

AMBIENT WATER Water Column Height (meters)

1-QHS

1	Х
2	0.331
3	0.331
4	0.324
5	0.352

15:00
6/30/2008
Low

Core #1 did not seal properly on bottom

Other
Analytes
Grainsize

CORE #1	N/A	SOD ave	
CORE #2	0.61	Std Dev	
CORE #3	1.80		
CORE #4	0.23		
CORF #5	0.82		

Adjusted SOD w/ DO

SOD ANALYSIS
TIME

1940	0
2010	30
2040	60
2110	90
2140	120
2210	150
2240	180
2310	210

8.97	8.89	8.44	8.27	10.17
8.79	8.35	7.89	7.92	9.92
8.66	8.11	7.54	7.77	9.81
8.54	7.92	7.25	7.65	9.73
8.46	7.79	7.05	7.55	9.71
8.38	7.65	6.86	7.46	9.68
8.32	7.53	6.70	7.37	9.66
8.25	7.36	6.49	7.32	9.61

Dissolved Oxgen (mg/l)

CORE #1 | CORE #2 | CORE #3 | CORE #4 | CORE #5

CORE #1	CORE #2	CORE #3	CORE #4	CORE #5	WQ
	20.0	19.9	19.9	20.0	19.9
	19.7	19.6	19.7	19.7	19.7
	19.6	19.6	19.7	19.6	19.6
	19.7	19.6	19.7	19.7	19.6
	19.6	19.5	19.6	19.6	19.5
	19.6	19.5	19.6	19.6	19.5
	19.5	19.5	19.6	19.5	19.4
	19.5	19.5	19.6	19.5	19.5

Temperature (C)

0.87

0.67

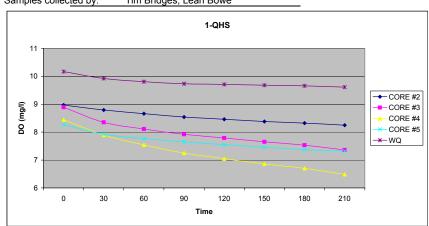
 SOD Ave
 1.70

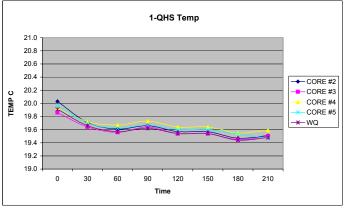
 Standard Deviation
 0.67

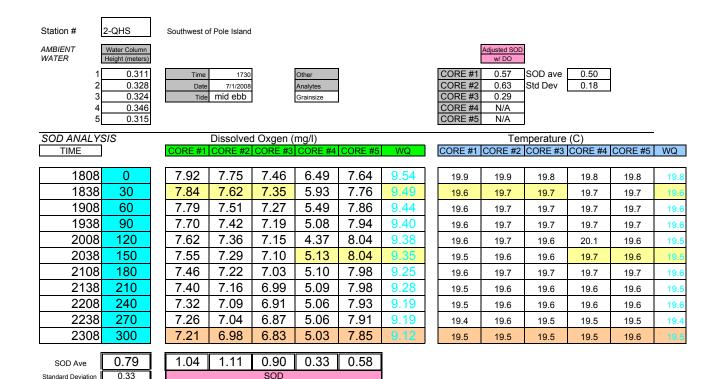
N/A	1.43	2.62	1.04	1.69
		SOD		

Analyzed by:

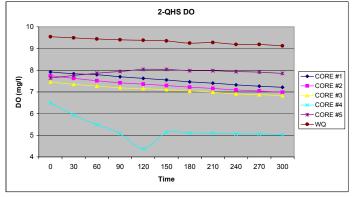
Samples collected by: Tim Bridges, Leah Bowe

