Technical Memorandum

Date: 14 September 2017

To: Nelson Walter, Amec Foster Wheeler, Portland, ME
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From: Emmet Curtis, Amec Foster Wheeler, Kennesaw, GA

Ref: Penobscot River Phase III Engineering Study

Re: WO3A-010 Task 2 BSAF Calculations
Summary of Biota-Sediment Accumulation Factor Evaluation
Amec Foster Wheeler Project No. 3616166052

Purpose

The purpose of this technical memorandum is to document calculated relationships between the mercury concentrations observed in sediment and the mercury concentrations observed in biota living and foraging within the Penobscot River system. These numerical relationships have been developed by calculating biota-sediment accumulation factors (BSAFs) for mercury and methyl mercury. BSAFs are used to describe the uptake of contaminants into biota from sediment and are used widely in evaluations of risk via dietary uptake for ecological receptors exposed to sediments. BSAFs provide insight into conditions driving bioaccumulation within a system and can be used to gauge the potential success of a remedy. BSAFs are one of the controlling factors in the development of preliminary remediation goals (PRGs). As sediment concentrations change in the system through active remediation or through natural recovery, mercury concentrations within biota tissue is also expected to change and this change can be estimated by the BSAF, and can be used to estimate reduction in risk resulting from decreased sediment mercury concentrations. These changes are not uniform for all species because mercury bioaccumulates/biomagnifies in the food web at differing rates for different species. Thus, BSAFs were evaluated for different trophic levels within the food web. BSAFs were also evaluated at various locations within the Penobscot system to spatially assess bioaccumulation throughout the system.

This technical memo, including attachments, summarizes the data and subsequent BSAF calculations for sediment and biota collected in 2016 and winter months of 2017. Sediment data include samples collected from the Penobscot River (and estuary), and reference locations in the

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Pleasant River and Frenchman Bay. Biota were also collected from these locations. Biota samples collected in 2016 included terrestrial insects (tissue), spiders (tissue), Nelsons sparrow (blood), red-winged blackbird (blood), polychaetes (tissue), American lobster (tissue), mummichog (tissue), rainbow smelt (tissue), American eel (tissue), Atlantic tomcod (tissue), and blue mussels (tissue). American black duck (tissue and blood) samples were collected in the winter months of January and February 2017 due to their migratory patterns and temporal restrictions of sampling.

Standard BSAF Development

The BSAF is defined as follows:

$$\text{BSAF} = \frac{\text{Biota Concentration (wet weight)}}{\text{Sediment Concentration (dry weight)}}$$

Ideally, BSAFs should be developed from spatially and temporally collocated biota and sediment samples under similar system conditions. The 2016 sediment and biota data were utilized to calculate BSAFs for biota by location for total mercury and methyl mercury. A portion of the sediments collected in 2016 were directly collocated with biota sample locations (Table 1), while additional sediment samples were also used in development of the BSAFs (Table 2). Sediment samples were collected from 0 up to 6 inches in depth. The bioactive zone in estuarine and freshwater tidal environments, like the Penobscot system, is typically 10 to 15 cm (4 to 6 inches); while marine environments tend to have a shallower bioactive zone (5 to 10 cm) (USEPA, 2015). The sediments used for BSAFs were determined by the home range of the biota (Table 3), as well as accounting for habitat type and potential exposure of the receptor and its prey. That is, for each biota collection location, the sediments used in the BSAF at that particular location included sediments within the radius of the biota's home range. For example, lobster have a home range of approximately 1.9 miles. Therefore, for a sediment-to-lobster BSAF collected at location "x", the sediments within a 1.9 mile-radius of location "x" were used in the BSAF calculation. Total mercury was analyzed for each 2016 sediment sample. The majority of the sediment samples were also analyzed for methyl mercury. Non-detect sediment samples were excluded from the analysis.

Total mercury was analyzed for each of the biota; however, methyl mercury was only analyzed for the lowest trophic level biota (i.e., polychaetes, terrestrial insects, and spiders). For the remaining biota, methyl mercury values were calculated by conversion of the total mercury result to a methyl mercury value based on the percentage of methyl mercury to total mercury in historical biota samples (Table 4). Exceptions to this table were red-winged blackbird and American black duck tissue, as historic samples were not available to calculate a methyl mercury percentage of total mercury. Red-winged blackbird utilized the Nelson's sparrow percentage as an estimate, while the percentage for American black duck tissue was based on the mean of values cited in literature. For fish and shellfish, similar sizes of species were collected for analysis to reduce variability in tissue concentrations due to varying sizes or ages. Non-detect biota samples were excluded from the analysis. A summary of the non-detect biota samples is presented in Table 5.

The 2016 biota and sediment samples paired using the home range of the biota were spatially mapped to sort data by study location (e.g., Mendall Marsh Southeast [MMSE], Mendall Marsh Southwest [MMSW], Odom Ledge). BSAFs were calculated using the median biota

concentrations and the median sediment concentrations for each study location. BSAFs were developed for total mercury and methyl mercury. These BSAFs, along with the median biota and sediment concentrations calculated to derive the BSAFs, were spatially mapped for each receptor by study location. A median study area (i.e., the Penobscot River study area) BSAF was then calculated using the BSAFs from each study location. The use of the median rather than the mean reduces the influence of a single high or low concentration on the overall BSAF calculation. The median was used to provide a better estimate of central tendency of bioaccumulation that is influenced by differences in the biogeochemical processes of the Penobscot system.

Standard BSAF Results Summary

The 2016 BSAF calculations are included in Attachment A and depicted in the attached figures. The BSAFs are summarized by biota and location for total mercury (Table 6) and methyl mercury (Table 7). Standard error estimates for each BSAF are also provided in Tables 6 and 7. The BSAFs are discussed in the following section by biota type. Additional samples collected in 2017 will be included to update the calculation of BSAFs.

Total Mercury

- Terrestrial insect BSAFs within the marsh areas ranged from 0.03 (W-17-N) to 2.6 (MMSE) (Figure 1a). The BSAF of 2.6 from MMSE appears elevated due to a lower median sediment concentration and a higher median tissue concentration compared to the other locations. Sediment concentrations for two of the MMSE samples were markedly lower than in samples collected from other locations in Mendall Marsh. The remaining BSAFs were relatively consistent across the marsh areas. The median study area BSAF (based on 3 locations) was 0.09 with a standard error of ±0.04. The low median sediment concentration based on samples collected in MMSE was excluded from the error propagation analysis due to skew (Table 6).
- Spider BSAFs within the marsh areas ranged from 0.30 (W-17-N) to 2.2 (MMSE) (Figure 2a). The BSAF of 2.2 from MMSE appears elevated due to a lower median sediment concentration compared to the other locations. The remaining BSAFs were relatively consistent across the marsh areas. The median study area BSAF (based on 3 locations) was 0.35 with a standard error of ±0.80 (Table 6).
- Nelson's sparrow BSAFs within the marsh areas ranged from 6.0 (W-17-N) to 73 (MMSE) (Figure 3a). The BSAF of 73 from MMSE appears elevated due to a lower sediment concentration compared to the other locations. The median study area BSAF (based on 3 locations) was 9.5 with a standard error of ±27 (Table 6).
- The red-winged blackbird BSAF within the marsh area of W-17-N was 2.0 with a standard error of ±1.7 (Figure 4a). Blackbirds were only collected from a single location within the study area (Table 6).
- Polychaete BSAFs within the study area ranged from 0.06 (South Verona) to 0.57 (Fort Point) (Figure 5a). The BSAF of 0.06 appears lower compared to other locations due to a low median tissue concentration. The remaining BSAFs were relatively consistent, slightly increasing from upstream to downstream on ebb tide. The median study area BSAF (based on 5 locations) was 0.28 with a standard error of ±0.11 (Table 6).
- American black duck blood and tissue BSAFs were calculated for two locations within the study area. Blood BSAFs were 0.43 (South Verona) and 0.95 (MM), while tissue BSAFs

were 0.33 (MM) and 0.50 (South Verona) (Figures 6a and 6b). The median study area blood BSAF was 0.69 with a standard error of ±0.17, while the median study area tissue BSAF was 0.42 with a standard error of ±0.23 (Table 6).

- American lobster BSAFs within the study area ranged from 0.33 (Turner Point) to 1.9 (Harborside) (Figure 7a). The BSAF of 1.9 from Harborside appears elevated due to a lower median sediment concentration compared to other locations. The remaining BSAFs were relatively consistent among locations. The median study area BSAF (based on 5 locations) was 0.36 with a standard error of ±0.38 (Table 6).
- Mummichog BSAFs within the study area ranged from 0.12 (OB-05) to 3.8 (MMSE). The BSAF of 3.8 from MMSE appears highly elevated due to a lower median sediment concentration compared to other locations. The remaining BSAFs were relatively consistent across the study area. The median study area BSAF (based on 4 locations) was 0.39 with a standard error of ±0.19; MMSE was excluded from the error propagation analysis due to skew, attributed to the low sediment concentration in comparison to other locations in Mendall Marsh (Table 6).
- Rainbow smelt BSAFs within the study area ranged from 0.07 (ES-13) to 0.36 (OB-05) and were relatively consistent among locations (Figure 9a). The median study area BSAF (based on 5 locations) was 0.10 with a standard error of ±0.07 (Table 6).
- American eel BSAFs within the study area ranged from 0.53 (OB-01) to 2.0 (OB-05) (Figure 10a). The BSAF of 2.0 from OB-05 appears elevated due to a lower median sediment concentration compared to other locations. The remaining BSAFs were relatively consistent across the study area. The median study area BSAF (based on 3 locations) was 0.97 with a standard error of ± 0.55 (Table 6).
- The Atlantic tomcod BSAF for the study area was 0.28 with a standard error of ±0.02 (Figure 11a). A single BSAF was calculated for the entire study area, as the species has a large home range (Table 6).
- Blue mussel BSAFs within the study area ranged from 0.09 (ES-03) to 1.2 (ES-FP) (Figure 12a). The BSAF of 1.2 from ES-FP appears elevated due to a lower median sediment concentration compared to other locations. The remaining BSAFs were relatively consistent across the study area. The median study area BSAF (based on 4 locations) was 0.26, with a standard error of ±0.33 (Table 6).

Background location mercury BSAFs were calculated for terrestrial insects, spiders, Nelson's sparrows, polychaetes, black duck, mummichog, smelt, and tomcod (Table 6). The BSAFs were generally an order of magnitude higher than the median study area BSAFs. Polychaete and smelt BSAFs were the same order of magnitude. The background location BSAFs are based on mercury data from uncontaminated areas and are considered more variable because bioavailability of mercury is dependent upon site-specific sediment conditions and is not based on a linear relationship. Background location BSAFs are provided for informational purposes only.

Methyl Mercury

- Terrestrial insect BSAFs within the marsh areas ranged from 1.5 (W-17-N) to 10 (MMSE) (Figure 1b). The BSAF of 1.5 from location W-17-N appears lower compared to other marsh areas due to a higher median sediment concentration. The remaining BSAFs were

relatively consistent across the marsh areas. The median marsh area BSAF (based on 3 locations) was 4.1 with a standard error of ±3.2 (Table 7).

- Spider BSAFs within the marsh areas ranged from 4.5 (W-17-N) to 19 (MMSE) (Figure 2b). The BSAF of 4.5 from location W-17-N appears lower compared to other marsh areas due to a higher median sediment concentration. The remaining BSAFs were relatively consistent across the marsh areas. The median marsh area BSAF (based on 3 locations) was 18 with a standard error of ±5.9 (Table 7).
- Nelson's sparrow BSAFs within the marsh areas ranged from 221 (W-17-N) to 811 (MMSW) (Figure 3b). The median marsh area BSAF (based on 3 locations) was 649 with a standard error of ±220 (Table 7).
- The red-winged blackbird BSAF within the marsh area of W-17-N was 111 with a standard error of ±140 (Figure 4b). Blackbirds were only collected from a single location within the study area (Table 7).
- Polychaete BSAFs within the study area ranged from 0.08 (South Verona) to 2.2 (Fort Point) (Figure 5b). The BSAF of 0.08 from South Verona appears lower compared to other locations due to a lower median tissue concentration, whereas the BSAF of 2.2 from Fort Point appears to be higher compared to other locations due to a lower median sediment concentration. The remaining BSAFs were relatively consistent. The median study area BSAF (based on 5 locations) was 0.66 with a standard error of ±0.49 (Table 7).
- American black duck blood and tissue BSAFs were calculated for two locations within the study area. Blood BSAFs were 26 (South Verona) and 84 (MM), while tissue BSAFs were 31 (South Verona) and 30 (MM) (Figures 6c and 6d). The median study area blood BSAF was 55 with a standard error of ±31, while the median study area tissue BSAF was 30 with an error of ±26 (Table 7).
- American lobster BSAFs within the study area ranged from 14 (Odom Ledge) to 248 (Harborside) (Figure 7b). The BSAF of 248 from Harborside appears highly elevated due to a lower median sediment concentration. The remaining BSAFs were relatively consistent. The median study area BSAF (based on 5 locations) was 27 with a standard error of ±4.4; the Harborside location was excluded from the error propagation analysis due to skew, attributed to the low sediment concentration in comparison to other locations (Table 7).
- Mummichog BSAFs within the study area ranged from 1.9 (BO-04) to 386 (MMSE) (Figure 8b). The BSAF of 386 from MMSE appears highly elevated due to a very low median sediment concentration relative to other locations. The median study area BSAF (based on 3 locations) was 4.0 with a standard error of ±1.3; MMSE was excluded from the error propagation analysis due to skew, attributed to the low sediment concentration in comparison to other locations in Mendall Marsh (Table 7).
- Rainbow smelt BSAFs within the study area ranged from 5.1 (South Verona) to 25 (Figure 9b). The BSAF of 25 from location OB-05 appears elevated due to a higher median tissue concentration compared to other locations. The remaining BSAFs were relatively consistent. The median study area BSAF (based on 5 locations) was 7.9 with a standard error of ±4.6 (Table 7).
- American eel BSAFs within the study area ranged from 34 (OB-05) to 89 (BO-05) (Figure 10b). The median study area BSAF (based on 2 locations) was 62 with a standard error of ±35 (Table 7).

- The Atlantic tomcod BSAF for the study area was 21 with a standard error of ±1.6 (Figure 11b). A single BSAF was calculated for the entire study area, as the species has a large home range (Table 7).
- Blue mussel BSAFs within the study area ranged from 0.90 (South Verona) to 9.8 (Fort Point) (Figure 12b). The BSAF of 0.90 from South Verona appears lower compared to other locations due to a higher median sediment concentration. The remaining values were relatively consistent. The median study area BSAF (based on 4 locations) was 5.2 with a standard error of ±2.3 (Table 7).

Background location methyl mercury BSAFs were calculated for terrestrial insects, spiders, Nelson's sparrows, and mummichog (Table 7). The BSAFs were generally within the same order of magnitude as the median study area BSAFs. The mummichog BSAF for Frenchman Bay was an order of magnitude higher than the study area. The background location BSAFs are based on mercury (for data requiring conversion to methyl mercury) and methyl mercury data from uncontaminated areas. Background location BSAFs are considered more variable because bioavailability of methyl mercury is dependent upon site-specific sediment conditions, the methylation potential may differ between the background and study areas, and bioaccumulation of methyl mercury is not based on a linear relationship. Background location BSAFs are provided for informational purposes only.

Summary

The following trends were observed in the BSAF evaluation:

- Methyl mercury BSAFs were higher than mercury BSAFs, as expected since methyl mercury is the predominant form that bioaccumulates in biota.
- Mercury BSAFs for terrestrial insects, spiders, and Nelson's sparrow were elevated at MMSE compared to the other marsh areas (W-17-N and MMSW) based on median study area BSAFs.
- Methyl mercury BSAFs for terrestrial insects, spiders, and Nelson's sparrow were lower at W-17-N compared to MMSE and MMSW, indicating greater potential for mercury methylation and bioaccumulation in Mendall Marsh.
- BSAFs for polychaetes were generally within the same order of magnitude and consistent between locations.
- Two locations were sampled for American black duck. South Verona blood and tissue BSAFs were relatively similar. MM blood BSAFs were higher than tissue BSAFs, but within the same of order of magnitude.
- BSAFs for lobsters were generally consistent between locations. Harborside BSAFs were elevated in comparison to other locations due to lower median sediment concentrations.
- Fish (i.e., mummichog, rainbow smelt, and eel) BSAFs were generally consistent as a whole, except for a few locations with elevated BSAFs due to either lower median sediment concentrations or elevated biota concentrations compared to other locations. Due to the tomcod's large home range radius, one BSAF was calculated for the entire study area.
- Blue mussel BSAFs were generally consistent, except for a few locations with either lower or higher median sediment concentrations compared to other locations.

- The BSAFs generated in this Tech Memo will be updated with available 2017 data and used in the ecological risk evaluation and in the generation of PRGs as part of the Alternatives Evaluation Report.

Normalized BSAF Development

A second BSAF evaluation was conducted using the 2016 data to provide a comparison to the standard BSAF calculation discussed in the prior two sections of this document. Methyl mercury binds to organic carbon in soil, so the organic content of the soil/sediment may affect the bioavailability. Methyl mercury typically accumulates in tissue, especially protein, and is not very lipid soluble like organic compounds. For normalization, biota tissue concentrations on a sample by sample basis were divided by percent lipids, and sediment concentrations were divided by percent total organic carbon (TOC) prior to dividing the biota concentration by the sediment concentration for the BSAF. Normalization of data by lipid and organic carbon content can prove useful in the development of BSAFs by correcting for differences in bioavailability and sorbing behavior. The normalized BSAFs have to be converted back to a non-normalized (e.g., denormalized) form for comparison to BSAFs using the standard approach. The denormalization process used the average percent lipids for the dataset to multiply by the biota term and average TOC for the dataset to multiply by the sediment term. Denormalization of the BSAFs allows for direct comparison to the standard BSAFs.

Attachment B includes the normalized and denormalized BSAF calculations. Comparison of the denormalized BSAFs to the standard BSAFs is provided in Attachment B, Table B-1. The ranges were similar for denormalized and standard BSAFs. Thus, either approach results in similar BSAFs. The recommendation for the study area is to proceed using the standard BSAF approach.

Historical BSAF Comparisons

Biota and sediment data collected within the study area between 2006 and 2012 were compiled and included in the BSAF evaluation. The historical biota and sediment data were paired using the home range of the biota and spatially mapped to sort data by study location. The paired datasets were reduced to include biota and sediment samples collected within 8 months of the other in an effort to evaluate biota samples temporally associated with sediment samples under similar system conditions, yet to provide a robust dataset for evaluation. BSAFs were calculated using the same approach as the 2016 BSAFs, using the median biota concentrations and the median sediment concentrations for each study location. Total mercury and methyl mercury data were available for biota and sediment. BSAFs were developed for total mercury and methyl mercury, and a median study area BSAF was calculated for each biota type.

Median study area BSAFs based on data collected in 2016/winter 2017 are summarized in Table 8, along with median study area BSAFs based on historical data collected between 2006 and 2012 to compare BSAFs by biota. Attachment C presents summary tables of the historical total mercury and methyl mercury BSAFs by biota and location, while Attachment D presents summary tables for the BSAF error propagation calculations.

Despite general inconsistencies with the number of biota and sediment samples collected, the lack of collocated biota and sediment samples, and variable locations of samples among the years of sampling, the BSAFs are notably similar.

- The mercury BSAFs are generally within the same magnitude, with the exception of the red-winged blackbird. However, limited blackbirds were sampled both historically and in 2016. The historical mercury BSAF for MMSE was elevated due to higher blood concentrations compared to other locations and the 2016 samples collected (W-17-N).
- The methyl mercury BSAFs are also generally within the same magnitude, with the exception of blue mussels. Historical sampling for blue mussels was conducted in Parker Cove, along with the ES Areas. Blue mussel sampling in 2016 focused on the ES Areas, resulting in noticeable BSAF inconsistencies.
- Generally, BSAFs were consistent between 2016 and historical data, and were within the same order of magnitude. BSAFs variably increased or decreased among mercury and methyl mercury for each biota, and among different biota, but generally remained the same order of magnitude.

As such, given the general consistencies between the BSAFs, 2016/2017 data will be used to calculate BSAFs as part of the risk assessment. Use of these recent datasets removes the uncertainties associated with the historical BSAFs due to the spatial and temporal differences observed in the historical pairing datasets.

