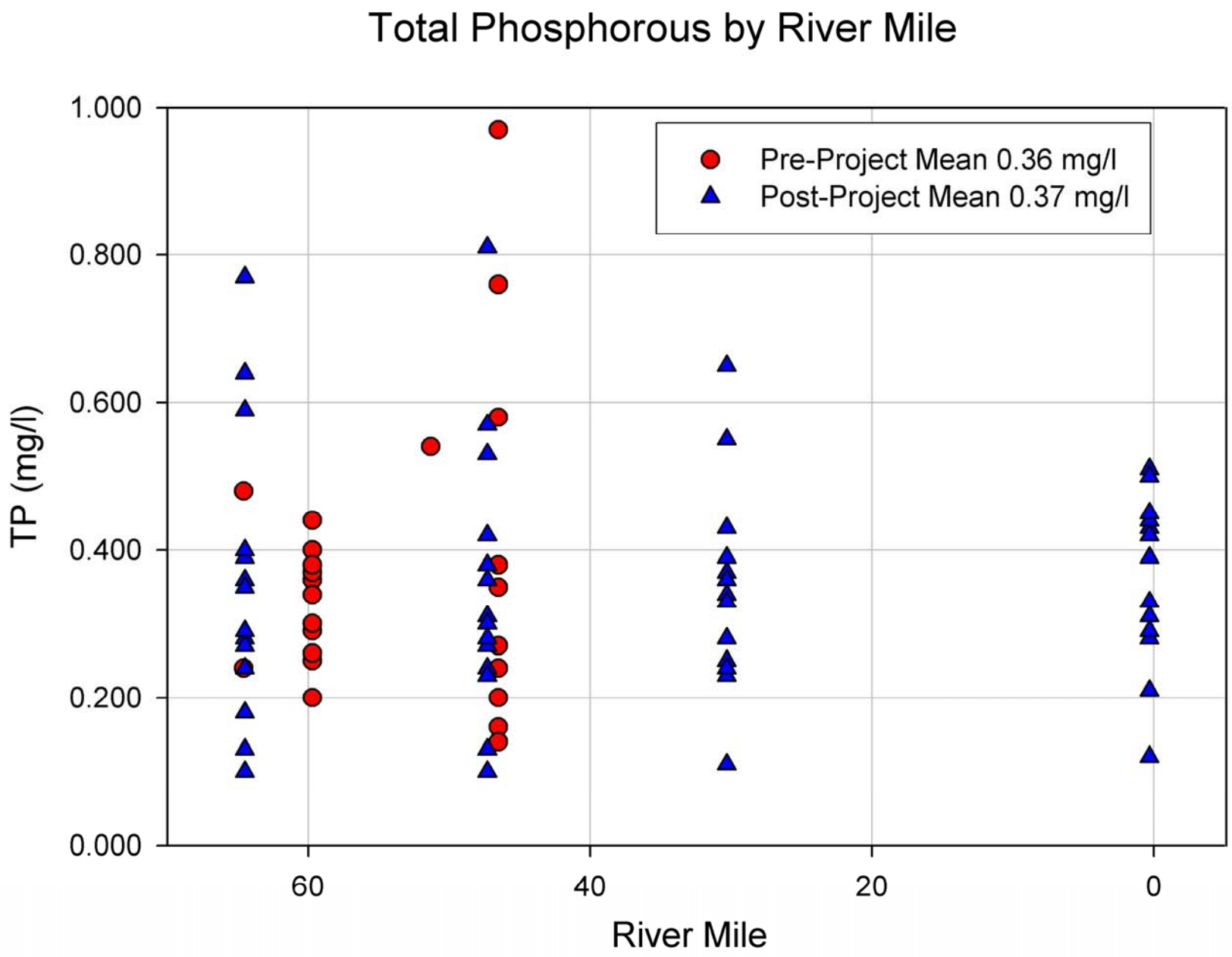

NO2/NO3 Concentrations
Steele Bayou at Bear Garden, MS
NO2/NO3 Nitrogen (mg/l)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
2
4
6
8
10
12
Month
Pre-Project Mean 0.51 mg/l
Post-Project Mean 0.33 mg/l