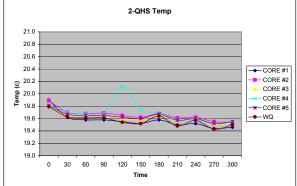


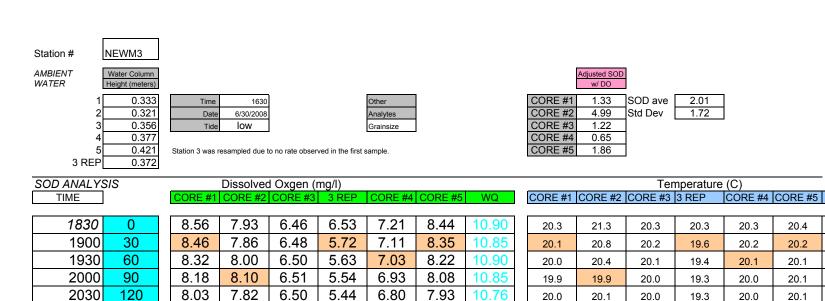




Analyzed by: Matt Arvanites, Morgan Lindenmayer, Sam Burke Samples collec Morgan, Tim Bridges, Leah Bowe







6.74

6.68

7.84

7.75

10.72

10.68

10.70

20.0

19.9

19.8

20.1

20.0

19.9

20.1

20.0

19.9

210 7.71 6.79 6.52 5.22 6.65 7.67 2.67 2.00 5.86 N/A 1.74 1.38 2.39 SOD Ave 1.82 SOD Standard Deviation

7.59

6.95

6.50

6.51

5.34

5.27

Analyzed by: Tim Bridges

150

180

2100

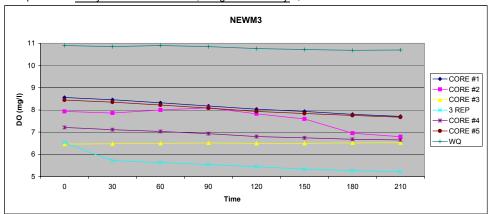
2130

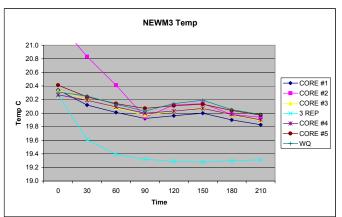
2200

Matt Arvanites, Morgan Lindenmayer, Sam Burke Samples collected by:

7.93

7.80





19.3

19.3

19.3

20.1

20.0

19.9

WQ

20.3

20.1

20.0

20.1

20.2

20.1

20.0

20.4

20.2

20.1

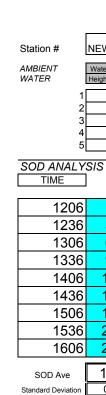
20.1

20.1

20.1

20.0

20.0



NEWM4	Deep Hole
Water Column	

Water	Column	
Height	(meters)	l

1	0.365
2	0.362
3	0.436
4	0.364
5	0.365

1200
1/2008
ebb

Analytes

Dissolved Oxgen (mg/l)

Adjusted SOD
w/ DO

CORE #1	0.58	SOD ave	
CORE #2	0.72	Std Dev	
CORE #3	0.87		
CORE #4	0.45		
CORE #5	Х		

Temperature (C)	