Recommendations

Additional sediment and biota monitoring data will be collected during the 2017 field season. The 2016 BSAFs will be updated with additional sediment and biota monitoring data collected during the 2017 field season to increase the robustness of the datasets. These updated BSAFs will be used in the development of PRGs and risk reduction calculations for the Penobscot system. As the ranges were similar for denormalized and standard 2016 BSAFs, the recommendation for the study area is to proceed using the standard approach. Lipid data for normalization of BSAFs are not necessary for samples collected in 2017 because either approach (e.g., the standard or the normalization BSAF approach) results in similar BSAFs.

Evaluation of bioaccumulation factors (BAFs) for biota to biota accumulation of mercury using the 2016/2017 data will be conducted in the Baseline Ecological Risk Assessment. Bioaccumulation in organisms at the base of the food web in small, localized areas is an indicator of bioaccumulation in upper trophic level receptors with larger home ranges. Thus, an organism's bioaccumulation potential in the local environment will be used to estimate the amount of bioaccumulation occurring in organisms that might feed in the entire Penobscot system. The BAFs, along with the BSAFs, will be used during the development of PRGs and quantification of risk reduction for the Penobscot system.

References

USEPA, 2015. *Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic Ecological Risk Assessments*. EPA/600/R-15/176 ERASC-015F. October 2015

Tables

Figures

Attachments

TABLES

TABLE 1
SUMMARY OF 2016 COLLOCATED SEDIMENT SAMPLES
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

		Parameter	Mercury		Methyl Mercury		TOC	
		Method	EPA 7474		EPA 1630[1]		Lloyd Kahn	
		Units	ng/g		ng/g		%	
Location ID	Sample Date	Sample ID	Result	Qual.	Result	Qual.	Result	Qual.
ADD-01	07/21/16	ADD-01_072116_SED_03	29.6	AO	1.19		20.6	
ADD-02	07/22/16	ADD-02_072216_SED_03	32.6	AO	4.11		2.67	
BO-04	07/25/16	BO-04_072516_SED_03	117	AO	1.85	J	1.26	J
BO-04-02	07/26/16	BO-04-02_072616_SED_03	980	AO	54.3	J	7.48	
BO-05	07/20/16	BO-05_072016_SED_03	1793	AO	13.5		9.26	
E-01-03	07/28/16	E-01-03_072816_SED_03	567	AO	11.5		3.91	J
E-01-04	07/28/16	E-01-04_072816_SED_03	569	AO	16.1		3.25	J
ES-03	07/28/16	ES-03_072816_SED_03	863	AO	6.40		4.85	J
ES-13	07/27/16	ES-13_072716_SED_03	416	AO	28.8		2.96	
ES-15	07/27/16	ES-15_072716_SED_03	151	AO	4.66		2.95	
ES-FP	07/28/16	ES-FP_072816_SED_03	48.1	AO	2.57		0.359	J
FRB-01	09/28/16	FRB-01_092816_SED_03	7.53	AO	0.122	U	0.444	
HB-01	12/01/16	HBI-01_120116_SED_03	53.5	AO	0.320	J	--	
HB-01	10/27/16	HB1_01_102716_SED3	--		--		0.628	J
L9-45	07/28/16	L9-45_072816_SED_03	72.9	AO	1.145		0.539	J
MMPOLY	07/29/16	MMPOLY_072916_SED_03	554	AO	13.4		4.82	
OB-05	07/26/16	OB-05_072616_SED_03	755	AO	19.3		5.75	
OL-01	07/27/16	OL-01_072716_SED_03	282	AO	11.7		1.79	
SVE-01	07/27/16	SVE-01_072716_SED_03	563	AO	31.3		2.56	
W-17-High-2016	07/21/16	W-17-HIGH_072116_SED_03	1267	AO	38.0		8.52	
W-17-Intertidal	07/26/16	W-17-INTERTIDAL_072616_SED_03	518	AO	3.77		1.66	
W-17-Low	07/26/16	W-17-LOW_072616_SED_03	471	AO	4.88	J	2.57	
W-17-Mid-2016	07/21/16	W-17-MID_072116_SED_03	1179	AO	5.15		4.86	
W17-N	07/21/16	W17-N_072116_SED_03	476	AO	86.8		15.6	
W-21-High	07/25/16	W-21-HIGH_072516_SED_03	929	AO	27.0		7.86	
W-21-Inter	07/25/16	W-21-INTERTIDAL_072516_SED_03	543	AO	4.04		5.13	
W-21-Low	07/25/16	W-21-LOW_072516_SED_03	705	AO	4.59		7.10	
W-21-Mid	07/25/16	W-21-MID_072516_SED_03	869	AO	4.74		5.78	
W-21-UM-Central-C	07/27/16	W-21UM-CENTRAL-C_072716_SED_03	617	AO	12.0		13.5	
W-21-UM-East-C	07/25/16	W-21UM-EAST-C_072516_SED_03	752	AO	2.19		5.78	
W-21-UM-West-A	07/27/16	W-21UM-WEST-A_07/27/16_SED_03	434	AO	1.22		11.4	
W-61-HIGH	11/08/16	W-61-HIGH_110816_SED_03	594	AO	8.33		15.8	
W-61-INT	11/08/16	W-61-INT_110816_SED_03	1163	AO	9.57		10.9	
W-61-LOW	11/08/16	W-61-LOW_110816_SED_03	927	AO	32.2		8.51	
W-61-MID	11/08/16	W-61-MID_110816_SED_03	1483	AO	11.4		12.1	
W-63-HIGH	11/08/16	W-63-HIGH_110816_SED_03	36.8	AO	0.397		0.41	J
W-63-INT	11/08/16	W-63-INT_110816_SED_03	1123	AO	19.2		9.81	
W-63-LOW	11/08/16	W-63-LOW_110816_SED_03	229	AO	3.85		2.52	
W-63-MID	11/08/16	W-63-MID_110816_SED_03	215	AO	11.9		4.64	
W-65-High	07/25/16	W-65-HIGH_072516_SED_03	84.3	AO	0.116	U	15.3	
W-65-Intertidal	07/25/16	W-65-INTERTIDAL_072516_SED_03	41.8	AO	0.354		0.458	
W-65-Low	07/25/16	W-65-LOW_072516_SED_03	32.6	AO	0.034	U	2.41	
W-65-Mid	07/25/16	W-65-MID_072516_SED_03	226	AO	9.02		26.0	

Notes:
O - samples were orginally analyzed for mercury via EPA 1631, but were reanalyzed via 7474.
[1]Methyl mercury results calculated using a regression equation based on methyl mercury concentrations measured by methylene chloride extraction versus methanolic KOH extraction.
EPA - United States Environmental Protection Agency
A - the reported concentration represents an average of triplicate analyses
J - the reported concentration is considered an estimated value
ng/g - nanograms per gram
% - percent
Qual. - qualifier
TOC - total organic carbon
U - the target parameter was not detected above the method dection limit
-- not available

Prepared By/Date: JAW 06/06/17
Checked By/Date: KPH 06/07/17

TABLE 2
SUMMARY OF 2016 NON-COLLOCATED SEDIMENT SAMPLES
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

		Parameter	Mercury		Methyl Mercury		TOC	
		Method	EPA 7474		EPA 1630[1]		Lloyd Kahn	
		Units	ng/g		ng/g		%	
Location ID	Sample Date	Sample ID	Result	Qual.	Result	Qual.	Result	Qual.
BU-02	06/20/16	BU2_060916_SED_G	856		--		8.02	J
BU-03	06/20/16	BU3_060916_SED_G	3590		--		9.49	J
BU-04	06/21/16	BU4_060716_SED_G	1100		--		26.6	J
BU-19L	06/21/16	BU19L_060716_SED_G	83.0		--		0.675	J
BU-20L	06/21/16	BU20L_060716_SED_G	1150		--		43.5	J
BU-21R	06/21/16	BU21R_060716_SED_G	926		--		16.7	J
BU-24R	06/20/16	BU24R_060716_SED_G	82.0		--		0.453	J
BU-26H	06/21/16	BU26H_060716_SED_G	994		--		38.6	J
BU-27H	06/21/16	BU27H_060716_SED_G	1220		--		39.2	J
BU-28H	06/20/16	BU28H_060716_ML_C	162		--		30.2	J
BU-29H	06/20/16	BU29H_060716_SED_G	809		--		5.24	J
BU-30F	06/21/16	BU30F_060716_SED_G	407		--		4.24	J
BU-31F	06/21/16	BU31F_060716_SED_G	734		--		37.8	J
BU-32F	06/21/16	BU32F_060716_SED_G	682		--		12.0	J
CJ01	10/08/16	CJ01_10082016_SED	150	O	1.93	J	--	
CJ03	10/08/16	CJ03_10082016_SED	497	O	7.03		--	
CJ04	10/08/16	CJ04_10082016_SED	512	O	4.54	J	--	
CJ05	10/08/16	CJ05_10082016_SED	545	O	5.08	J	--	
CJ06	10/08/16	CJ06_10082016_SED	573	O	4.72		--	
CJ07	10/08/16	CJ07_10082016_SED	295	O	2.43	J	--	
CJ08	10/08/16	CJ08_10082016_SED	194	O	2.12	J	--	
CJ09	10/08/16	CJ09_10082016_SED	382	O	2.62	J	2.77	J
CJ10	10/08/16	CJ10_10082016_SED	513	O	4.83	J	3.25	J
CJ11	10/07/16	CJ11_10072016_SED	728	O	7.98		--	
CJ12	10/07/16	CJ12_10072016_SED	543	O	4.79	J	2.69	J
CJ13	10/07/16	CJ13_10072016_SED	600	O	10.4		3.44	J
CJ17	10/08/16	CJ17_10082016_SED	455	O	4.66		--	
CJ18	10/08/16	CJ18_10082016_SED	494	O	5.96		--	
CJ19	10/07/16	CJ19_10072016_SED	252	O	3.99	J	--	
CJ20	10/07/16	CJ20_10072016_SED	509	O	4.54	J	3.30	J
CJ21	10/07/16	CJ21_10072016_SED	303	O	2.52	J	2.57	J
CJ22	10/07/16	CJ22_10072016_SED	190	O	1.97	J	1.90	J
E-01-01	07/28/16	E-01-01_072816_SED_03	1207	AO	21.1		5.93	J
EC-37ABCDE	06/21/16	EC37ABCDE_060916_SED_C	842		--		6.97	J
EC-38	06/10/16	EC38ABCDE_060916_SED_C	777		--		4.77	J
EC-38ABCDE	06/21/16	EC38ABCDE_060916_ML_C	973		--		7.82	J
EC-39ABC	06/21/16	EC39ABC_060916_ML_C	896		--		7.21	J
EC-39ABC	06/20/16	EC39ABC_060916_SED_C	578		--		5.72	J
EC-40AB	06/10/16	EC40AB_061016_SED_C	650		--		4.24	J
EC-41ABCDE	06/21/16	EC41ABCDE_060916_SED_C	885		--		25.5	J
ES-02	07/27/16	ES-02_072716_SED_03	961	AO	38.0		7.37	
ES-04	07/28/16	ES-04_072816_SED_03	301	AO	2.70		3.36	
FF-01H	06/21/16	FF1H_060616_SED_G	78.0		--		1.70	J
FF-02H	06/20/16	FF2H_060616_SED_G	177		--		0.894	J
FF-03H	06/21/16	FF3H_060616_SED_G	83.0		--		1.04	J
FF-05H	06/21/16	FF5H_060616_SED_G	79.0		--		0.318	J
FF-06H	06/21/16	FF6H_060616_SED_G	93.0		--		0.329	J
FF-10F	06/20/16	FF10F_060616_SED_G	770		--		6.38	J
FF-11F	06/20/16	FF11F_060616_SED_G	339		--		1.89	J
FF-12F	06/21/16	FF12F_060616_SED_G	74.0		--		1.39	J
FF-08F	06/20/16	FF8F_060616_SED_G	745		--		3.27	J
FF-09F	06/20/16	FF9F_060616_SED_G	62.0		--		0.517	J
FF-14F	06/21/16	FF14F_060616_SED_G_1	47.0		--		0.328	J
FF-14F	06/21/16	FF14F_060616_SED_G_2	222		--		3.14	J
FF-16H	06/21/16	FF16H_060616_SED_G	139		--		0.795	J
FF54	10/19/16	FF54_10192016_SED	1040	O	12.4		4.86	
FPC-01	06/09/16	FPC1_060816_SED_G	389		--		2.30	J
FPC-02	06/09/16	FPC2_060816_SED_G	588		--		2.40	J
FPC-03	06/09/16	FPC3_060816_SED_G	694		--		4.1	J
FPC-04	06/09/16	FPC4_060816_SED_G	681		--		3.37	J
GP-33	06/10/16	GP33H_060916_SED_C	283		--		3.06	J
GP-34AB	06/20/16	GP34AB_060916_SED_C	397		--		3.2	J
GP-35ABC	06/20/16	GP35ABC_060916_SED_C	822		--		6.09	J
GP-36	06/10/16	GP36ABC_060816_SED_C	518		--		5.15	J
GP-36ABC	06/20/16	GP36ABC_060916_SED_C	883		--		5.96	J
HA-01	06/09/16	HA1_060916_SED_G	438		--		8.83	J
MM62	10/20/16	MM62_10202016_SED	714	O	14.9		5.84	
MM65	10/19/16	MM65_10192016_SED	821	O	21.4	J	6.74	
MM71	10/20/16	MM71_10202016_SED	1040	O	7.74	J	6.48	
OD-01	06/09/16	OD1_060916_SED_G	454		--		2.45	J
OD-02	06/09/16	OD2_060916_SED_G	568		--		1.66	J
OD-03	06/09/16	OD3_060916_SED_G	634		--		4.91	J
OV-01	07/22/16	OV-01_072216_SED_03	27.7	AO	0.034	J	0.367	
OV-02	07/22/16	OV-02_072216_SED_03	62.8	AO	6.30		4.37	
OV-04	07/22/16	OV-04_072216_SED_03	22.3	AO	0.031	U	0.438	
VE52	10/15/16	VE52_10152016_SED	96.3	O	1.90		1.01	
VN74	10/17/16	VN74_10172016_SED	640	O	7.26	J	4.85	
VN77	10/17/16	VN77_10172016_SED	647	O	8.04	J	3.78	
W-21-UM-South	07/27/16	W-21UM-SOUTH_072716_SED_03	267	AO	5.94		10.9	

Notes:
J - the reported concentration is considered an estimated value
ng/g - nanograms per gram
% - percent
Qual. - qualifier
TOC - total organic carbon
A - the reported concentration represents an average of analysis runs
U - the target parameter was not detected above the method dection limit
-- not available
O - samples were orginally analyzed for mercury via EPA 1631, but were reanalyzed via 7474.
[1]Methyl mercury results calculated using a regression equation based on methyl mercury concentrations measured by methylene chloride extraction versus methanolic KOH extraction.

Prepared By/Date: JAW 06/06/17
Checked By/Date: KPH 06/07/17

TABLE 3
BIOTA HOME RANGES
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Species	Group	Home Range (Text)	Maximum Home Range [Numeric (km)] ***	Maximum Home Range [Numeric (ha)] ***	convert Home Range in ha to ft^2	Home Range Radius	Home Range Radius Recommended	Role in Maine (all bird data from Cornell's allaboutbirds.org)	Notes	Source
Red-winged blackbird	bird	153 (in marshes) -29,235 (in uplands) m^2; males tend to control territory of 2,000 m^2, several females will occupy territory of single male	NA	3	314,683	316 ft	300 ft	summer - breeding		http://animaldiversity.org/accounts/Agelaius_phoeniceus/
Nelson's sparrow	bird	male: 119.68±19.43 ha; female: 43.58±13.10 ha	NA	139	14,973,661	2,183 ft	0.4 mi	summer - breeding	source study took place in tidal marsh in southern Gulf of Maine	http://www.jstor.org/stable/40600425?seq=1#page_scan_tab_contents
Black duck (wintering individuals)	bird	Overall home range sizes averaged 4987 ha (range 54 – 28 070 ha), and maximum distances moved from the roost averaged 9.9 km (range 0.9–42.8 km)	NA	4,987	536,795,693	13,072 ft	2.5 mi	year round and summer breeding	source study used postfledgling juveniles in Moosehom National Wildlife Refuge in eastern Maine	http://www.nrcresearchpress.com/doi/abs/10.1139/z90-192?journalCode=cjz#.VzSb2vkrJhE
Blue mussel	aquatic invertebrate	sessile adults; larvae dispersal dependent on abiotic and ambient factors like tides. In one study, larval dispersal was typically ~30 km, at least 64 km in some cases	64	NA	NA	104,987 ft	50 ft		note that source study took place off the coast of England (different currents than coastal Maine); adults are sessile so used 50 ft radius rather than larger radius based on glochidia dispersal; 50 ft radius allows for sediment pairing in BSAF development	http://marine.rutgers.edu/~wilkin/wip/mfish/GilgHilbish_BlueMussels_Ecology2003.pdf
polychaetes	aquatic invertebrate	Burrow depth is related to size, although most worms inhabit the upper 5 cm. Emergence distance 2.55 ± 0.13 cm.	0.00005	NA	NA	0.082 ft	50 ft		50 ft radius allows for sediment pairing in BSAF development	http://www.macn.secyt.gov.ar/investigacion/descargas/ecologia/articulos/palomo/2000_palomo-iribarne.pdf http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3796461/#pone.0077431.s005
American eel	aquatic vertebrate	Max 4.2 to 4.7 km (river). In Hudson River, 70% of individuals ranged less than 1 km from original tagging area over 2 to 12 months	1	NA	NA	1,640 ft	0.3 mi		spawn in saltwater, return to freshwater to live	http://www.asmfc.org/uploads/file/Chp7_American_Eel_Final.pdf; references section has several home range studies that might be useful
Atlantic tomcod	aquatic vertebrate	May migrate up to 150 miles between coastal nonspawning waters and riverine spawning habitat; they are an inshore species (generally <10m) during non-spawning, then range upstream of the head of the tide during spawning, which represents approximately 35 miles in the Penobscot River.	241	NA	NA	35 mi	35 mi		migrate into the lower reaches of the Penobscot and other Maine rivers during the late fall to feed and then spawn near the head of the tide in mid-winter, hence the nickname"frostfish." By spring migrate back to estuarine and marine areas to grow. Historically, did not migrate beyond Milford Dam.	http://www.penobscotriver.org/content/4027/anadromous-fish; http://maine.gov/dmr/searunfish/reports/Penobscot_Operational_Plan_final_2009.pdf Bergeron et al 1998 http://explorer.natureserve.org/servlet/NatureServe?searchName=Microgadus+tomcod
Rainbow smelt	aquatic vertebrate	Historically, did not migrate beyond Milford Dam (river mile 33.25)	54	NA	NA	16.6 mi	16.6 mi		general cycle - in spring they spawn at head of tide in streams and rivers, in summer the YOY are in estuaries and adults in coastal waters, in fall fish move towards shore and into bays and mouths of rivers, winter in sheltered bays and large tidal rivers. current range in penobscot is smaller than historical because of dams and other impediments to movement. Historically, did not migrate beyond Milford Dam.	https://www1.maine.gov/dmr/smelt/documents/range.pdf; http://maine.gov/dmr/searunfish/reports/Penobscot_Operational_Plan_final_2009.pdf http://lowimpacthydro.org/lihi-certificate-113-milford-hydroelectric-project-on-the-penobscot-river-me/
Mummichog	aquatic vertebrate	home range of adults and large YOY (20–100 mm SL) to be 15 ha at high tide	NA	15	1,614,585	717 ft	700 ft		study took place in New Jersey salt marsh	https://marine.rutgers.edu/pubs/private/156%20(2).pdf

TABLE 3
BIOTA HOME RANGES
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Species	Group	Home Range (Text)	Maximum Home Range [Numeric (km)] ***	Maximum Home Range [Numeric (ha)] ***	convert Home Range in ha to ft^2	Home Range Radius	Home Range Radius Recommended	Role in Maine (all bird data from Cornell's allaboutbirds.org)	Notes	Source
Lobster	aquatic invertebrate	mesocosm study - mean home range size = 760.1 ± 132.0 m^2; average core area = 74 ± 10.9 $m^{2.}$; Campbell & Stasko noted 6-14 km, up to 51 km; UNH info said adolescents moving < 300 m and mature lobsters ~32 km	6	0.089	9,602	1.9 mi	1.9 mi		study notes that lobsters change core areas and home ranges daily; Campbell & Stasko present different range	https://www.researchgate.net/publication/233226147_Home_range_dynamics_of_the_American_lobster_Homarus_americanus Campbell & Stasko 1986 Lobsters.unh.edu/offshore_fishery/faq/faq.html
Terrestrial insects	terrestrial invertebrate	distance covered during foraging may range from 5 (springtail) to 400 m (darkling beetle). Study of honeybees - individuals recovered from 45 to 5,983 m from apiary of origin. Study of ant colony foraging showed mean total foraging area maxing out at around 30 m^2	6.0	NA	NA	9,815 ft	500 ft		various studies	http://www.nri.org/projects/publications/ecological_methods/h_chapter8_en.pdf; http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3281370/; https://web.stanford.edu/~dmgordon/old2/Gordon1995.pdf
Spiders	terrestrial invertebrate	mark-recapture study showed the spiders moved very little over the temporal and spatial scale used: 0–54% per day chance of moving to the adjacent 1-m^2 plot around the pond and 0–2% per day chance of moving to the adjacent 1-m^2 plot to and from the pond	NA	0.09	9,688	56 ft	200 ft		study used wolf spiders in virginia; study states finding is in contrast to other studies that have shown wolf spiders to completely exit a 900-m2 quadrant within several days - possible causes of this low mobility and its implications for wolf spider distribution and abundance at the pond edge discussed in study 200 ft radius allows for wetland sediment pairing in BSAF development	http://www.bioone.org/doi/abs/10.1636/05-85.1?mobileUi=0&journalCode=arac might be able to infer something from this study too: http://www.americanarachnology.org/JoA_free/JoA_v25_n1/JoA_v25_p1.pdf

Notes:
*** See Notes column for details

Prepared by/Date: SEB 5/12/16
Checked by/Date: RRP 5/19/16

TABLE 4
BIOTA METHYL MERCURY PERCENTAGES OF TOTAL MERCURY
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Biota	Min	Max	Mean	*n*
American Black Duck (Blood)	77%	81%	79%	3
American Black Duck (Tissue)	--	--	80%[1]	--
Terrestrial Insects	0%	100%	63%	120
Mummichog	10%	100%	86%	35
American Eel	50%	100%	88%	184
Blue Mussel	9%	94%	43%	945
American Lobster	11%	100%	78%	1286
Nelson's Sparrow	82%	100%	96%	24
Polychaete	35%	37%	36%	3
Rainbow Smelt	27%	100%	79%	114
Spiders	23%	100%	80%	124
Atlantic Tomcod	5%	100%	80%	98
Red-Winged Blackbird	--	--	96%[2]	--

Notes:
-- = Not Available
[1]Mean percentage of values cited in literature.
[2]Mean percentage value for Nelson's sparrow.
[3]Mean percentage from the Phase I Update Report (July 2009).