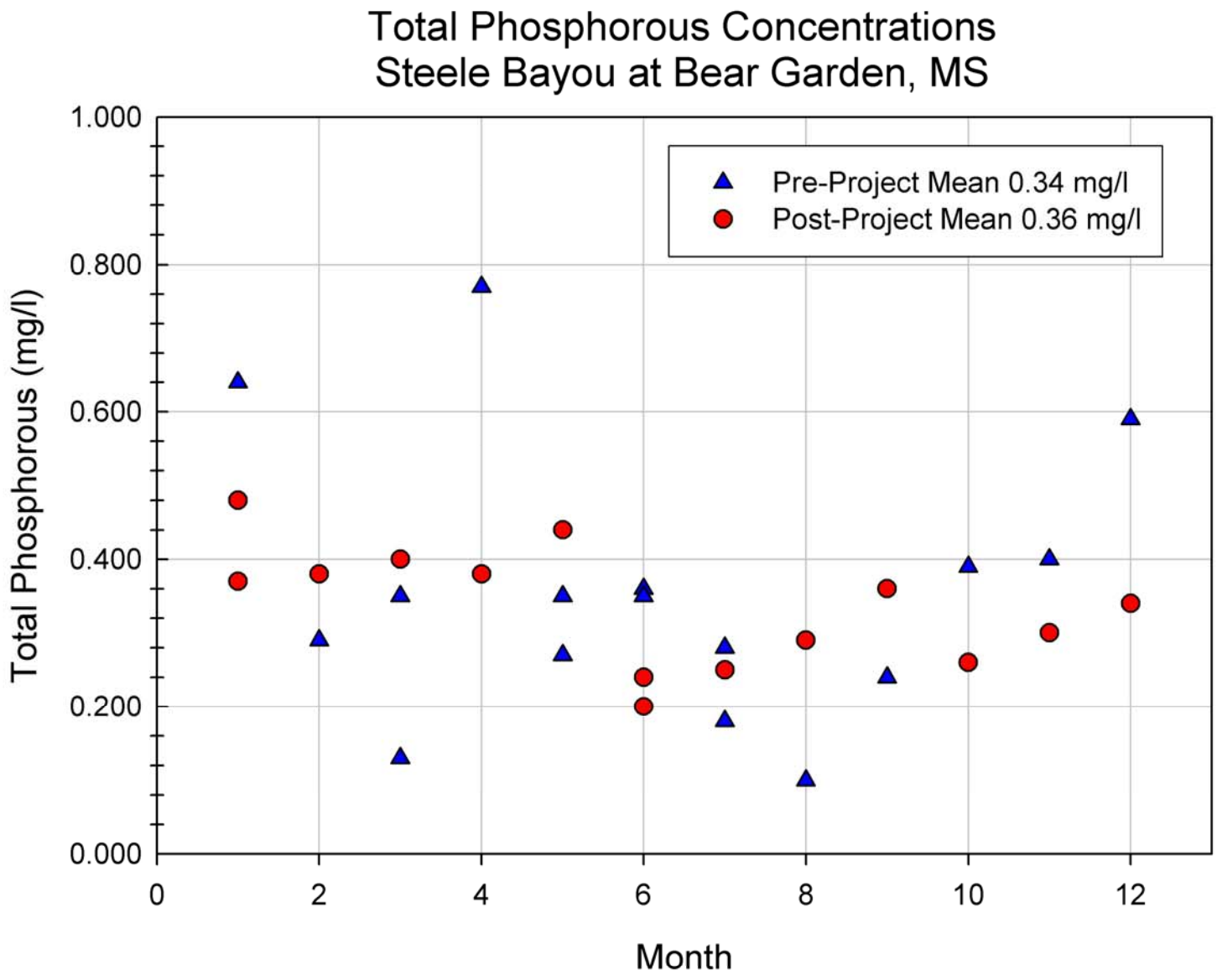

NO2/NO3 Concentrations
Steele Bayou at Grace, MS
Pre-Project Mean 0.57 mg/l
Post-Project Mean 0.29 mg/l
NO2/NO3 Nitrogen (mg/l)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
2
4
6
8
10
12
Month