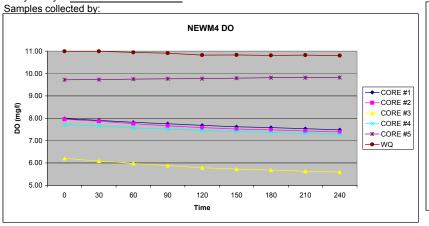
0.66

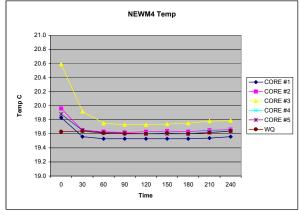
0.18

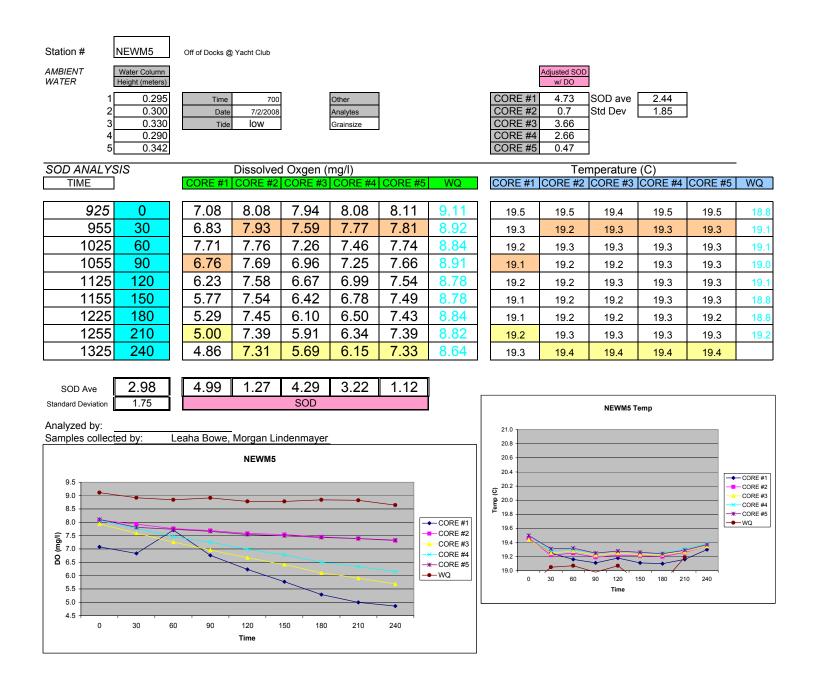
0	7.98	7.95	6.21	7.71	9.72	10.
30	7.90	7.87	6.09	7.65	9.73	10.
60	7.82	7.76	5.98	7.57	9.75	10.
90	7.75	7.66	5.89	7.52	9.76	10.
120	7.68	7.58	5.79	7.45	9.77	10.
150	7.62	7.52	5.73	7.41	9.79	10.
180	7.58	7.48	5.69	7.37	9.81	10.
210	7.53	7.43	5.63	7.32	9.81	10.
240	7.48	7.39	5.59	7.28	9.82	10.
4.40	4.05	4.40	4.00	2.22		1
1.13	1.05	1.19	1.36	0.92	N/A	
0.19			SOD			
	30 60 90 120 150 180 210 240	30 7.90 60 7.82 90 7.75 120 7.68 150 7.62 180 7.58 210 7.48 1.13 1.05	30 7.90 7.87 60 7.82 7.76 90 7.75 7.66 120 7.68 7.58 150 7.62 7.52 180 7.53 7.43 240 7.48 7.39 1.13 1.05 1.19	30 7.90 7.87 6.09 60 7.82 7.76 5.98 90 7.75 7.66 5.89 120 7.68 7.58 5.79 150 7.62 7.52 5.73 180 7.58 7.48 5.69 210 7.53 7.43 5.63 240 7.48 7.39 5.59 1.13 1.05 1.19 1.36	30 7.90 7.87 6.09 7.65 60 7.82 7.76 5.98 7.57 90 7.75 7.66 5.89 7.52 120 7.68 7.58 5.79 7.45 150 7.62 7.52 5.73 7.41 180 7.58 7.48 5.69 7.37 210 7.53 7.43 5.63 7.32 240 7.48 7.39 5.59 7.28 1.13 1.05 1.19 1.36 0.92	30 7.90 7.87 6.09 7.65 9.73 60 7.82 7.76 5.98 7.57 9.75 90 7.75 7.66 5.89 7.52 9.76 120 7.68 7.58 5.79 7.45 9.77 150 7.62 7.52 5.73 7.41 9.79 180 7.58 7.48 5.69 7.37 9.81 210 7.48 7.39 5.59 7.28 9.82 1.13 1.05 1.19 1.36 0.92 N/A

Temperature (C)					
CORE #1	CORE #2	CORE #3	CORE #4	CORE #5	WQ
19.8	20.0	20.6	19.9	19.9	19.6
19.6	19.7	19.9	19.6	19.7	19.6
19.5	19.6	19.8	19.6	19.6	19.6
19.5	19.6	19.7	19.6	19.6	19.6
19.5	19.6	19.7	19.6	19.6	19.6
19.5	19.6	19.7	19.6	19.6	19.6
19.5	19.6	19.8	19.6	19.6	19.6
19.5	19.7	19.8	19.6	19.6	19.6
19.6	19.7	19.8	19.7	19.6	19.6

Analyzed by:







SOD SITE FORM New Meadows/ Quahog Bay

Station #

NEWM6

AMBIENT WATER

	Water Column Height (meters)		
1	0.371	Time	7/2/2008
2	0.375	Date	7:30
3	0.452	Tide	mid flood
4	0.408		
_			