Prepared by/Date: KPH 09/07/17
Checked by/Date: LSV 09/07/17

TABLE 5
BIOTA NON-DETECT SUMMARY
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Biota	Location ID	Sample Date	Sample ID	Parameter	Result (ng/g)	Qualifier
Polychaete Worm	ES-FP	07/28/16	ES-FP_072816_POL_03_WB	Methyl Mercury	0.40	UJ
Polychaete Worm	ES-13	07/27/16	ES-13_072716_POL_03_WB	Methyl Mercury	0.40	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_01_WB	Mercury	1.90	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_02_WB	Mercury	2.46	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_03_WB	Mercury	1.15	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_05_WB	Mercury	1.82	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_01_WB	Methyl mercury	0.40	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_02_WB	Methyl mercury	0.40	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_03_WB	Methyl mercury	0.50	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_04_WB	Methyl mercury	0.50	U
Polychaete Worm	FRB-01	09/28/16	FRB-01_092816_POL_05_WB	Methyl mercury	0.40	U

Notes:
U - the target parameter was not detected above the method dection limit.
J - the reported concentration is considered an estimated value.
ng/g - nanograms per gram

Prepared By/Date: KPH 07/05/17
Checked By/Date: NSR 07/05/17

TABLE 6
TOTAL MERCURY BSAF SUMMARY
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Total Mercury BSAF Summary[1]													
	Terrestrial Insects	Spiders	Nelsons Sparrow	Red-Winged Blackbird	Polychaetes	Black Duck		Lobsters	Mummichog	Rainbow Smelt	Eel	Tomcod	Blue Mussel
	Tissue		Blood		Tissue	Blood	Tissue	Tissue					
BO-05	-	-	-	-	-	-	-	-	-	-	0.76	-	-
BO-04	-	-	-	-	0.19 ±0.039	-	-	-	0.61 ±0.14	-	-	-	-
OB-05	-	-	-	-	0.28 ±0.012	-	-	-	0.12 ±0.0070	0.36 ±3.0E-5	2.0 ±2.2	-	-
OB-04	-	-	-	-	-	-	-	-	-	0.10 ±0.015	-	-	-
W-17-N	0.026 ±0.048	0.30 ±0.19	6.0 ±2.3	2.0 ±1.7	-	-	-	-	-	-	-	-	-
MMPOLY	-	-	-	-	0.34 ±0.096	-	-	-	-	-	-	-	-
OB-01	-	-	-	-	-	-	-	-	0.18	0.17 ±0.020	0.53 ±0.21	-	-
MM-Southeast	2.6[3] ±2.3	2.2 ±1.9	73 ±63	-	-	-	-	-	3.8[3] ±0.95	-	-	-	-
MM-Southwest	0.090 ±0.022	0.35 ±0.038	9.5 ±2.3	-	-	0.95 ±0.25	0.33 ±0.32	-	-	-	-	-	-
ES-15	-	-	-	-	-	-	-	-	-	-	-	-	0.38 ±0.023
Odom Ledge	-	-	-	-	-	-	-	0.36 ±0.12	-	-	-	-	-
South Verona (ES-13)	-	-	-	-	0.059 ±0.032	0.43 ±0.09	0.50 ±0.14	0.64 ±0.18	-	0.071 ±5.7E-6	-	-	0.15 ±0.0089
ES-03	-	-	-	-	-	-	-	-	-	-	-	-	0.09 ±0.0072
Fort Point (ES-FP)	-	-	-	-	0.57 ±0.14	-	-	-	-	0.10 ±0.013	-	-	1.2 ±0.10
Cape Jellison	-	-	-	-	-	-	-	0.36 ±0.061	-	-	-	-	-
Turner Point	-	-	-	-	-	-	-	0.33 ±0.054	-	-	-	-	-
Harborside	-	-	-	-	-	-	-	1.9 ±0.15	-	-	-	-	-
Penobscot (System-Wide)	-	-	-	-	-	-	-	-	-	-	-	0.28 ±0.023	-
Median Study Area BSAF	0.09[3] ±0.040	0.35 ±0.80	9.5 ±27	2.0 ±1.7	0.28 ±0.11	0.69 ±0.17	0.42 ±0.23	0.36 ±0.38	0.39[3] ±0.19	0.10 ±0.067	0.76 ±0.55	0.28 ±0.023	0.26 ±0.33
Median Marsh BSAF	0.09[3] ±0.040	0.35 ±0.80	9.5 ±27	2.0 ±1.7	--	0.95 ±0.25	0.33 ±0.32	--	3.8 ±0.95	--	--	--	--
Median Penobscot River BSAF	--	--	--	--	0.28 ±0.11	0.43 ±0.09	0.50 ±0.14	0.36 ±0.38	0.18 ±0.19	0.10 ±0.067	0.76 ±0.55	--	0.26 ±0.33
Background Locations													
Addison/Pleasant River	0.54 ±0.46	1.0 ±0.16	15 ±2.0	-	-	-	-	-	-	-	-	-	-
Frenchman Bay	-	-	-	-	0.63	5.8 ±1.1	5.9 ±1.1	-	1.1 ±0.074	0.88 ±0.033	-	4.8	-

- Not Sampled
BSAF value appears increased due to low sediment concentrations.
BSAF value appears decreased due to high sediment concentrations.
BSAF value appears decreased due to low biota concentrations.
BSAF value appears increased due to high biota concentrations.

[1]BSAF data was derived from sample collection in 2016/winter 2017.
[2]Locations organized from upstream to downstream, on ebb tide.
[3]Location excluded from error propagation analysis, due to the skew of the dataset.

Prepared by/Date: JAW 6/5/17
Checked by/Date: KPH 6/5/17

TABLE 7
METHYL MERCURY BSAF SUMMARY
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Methyl Mercury BSAF Summary[1]													
	Terrestrial Insects	Spiders	Nelsons Sparrow	Red-Winged Blackbird	Polychaetes	Black Duck		Lobsters	Mummichog	Rainbow Smelt	Eel	Tomcod	Blue Mussel
	Tissue		Blood		Tissue	Blood	Tissue	Tissue					
BO-05	-	-	-	-	-	-	-	-	-	-	89	-	-
BO-04	-	-	-	-	0.15 ±0.0098	-	-	-	1.9 ±6.7	-	-	-	-
OB-05	-	-	-	-	0.66 ±0.024	-	-	-	4.0 ±0.23	25 ±7.0	34 ±14	-	-
OB-04	-	-	-	-	-	-	-	-	-	5.5 ±1.7	-	-	-
W-17-N	1.5 ±0.56	4.5 ±1.6	221 ±252	111 ±140	-	-	-	-	-	-	-	-	-
MMPOLY	-	-	-	-	0.74 ±0.17	-	-	-	-	-	-	-	-
OB-01	-	-	-	-	-	-	-	-	-	12 ±3.9	-	-	-
MM-Southeast	10 ±5.3	19 ±2.5	649 ±57	-	-	-	-	-	386[4] ±86	-	-	-	-
MM-Southwest	4.0 ±0.88	18 ±3.2	811 ±437	-	-	84 ±47	30 ±33	-	-	-	-	-	-
ES-15	-	-	-	-	-	-	-	-	-	-	-	-	5.2 ±0.32
Odom Ledge	-	-	-	-	-	-	-	14 ±3.7	-	-	-	-	-
South Verona (ES-13)	-	-	-	-	0.083 ±0.031	26 ±15	31 ±19	25 ±10	-	5.1 ±1.5	-	-	0.90 ±0.055
ES-03	-	-	-	-	-	-	-	-	-	-	-	-	5.2 ±0.42
Fort Point (ES-FP)	-	-	-	-	2.2 ±1.3	-	-	-	-	7.9 ±2.8	-	-	9.8 ±0.81
Cape Jellison	-	-	-	-	-	-	-	30 ±5.3	-	-	-	-	-
Turner Point	-	-	-	-	-	-	-	27 ±4.9	-	-	-	-	-
Harborside	-	-	-	-	-	-	-	248[4] ±19	-	-	-	-	-
Penobscot (System-Wide)	-	-	-	-	-	-	-	-	-	-	-	21 ±1.6	-
Median Study Area BSAF	4.0 ±3.2	18 ±5.9	649 ±220	111 ±140	0.66 ±0.49	55 ±31	30 ±26	26[4] ±4.4	4.0[4] ±1.3	7.9 ±4.6	62 ±35	21 ±1.6	5.2 ±2.3
Median Marsh BSAF	4.0 ±3.2	18 ±5.9	649 ±220	111 ±140	--	84 ±47	30 ±33	--	3864 ±86	--	--	--	--
Median Penobscot River BSAF	--	--	--	--	0.66 ±0.49	26 ±15	31 ±19	26[4] ±4.4	2.9 ±1.3	7.9 ±4.6	62 ±35	--	5.2 ±2.3
Background Locations													
Addison/Pleasant River	7.0 ±2.3	8.7 ±3.8	169 ±118	-	-	-	-	-	-	-	-	-	-
Frenchman Bay	-	-	-	-		-	-	-	56 ±4.0	-	-	-	-

- Not Sampled
BSAF value appears increased due to low sediment concentrations.
BSAF value appears decreased due to high sediment concentrations.
BSAF value appears decreased due to low biota concentrations.
BSAF value appears increased due to high biota concentrations.

[1]BSAF data was derived from sample collection in 2016/winter 2017.
[2]Locations organized from upstream to downstream, on ebb tide.
[3]BSAFs based on conversion of total mercury to methyl mercury in tissue based on historical site-specific data.
[4]Location excluded from error propagation analysis, due to the skew of the dataset.

Prepared by/Date: JAW 6/5/17
Checked by/Date: KPH 6/5/17

TABLE 8
COMPARISON OF 2016 BSAFs TO HISTORICAL BSAFs
SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Biota		Mercury		Methyl Mercury	
		Median Site BSAF[1]	Historical Median Site BSAF	Median Site BSAF[1]	Historical Median Site BSAF
Terrestrial Insects	Tissue	0.09	0.03	4.1	1.2
Spiders		0.35	0.75	18	27
Nelsons Sparrow[2]	Blood	9.5	7.1	649	129
Red-Winged Blackbird[2]		2.0	32	111	--
Polychaetes	Tissue	0.28	--	0.66	--
Black Duck[2]	Blood	0.69	1.0	55	41
	Tissue	0.42	1.1	30	41
Lobsters[2]	Tissue	0.36	0.37	27	20
Mummichog[2]		0.39	0.40	4.0	24
Rainbow Smelt[2]		0.10	0.17	7.9	14
Eel[2]		0.97	0.56	62	42
Tomcod[2]		0.28	0.25	21	21
Blue Mussel[2]		0.26	0.76	5.2	48

Notes:
- Not Available
[1]BSAF data was derived from sample collection in 2016/winter 2017.
[2]Methyl Mercury Median Site BSAFs based on conversion of total mercury to methyl mercury in tissue based on historical site-specific data.

Prepared by/Date: JAW 6/22/17
Checked by/Date: NSR 6/22/17

FIGURES

Addison/Pleasant River Inset

Pleasant River

BSAF	0.540
Biota	16.8
Sed	31.1

W-17-N

BSAF	0.026
Biota	30.4
Sed	1179

OB1

Mendall Marsh

BSAF	2.63
Biota	222
Sed	84

MM-Southeast

MM-Southwest

W21

BSAF	0.090
Biota	47.5
Sed	526

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Mendall Marsh Geographic Area Label

N

0 0.25 0.5 Miles

Legend

- City
- Relevant Site Landmark
- Area ID
- Terrestrial Insect Sample Location
- Collocated Sediment Sample Location
- Sediment Sample Location Outside of Radius
- Sediment Sample Location within Radius
- Terrestrial Insect Home Range Radius - 500ft

amec foster wheeler

Figure 1a
2016 Terrestrial Insects
Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Addison/Pleasant River Inset

Pleasant River

BSAF	7.03
Biota	18.6
Sed	2.65

W-17-N

BSAF	1.49
Biota	56.7
Sed	38.0

OB1

Mendall Marsh

BSAF	10.1
Biota	91.2
Sed	9.02

MM-Southeast

MM-Southwest

W21

BSAF	4.05
Biota	26.8
Sed	6.62

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Mendall Marsh Geographic Area Label

N

0 0.25 0.5 Miles

Legend

- City
- Relevant Site Landmark
- Area ID
- Terrestrial Insect Sample Location
- Sediment Sample Location within Radius
- Collocated Sediment Sample Location
- Sediment Sample Location Outside of Radius
- Terrestrial Insect Home Range Radius - 500ft

amec foster wheeler

Figure 1b
2016 Terrestrial Insects
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Addison/Pleasant River Inset

Pleasant River

BSAF	1.01
Biota	31.4
Sed	31.1

W-17-N

BSAF	0.302
Biota	263
Sed	871

OB1

Mendall Marsh

BSAF	2.24
Biota	205
Sed	84

MM-Southeast

MM-Southwest

W21

BSAF	0.355
Biota	219
Sed	617

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BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 0.25 0.5 Miles

Legend

- City
- Relevant Site Landmark
- Area ID
- Biota
- Collocated Sediment Sample Location
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Spider Home Range Radius - 200ft
- Mendall Marsh Geographic Area Label

Figure 2a
2016 Spider Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Addison/Pleasant River Inset

Pleasant River

BSAF	8.65
Biota	22.9
Sed	2.65

W-17-N

BSAF	4.52
Biota	282
Sed	62.4

OB1

Mendall Marsh

BSAF	19.3
Biota	174
Sed	9.02

MM-Southeast

MM-Southwest

W21

BSAF	18.1
Biota	217
Sed	12.0

amec foster wheeler

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 0.25 0.5 Miles

Legend

- City
- Relevant Site Landmark
- Area ID
- Biota
- Sediment Sample Location within Radius
- Collocated Sediment Sample Location
- Sediment Sample Location Outside of Radius
- Spider Home Range Radius - 200ft
- Mendall Geographic
- Marsh Area Label

Figure 2b
2016 Spider
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Addison/Pleasant River Inset

Pleasant River

BSAF	15
Biota	467
Sed	31

W-17-N

BSAF	6.0
Biota	5000
Sed	828

OB1

Mendall Marsh

BSAF	73
Biota	6130
Sed	84

MM-Southeast

BSAF	9.5
Biota	5840
Sed	617

MM-Southwest

W21

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Note:
Circle represents combination of 0.4 mile radius home ranges of each sample location

0 0.25 0.5 Miles

N

Legend

- City
- Relevant Site Landmark
- Area ID
- Mendall Marsh — Geographic Area Label
- Nelson's Sparrow Sample Location
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Nelson's Sparrow Home Range Radius - 0.4mi

amec foster wheeler

Figure 3a
2016 Nelson's Sparrow Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Addison/Pleasant River Inset

Pleasant River

BSAF	169
Biota	446
Sed	2.65

W-17-N

BSAF	221
Biota	4777
Sed	21.6

OB1

Mendall Marsh

BSAF	649
Biota	5856
Sed	9.02

MM-Southeast

BSAF	811
Biota	5579
Sed	6.88

MM-Southwest

W21

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Note:
Circle represents combination of 0.4 mile radius home ranges of each sample location

0 0.25 0.5 Miles

N

Legend

- City
- Relevant Site Landmark
- Area ID
- Mendall Marsh — Geographic Area Label
- Sediment Sample Location within Radius
- Nelson's Sparrow Sample Location
- Sediment Sample Location Outside of Radius
- Nelson's Sparrow Home Range Radius - 0.4mi

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Figure 3b
2016 Nelson's Sparrow
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Note:
Circle represents combination of 300 foot radius home ranges of each sample location

0 250 500 Feet

Legend

- Area ID
- Biota
- **Mendall Marsh** Geographic Area Label
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Red-winged Blackbird Home Range Radius - 300ft

amec foster wheeler

Figure 4a
2016 Red-winged Blackbird Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Mendall Marsh Geographic Area Label

Notes:
1.Circle represents combination of 300 foot radius home ranges of each sample location
2.BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

0 250 500 Feet

Legend

- Area ID
- Biota
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Red-winged Blackbird Home Range Radius - 300ft

amec foster wheeler

Figure 4b
2016 Red-winged Blackbird
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052	Prepared/Date: RD 9/15/2017	Checked/Date: KPH 9/15/2017	NAD83 State Plane Maine East, US Survey Feet

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Frenchman Bay Inset

BSAF	0.630
Biota	3.18
Sed	7.53

Frenchman Bay

BSAF	0.189
Biota	185
Sed	980

BO4

Former Holtrachem Facility

BSAF	0.285
Biota	215
Sed	755

Orrington

RM 20

OB5

OB4

RM 15

BSAF	0.343
Biota	190
Sed	554

W-17-N

OB1

Mendall Marsh

RM 10

MM-Southeast

MM-Southwest

W21

Bucksport

ES02E

Verona Island

RM 5

ES15

Odom Ledge

BSAF	0.059
Biota	24.7
Sed	416

ES13

South Verona

Devereaux Cove

ES03

BSAF	0.570
Biota	24.5
Sed	48.1

Fort Point Cove

ESFP

Fort Point

RM 0

Cape Jellison

amec foster wheeler

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Mendall Marsh Geographic Area Label

0 1 2 Miles

N

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Polychaete Sample Location
- Collocated Sediment Sample Location
- Sediment Sample within Radius
- Sediment Sample Location Outside of Radius
- Polychaete Home Range Radius - 50ft

Figure 5a
2016 Polychaetes
Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Frenchman Bay Inset

Frenchman Bay

BSAF	0.153
Biota	8.30
Sed	54.3

BO4

Former Holtrachem Facility

BSAF	0.657
Biota	12.7
Sed	19.3

Orrington

RM 20

OB5

OB4

RM 15

BSAF	0.739
Biota	9.90
Sed	13.4

W-17-N

OB1

Mendall Marsh

RM 10

MM-Southeast

MM-Southwest

W21

Bucksport

ES02E

Verona Island

RM 5

ES15

Odom Ledge

BSAF	0.083
Biota	2.40
Sed	28.8

ES13

South Verona

Devereaux Cove

ES03

Fort Point Cove

BSAF	2.24
Biota	5.75
Sed	2.57

ESFP

Fort Point

RM 0

Cape Jellison

Note: Frenchman Bay sediment concentration was a non-detect and no BSAF could be calculated.