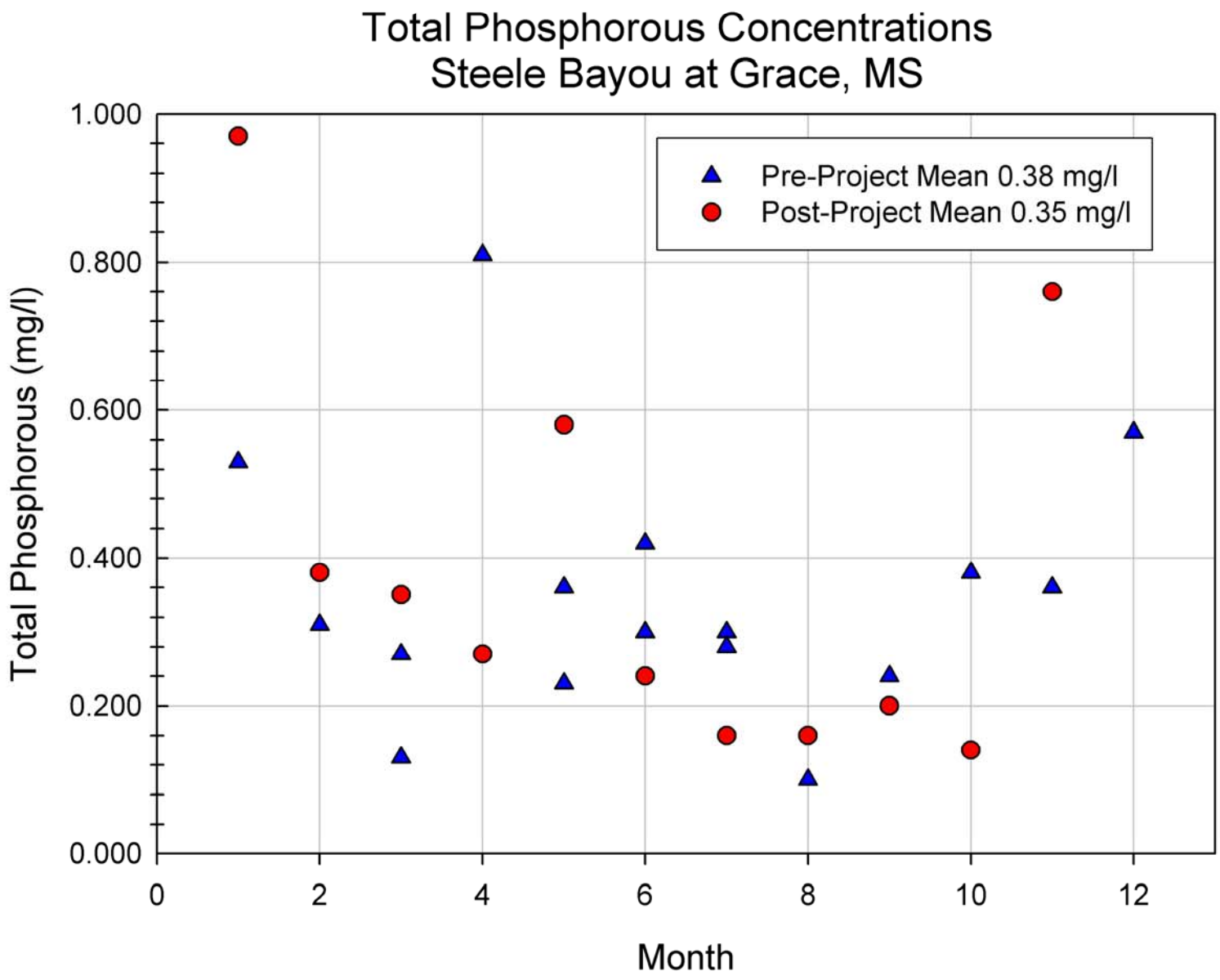

Ammonia Nitrogen by River Mile
Pre-Project Mean 0.186 mg/l
Post-Project Mean 0.223 mg/l
NH3-Nitrogen (mg/l)
1.000
0.800
0.600
0.400
0.200
0.000
60
40
20
0
River Mile