Analytes Grainsize

Adjusted SOD	
w/ DO	
2.92	SOD ave
N/A	Std Dev
N/A	
0.39	
N/A	
	2.92 N/A N/A 0.39

1.66 ave 1.79

0.412 SOD ANALYSIS

TIME	
1	
923	0
953	30
1023	60
1053	90
1123	120
1153	150
1223	180
1253	210
1323	240

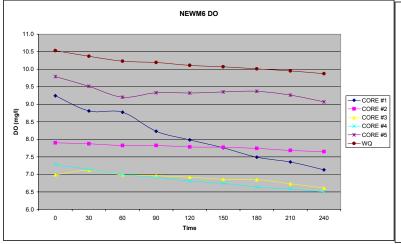
Dissolved Oxgen (mg/l)					
CORE #1	CORE #2	CORE #3	CORE #4	CORE #5	WQ
9.24	7.90	6.99	7.28	9.79	10.53
8.81	7.87	7.12	7.14	9.51	10.37
8.77	7.82	6.99	7.00	9.20	10.23
8.23	7.82	6.96	6.91	9.33	10.19
7.98	7.78	6.92	6.81	9.32	10.11
7.76	7.77	6.86	6.74	9.35	10.07
7.49	7.74	6.85	6.64	9.37	10.01
7.35	7.68	6.73	6.58	9.26	9.95
7.13	7.65	6.61	6.50	9.07	9.87

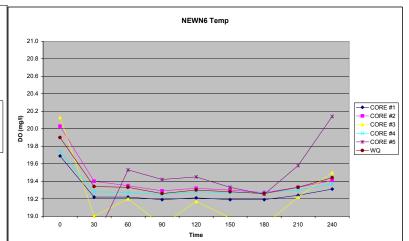
	Ter	nperature	(C)		
CORE #1	CORE #2	CORE #3	CORE #4	CORE #5	WQ
			,	,	
19.7	20.0	20.1	19.7	18.4	19.9
19.2	19.4	19.0	19.3	18.7	19.3
19.2	19.4	19.2	19.3	19.5	19.3
19.2	19.3	18.9	19.3	19.4	19.3
19.2	19.3	19.2	19.3	19.5	19.3
19.2	19.3	19.0	19.3	19.3	19.3
19.2	19.3	18.9	19.3	19.3	19.3
19.2	19.3	19.2	19.3	19.6	19.3
19.3	19.4	19.5	19.4	20.1	19.4

2.05 SOD Ave 1.84 Standard Deviation

0.56 1.13 1.79 N/A 4.71 SOD

Analyzed by: Morgan Lindenmayer Samples collected by:





Measurement of Sediment Oxygen Demand (SOD) in the New Meadows/ Quahog Bay, Maine

Summer 2008

Project Work/QA Plan

U.S. Environmental Protection Agency Region 1, New England

Office of Environmental Measurement and Evaluation Ecosystem Assessment Unit

Project Work/QA Plan Acceptance	
EPA QA Officer	
Ouve Di Mattei Steve Di Mattei, EPA/OEME/EQA	Date: 6/27/08
EPA Project Officer	
_Tim Bridges	
Tim Bridges, EPA/OEME/ECA	Date: 6/27/08
Friends of Casco Bay	
	Date:
Mike Doan, Water Quality Specialist	

1.0 Project Overview

Friends of Casco Bay and EPA's Region 1 Office of Environmental Protection (OEP) has requested the Office of Environmental Measurement and Evaluation (OEME) assistance in evaluating the sediment oxygen demand (SOD) in the New Meadows River and Quahog Bay in the tidal estuary as well as the deep hole of New Meadows River above the Route 1 bridge. Friends of Casco Bay is requesting that the SOD testing be performed to aid in identifying the significance of sediment oxygen demand at these two river basins as well as looking at five year trends in sediment from the 2003 sampling event conducted by EPA. These investigations will provide the Friends of Casco Bay with measured rates of SOD at stations in the New Meadows River and Quahog Bay. The SOD rates will also be used to identify areas of potential concern.