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Mendall Marsh Geographic Area Label

0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Sediment Sample within Radius
- Polychaete Sample Location
- Collocated Sediment Sample Location
- Sediment Sample Location Outside of Radius
- Polychaete Home Range Radius - 50ft

amec foster wheeler

Figure 5b
2016 Polychaetes
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Frenchman Bay Inset

BSAF	5.8
Biota	44
Sed	7.5

Frenchman Bay

RM 15

W-17-N

OB1

BSAF	0.95
Biota	504
Sed	531

Mendall Marsh

RM 10

MM-Southeast

MM-Southwest

W21

Bucksport

ES02E

Verona Island

BSAF	0.43
Biota	377
Sed	883

RM 5

ES15

Odom Ledge

ES13

South Verona

Devereaux Cove

ES03

Fort Point Cove

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 1 2 Miles

Legend

- River Mile Marker
- City
- Area ID
- Black Duck Sample Location
- Sediment Sample Location Inside of Radius (excluded)
- Sediment Sample Location Inside of Radius
- Sediment Sample Location Outside of Radius
- Black Duck Home Range Radius - 2.5mi
- Mendall Marsh — Geographic Area Label

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Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

Figure 6a
2016 Black Duck
Mercury Blood BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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Frenchman Bay Inset

BSAF	5.9
Biota	45
Sed	7.5

Frenchman Bay

RM 15

W-17-N

OB1

BSAF	0.33
Biota	177
Sed	531

Mendall Marsh

RM 10

MM-Southeast

MM-Southwest

W21

Bucksport

ES02E

Verona Island

BSAF	0.50
Biota	441
Sed	883

RM 5

ES15

Odom Ledge

ES13

South Verona

Devereaux Cove

ES03

Fort Point Cove

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BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 1 2 Miles

Legend

- River Mile Marker
- City
- Area ID
- Black Duck Sample Location
- Sediment Sample Location Inside of Radius (excluded)
- Sediment Sample Location Inside of Radius
- Sediment Sample Location Outside of Radius
- Black Duck Home Range Radius - 2.5mi
- Mendall Marsh — Geographic Area Label

amec foster wheeler

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

Figure 6b
2016 Black Duck
Mercury Tissue BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Frenchman Bay Inset

BSAF	NA
Biota	34
Sed	NA

Frenchman Bay

RM 15

W-17-N

OB1

BSAF	84
Biota	397
Sed	4.7

Mendall Marsh

RM 10

MM-Southeast

MM-Southwest

W21

Bucksport

ES02E

Verona Island

BSAF	26
Biota	297
Sed	11

RM 5

ES15

Odom Ledge

ES13

South Verona

Devereaux Cove

ES03

Fort Point Cove

Notes:
1. Frenchman Bay sediment concentration was a non-detect and no BSAF could be calculated.
2. Circle represents combination of 300 foot radius home ranges of each sample location.
3. BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 1 2 Miles

Legend

- River Mile Marker
- City
- Area ID
- Black Duck Sample Location
- Sediment Sample Location Inside of Radius (excluded)
- Sediment Sample Location Inside of Radius
- Sediment Sample Location Outside of Radius
- Black Duck Home Range Radius - 2.5mi
- **Mendall Marsh** Geographic Area Label

amec foster wheeler

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Figure 6c
2016 Black Duck
Methyl Mercury Blood BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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Frenchman Bay Inset

BSAF	NA
Biota	36
Sed	NA

Frenchman Bay

RM 15

W-17-N

OB1

BSAF	30
Biota	142
Sed	4.7

Mendall Marsh

RM 10

MM-Southeast

MM-Southwest

W21

Bucksport

ES02E

Verona Island

BSAF	31
Biota	353
Sed	11

RM 5

ES15

Odom Ledge

ES13

South Verona

Devereaux Cove

ES03

Fort Point Cove

Notes:
1. Frenchman Bay sediment concentration was a non-detect and no BSAF could be calculated.
2. Circle represents combination of 300 foot radius home ranges of each sample location.
3. BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 1 2 Miles

Legend

- River Mile Marker
- City
- Area ID
- Black Duck Sample Location
- Sediment Sample Location Inside of Radius (excluded)
- Sediment Sample Location Inside of Radius
- Sediment Sample Location Outside of Radius
- Black Duck Home Range Radius - 2.5mi
- **Mendall Marsh** Geographic Area Label

amec foster wheeler

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

Figure 6d
2016 Black Duck
Methyl Mercury Tissue BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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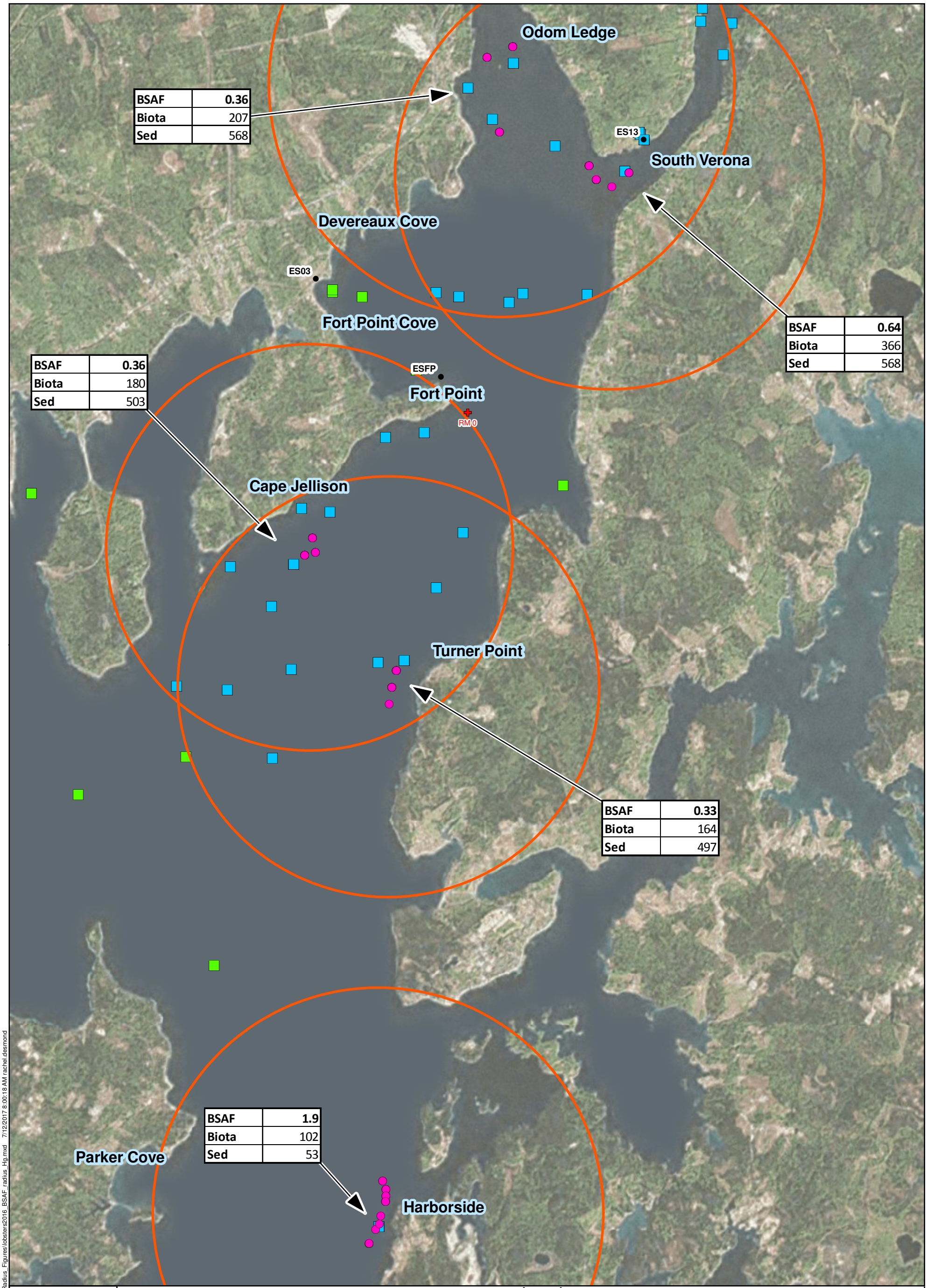

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Note:
Circle represents combination of 1.9 mile radius home ranges of each sample location

0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- **Mendall Marsh** Geographic Area Label
- Lobster Sample Location
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Lobster Home Range Radius - 1.9mi

amec foster wheeler

Figure 7a
2016 Lobster Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052	Prepared/Date: RD 9/15/2017	Checked/Date: KPH 9/15/2017	NAD83 State Plane Maine East, US Survey Feet

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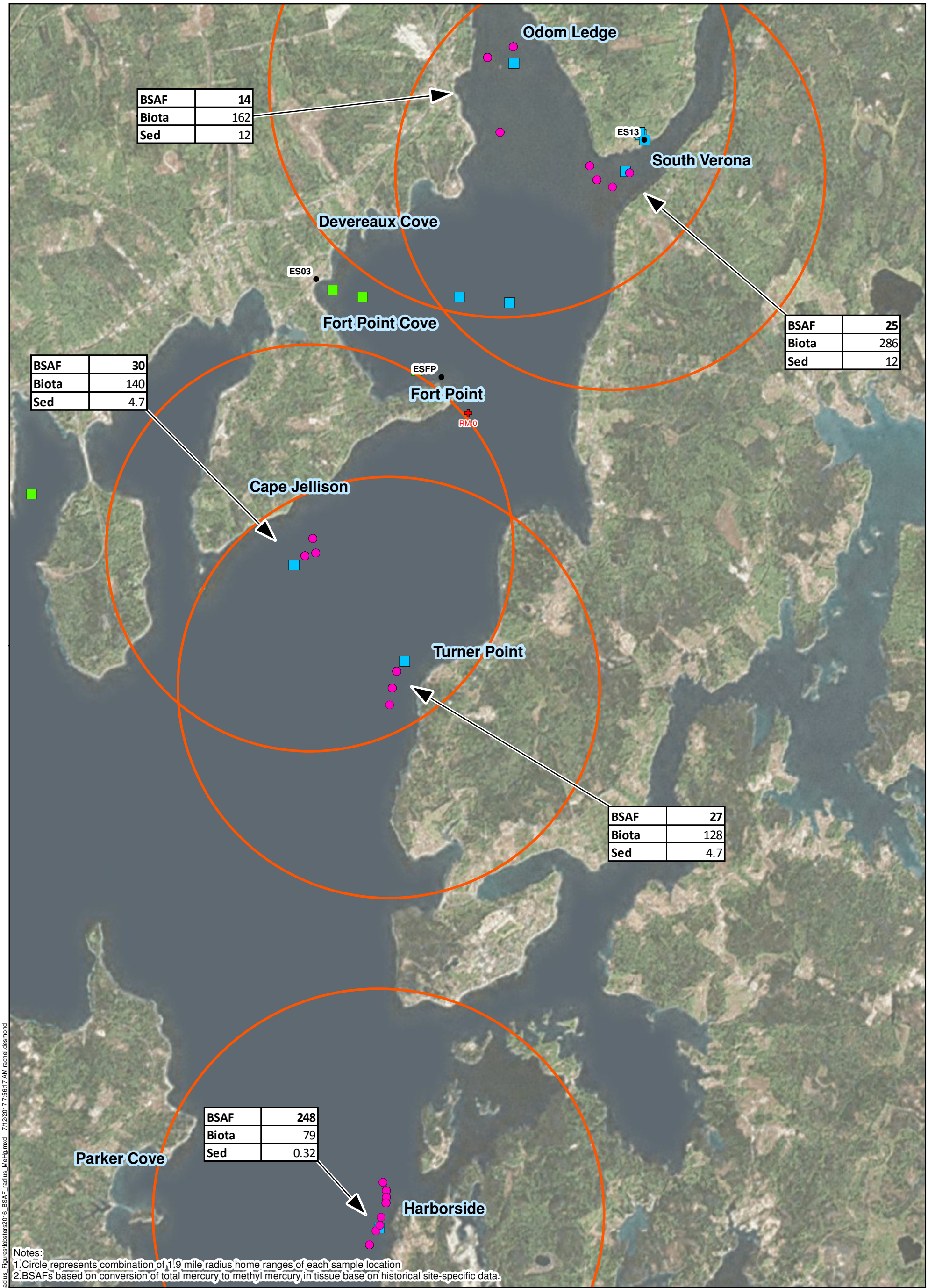
Odom Ledge
BSAF 14
Biota 162
Sed 12
ES13
South Verona
Devereaux Cove
ES03
Fort Point Cove
BSAF 25
Biota 286
Sed 12
BSAF 30
Biota 140
Sed 4.7
ESFP
Fort Point
RM 0
Cape Jellison
Turner Point
BSAF 27
Biota 128
Sed 4.7
Parker Cove
BSAF 248
Biota 79
Sed 0.32
Harborside
Notes:
1.Circle represents combination of 1.9 mile radius home ranges of each sample location
2.BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.
BSAF unitless
Biota in ng/g
Sediment in ng/g
N
River Mile Marker
City
Relevant Site Landmark
Area ID
Legend
Sediment Sample Location within Radius
Lobster Sample Location
Sediment Sample Location Outside of Radius
Lobster Home Range Radius - 1.9mi
Mendall Geographic
Marsh Area Label
0 1 2 Miles
amec foster wheeler
Project: 3616166052
Prepared/Date: RD 9/15/2017
Checked/Date: KPH 9/15/2017
NAD83 State Plane Maine East, US Survey Feet
Figure 7b
2016 Lobster
Methyl Mercury BSAFs
Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study
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Frenchman Bay Inset

BSAF	1.06
Biota	7.96
Sed	7.53

Frenchman Bay

BO4

BSAF	0.608
Biota	71.2
Sed	117

Former Holtrachem Facility

Orrington

RM 20

OB5

BSAF	0.118
Biota	89.1
Sed	755

OB4

RM 15

W-17-N

BSAF	0.180
Biota	134
Sed	745

OB1

RM 10

Mendall Marsh

BSAF	3.77
Biota	159
Sed	42.2

MM-Southeast

MM-Southwest

W21

amec foster wheeler

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Mendall Marsh Geographic Area Label

0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Mummichog Sample Location
- Collocated Sediment Sample Location
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Mummichog Home Range Radius - 700ft

Figure 8a
2016 Mummichog Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Frenchman Bay Inset

BSAF	56.5
Biota	6.86
Sed	0.122

Frenchman Bay

BSAF	1.88
Biota	61.4
Sed	32.6

BO4

Former Holtrachem Facility

Orrington

BSAF	3.97
Biota	76.8
Sed	19.3

RM 20

OB5

OB4

RM 15

W-17-N

BSAF	NA
Biota	116
Sed	NA

OB1

RM 10

Mendall Marsh

BSAF	386
Biota	137
Sed	0.354

MM-Southeast

MM-Southwest

W21

Note:
1.BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Mendall Marsh Geographic Area Label

N

0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Sediment Sample Location within Radius
- Mummichog Sample Location
- Co-located Sediment Sample Location
- Sediment Sample Location Outside of Radius
- Mummichog Home Range Radius - 700ft

amec foster wheeler

Figure 8b
2016 Mummichog
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Frenchman Bay Inset

BSAF	0.88
Biota	6.6
Sed	7.5

BSAF	0.36
Biota	201
Sed	554

BSAF	0.10
Biota	55
Sed	568

BSAF	0.17
Biota	91
Sed	544

BSAF	0.07
Biota	38
Sed	544

BSAF	0.10
Biota	55
Sed	559

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Note:
Circle represents combination of 16.6 mile radius home ranges of each sample location

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Rainbow Smelt Sample Location
- Sediment Sample Location within Radius
- Rainbow Smelt Home Range Radius - 16.6mi
- Mendall Marsh — Geographic Area Label

N

0 1 2 Miles

amec foster wheeler

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

Figure 9a
2016 Rainbow Smelt Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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Orono
OV4
RM 35
Veazie
Former Veazie Dam
RM 30
Bangor
Brewer
BO5
RM 25
BO4
Former Holtrachem Facility
Orrington
RM 20
OB5

BSAF	25
Biota	159
Sed	6.4

OB4

BSAF	5.5
Biota	43
Sed	7.9

RM 15
W-17-N
OB1

BSAF	12
Biota	72
Sed	6.0

Mendall Marsh
RM 10
MM-Southeast
MM-Southwest
W21
Bucksport
ES02E
Verona Island
RM 5
ES15
Odom Ledge

BSAF	5.1
Biota	30
Sed	5.9

ES13
Devereaux Cove
South Verona

BSAF	7.9
Biota	44
Sed	5.6

ES03
Fort Point Cove
ESFP
Fort Point
RM 0
Cape Jellison
Belfast
Turner Point
Blue Hill
Kellys Cove
Parker Cove
Harborside

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Rainbow Smelt Sample Location
- Sediment Sample Location within Radius
- Rainbow Smelt Home Range Radius - 16.6mi
- Mendall Marsh — Geographic Area Label

Notes:
1.Circle represents combination of 16.6 mile radius home ranges of each sample location
2.BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

amec foster wheeler

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

Figure 9b
2016 Rainbow Smelt
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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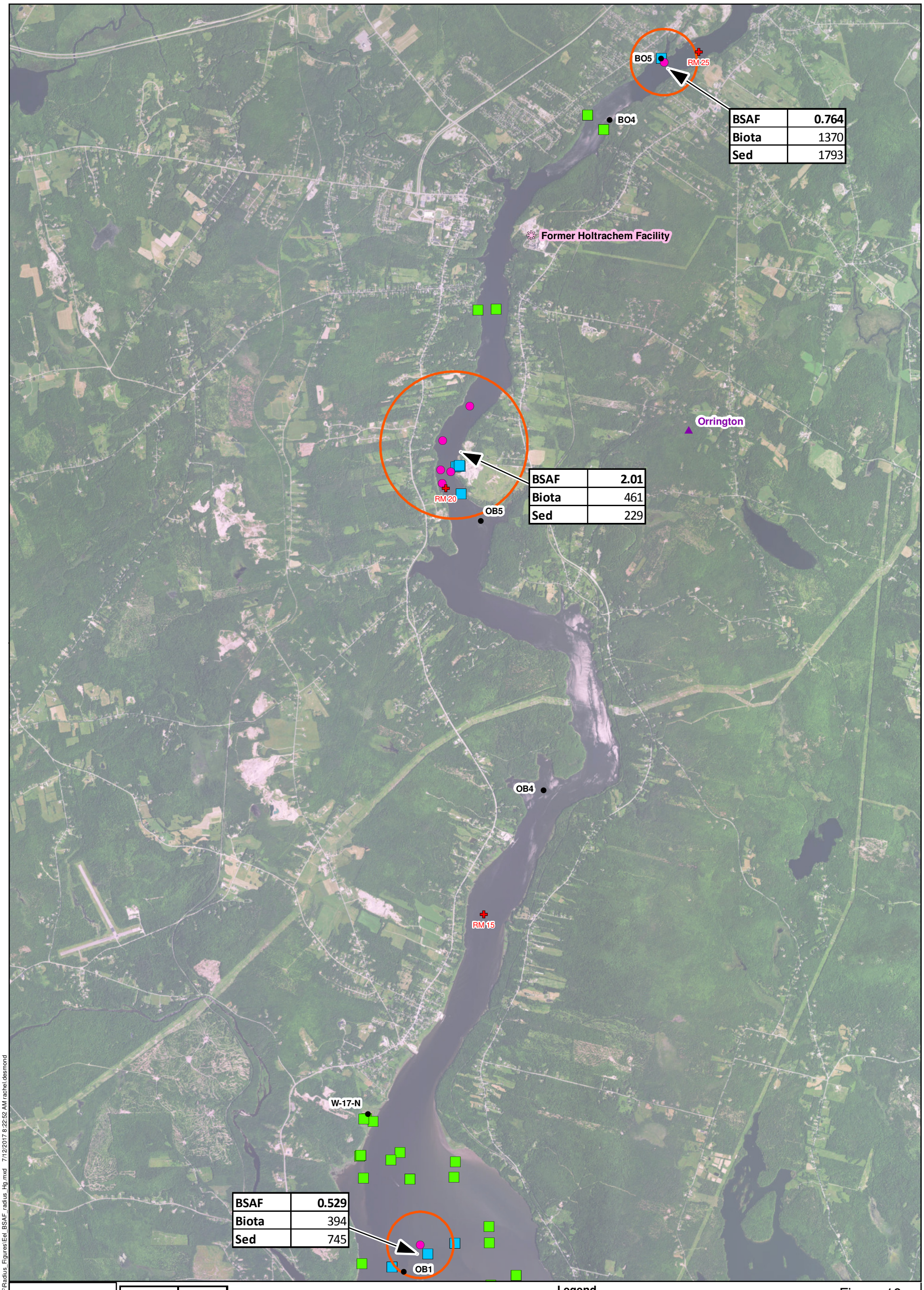