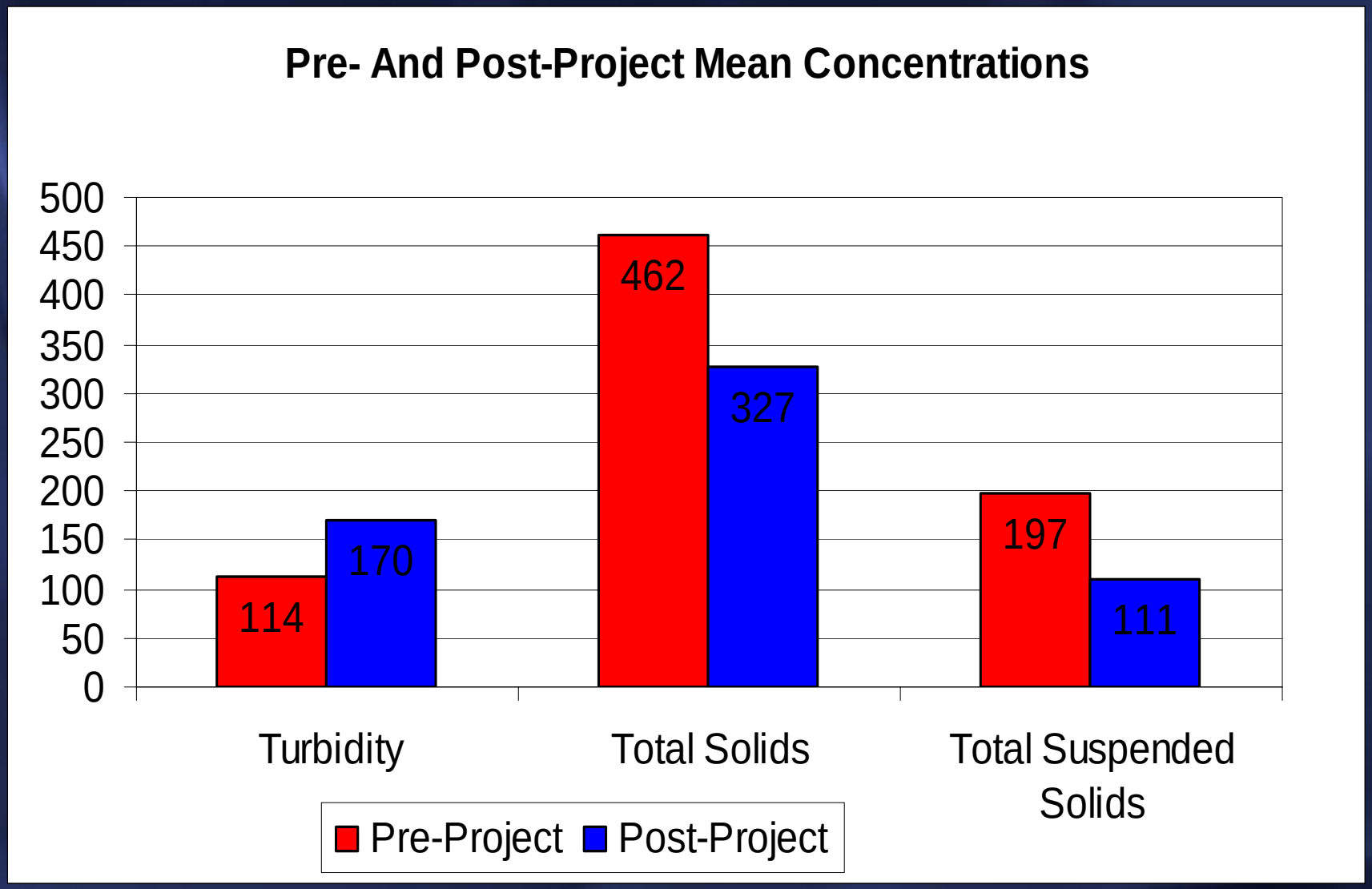

Ammonia Concentrations
Steele Bayou at Bear Garden, MS
Pre-Project Mean 0.24 mg/l
Post-Project Mean 0.17 mg/l
NH3 (mg/l)
0.800
0.600
0.400
0.200
0.000
0
2
4
6
8
10
12
Month