The site selections are based on known areas of low dissolved oxygen as well as historical 2003 sampling SOD sites in the New Meadows River and Quahog Bay. Sites are in areas where there is the best chance of finding fine sediment with lower dissolved oxygen including behind impoundments. Site descriptions are shown in Table 2. Sample locations will be displayed on in map in the final report. Each core sampling location will be documented through the use of Global Positioning System (GPS).

A list of key stakeholders for this project is found in Table 1.

Table 1. Key Stakeholders

Friends of Casco Bay	USEPA Quality Assurance	USEPA Project Officer(s)	EPA Laboratory Activities	Field Activities
Mike Doan	Tom Faber	Tim Bridges	Tim Bridges	USEPA

2.0 SOD Method Summary

This method involves confining a measurable volume of sediment and its overlying water, in a core sample and measuring the depletion of dissolved oxygen over time. Sediment sample cores are taken and transferred to a temperature controlled water bath. The dissolved oxygen concentration within these cores is measured over a specified period of time. Following the monitoring period, the SOD of the sediment is calculated. See Sediment Oxygen Demand Determination SOP 6.0 attached in Appendix A.

SOD is the total of biological and chemical processes in sediment that utilize oxygen. SOD studies are useful in the development of predictive mathematical models that will determine waste load allocations. They are also useful in measuring the depletion of oxygen in stratified waters when there are concerns about nutrient regeneration and the loss of aquatic life.

3.0 Interferences and Potential Problems

Sampling will be conducted at low energy depositional areas that are deep holes for this project. Every effort will be made to collect depositional sediment rather than sand or gravel. Sand and gravel does not bind the contaminants that may be present. In addition, sediment samples should be collected up gradient of major bridge and roadways to avoid contaminants from road runoff. There are no significant known interferences for this project.

4.0 Sample Handling and Preservation

TOC and grain size samples will be preserved on ice in a cooler until they arrive at the laboratory. Samples will then be refrigerated at 4°C. Table 4 and 5 list the holding time and preservation necessary for each parameter collected. The sample label will contain the following information: sample number; sample location or identifier; date and time of collection; and sampling personnel. Samples for SOD will have analysis performed within 4 hours of collection. Samples will be warmed to close to 20°C before analysis. Samples will be collected according to the SOD SOP in Appendix A.

A bound field notebook will be maintained by field personnel to record sample collection information. A chain of custody form will be used to document the types and numbers of samples collected and logged. The sample storage coolers will be taped with signed chain-of-custody tape while the samples are being stored in the mobile laboratory.

5.0 Station Monitoring

Table 2. Sediment Station Descriptions and Locations

Station #	Station Description
1-QHS	Deep Hole west of Southern tip of Pole
	Island in Quahog Bay
2-QHS	North Ledge in Quahog Bay
3-NEWM	New Meadows Upper Lake Deep Hole
4-NEWM	New Meadows Lower Lake Deep Hole
5-NEWM	New Meadows at Marina
6-NEWM	New Meadows River at Woodward Cove by
	Gurnet Point

Latitude	Longitude			
Deg Min Sec	Deg Min Sec			
43. 47 70 N	69. 55 50 W			
43. 48 60 N	69. 55 00 W			
43. 49 40 N	69. 52 10 W			

6.0 Analytical Parameters

Analyses for SOD and dissolved oxygen will be conducted in the OEME Mobile Biology Trailer on site near the study areas. Grain Size and TOC will be performed at OEME when

crews arrive back from the field and after they are logged into the sample custodian. Refer to Appendix A for sample collection procedure.

Table 3: Analytical Parameters for Water

Parameter	# of Samples	Container	Method	Preservation	Holding Times
Dissolved Oxygen	6	N/A	SM 4550 O G	N/A	Immediate
Temperature	6	N/A	SM 2550 B	N/A	Immediate

Table 4: Sediment Analytical Parameters

Parameter	# of Samples	+Dup.1	Total	Container	Method	Preservation	Holding Times
SOD	6	N/A	6	5 Acrylic Cores/site	OEME SOD SOP 7/07 REV 6.0	N/A	none
Grain Size	6	1	7	250 ml WM glass jar	OEME	Ice 4°C	28 days

¹ Duplicates samples will be collected in the field.