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

Note:
Circle represents combination of 0.3 mile radius home ranges of each sample location

N

Mendall Marsh Geographic Area Label

0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Eel Sample Location
- Sediment Sample Location within Radius
- Sediment Sample Location Outside of Radius
- Eel Home Range Radius - 0.3mi

Figure 10a
2016 Eel
Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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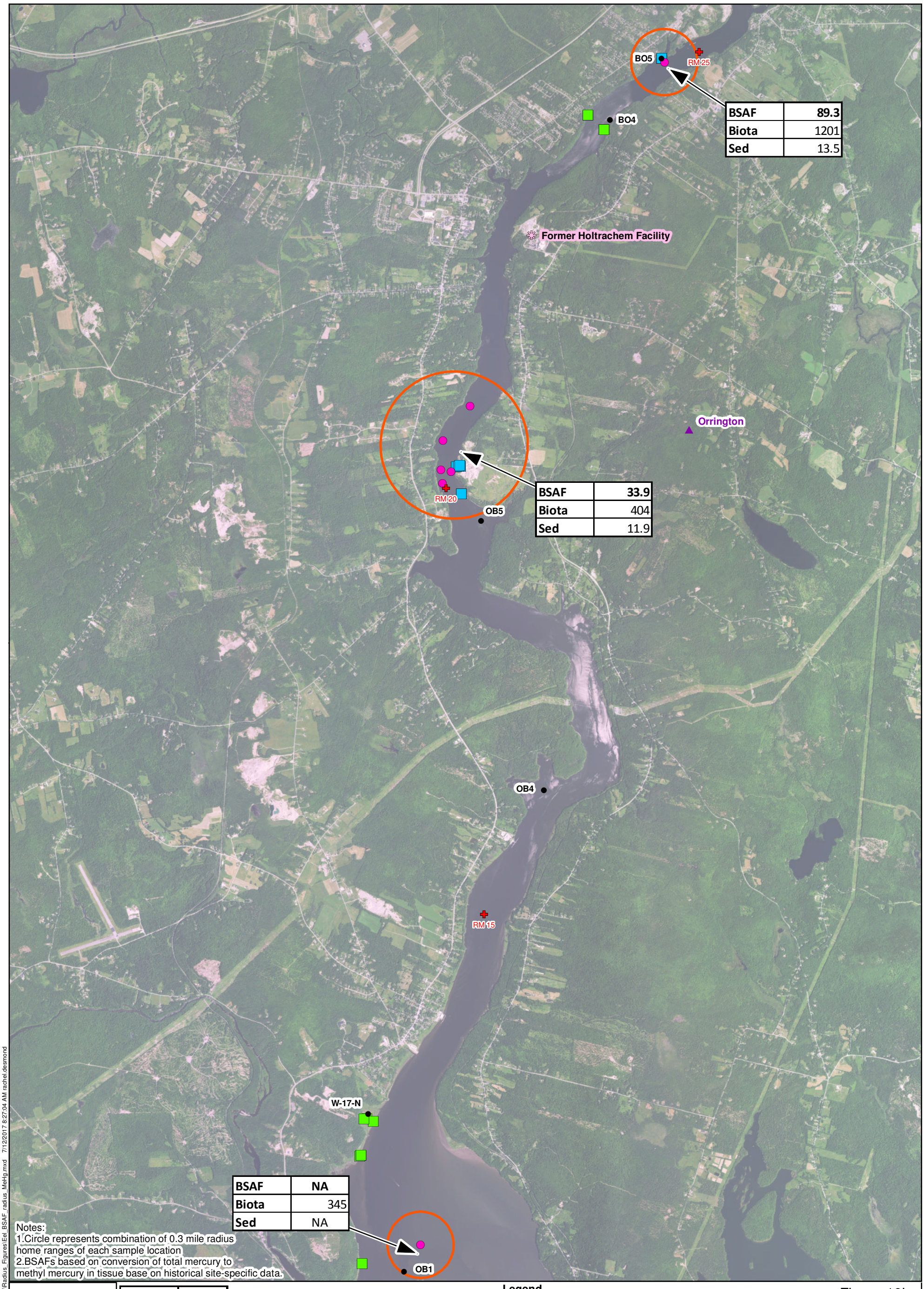

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 1 2 Miles

Mendall Marsh Geographic Area Label

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Sediment Sample Location within Radius
- Eel Sample Location
- Sediment Sample Location Outside of Radius
- Eel Home Range Radius - 0.3mi

Figure 10b
2016 Eel
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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Frenchman Bay Inset

BSAF	4.8
Biota	37
Sed	7.5

BSAF	NA
Biota	308
Sed	NA

BSAF	NA
Biota	152
Sed	NA

BSAF	0.28
Biota	155
Sed	543

BSAF	NA
Biota	174
Sed	NA

BSAF	NA
Biota	103
Sed	NA

BSAF	NA
Biota	65
Sed	NA

Frenchman Bay
BO4
Former Holtrachem Facility
Orrington
RM 20
OB5
OB4
RM 15
W-17-N
Mendall Marsh
OB1
RM 10
MM-Southeast
MM-Southwest
W21
Bucksport
ES02E
RM 5
ES15
Verona Island
Odom Ledge
ES13
South Verona
Devereaux Cove
ES03
Fort Point Cove
ESFP
Fort Point
RM 0

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N
0 1 2 Miles

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Tomcod Sample Location
- Sediment Sampl Location within Radius
- Mendall Marsh — Geographic Area Label

Figure 11a
2016 Tomcod
Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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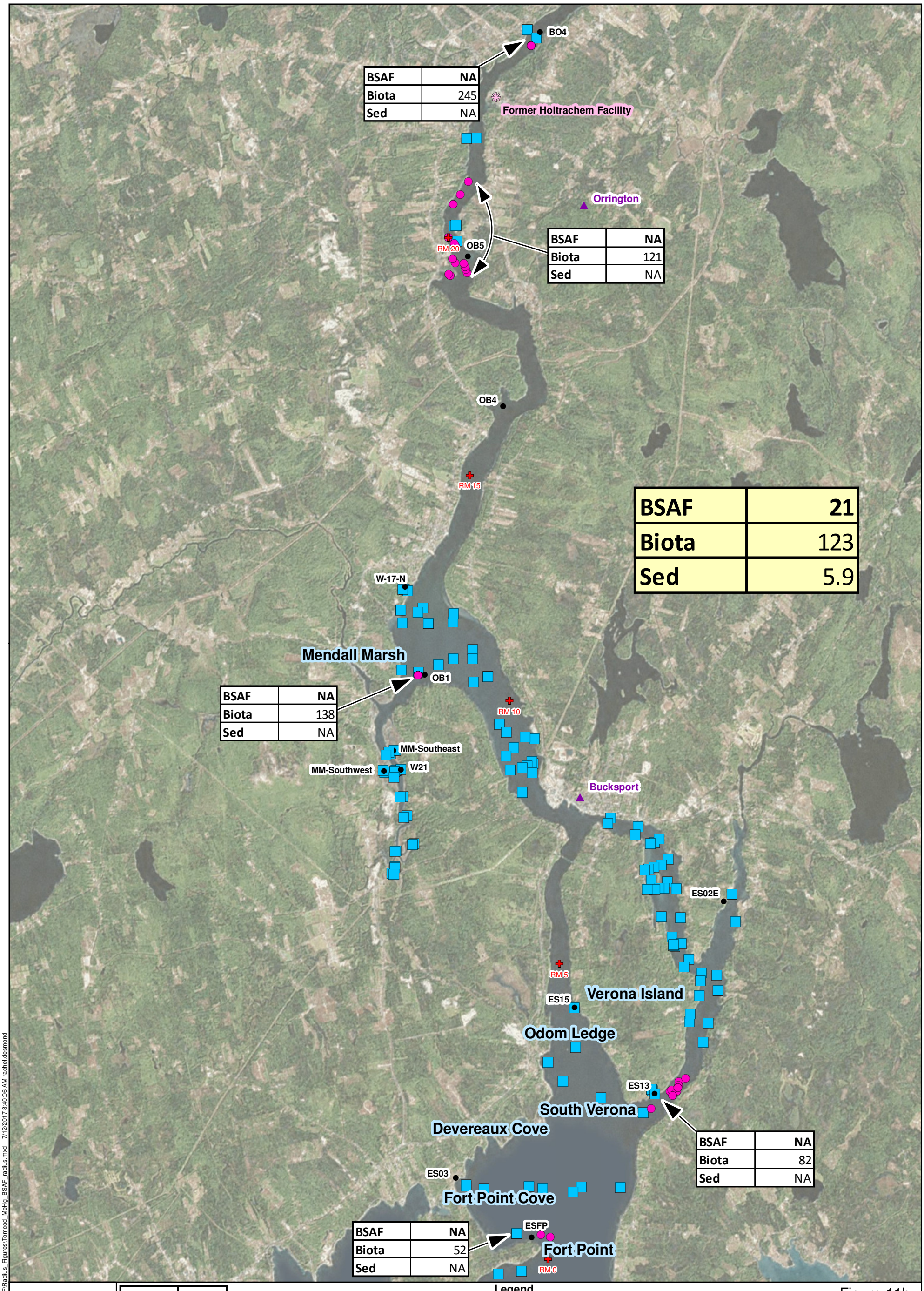

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Legend

- River Mile Marker
- City
- Relevant Site Landmark
- Area ID
- Tomcod Sample Location
- Sediment Sampl Location within Radius
- Mendall Marsh — Geographic Area Label

Note:
1.BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

0 1 2 Miles

NAD83 State Plane Maine East, US Survey Feet

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017

Figure 11b
2016 Tomcod
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

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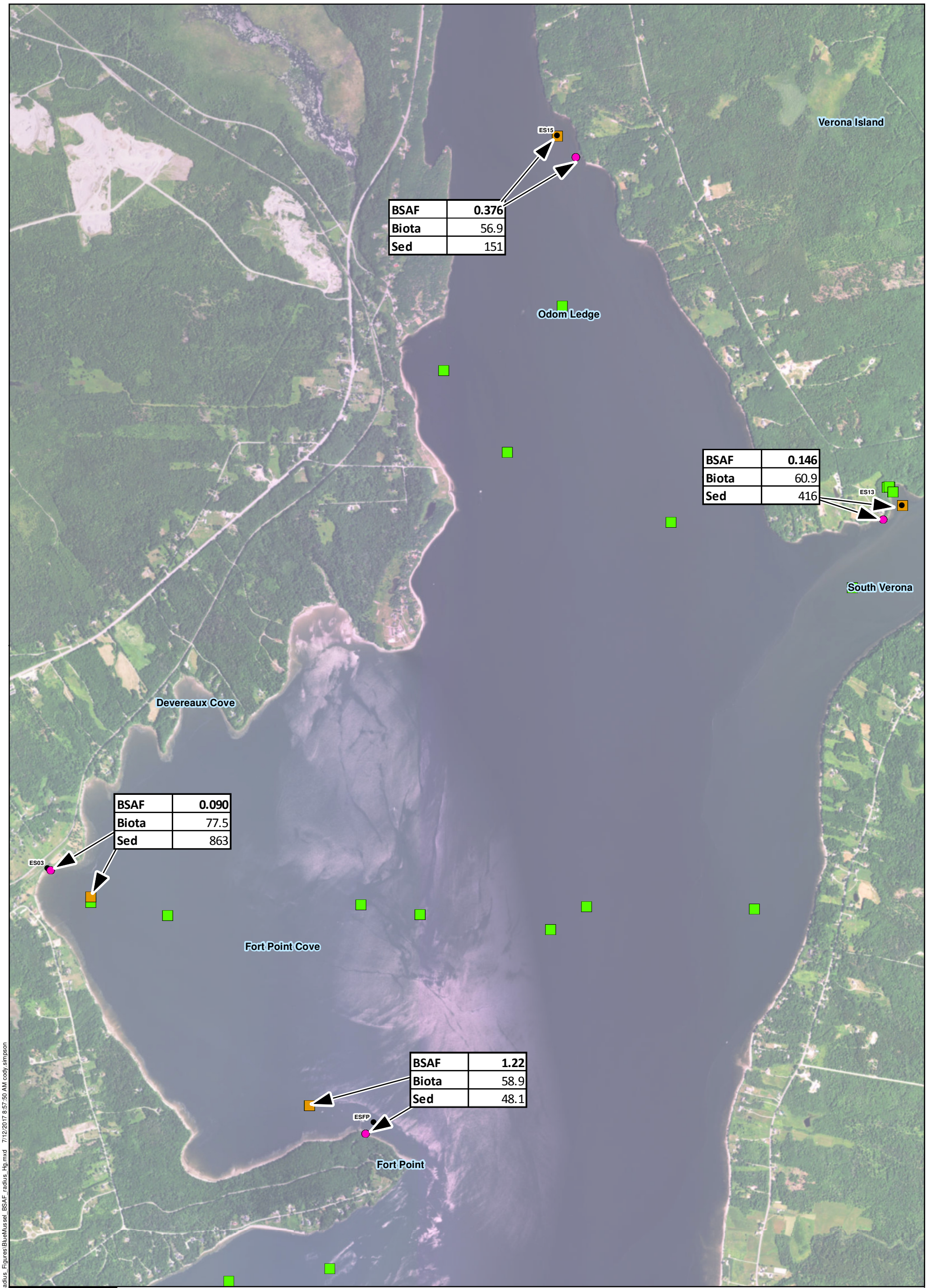

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

0 0.25 0.5 Miles

Legend

- City
- Relevant Site Landmark
- Area ID
- **Mendall** Geographic
- **Marsh** Area Label
- Blue Mussel Sample Location
- Co-located Sediment Sample Location
- Sediment Sample Location Outside of Radius

amec foster wheeler

Figure 12a
2016 Blue Mussel
Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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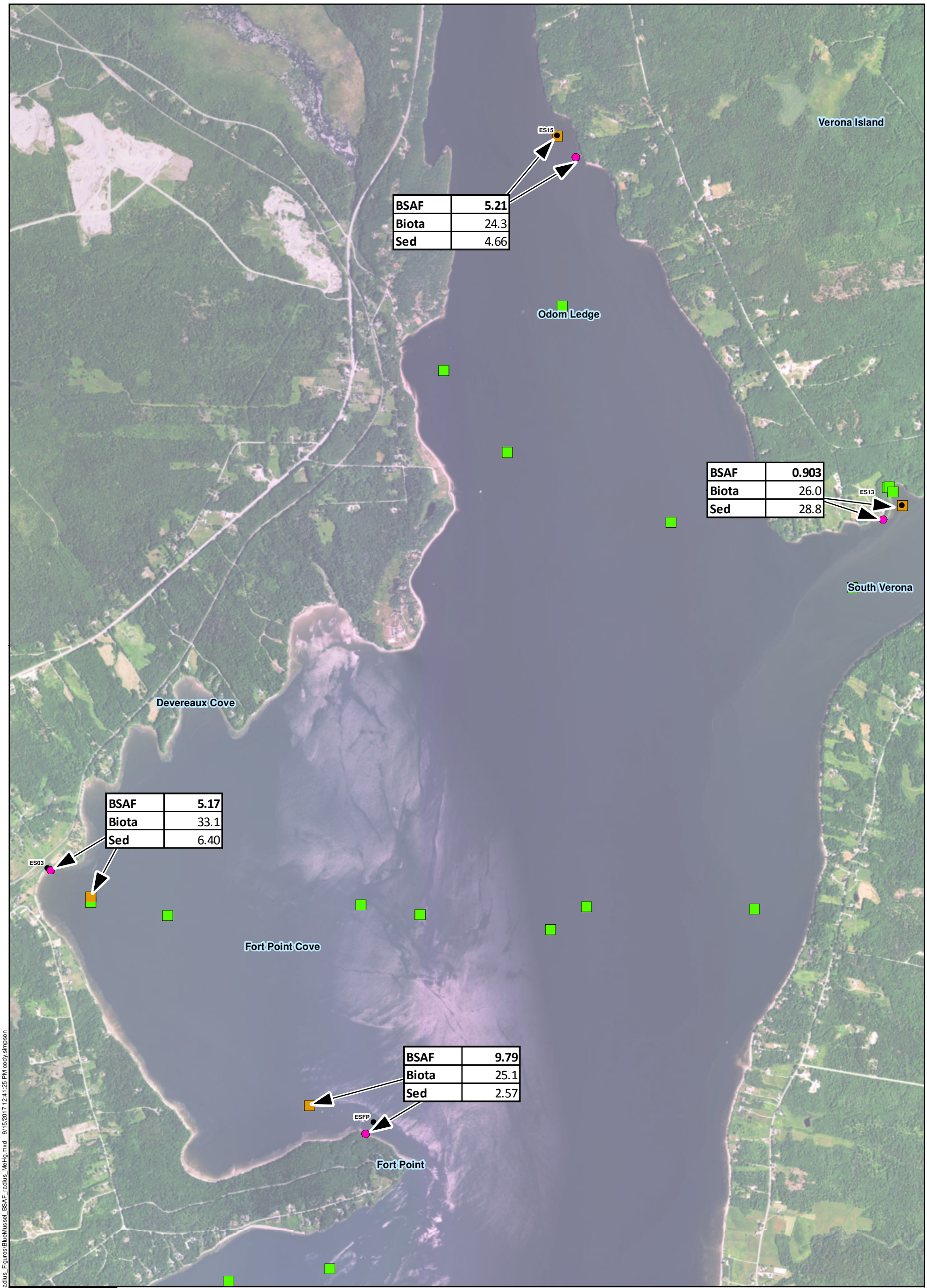

BSAF	unitless
Biota	in ng/g
Sediment	in ng/g

N

Notes:
1.Circle represents combination of 300 foot radius home ranges of each sample location
2.BSAFs based on conversion of total mercury to methyl mercury in tissue base on historical site-specific data.