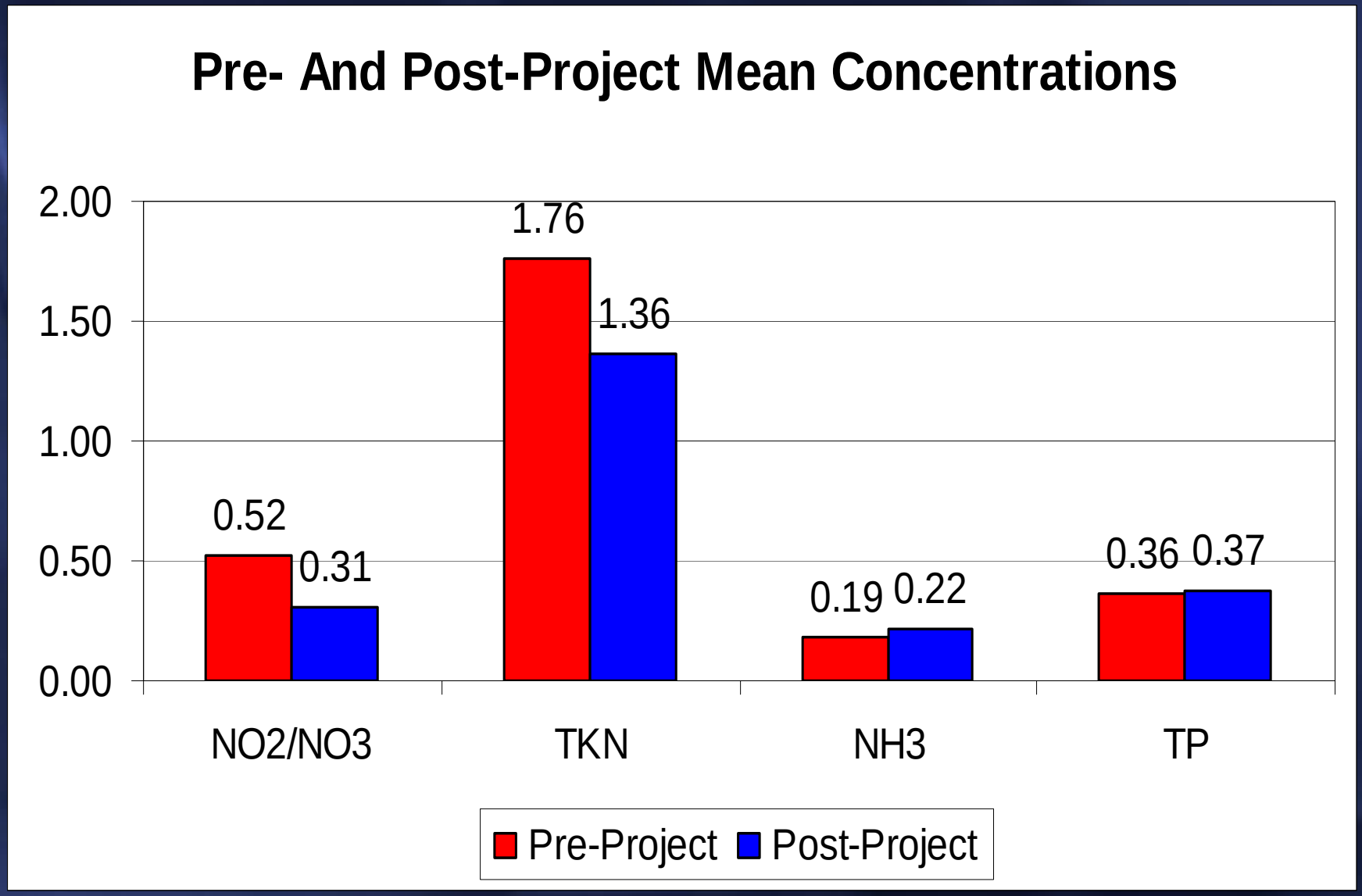

Ammonia Concentrations
Steele Bayou at Grace, MS
Pre-Project Mean 0.13 mg/l
Post-Project Mean 0.24 mg/l
NH3 (mg/l)
0.800
0.600
0.400
0.200
0.000
0
2
4
6
8
10
12
Month