Table 5: Water Analytical References and QC Goals

Parameter # of Samples		Ranges	Precision	Accuracy	Completeness
Dissolved Oxygen	6	0.02 to 10.0 mg/L	± 0.1 mg/L	± 0.1 mg/L	90%
Temperature	6	- 5.0 to + 50.0°C	N/A	± 0.1°C	95%

Table 6: Sediment Analytical References and QC Goals

Parameter	# of Samples	Range	Precision	Accuracy	Completeness
SOD	6	0.02 - 3.99 (g O ₂ /M ² /day)	Multi-core, Standard Deviation <50 %	±0.1 (g O ₂ /M ² /day)	90%

7.0 Project Schedule

1) Scoping Meeting	6/17/08
2) Site Recon	6/17/08
3) Collect water and sediment samples	6/30 -7/02/08
4) Complete sediment oxygen demand analysis and testing	7/02/08
5) Complete all analytical reports and release data	11/30/08
6) Complete assessment report incorporating all data	11/30/08
7) Meet with MDEP to discuss data	by 11/30/08

8.0 Data Quality

The quality of the data is to be within ranges associated with the specific approved protocols. Refer to parameter methods and standard operating procedures for more information.

Data Representativeness:

The sample must be representative of conditions existing at the time of sample collection. Field and laboratory conditions, which may affect sample integrity, are to be documented in the field logbook. At least 80% of the data must be determined to be representative for the project to be considered complete.

Laboratory Data Evaluation:

After data is review by the analyst, it is reviewed and signed off for release by the Field Project Manager and Acting EMT Team Leader.

Corrective Action:

When it is found that data is incomplete or that results are unacceptable, the Project Officer may determine that one or more of the following procedures for corrective action shall be undertaken:

1. Incomplete data:

Omissions from logs, notebooks and worksheets place the entire analysis in question. If data does not meet the 90% data completeness requirement, a meeting will be held with the analyst and QA officer to determine an appropriate response. Incomplete field sampling data may require re- sampling of the questionable location. Incomplete laboratory data usually calls for reintroduction or re- analysis of the questionable sample if feasible.

2. Conflicting or poor quality data:

When results from duplicates, spikes, blanks, etc. do not meet the described QC goals, the project officer and QA officer will review the available data. Upon examination, all or some of the following actions may be applied:

- a. Systems audit for analyte in question.
- b. Determination of matrix interference.
- c. Re-sampling of the questionable sample.
- d. Reconsideration of acceptable limits with statements explaining the results of the action/rationale taken.
- e. Rejection of data and exclusion from the report with written explanation.
- f. Rejection of the entire sample/site location with recommendation of relocation of sample site or reconsideration of results.