0 0.25 0.5 Miles

Legend

- City
- Relevant Site Landmark
- Area ID
- Blue Mussel Sample Location
- Co-located Sediment Sample Location
- Sediment Sample Location Outside of Radius
- **Mendall Marsh** Geographic Area Label

Figure 12b
2016 Blue Mussel
Methyl Mercury BSAFs

Tech. Memo.
BSAF Calculations
Penobscot River
Phase III Engineering Study

Project: 3616166052 | Prepared/Date: RD 9/15/2017 | Checked/Date: KPH 9/15/2017 | NAD83 State Plane Maine East, US Survey Feet

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ATTACHMENT A
Supporting Tables for 2016 BSAF Calculations

A-1a
2016 Terrestrial Insect BSAFs
Mercury

Location	Insects (Median)	Sediment		BSAF
Site				
W-17-High-2016	30.4 ng/g	1267 ng/g	Mercury	
W-17-Mid-2016	30.4 ng/g	1179 ng/g	Mercury	
W17-N	30.4 ng/g	476 ng/g	Mercury	
W-17 (Median)	**30.4 ng/g**	**1179 ng/g**	**Mercury**	**0.026**
W-65-High	222 ng/g	84 ng/g	Mercury	
W-65-Low	222 ng/g	33 ng/g	Mercury	
W-65-Mid	222 ng/g	226 ng/g	Mercury	
Mendall Marsh SE (Median)	**222 ng/g**	**84 ng/g**	**Mercury**	**2.6**
W-21-UM-Central-C	47.5 ng/g	617 ng/g	Mercury	
W-21-UM-West-A	47.5 ng/g	434 ng/g	Mercury	
Mendall Marsh SW (Median)	**47.5 ng/g**	**526 ng/g**	**Mercury**	**0.090**
Reference				
ADD-01	16.8 ng/g	29.6 ng/g	Mercury	
ADD-02	16.8 ng/g	32.6 ng/g	Mercury	
ADD (Median)	**16.8 ng/g**	**31.1 ng/g**	**Mercury**	**0.54**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-1b
2016 Terrestrial Insect BSAFs
Methyl Mercury

Location	Insects (Median)	Sediment		BSAF
Site				
W-17-High-2016	56.7 ng/g	38.0 ng/g	Methyl mercury	
W-17-Mid-2016	56.7 ng/g	5.15 ng/g	Methyl mercury	
W17-N	56.7 ng/g	86.8 ng/g	Methyl mercury	
W-17 (Median)	**56.7 ng/g**	**38.0 ng/g**	**Methyl mercury**	**1.5**
Mendall Marsh SE (Median)	**91.2 ng/g**	**9.02 ng/g**	**Methyl mercury**	**10**
W-21-UM-Central-C	26.8 ng/g	12.01 ng/g	Methyl mercury	
W-21-UM-West-A	26.8 ng/g	1.22 ng/g	Methyl mercury	
Mendall Marsh SW (Median)	**26.8 ng/g**	**6.62 ng/g**	**Methyl mercury**	**4.0**
Reference				
ADD-01	18.6 ng/g	1.19 ng/g	Methyl mercury	
ADD-02	18.6 ng/g	4.11 ng/g	Methyl mercury	
ADD (Median)	**18.6 ng/g**	**2.65 ng/g**	**Methyl mercury**	**7.0**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-2a
2016 Spider BSAFs
Mercury

Location	Spiders (Median)	Sediment		BSAF
Site				
W-17-High-2016	263 ng/g	1267 ng/g	Mercury	
W17-N	263 ng/g	476 ng/g	Mercury	
W-17 (Median)	**263 ng/g**	**871 ng/g**	**Mercury**	**0.30**
W-65-High	205 ng/g	84 ng/g	Mercury	
W-65-Low	205 ng/g	33 ng/g	Mercury	
W-65-Mid	205 ng/g	226 ng/g	Mercury	
Mendall Marsh SE (Median)	**205 ng/g**	**84 ng/g**	**Mercury**	**2.2**
Mendall Marsh SW	**219 ng/g**	**617 ng/g**	**Mercury**	**0.35**
Reference				
ADD-01	31.4 ng/g	29.6 ng/g	Mercury	
ADD-02	31.4 ng/g	32.6 ng/g	Mercury	
ADD (Median)	**31.4 ng/g**	**31.1 ng/g**	**Mercury**	**1.0**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-2b
2016 Spider BSAFs
Methyl Mercury

Location	Spiders (Median)	Sediment		BSAF
Site				
W-17-High-2016	282 ng/g	38.0 ng/g	Methyl mercury	
W17-N	282 ng/g	86.8 ng/g	Methyl mercury	
W-17 (Median)	**282 ng/g**	**62.4 ng/g**	**Methyl mercury**	**4.5**
Mendall Marsh SE (Median)	**174 ng/g**	**9.02 ng/g**	**Methyl mercury**	**19**
Mendall Marsh SW	**217 ng/g**	**12.0 ng/g**	**Methyl mercury**	**18**
Reference				
ADD-01	22.9 ng/g	1.19 ng/g	Methyl mercury	
ADD-02	22.9 ng/g	4.11 ng/g	Methyl mercury	
ADD (Median)	**22.9 ng/g**	**2.65 ng/g**	**Methyl mercury**	**8.7**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-3a
2016 Nelsons Sparrow BSAFs
Mercury

Location	Sparrows (Median)	Sediment		BSAF
Site				
W17-N	5000 ng/g	476 ng/g	Mercury	
W-17-High-2016	5000 ng/g	1267 ng/g	Mercury	
W-17-Low	5000 ng/g	471 ng/g	Mercury	
W-17-Mid-2016	5000 ng/g	1179 ng/g	Mercury	
W17 (Median)	**5000 ng/g**	**828 ng/g**	**Mercury**	**6.0**
W-65-High	6130 ng/g	84 ng/g	Mercury	
W-65-Low	6130 ng/g	33 ng/g	Mercury	
W-65-Mid	6130 ng/g	226 ng/g	Mercury	
Mendall Marsh SE (Median)	**6130 ng/g**	**84 ng/g**	**Mercury**	**73**
W-21-UM-Central-C	5840 ng/g	617 ng/g	Mercury	
W-21-UM-East-C	5840 ng/g	752 ng/g	Mercury	
W-21-UM-West-A	5840 ng/g	434 ng/g	Mercury	
W-21-High	5840 ng/g	929 ng/g	Mercury	
W-21-Low	5840 ng/g	705 ng/g	Mercury	
W-21-Mid	5840 ng/g	869 ng/g	Mercury	
W-65-High	5840 ng/g	84 ng/g	Mercury	
W-65-Low	5840 ng/g	33 ng/g	Mercury	
W-65-Mid	5840 ng/g	226 ng/g	Mercury	
Mendall Marsh SW (Median)	**5840 ng/g**	**617 ng/g**	**Mercury**	**9.5**
Reference				
ADD-01	467 ng/g	29.6 ng/g	Mercury	
ADD-02	467 ng/g	32.6 ng/g	Mercury	
ADD (Median Sediment)	**467 ng/g**	**31.1 ng/g**	**Mercury**	**15**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-3b
2016 Nelsons Sparrow BSAFs
Methyl Mercury

Location	Sparrows (Median)	Sediment		BSAF
Site				
W17-N	4777 ng/g	86.8 ng/g	Methyl Mercury	
W-17-High-2016	4777 ng/g	38.0 ng/g	Methyl Mercury	
W-17-Low	4777 ng/g	4.88 ng/g	Methyl Mercury	
W-17-Mid-2016	4777 ng/g	5.15 ng/g	Methyl Mercury	
W17 (Median)	**4777 ng/g**	**21.6 ng/g**	**Methyl Mercury**	**221**
W-65-Mid	5856 ng/g	9.02 ng/g	Methyl Mercury	
Mendall Marsh SE (Median)	**5856 ng/g**	**9.02 ng/g**	**Methyl Mercury**	**649**
W-21-UM-Central-C	5579 ng/g	12.0 ng/g	Methyl Mercury	
W-21-UM-East-C	5579 ng/g	2.19 ng/g	Methyl Mercury	
W-21-UM-West-A	5579 ng/g	1.22 ng/g	Methyl Mercury	
W-21-High	5579 ng/g	27.0 ng/g	Methyl Mercury	
W-21-Low	5579 ng/g	4.59 ng/g	Methyl Mercury	
W-21-Mid	5579 ng/g	4.74 ng/g	Methyl Mercury	
W-65-High	5579 ng/g	9.02 ng/g	Methyl Mercury	
W-65-Mid	5579 ng/g	9.02 ng/g	Methyl Mercury	
Mendall Marsh SW (Median)	**5579 ng/g**	**6.88 ng/g**	**Methyl Mercury**	**811**
Reference				
ADD-01	446 ng/g	1.19 ng/g	Methyl Mercury	
ADD-02	446 ng/g	4.11 ng/g	Methyl Mercury	
ADD (Median Sediment)	**446 ng/g**	**2.65 ng/g**	**Methyl Mercury**	**169**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-4a
2016 Red-winged Blackbird BSAFs
Mercury

Location	Blackbird (Median)	Sediment		BSAF
W-17-Mid-2016	2500 ng/g	1179 ng/g	Mercury	
W-17-High-2016	2500 ng/g	1267 ng/g	Mercury	
W-17 (Median)	**2500 ng/g**	**1223 ng/g**	**Mercury**	**2.0**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-4b
2016 Red-winged Blackbird BSAFs
Methyl Mercury

Location	Blackbird (Median)	Sediment		BSAF
W-17-Mid-2016	2388 ng/g	5.15 ng/g	Methyl Mercury	
W-17-High-2016	2388 ng/g	38.0 ng/g	Methyl Mercury	
W-17 (Median)	**2388 ng/g**	**21.6 ng/g**	**Methyl Mercury**	**111**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-5a
2016 Polychaete BSAFs
Mercury

Location	Poly. Worms (Median)	Sediment		BSAF
Site				
BO-04	185 ng/g	980 ng/g	Mercury	0.19
OB-05	215 ng/g	755 ng/g	Mercury	0.28
MMPOLY (Mendall Marsh)	190 ng/g	554 ng/g	Mercury	0.34
ES-13 (South Verona)	24.7 ng/g	416 ng/g	Mercury	0.059
ES-FP (Fort Point)	24.5 ng/g	48.1 ng/g	Mercury	0.57
Reference				
FRB-01	3.180 ng/g	7.53 ng/g	Mercury	0.63

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-5b
2016 Polychaete BSAFs
Methyl Mercury

Location	Poly. Worms (Median)	Sediment		BSAF
Site				
BO-04	8.3 ng/g	54.3 ng/g	Methyl mercury	0.15
OB-05	12.7 ng/g	19.3 ng/g	Methyl mercury	0.66
MMPOLY (Mendall Marsh)	9.9 ng/g	13.4 ng/g	Methyl mercury	0.74
ES-13 (South Verona)	2.4 ng/g	28.8 ng/g	Methyl mercury	0.083
ES-FP (Fort Point)	5.75 ng/g	2.57 ng/g	Methyl mercury	2.2

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-6a
2016 Black Duck Blood BSAFs
Mercury

Location	Black Duck Blood (Median)	Sediment		BSAF
Site				
BU-24R	504 ng/g	82 ng/g	Mercury	
FF-03H	504 ng/g	83 ng/g	Mercury	
MMPOLY	504 ng/g	554 ng/g	Mercury	
MM-62	504 ng/g	714 ng/g	Mercury	
MM-65	504 ng/g	821 ng/g	Mercury	
MM-71	504 ng/g	1040 ng/g	Mercury	
W-17-Intertidal	504 ng/g	518 ng/g	Mercury	
W-17-Low	504 ng/g	471 ng/g	Mercury	
W-21-High	504 ng/g	929 ng/g	Mercury	
W-21-Intertidal	504 ng/g	543 ng/g	Mercury	
W-21-Low	504 ng/g	705 ng/g	Mercury	
W-21-Mid	504 ng/g	869 ng/g	Mercury	
W-21-UM-Central-C	504 ng/g	617 ng/g	Mercury	
W-21-UM-East-C	504 ng/g	752 ng/g	Mercury	
W-21-UM-South	504 ng/g	267 ng/g	Mercury	
W-21-UM-West-A	504 ng/g	434 ng/g	Mercury	
W-65-High	504 ng/g	84 ng/g	Mercury	
W-65-Intertidal	504 ng/g	42 ng/g	Mercury	
W-65-Low	504 ng/g	33 ng/g	Mercury	
W-65-Mid	504 ng/g	226 ng/g	Mercury	
Mendall Marsh (Media	**504 ng/g**	**531 ng/g**	**Mercury**	**0.95**
EC-39ABC	377 ng/g	896 ng/g	Mercury	
EC-39ABC	377 ng/g	578 ng/g	Mercury	
ES-02	377 ng/g	961 ng/g	Mercury	
ES-13	377 ng/g	416 ng/g	Mercury	
ES-15	377 ng/g	151 ng/g	Mercury	
GP-36ABC	377 ng/g	883 ng/g	Mercury	
VE-52	377 ng/g	96.3 ng/g	Mercury	
W-61-High	377 ng/g	594 ng/g	Mercury	
W-61-Intertidal	377 ng/g	1163 ng/g	Mercury	
W-61-Low	377 ng/g	927 ng/g	Mercury	
W-61-Mid	377 ng/g	1483 ng/g	Mercury	
South Verona (Median	**377 ng/g**	**883 ng/g**	**Mercury**	**0.43**
Reference				
FRB-01	**43.5 ng/g**	**7.53 ng/g**	**Mercury**	**5.8**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 09/05/17
Checked By: TAN 09/05/17

A-6b
2016 Black Duck Tissue BSAFs
Mercury

Location	Black Duck Tissue (Median)	Sediment		BSAF
Site				
BU-24R	177 ng/g	82 ng/g	Mercury	
FF-03H	177 ng/g	83 ng/g	Mercury	
MMPOLY	177 ng/g	554 ng/g	Mercury	
MM-62	177 ng/g	714 ng/g	Mercury	
MM-65	177 ng/g	821 ng/g	Mercury	
MM-71	177 ng/g	1040 ng/g	Mercury	
W-17-Intertidal	177 ng/g	518 ng/g	Mercury	
W-17-Low	177 ng/g	471 ng/g	Mercury	
W-21-High	177 ng/g	929 ng/g	Mercury	
W-21-Intertidal	177 ng/g	543 ng/g	Mercury	
W-21-Low	177 ng/g	705 ng/g	Mercury	
W-21-Mid	177 ng/g	869 ng/g	Mercury	
W-21-UM-Central-C	177 ng/g	617 ng/g	Mercury	
W-21-UM-East-C	177 ng/g	752 ng/g	Mercury	
W-21-UM-South	177 ng/g	267 ng/g	Mercury	
W-21-UM-West-A	177 ng/g	434 ng/g	Mercury	
W-65-High	177 ng/g	84 ng/g	Mercury	
W-65-Intertidal	177 ng/g	42 ng/g	Mercury	
W-65-Low	177 ng/g	33 ng/g	Mercury	
W-65-Mid	177 ng/g	226 ng/g	Mercury	
Mendall Marsh (Median)	**177 ng/g**	**531 ng/g**	**Mercury**	**0.33**
EC-39ABC	441 ng/g	896 ng/g	Mercury	
EC-39ABC	441 ng/g	578 ng/g	Mercury	
ES-02	441 ng/g	961 ng/g	Mercury	
ES-13	441 ng/g	416 ng/g	Mercury	
ES-15	441 ng/g	151 ng/g	Mercury	
GP-36ABC	441 ng/g	883 ng/g	Mercury	
VE-52	441 ng/g	96.3 ng/g	Mercury	
W-61-High	441 ng/g	594 ng/g	Mercury	
W-61-Intertidal	441 ng/g	1163 ng/g	Mercury	
W-61-Low	441 ng/g	927 ng/g	Mercury	
W-61-Mid	441 ng/g	1483 ng/g	Mercury	
South Verona (Median)	**441 ng/g**	**883 ng/g**	**Mercury**	**0.50**
Reference				
FRB-01	**44.8 ng/g**	**7.53 ng/g**	**Mercury**	**5.9**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 09/05/17
Checked By: TAN 09/05/17

A-6c
2016 Black Duck Blood BSAFs
Methyl Mercury

Location	Black Duck Blood (Median)	Sediment		BSAF
Site				
MMPOLY	397 ng/g	13.40 ng/g	Methyl mercury	
W-17-Intertidal	397 ng/g	3.77 ng/g	Methyl mercury	
W-17-Low	397 ng/g	4.88 ng/g	Methyl mercury	
W-21-High	397 ng/g	27.04 ng/g	Methyl mercury	
W-21-Intertidal	397 ng/g	4.04 ng/g	Methyl mercury	
W-21-Low	397 ng/g	4.59 ng/g	Methyl mercury	
W-21-Mid	397 ng/g	4.74 ng/g	Methyl mercury	
W-21-UM-Central-C	397 ng/g	12.01 ng/g	Methyl mercury	
W-21-UM-East-C	397 ng/g	2.19 ng/g	Methyl mercury	
W-21-UM-South	397 ng/g	5.94 ng/g	Methyl mercury	
W-21-UM-West-A	397 ng/g	1.22 ng/g	Methyl mercury	
W-65-Intertidal	397 ng/g	0.35 ng/g	Methyl mercury	
W-65-Mid	397 ng/g	9.02 ng/g	Methyl mercury	
Mendall Marsh (Median)	**397 ng/g**	**4.74 ng/g**	**Methyl mercury**	**84**
ES-02	297 ng/g	37.99 ng/g	Methyl mercury	
ES-13	297 ng/g	28.75 ng/g	Methyl mercury	
ES-15	297 ng/g	4.66 ng/g	Methyl mercury	
W-61-High	297 ng/g	8.33 ng/g	Methyl mercury	
W-61-Intertidal	297 ng/g	9.57 ng/g	Methyl mercury	
W-61-Low	297 ng/g	32.18 ng/g	Methyl mercury	
W-61-Mid	297 ng/g	11.38 ng/g	Methyl mercury	
South Verona (Median)	**297 ng/g**	**11.38 ng/g**	**Methyl mercury**	**26**
Reference				
FRB-01	**34 ng/g**	**NA ng/g**	**Methyl mercury**	**NA**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 09/05/17
Checked By: TAN 09/05/17

A-6d
2016 Black Duck Tissue BSAFs
Methyl Mercury

Location	Black Duck Tissue (Median)	Sediment		BSAF
Site				
MMPOLY	142 ng/g	13.40 ng/g	Methyl mercury	
W-17-Intertidal	142 ng/g	3.77 ng/g	Methyl mercury	
W-17-Low	142 ng/g	4.88 ng/g	Methyl mercury	
W-21-High	142 ng/g	27.04 ng/g	Methyl mercury	
W-21-Intertidal	142 ng/g	4.04 ng/g	Methyl mercury	
W-21-Low	142 ng/g	4.59 ng/g	Methyl mercury	
W-21-Mid	142 ng/g	4.74 ng/g	Methyl mercury	
W-21-UM-Central-C	142 ng/g	12.01 ng/g	Methyl mercury	
W-21-UM-East-C	142 ng/g	2.19 ng/g	Methyl mercury	
W-21-UM-South	142 ng/g	5.94 ng/g	Methyl mercury	
W-21-UM-West-A	142 ng/g	1.22 ng/g	Methyl mercury	
W-65-Intertidal	142 ng/g	0.35 ng/g	Methyl mercury	
W-65-Mid	142 ng/g	9.02 ng/g	Methyl mercury	
Mendall Marsh (Median)	**142 ng/g**	**4.74 ng/g**	**Methyl mercury**	**30**
ES-02	353 ng/g	37.99 ng/g	Methyl mercury	
ES-13	353 ng/g	28.75 ng/g	Methyl mercury	
ES-15	353 ng/g	4.66 ng/g	Methyl mercury	
W-61-High	353 ng/g	8.33 ng/g	Methyl mercury	
W-61-Intertidal	353 ng/g	9.57 ng/g	Methyl mercury	
W-61-Low	353 ng/g	32.18 ng/g	Methyl mercury	
W-61-Mid	353 ng/g	11.38 ng/g	Methyl mercury	
South Verona (Median)	**353 ng/g**	**11.38 ng/g**	**Methyl mercury**	**31**
Reference				
FRB-01	**35.8 ng/g**	**NA ng/g**	**Methyl mercury**	**NA**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 09/05/17
Checked By: TAN 09/05/17

A-7a
2016 Lobster BSAFs
Mercury

Location	Lobster (Median)	Sediment (Median)		BSAF
Odom Ledge	206.5 ng/g	568 ng/g	Mercury	0.36
South Verona	366.0 ng/g	568 ng/g	Mercury	0.64
Cape Jellison	179.5 ng/g	503 ng/g	Mercury	0.36
L9-45 (Turner Point)	164.0 ng/g	497 ng/g	Mercury	0.33
HB-01 (Haborside)	101.5 ng/g	53.5 ng/g	Mercury	1.9

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-7b
2016 Lobster BSAFs
Methyl Mercury

Location	Lobster (Median)	Sediment (Median)		BSAF
Odom Ledge	162 ng/g	11.6 ng/g	Methyl Mercury	14
South Verona	286 ng/g	11.5 ng/g	Methyl Mercury	25
Cape Jellison	140 ng/g	4.69 ng/g	Methyl Mercury	30
L9-45 (Turner Point)	128 ng/g	4.72 ng/g	Methyl Mercury	27
HB-01 (Haborside)	79.4 ng/g	0.320 ng/g	Methyl Mercury	248

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-8a
2016 Mummichog BSAFs
Mercury