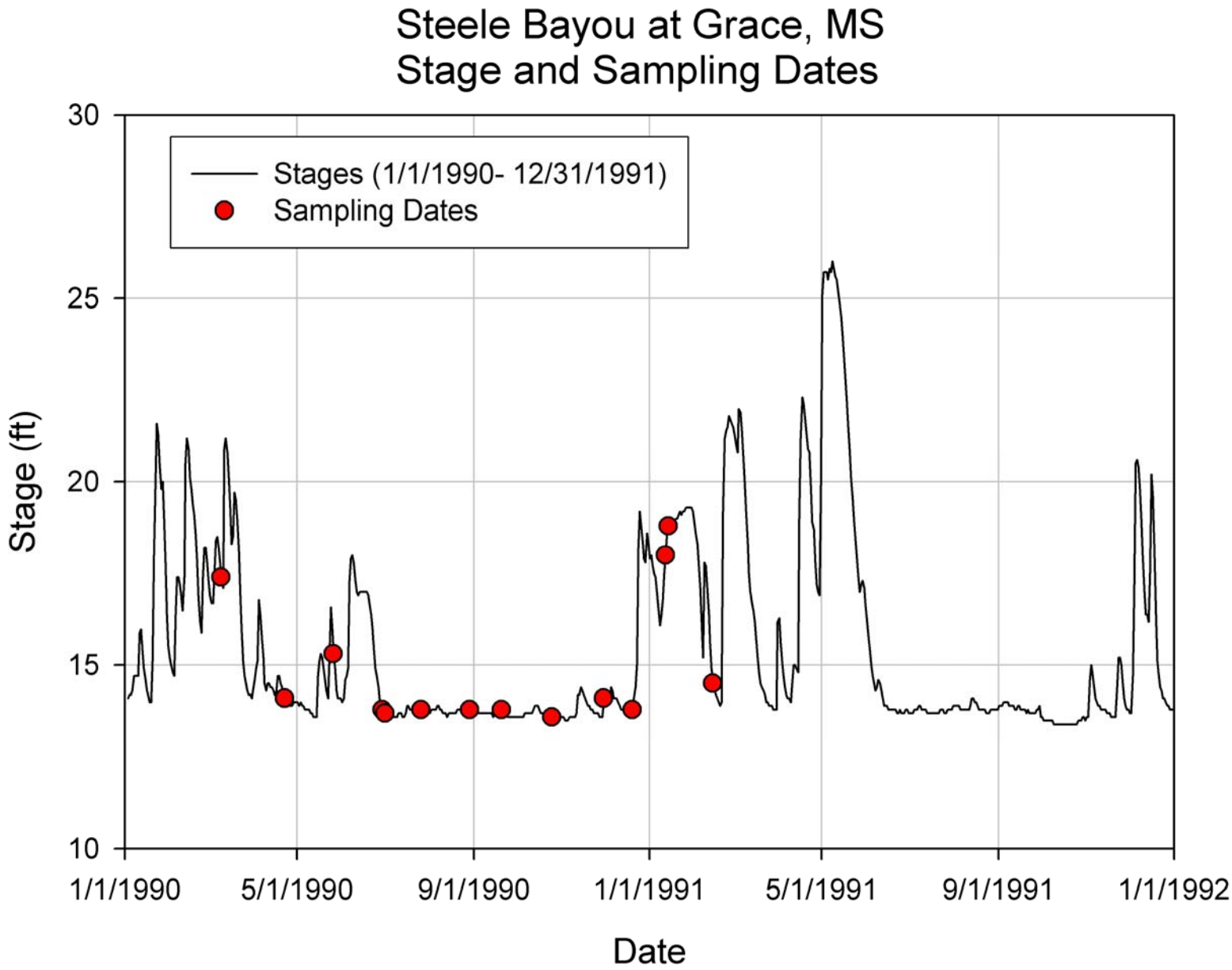

Total Phosphorous by River Mile
Pre-Project Mean 0.36 mg/l
Post-Project Mean 0.37 mg/l
TP (mg/l)
1.000
0.800
0.600
0.400
0.200
0.000
60
40
20
0
River Mile