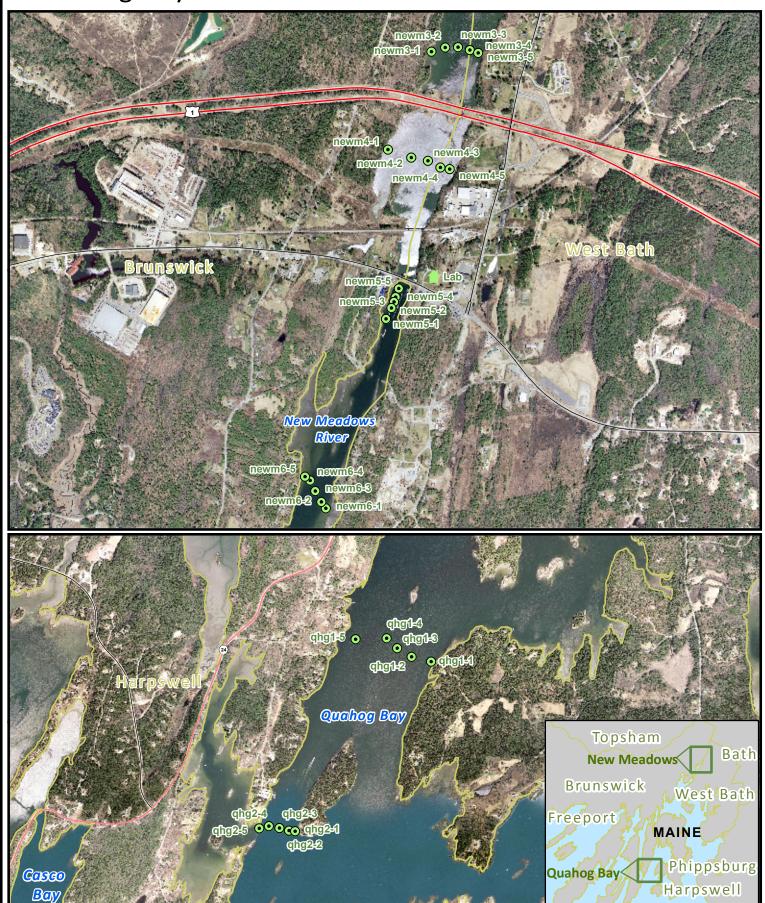
9.0 Final Report

The final report will include all analytical results and water/sediment quality evaluations. The report will be written by Tim Bridges and sent to Diane Gould at OEP and Mike Doan, Friends of Casco Bay for future decision-making. If necessary, a meeting will be scheduled when the final report is released to discuss the results and future monitoring. A copy will remain in OEME central files. Other copies will be available upon request.

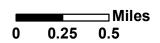
10.0 Reconciliation with Project Objectives

If the project objectives stated in section 1.0 and the QC goals in Tables 5 and 6 are met then the project goals have been met. If the project goals have not been met, project management will meet to determine future work under this QAPP.

Quahog Bay and New Meadows SOD Station Locations









Latitude	Longitude	Station	PDOP	Date	Time	# of Pos	Horiz Acc	
decdeg	decdeg				EDT		meters	
<u> </u>								
	-69.866788		2.7		03:51:12pm	20	0.7	
	-69.865958				03:54:37pm	21	0.8	
43.920947			2.1		04:03:37pm	20	0.6	
		NEWM3-3rep	2.4		08:41:01am	23	0.5	
	-69.864491		2.4		08:43:55am	20	0.5	
43.920644	-69.863989	NEWM3-5	2.4	7/1/2008	08:47:06am	21	0.5	
	-69.869698		3.5		09:32:12am	21	0.7	
	-69.868336		4.7		09:42:33am	20	0.6	
	-69.867350		2.4		09:48:07am	21	0.6	
	-69.866632		3.0		10:05:45am	20	8.0	
43.915700	-69.866073	NEWM4-5	2.6	7/1/2008	10:12:37am	20	0.7	
		_						
	-69.915228		2.3		02:58:10pm	23	0.6	
	-69.916747		3.8		03:03:38pm	21	0.7	
	-69.917863		2.2		03:11:14pm	23	0.6	
43.808678	-69.918690	QHG 2-4	2.5	7/1/2008	03:30:08pm	21	0.7	
43.808613	-69.921099	QHG 2-5	3.6	7/1/2008	03:39:53pm	34	1	
	-69.928612		3.6		03:53:40pm	23	0.9	
43.794045	-69.927853	QHG 1-4	3.4		04:15:10pm	21	0.7	
	-69.927032		3.4		04:31:46pm	21	0.8	
	-69.926292		3.3		04:35:35pm	20	0.7	
43.793651	-69.925827	QHG 1-1	2.9	7/1/2008	04:41:34pm	20	0.8	
	-69.874582		5.9		07:35:34am	21	8.0	
	-69.874835		2.2		07:39:55am	21	0.7	
43.902119	-69.875158	NEWM6-3	3.2	7/2/2008	07:44:34am	20	0.7	
43.902582	-69.875424		3.4	7/2/2008	07:48:29am	20		
43.902761	-69.875718	NEWM6-5	2.2	7/2/2008	07:53:53am	20	0.6	
	-69.869500		5.5		09:29:14am	22	0.9	
	-69.869721		2.0		09:30:43am	30	0.6	
43.910100	-69.869849	NEWM5-3	3.4	7/2/2008	09:31:39am	34	0.6	
	-69.870017		2.4		09:32:44am	33	0.6	
43.909384	-69.870380	NEWM5-1	3.6	7/2/2008	09:34:02am	38	8.0	

Postprocessed Code GeoXT 2005 Point_generic NEWMEADOWS.cor