Location	Mummichog (Median)	Sediment (Median)		BSAF
Site				
BO-04	71.15 ng/g	117.07 ng/g	Mercury	0.61
OB-05	89.05 ng/g	755 ng/g	Mercury	0.12
OB-01	134 ng/g	745 ng/g	Mercury	0.18
Mendall Marsh SE	159 ng/g	42.2 ng/g	Mercury	3.8
Reference				
FRB-01	7.96 ng/g	7.53 ng/g	Mercury	1.1

A-8b
2016 Mummichog BSAFs
Methyl Mercury

Location	Mummichog (Median)	Sediment (Median)		BSAF
Site				
BO-04	61.4 ng/g	32.6 ng/g	Methyl Mercury	1.9
OB-05	76.8 ng/g	19.3 ng/g	Methyl Mercury	4.0
OB-01	116 ng/g	NA ng/g	Methyl Mercury	NA
Mendall Marsh SE	137 ng/g	0.354 ng/g	Methyl Mercury	386
Reference				
FRB-01	6.86 ng/g	0.122 ng/g	Methyl Mercury	56

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-9a
2016 Rainbow Smelt BSAFs
Mercury

Location	Smelt (Median)	Sediment (Median)		BSAF
Site				
OB-05	201 ng/g	554 ng/g	Mercury	0.36
OB-04	54.9 ng/g	568 ng/g	Mercury	0.10
OB-01	90.8 ng/g	544 ng/g	Mercury	0.17
ES-13	38.4 ng/g	544 ng/g	Mercury	0.071
ES-FP	55.4 ng/g	559 ng/g	Mercury	0.099
Reference				
FRB-01	6.64 ng/g	7.53 ng/g	Mercury	0.88

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-9b
2016 Rainbow Smelt BSAFs
Methyl Mercury

Location	Smelt (Median)	Sediment (Median)		BSAF
Site				
OB-05	159 ng/g	6.35 ng/g	Methyl Mercury	25
OB-04	43.4 ng/g	7.89 ng/g	Methyl Mercury	5.5
OB-01	71.7 ng/g	5.95 ng/g	Methyl Mercury	12
ES-13	30.3 ng/g	5.94 ng/g	Methyl Mercury	5.1
ES-FP	43.7 ng/g	5.55 ng/g	Methyl Mercury	7.9

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-10a
2016 American Eel BSAFs
Mercury

Location	Eel (Median)	Sediment		BSAF
BO-05	**1370 ng/g**	**1793 ng/g**	**Mercury**	**0.76**
OB-05	461 ng/g	755 ng/g	Mercury	
W-63-High	461 ng/g	36.8 ng/g	Mercury	
W-63-Intertidal	461 ng/g	1123 ng/g	Mercury	
W-63-Low	461 ng/g	229 ng/g	Mercury	
W-63-Mid	461 ng/g	215 ng/g	Mercury	
OB-05 (Median)	**461 ng/g**	**229 ng/g**	**Mercury**	**2.0**
FF-08F	394 ng/g	745 ng/g	Mercury	
FF-09F	394 ng/g	62 ng/g	Mercury	
FF-10F	394 ng/g	770 ng/g	Mercury	
OB-01 (Median)	**394 ng/g**	**745 ng/g**	**Mercury**	**0.53**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-10b
2016 American Eel BSAFs
Methyl Mercury

Location	Eel (Median)	Sediment		BSAF
BO-05	**1201 ng/g**	**13.5 ng/g**	**Methyl Mercury**	**89**
OB-05	404 ng/g	19.3 ng/g	Methyl Mercury	
W-63-High	404 ng/g	0.397 ng/g	Methyl Mercury	
W-63-Intertidal	404 ng/g	19.2 ng/g	Methyl Mercury	
W-63-Low	404 ng/g	3.85 ng/g	Methyl Mercury	
W-63-Mid	404 ng/g	11.9 ng/g	Methyl Mercury	
OB-05 (Median)	**404 ng/g**	**11.9 ng/g**	**Methyl Mercury**	**34**
FF-08F	345 ng/g	NA ng/g	Methyl Mercury	
FF-09F	345 ng/g	NA ng/g	Methyl Mercury	
FF-10F	345 ng/g	NA ng/g	Methyl Mercury	
OB-01 (Median)	**345 ng/g**	**NA ng/g**	**Methyl Mercury**	**NA**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-11a
2016 Atlantic Tomcod BSAFs
Mercury

Location	Tomcod (Median)	Sediment (Median)		BSAF
Site				
BO-04	308 ng/g	-- ng/g	Mercury	
OB-05	152 ng/g	-- ng/g	Mercury	
OB-01	174 ng/g	-- ng/g	Mercury	
ES-13	103 ng/g	-- ng/g	Mercury	
ES-FP	64.9 ng/g	-- ng/g	Mercury	
Penobscot River	**155 ng/g**	**543 ng/g**	**Mercury**	**0.28**
Reference				
FRB-01	**36.5 ng/g**	**7.53 ng/g**	**Mercury**	**4.8**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

A-11b
2016 Atlantic Tomcod BSAFs
Methyl Mercury

Location	Tomcod (Median)		Sediment (Median)			BSAF
Site						
BO-04	245	ng/g	--	ng/g	Methyl Mercury	
OB-05	121	ng/g	--	ng/g	Methyl Mercury	
OB-01	138	ng/g	--	ng/g	Methyl Mercury	
ES-13	81.9	ng/g	--	ng/g	Methyl Mercury	
ES-FP	51.6	ng/g	--	ng/g	Methyl Mercury	
Penobscot River	**123**	**ng/g**	**5.95**	**ng/g**	**Methyl Mercury**	**21**

Note:
Individual results are available in Appendix C of the 2016 Biota Monitoring Report

Prepared By: KPH 06/27/17
Checked By: NSR 06/27/17

ATTACHMENT B
Normalization of BSAFs

Normalization of BSAFs

A second BSAF evaluation was conducted using the 2016 data to provide a comparison to the standard BSAF calculation. Methyl mercury binds to organic carbon in soil so the organic content of the soil/sediment may affect the bioavailability. Methyl mercury typically accumulates in tissue, especially protein, and is not very lipid soluble like organic compounds. For normalization, biota tissue concentrations were divided by percent lipids, and sediment concentrations were divided by percent total organic carbon (TOC) prior to the standard division of biota by sediment for the BSAF. The equation is as follows:

$$\text{BSAF} = \frac{\text{Biota Concentration (wet weight) / Percent Lipid}}{\text{Sediment Concentration (dry weight) / Percent Total Organic Carbon}}$$

Normalization of data by lipid and organic carbon content can prove useful in the development of BSAFs by correcting for differences in bioavailability and binding behavior. The normalized BSAFs were then denormalized using the average percent lipids and average TOC for each location using the following equation:

$$\text{Denormalized BSAF} = \frac{\text{Normalized BSAF * Average Percent Lipid}}{\text{Average Percent Total Organic Carbon}}$$

Denormalization of the BSAFs allows for direct comparison to the standard BSAFs.

Comparison of the denormalized BSAFs to the standard BSAFs is provided in Table B-1. The ranges were similar for denormalized and standard BSAFs. Thus, either approach results in similar BSAFs. The recommendation for the study area is to proceed using the standard approach. Lipid data for normalization of BSAFs are not necessary for samples collected in 2017 because either approach (e.g., the standard or the normalization BSAF approach) results in similar BSAFs.

B-1

COMPARISON OF 2016 BSAFs -
DENORMALIZED BSAFs VS. STANDARD BSAFs

SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

		Denormalized BSAFs (ww/dw)[1]		BSAFs (ww/dw)	
Biota	**Location**	**Hg BSAF**	**MeHg BSAF**	**Hg BSAF**	**MeHg BSAF**
Lobster	Odom Ledge	0.30	8.4	0.36	14
	South Verona	0.46	15	0.64	25
	Cape Jellison	0.39	29	0.36	30
	L9-45 (Turner Point)	0.41	29	0.33	27
	HB-01 (Haborside)	2.0	255	1.9	248
Insect	W-17	0.022	1.1	0.026	1.5
	Mendall Marsh SE	2.5	32	2.6	10
	Mendall Marsh SW	0.091	4.2	0.090	4.0
	ADD	0.24	1.5	0.54	7.0
Spider	W-17	0.23	4.5	0.30	4.5
	Mendall Marsh SE	2.4	58	2.2	19
	Mendall Marsh SW	0.41	18	0.35	18
	ADD	0.45	2.5	1.0	8.7
Polychaete	BO-04	0.19	0.15	0.19	0.15
	OB-05	0.28	0.66	0.28	0.66
	MMPOLY (Mendall Marsh)	0.34	0.74	0.34	0.74
	ES-13 (South Verona)	0.089	0.094	0.059	0.083
	ES-FP (Fort Point)	0.63	3.4	0.57	2.2
	FRB-01	0.42	NA	0.63	NA
Duck (Tissue)	Mendall Marsh	0.32	29	0.33	30
	South Verona	0.44	24	0.50	31
	Frenchman Bay	6.4	NA	5.9	NA
Mummichog	BO-04	0.13	2.2	0.61	1.9
	OB-05	0.13	4.3	0.12	4.0
	OB-01	0.18	NA	0.18	NA
	Mendall Marsh SE	3.3	2.2	3.8	386
	FRB-01	1.0	NA	1.1	56
Smelt	OB-05	0.24	17	0.36	25
	OB-04	0.058	5.1	0.10	5.5
	OB-01	0.12	9.4	0.17	12
	ES-13	0.045	3.7	0.071	5.1
	ES-FP	0.070	6.0	0.099	7.9
	FRB-01	0.88	NA	0.88	NA
Eel	BO-05	0.76	89	0.76	89
	OB-05	3.1	127	2.0	34
	OB-01	0.96	NA	0.53	NA
Tomcod	Penobscot River	0.20	16	0.28	21
	FRB-01	4.8	NA	4.8	NA

B-1
COMPARISON OF 2016 BSAFs -
DENORMALIZED BSAFs VS. STANDARD BSAFs

SUMMARY OF BIOTA-SEDIMENT ACCUMULATION FACTOR EVALUATION

		Denormalized BSAFs (ww/dw)[1]		BSAFs (ww/dw)	
Biota	**Location**	**Hg BSAF**	**MeHg BSAF**	**Hg BSAF**	**MeHg BSAF**
Blue Mussel	ES-15	0.38	5.2	0.38	5.2
	ES-13	0.15	0.90	0.15	0.90
	ES-03	0.094	5.2	0.090	5.2
	ES-FP	1.2	9.8	1.2	9.8
	Median Study Area BSAF	0.36	5	0.36	9

Prepared By/Date: NSR 6/27/17
Checked By/Date: KPH 6/28/17

Notes:
Hg = Mercury
MeHg = Methyl Mercury
BSAF = Biota-Sediment Accumulation Factor
TOC = Total Organic Carbon
ww = wet weight
dw = dry weight
NA = Not Available
[1]Denormalized BSAF = (Normalized BSAF * Average % Lipids) ÷ Average % TOC

B-1a
2016 Normalized Terrestrial Insect BSAFs
Mercury

Location	Normalized Insect (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
W-17	1,086	14,876	Mercury	0.073	2.9%	9.7%	0.022
Mendall Marsh SE	7,655	694	Mercury	11	3.3%	15%	2.5
Mendall Marsh SW	1,397	4,208	Mercury	0.33	3.4%	12%	0.091
Reference							
ADD	509	684	Mercury	1	3.7%	12%	0.24

[1]Normalized BSAF = ([Median] Insect ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-1b
2016 Normalized Terrestrial Insect BSAFs
Methyl Mercury

Location	Normalized Insect (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
W-17	1,668	446	Methyl Mercury	3.7	2.9%	9.7%	1.1
Mendall Marsh SE	2,857	20	Methyl Mercury	141	3.3%	15%	32
Mendall Marsh SW	766	50	Methyl Mercury	15	3.4%	12%	4.2
Reference							
ADD	374	80	Methyl Mercury	4.7	3.7%	12%	1.5

[1]Normalized BSAF = ([Median] Insect ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-2a
2016 Normalized Spider BSAFs
Mercury

Location	Normalized Spider (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
W-17	9,741	8,963	Mercury	1.1	2.6%	12%	0.23
Mendall Marsh SE	7,615	694	Mercury	11	3.2%	15%	2.4
Mendall Marsh SW	8,111	4,104	Mercury	2.0	2.8%	13%	0.41
Reference							
ADD	2,210	684	Mercury	3.2	1.6%	12%	0.45

[1]Normalized BSAF = ([Median] Spider ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-2b
2016 Normalized Spider BSAFs
Methyl Mercury

Location	Normalized Spider (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
W-17	10,692	501	Methyl Mercury	21	2.6%	12%	4.5
Mendall Marsh SE	5,422	20	Methyl Mercury	268	3.2%	15%	58
Mendall Marsh SW	8,037	89	Methyl Mercury	90	2.8%	13%	18
Reference							
ADD	1,431	80	Methyl Mercury	18	1.6%	12%	2.5

[1]Normalized BSAF = ([Median] Spider ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-3a
2016 Normalized Polychaete BSAFs
Mercury

Location	Normalized Polychaete (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
BO-04	5,606	13,115	Mercury	0.43	3.3%	7.5%	0.19
OB-05	6,515	13,142	Mercury	0.50	3.3%	5.7%	0.28
MMPOLY (Mendall Marsh)	5,758	11,501	Mercury	0.50	3.3%	4.8%	0.34
ES-13 (South Verona)	1,156	14,065	Mercury	0.082	3.2%	3.0%	0.089
ES-FP (Fort Point)	1,048	13,417	Mercury	0.078	2.9%	0.36%	0.63
Reference							
FRB-01	202	1,711	Mercury	0.12	1.6%	0.44%	0.42

[1]Normalized BSAF = ([Median] Polychaete ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-3b
2016 Normalized Polychaete BSAFs
Methyl Mercury

Location	Normalized Polychaete (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
BO-04	252	726	Methyl mercury	0.35	3.3%	7.5%	0.15
OB-05	385	337	Methyl mercury	1.1	3.3%	5.7%	0.66
MMPOLY (Mendall Marsh)	300	278	Methyl mercury	1.1	3.3%	4.8%	0.74
ES-13 (South Verona)	85	971	Methyl mercury	0.087	3.2%	3.0%	0.094
ES-FP (Fort Point)	315	716	Methyl mercury	0.44	2.8%	0.36%	3.4

[1]Normalized BSAF = ([Median] Polychaete ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-4a
2016 Normalized Black Duck Tissue BSAFs
Mercury

Location	Normalized Black Duck (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
Mendall Marsh	10,625	9,925	Mercury	1.07	2.1%	7.2%	0.32
South Verona	18,778	11,599	Mercury	1.6	2.2%	7.9%	0.44
Reference							
Frenchman Bay	2,635	1,696	Mercury	1.6	1.8%	0.44%	6.4

[1]Normalized BSAF = ([Median] Duck ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 09/05/17

Checked By: TAN 09/05/17

B-4b
2016 Normalized Black Duck Tissue BSAFs
Methyl Mercury

Location	Normalized Black Duck (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
Mendall Marsh	8,500	79	Methyl Mercury	108	2.1%	7.9%	29
South Verona	15,022	158	Methyl Mercury	95	2.2%	8.6%	24
Reference							
Frenchman Bay	2,108	NA	Methyl Mercury	NA	NA	NA	NA

[1]Normalized BSAF = ([Median] Duck ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)
[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC
TOC = Total Organic Carbon

Prepared By: KPH 09/05/17
Checked By: TAN 09/05/17

B-5a
2016 Normalized Lobster BSAFs
Mercury

Location	Normalized Lobster (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Odom Ledge	36,882	15,137	Mercury	2.4	0.68%	5.6%	0.30
South Verona	66,908	14,283	Mercury	4.7	0.53%	5.4%	0.46
Cape Jellison	20,683	18,683	Mercury	1.1	0.85%	2.4%	0.39
L9-45 (Turner Point)	22,495	18,407	Mercury	1.2	0.78%	2.3%	0.41
HB-01 (Haborside)	11,677	8,521	Mercury	1.4	0.89%	0.63%	2.0

[1]Normalized BSAF = ([Median] Lobster ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-5b
2016 Normalized Lobster BSAFs
Methyl Mercury

Location	Normalized Lobster (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Odom Ledge	28,867	336	Methyl Mercury	86	0.68%	6.9%	8.4
South Verona	52,369	294	Methyl Mercury	178	0.53%	6.5%	15
Cape Jellison	15,793	191	Methyl Mercury	82	0.85%	2.4%	29
L9-45 (Turner Point)	17,607	202	Methyl Mercury	87	0.78%	2.3%	29
HB-01 (Haborside)	9,140	51	Methyl Mercury	179	0.89%	0.63%	255

[1]Normalized BSAF = ([Median] Lobster ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-6a
2016 Normalized Mummichog BSAFs
Mercury

Location	Normalized Mummichog (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
BO-04	2,116	12,563	Mercury	0.17	3.4%	4.4%	0.13
OB-05	2,947	13,142	Mercury	0.22	3.3%	5.7%	0.13
OB-01	2,978	22,783	Mercury	0.13	4.5%	3.3%	0.18
Mendall Marsh SE	3,102	9,214	Mercury	0.34	4.5%	0.5%	3.3
Reference							
FRB-01	166	1,696	Mercury	0.10	4.7%	0.4%	1.0

[1]Normalized BSAF = ([Median] Mummichog ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-6b
2016 Normalized Mummichog BSAFs
Methyl Mercury

Location	Normalized Mummichog (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
BO-04	1,826	642	Methyl Mercury	2.8	3.4%	4.4%	2.2
OB-05	2,543	337	Methyl Mercury	7.6	3.3%	5.7%	4.3
OB-01	2,569	NA	Methyl Mercury	NA	NA	NA	NA
Mendall Marsh SE	2,676	77	Methyl Mercury	35	4.5%	0.5%	2.2
Reference							
FRB-01	143	NA	Methyl Mercury	NA	NA	NA	NA

[1]Normalized BSAF = ([Median] Mummichog ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-7a
2016 Normalized Rainbow Smelt BSAFs
Mercury

Location	Normalized Rainbow Smelt (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
OB-05	5,432	12,004	Mercury	0.45	3.7%	7.1%	0.24
OB-04	927	12,084	Mercury	0.077	5.7%	7.5%	0.058
OB-01	2,215	12,084	Mercury	0.18	4.5%	7.1%	0.12
ES-13	480	12,041	Mercury	0.040	8.0%	7.1%	0.045
ES-FP	1,057	12,135	Mercury	0.087	5.8%	7.3%	0.070
Reference							
FRB-01	178	1,696	Mercury	0.10	3.7%	0.44%	0.88

[1]Normalized BSAF = ([Median] Smelt ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/06/17

Checked By: JAW 07/10/17

B-7b
2016 Normalized Rainbow Smelt BSAFs
Methyl Mercury

Location	Normalized Rainbow Smelt (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
OB-05	4,291	155	Methyl Mercury	28	3.7%	6.0%	17
OB-04	732	146	Methyl Mercury	5.0	5.7%	5.7%	5.1
OB-01	1,749	148	Methyl Mercury	12	4.5%	5.6%	9.4
ES-13	379	146	Methyl Mercury	2.6	8.0%	5.6%	3.7
ES-FP	835	149	Methyl Mercury	5.6	5.8%	5.4%	6.0

[1]Normalized BSAF = ([Median] Smelt ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/06/17

Checked By: JAW 07/10/17

B-8a
2016 Normalized American Eel BSAFs
Mercury

Location	Normalized American Eel (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
BO-05	18,767	19,377	Mercury	0.97	7.3%	9.3%	0.76
OB-05	26,750	9,105	Mercury	2.9	4.9%	4.6%	3.1
OB-01	17,130	12,078	Mercury	1.4	2.3%	3.4%	0.96

[1]Normalized BSAF = ([Median] Eel ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/06/17

Checked By: JAW 07/10/17

B-8b
2016 Normalized American Eel BSAFs
Methyl Mercury

Location	Normalized American Eel (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
BO-05	16,448	145	Methyl Mercury	113	7.3%	9.3%	89
OB-05	23,444	195	Methyl Mercury	120	4.9%	4.6%	127
OB-01	15,013	NA	Methyl Mercury	NA	NA	NA	NA

[1]Normalized BSAF = ([Median] Eel ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/06/17

Checked By: JAW 07/10/17

B-9a
2016 Normalized Atlantic Tomcod BSAFs
Mercury

Location	Normalized Tomcod (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
Penobscot River	58,167	11,912	Mercury	4.9	0.27%	6.8%	0.20
Reference							
FRB-01	10,139	1,696	Mercury	6.0	0.36%	0.44%	4.8