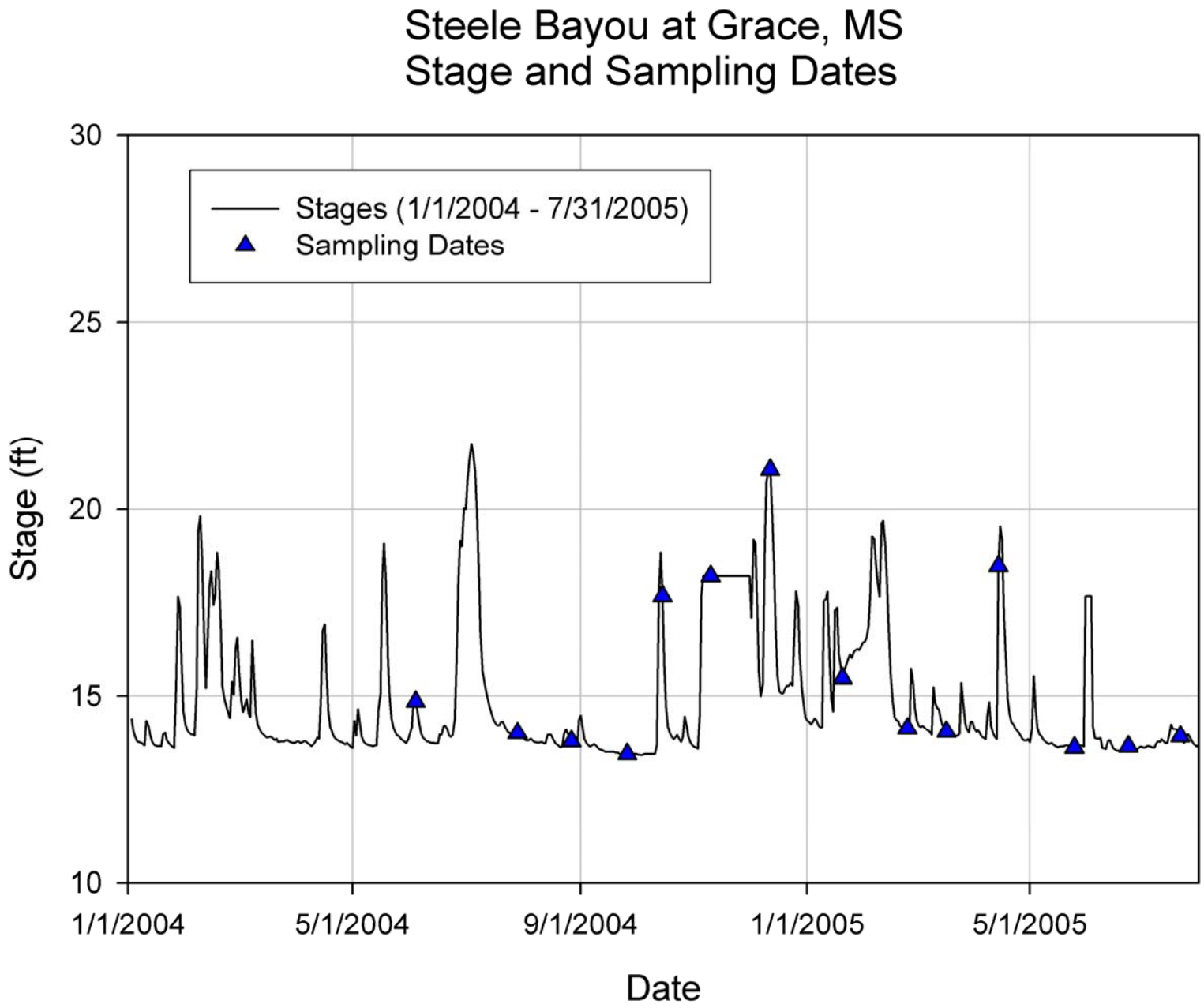

Total Phosphorous Concentrations
Steele Bayou at Bear Garden, MS
Pre-Project Mean 0.34 mg/l
Post-Project Mean 0.36 mg/l
Total Phosphorous (mg/l)
1.000
0.800
0.600
0.400
0.200
0.000
0
2
4
6
8
10
12
Month


Total Phosphorous Concentrations
Steele Bayou at Grace, MS
Pre-Project Mean 0.38 mg/l
Post-Project Mean 0.35 mg/l
Total Phosphorous (mg/l)
1.000
0.800
0.600
0.400
0.200
0.000
0
2
4
6
8
10
12
Month


Pre- And Post-Project Mean Concentrations
500
450
400
350
300
250
200
150
100
50
0
114
170
462
327
197
111
Turbidity
Total Solids
Total Suspended Solids
Pre-Project
Post-Project


Pre- And Post-Project Mean Concentrations
2.00
1.50
1.00
0.50
0.00
0.52
0.31
1.76
1.36
0.19
0.22
0.36
0.37
NO2/NO3
TKN
NH3
TP
Pre-Project
Post-Project


Steele Bayou at Grace, MS
Stage and Sampling Dates
Stages (1/1/1990- 12/31/1991)
Sampling Dates
Stage (ft)
30
25
20
15
10
1/1/1990
5/1/1990
9/1/1990
1/1/1991
5/1/1991
9/1/1991
1/1/1992
Date


Steele Bayou at Grace, MS
Stage and Sampling Dates
Stages (1/1/2004 - 7/31/2005)
Sampling Dates
Stage (ft)
30
25
20
15
10
1/1/2004
5/1/2004
9/1/2004
1/1/2005
5/1/2005
Date

Summary

- 29% Reduction in TS
- 44% Reduction in TSS
- 41% Reduction in NO2/NO3
- 23% Reduction in TKN
- 18% Increase in Ammonia
- 49% Increase in Turbidity
- No Significant Change in TP

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Possible Reasons

- Installation of Grade Control Structures
- Changes in Landuse
- Changes in Agricultural Best Management Practices

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Questions?

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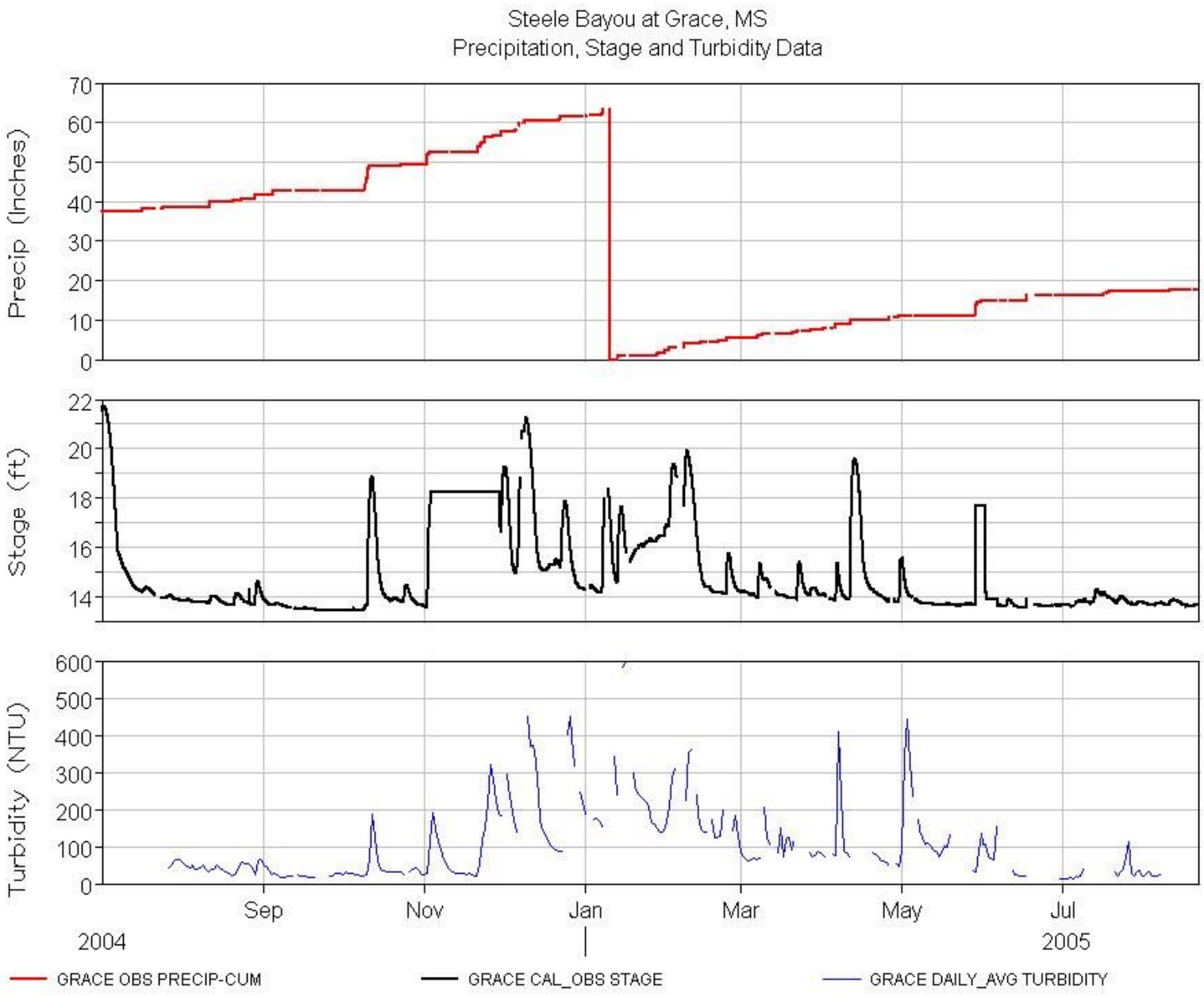
Steele Bayou at Grace, MS
Precipitation, Stage and Turbidity Data
Precip (Inches)
70
60
50
40
30
20
10
0
Stage (ft)
22
20
18
16
14
Turbidity (NTU)
600
500
400
300
200
100
0
Sep
Nov
Jan
Mar
May
Jul
2004
2005
GRACE OBS PRECIP-CUM
GRACE CAL_OBS STAGE
GRACE DAILY_AVG TURBIDITY