[1]Normalized BSAF = ([Median] Tomcod ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-9b
2016 Normalized Atlantic Tomcod BSAFs
Methyl Mercury

Location	Normalized Tomcod (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
Penobscot River	46,272	142	Methyl Mercury	325	0.27%	5.7%	16
Reference							
FRB-01	8,065	NA	Methyl Mercury	NA	NA	NA	NA

[1]Normalized BSAF = ([Median] Tomcod ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)

[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC

TOC = Total Organic Carbon

Prepared By: KPH 07/07/17

Checked By: JAW 07/10/17

B-10
2016 Normalized Blue Mussel BSAFs
Mercury and Methyl Mercury

Location	Normalized Blue Mussel (Median) (ng/g lipid)	Normalized Sediment (Median) (ng/g TOC)		Normalized BSAF[1]	Average % Lipids	Average % TOC	De-Normalized BSAF[2]
Site							
ES-15	3,553	5,130	Mercury	0.69	1.6%	3.0%	0.38
ES-13	3,803	14,065	Mercury	0.27	1.6%	3.0%	0.15
ES-03	4,791	17,819	Mercury	0.27	1.7%	4.8%	0.094
ES-FP	3,678	13,417	Mercury	0.27	1.6%	0.36%	1.2
Site							
ES-15	1,517	158	Methyl mercury	9.6	1.6%	3.0%	5.2
ES-13	1,624	971	Methyl mercury	1.7	1.6%	3.0%	0.90
ES-03	1,961	132	Methyl mercury	15	1.7%	4.8%	5.2
ES-FP	1,570	716	Methyl mercury	2.2	1.6%	0.36%	9.8

[1]Normalized BSAF = ([Median] Mussel ÷ % Lipids) ÷ ([Median] Sediment ÷ % TOC)
[2]De-normalized BSAF = (Normalized BSAF × Average % Lipids) ÷ Average % TOC
TOC = Total Organic Carbon

Prepared By: KPH 07/07/17
Checked By: JAW 07/10/17

ATTACHMENT C
Summary Tables for Historical BSAF Calculations

C-1
SUMMARY TABLE FOR HISTORICAL BSAFS - MERCURY

SUMMARY OF BIOTA - SEDIMENT ACCUMULATION FACTOR EVALUATION

Pairing (A/B)	Constituent	Exposure Area	Biota Median (A) [ng/g]	Sediment Median (B) [ng/g]	BSAF [-]	Median Exposure Area BSAF	Median Study Area BSAF
Spider/Sediment	Hg/Hg	Marsh River	4545	910	4.99	4.99	
Spider/Sediment	Hg/Hg	W-17-N	968	774	1.25	0.84	0.75
Spider/Sediment	Hg/Hg	W-17-N	494	586	0.843		
Spider/Sediment	Hg/Hg	W-17-N	81	246	0.329		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southeast	163	597	0.274	0.501	
Spider/Sediment	Hg/Hg	Mendall Marsh - Southeast	300	458	0.655		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southeast	193	557	0.347		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southeast	146	128	1.14		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	161	976	0.165	0.897	
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	464	517	0.897		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	178	501	0.356		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	53	85	0.625		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	2420	285	8.49		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	1080	678	1.59		
Spider/Sediment	Hg/Hg	Mendall Marsh - Southwest	1105	209	5.29		
Insect/Sediment	Hg/Hg	W21/Mendall Marsh SW	25	836	0.0303	0.0303	0.030
Nelsons Sparrow Blood/Sediment	Hg/Hg	W-17-N	6304	1009	6.25	6.00	7.1
Nelsons Sparrow Blood/Sediment	Hg/Hg	W-17-N	4202	929	4.52		
Nelsons Sparrow Blood/Sediment	Hg/Hg	W-17-N	4613	803	5.75		
Nelsons Sparrow Blood/Sediment	Hg/Hg	W-17-N	5640	861	6.55		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SW	7325	905	8.10	7.15	
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SW	5075	836	6.07		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SW	3250	836	3.89		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SW	5506	888	6.20		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SW	6595	492	13.4		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SW	7630	508	15.0		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SE	9972	905	11.0	13.0	
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SE	7329	492	14.9		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SE	6984	906	7.71		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SE	4191	888	4.72		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SE	5490	317	17.3		
Nelsons Sparrow Blood/Sediment	Hg/Hg	Mendall Marsh SE	10470	340	30.8		
Red-winged Blackbird Blood/Sediment	Hg/Hg	Mendall Marsh SE	11040	183	60.5	60.5	32
Red-winged Blackbird Blood/Sediment	Hg/Hg	Mendall Marsh SW	2182	779	2.80	2.80	
Red-winged Blackbird Blood/Sediment	Hg/Hg	Marsh River	1147	901	1.27	1.27	
Mummichog/Sediment	Hg/Hg	BO Area	85	83	1.04	0.20	0.40
Mummichog/Sediment	Hg/Hg	BO Area	232	507	0.457		
Mummichog/Sediment	Hg/Hg	BO Area	120	769	0.156		
Mummichog/Sediment	Hg/Hg	BO Area	213	1141	0.187		
Mummichog/Sediment	Hg/Hg	BO Area	262	1300	0.201		
Mummichog/Sediment	Hg/Hg	W-21	158	613	0.258	0.382	
Mummichog/Sediment	Hg/Hg	W-21	343	678	0.506		
Mummichog/Sediment	Hg/Hg	ES-13	257	77	3.35	3.35	
Mummichog/Sediment	Hg/Hg	OB-03	293	863	0.340	0.601	
Mummichog/Sediment	Hg/Hg	OB-03	380	441	0.862		
Eel/Sediment	Hg/Hg	OB-01	552	423	1.30	0.90	0.56
Eel/Sediment	Hg/Hg	OB-01	494	969	0.509		
Eel/Sediment	Hg/Hg	OB-01	465	363	1.28		
Eel/Sediment	Hg/Hg	OB-01	459	969	0.474		
Eel/Sediment	Hg/Hg	OB-03	596	1057	0.564	0.564	
Eel/Sediment	Hg/Hg	W-10	423	863	0.490	0.490	
Eel/Sediment	Hg/Hg	OB-05	449	1160	0.386	0.386	
Eel/Sediment	Hg/Hg	OB-05	472	1239	0.381		
Eel/Sediment	Hg/Hg	OB-05	613	1080	0.568		
Eel/Sediment	Hg/Hg	W-63 Intertidal	548	2290	0.239	0.239	
Eel/Sediment	Hg/Hg	W-63 Intertidal	399	1145	0.348		
Eel/Sediment	Hg/Hg	W-63 Intertidal	380	1650	0.230		
Eel/Sediment	Hg/Hg	OV	392	70	5.59	6.01	
Eel/Sediment	Hg/Hg	OV	181	28	6.42		
Eel/Sediment	Hg/Hg	OV	208	120	1.73		
Eel/Sediment	Hg/Hg	OV	236	283	0.833		
Eel/Sediment	Hg/Hg	OV	821	120	6.84		
Eel/Sediment	Hg/Hg	OV	427	51	8.33		
Eel/Sediment	Hg/Hg	BO Area	436	1204	0.362	0.556	
Eel/Sediment	Hg/Hg	BO Area	423	1370	0.309		
Eel/Sediment	Hg/Hg	BO Area	590	1060	0.556		
Eel/Sediment	Hg/Hg	BO Area	749	1800	0.416		
Eel/Sediment	Hg/Hg	BO Area	457	414	1.10		
Eel/Sediment	Hg/Hg	BO Area	601	416	1.44		
Eel/Sediment	Hg/Hg	BO Area	420	430	0.976		
Mussel/Sediment	Hg/Hg	Parker Cove ES-01	44	38	1.15	2.26	0.76
Mussel/Sediment	Hg/Hg	Parker Cove ES-01	36	45	0.786		
Mussel/Sediment	Hg/Hg	Parker Cove ES-08	35	9	3.84		

C-1
SUMMARY TABLE FOR HISTORICAL BSAFS - MERCURY

SUMMARY OF BIOTA - SEDIMENT ACCUMULATION FACTOR EVALUATION

Pairing (A/B)	Constituent	Exposure Area	Biota Median (A) [ng/g]	Sediment Median (B) [ng/g]	BSAF [-]	Median Exposure Area BSAF	Median Study Area BSAF
Mussel/Sediment	Hg/Hg	Parker Cove ES-08	32	9	3.37		
Mussel/Sediment	Hg/Hg	ES-03	88	57	1.54	0.74	
Mussel/Sediment	Hg/Hg	ES-04	46	63	0.737		
Mussel/Sediment	Hg/Hg	ES-04	39	21	1.80		
Mussel/Sediment	Hg/Hg	ES-07	22	23	0.953		
Mussel/Sediment	Hg/Hg	ES-10	29	145	0.202		
Mussel/Sediment	Hg/Hg	ES-12	109	161	0.676		
Mussel/Sediment	Hg/Hg	ES-13	84	190	0.439		
Mussel/Sediment	Hg/Hg	ES-13	142	513	0.276		
Mussel/Sediment	Hg/Hg	ES-14	98	99	0.988		
Mussel/Sediment	Hg/Hg	ES-15	114	153	0.743		
Mussel/Sediment	Hg/Hg	ES-15	62	167	0.374		
Mussel/Sediment	Hg/Hg	SW of Former Holtrachem Facility	85	121	0.704	0.70	
Black Duck Blood/Sediment	Hg/Hg	ES13	138	481	0.286	0.39	1.0
Black Duck Blood/Sediment	Hg/Hg	ES13	299	599	0.500		
Black Duck Blood/Sediment	Hg/Hg	Mendall Marsh	107	299	0.357	1.738	
Black Duck Blood/Sediment	Hg/Hg	Mendall Marsh	997	324	3.08		
Black Duck Blood/Sediment	Hg/Hg	Mendall Marsh	434	336	1.29		
Black Duck Blood/Sediment	Hg/Hg	Mendall Marsh	257	365	0.705		
Black Duck Blood/Sediment	Hg/Hg	Mendall Marsh	729	334	2.18		
Black Duck Blood/Sediment	Hg/Hg	Mendall Marsh	903	322	2.80		
Black Duck Tissue/Sediment	Hg/Hg	Mendall Marsh	982	711	1.38	1.38	1.11
Black Duck Tissue/Sediment	Hg/Hg	Mendall Marsh	707	841	0.84	0.84	
Lobster/Sediment	Hg/Hg	Penobscot-09-02-B	5570	71.7	77.6		0.37
Lobster/Sediment	Hg/Hg	S-02-02, S-03-01	398	99.2	4.01		
Lobster/Sediment	Hg/Hg	L9-33,34,35,57	111	230	0.48		
Lobster/Sediment	Hg/Hg	L8-32,33,59,60,61, 62,80,81	177	246	0.72		
Lobster/Sediment	Hg/Hg	L9-07,08,09,10,22,24,25,26,27, 23	98	282	0.348		
Lobster/Sediment	Hg/Hg	L12-56,57	575	311	1.85		
Lobster/Sediment	Hg/Hg	L9-01,02,03,04	97	361	0.269		
Lobster/Sediment	Hg/Hg	L8-65,67	234	365	0.641		
Lobster/Sediment	Hg/Hg	L12-07,08,09,10,37,39,40,41, 42, 46, 47, 48,55	266	432	0.616		
Lobster/Sediment	Hg/Hg	L8-32, L9-42, 43, 59, 60, 61, 62, 63	162	445	0.364		
Lobster/Sediment	Hg/Hg	L12-38	233	446	0.523		
Lobster/Sediment	Hg/Hg	L9-06	163	458	0.356		
Lobster/Sediment	Hg/Hg	L12-05, 06, 33, 34, 35, 36, 49, 50, 51, 54	214	459	0.466		
Lobster/Sediment	Hg/Hg	L9-80	445	472	0.943		
Lobster/Sediment	Hg/Hg	L9-71, 76	410	512	0.801		
Lobster/Sediment	Hg/Hg	L9-44, 64	82.5	568	0.145		
Lobster/Sediment	Hg/Hg	L8-74, 75	587	598	0.982		
Lobster/Sediment	Hg/Hg	L9-46, 47, 65	244	603	0.405		
Lobster/Sediment	Hg/Hg	L9-45	514	645	0.797		
Lobster/Sediment	Hg/Hg	ES-15-S-TR	306	666	0.459		
Lobster/Sediment	Hg/Hg	L10-45, 54, 55, 56, 57, 67, L8-73	211	672	0.314		
Lobster/Sediment	Hg/Hg	L8-76	449	693	0.648		
Lobster/Sediment	Hg/Hg	L9-81	472	700	0.674		
Lobster/Sediment	Hg/Hg	L10-44, 46, 53, 58, 75, 76	192	703	0.273		
Lobster/Sediment	Hg/Hg	L8-77, 78, 79	211	737	0.286		
Lobster/Sediment	Hg/Hg	L9-82, 83	177	739	0.240		
Lobster/Sediment	Hg/Hg	L9-15, 66, 67, 74	200	770	0.260		
Lobster/Sediment	Hg/Hg	L9-17, 70, 75, 79	282	771	0.366		
Lobster/Sediment	Hg/Hg	L8-01, 03, 04, 34, 35, 36	114	772	0.1477		
Lobster/Sediment	Hg/Hg	L9-16	220	773	0.2848		
Lobster/Sediment	Hg/Hg	L9-18	244	778	0.314		
Lobster/Sediment	Hg/Hg	L9-13, 14, 68	164	781	0.210		
Lobster/Sediment	Hg/Hg	L9-69, 72, 73, 78	187	788	0.237		
Lobster/Sediment	Hg/Hg	L8-90	256	810	0.316		
Lobster/Sediment	Hg/Hg	L8-90	325	836	0.389		
Lobster/Sediment	Hg/Hg	L10-59, 68, 69	393	1192	0.330		
Lobster/Sediment	Hg/Hg	L10-47, 60, 62, 70, 71, 72, 73, 77	468	1550	0.302		
Lobster/Sediment	Hg/Hg	L10-48, 49, 50, 51, 52, 61, 63, 64, 65, 66, 74	287	1595	0.180		
Smelt/Sediment	Hg/Hg	ES-02-E, ES-03, ES-04-W, ES-05-S, ES-06-S, ES-09, ES-10, ES-11-N, ES-12, ES-13, ES-14, ES-15, ES-FP, OB-01, OB-02, OB-04	68.3	409	0.167	0.167	0.17
Smelt/Sediment	Hg/Hg	ES-04, 07, 10, 13, 14	57.1	576	0.0990	0.0990	
Smelt/Sediment	Hg/Hg	OB-03, OB-05	109	665	0.164	0.1639	
Smelt/Sediment	Hg/Hg	ES-02, 03, 05, 09, 11, 12, 13, 14, 15, OB-03, 04, 05	55.6	987	0.0564	0.0685	

C-1
SUMMARY TABLE FOR HISTORICAL BSAFS - MERCURY

SUMMARY OF BIOTA - SEDIMENT ACCUMULATION FACTOR EVALUATION

Pairing (A/B)	Constituent	Exposure Area	Biota Median (A) [ng/g]	Sediment Median (B) [ng/g]	BSAF [-]	Median Exposure Area BSAF	Median Study Area BSAF
Smelt/Sediment	Hg/Hg	ES-02, 03, 05, 09, 11, 12, 13, 14, 15, OB-03, 04, 05	55.6	689	0.0807		
Smelt/Sediment	Hg/Hg	OB-04	186	1055	0.176	0.176	
Smelt/Sediment	Hg/Hg	OB-04	186	467.75	0.398		
Smelt/Sediment	Hg/Hg	OB-04	90.4	674	0.134		
Smelt/Sediment	Hg/Hg	ES-02, 05, 06, 09, 11, OB-01, 02	87.3	1070	0.0816	0.082	
Smelt/Sediment	Hg/Hg	ES-03, 04, 10, 12, 13, 14, 15, FP	54.5	159	0.342	0.217	
Smelt/Sediment	Hg/Hg	ES-03, 04, 10, 12, 13, 14, 15, FP	54.5	589	0.0924		
Smelt/Sediment	Hg/Hg	ES-04, 07, 10, 14	54.9	222	0.247	0.247	
Smelt/Sediment	Hg/Hg	ES-02, 05, 06, 09, 11, OB-01, 02, 04	90.4	246	0.367	0.367	
Smelt/Sediment	Hg/Hg	ES-02, 05, 06, 09, 11, OB-01	90.3	600	0.151	0.153	
Smelt/Sediment	Hg/Hg	ES-02, 05, 06, 09, 11, OB-01	85.8	548	0.156		
Smelt/Sediment	Hg/Hg	OB-03, OB-05	109	598	0.182	0.170	
Smelt/Sediment	Hg/Hg	OB-01, OB-02	100	631	0.158		
Smelt/Sediment	Hg/Hg	ES-13	75.2	491	0.153	0.153	
Tomcod/Sediment	Hg/Hg	Riverwide	124.5	499	0.249	0.249	0.25

Notes:
ng/g = nanograms per gram
BSAF = Biota-Sediment Accumulation Factor
Marsh River locations excluded from median study area BSAFs.

Prepared by/Date: JPM 6/22/17
Checked by/Date: NSR 6/22/17

C-2
SUMMARY OF TABLE FOR HISTORICAL BSAFS - METHYL MERCURY

SUMMARY OF BIOTA - SEDIMENT ACCUMULATION FACTOR EVALUATION

Pairing (A/B)	Constituent	Exposure Area	Biota Median (A) [ng/g]	Sediment Median (B) [ng/g]	BSAF [-]	Median Exposure Area BSAF	Median Study Area BSAF
Spider/Sediment	MeHg/MeHg	Marsh River	4265.0	20.9	205	205	
Spider/Sediment	MeHg/MeHg	W-17-N	906.5	17.2	52.9	8.0	27
Spider/Sediment	MeHg/MeHg	W-17-N	482.0	60.5	7.96		
Spider/Sediment	MeHg/MeHg	W-17-N	47.3	8.8	5.35		
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southeast	148.7	49.5	3.00	18.56	
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southeast	199.7	7.3	27.2		
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southeast	143.0	14.4	9.94		
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southeast	84.6	0.34	246		
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southwest	124.0	65.7	1.89	106.77	
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southwest	36.5	0.22	166		
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southwest	2320.0	20.3	114		
Spider/Sediment	MeHg/MeHg	Mendall Marsh - Southwest	997.5	10.1	99.3		
Insect/Sediment	MeHg/MeHg	W21/Mendall Marsh SW	37.8	32.9	1.15	1.15	1.2
Nelsons Sparrow Blood/Sediment	MeHg/MeHg	W21/Mendall Marsh SW	3175.00	24.7	129	129	129
Mussel/Sediment	MeHg/MeHg	Parker Cove ES-08	8.5	0.040	210	131	48
Mussel/Sediment	MeHg/MeHg	Parker Cove ES-08	14.0	0.050	281		
Mussel/Sediment	MeHg/MeHg	Parker Cove ES-01	12.5	0.284	44		
Mussel/Sediment	MeHg/MeHg	Parker Cove ES-01	20.0	0.384	52		
Mussel/Sediment	MeHg/MeHg	ES-03	35	0.45	77	17	
Mussel/Sediment	MeHg/MeHg	ES-04	19	0.10	188		
Mussel/Sediment	MeHg/MeHg	ES-04	19.45	1.69	12		
Mussel/Sediment	MeHg/MeHg	ES-07	8.4	0.15	56		
Mussel/Sediment	MeHg/MeHg	ES-10	11	0.21	52		
Mussel/Sediment	MeHg/MeHg	ES-12	46	2.67	17		
Mussel/Sediment	MeHg/MeHg	ES-13	36.2	5.58	6		
Mussel/Sediment	MeHg/MeHg	ES-13	62	9.18	7		
Mussel/Sediment	MeHg/MeHg	ES-14	25	0.45	55		
Mussel/Sediment	MeHg/MeHg	ES-15	35	2.61	13		
Mussel/Sediment	MeHg/MeHg	ES-15	20	2.68	7		
Mussel/Sediment	MeHg/MeHg	SW of Former Holtrachem Facility	20.20	1.23	16	16	
Black Duck Blood/Sediment	MeHg/MeHg	Mendall Marsh	1470	19.9	73.9	73.9	41
Black Duck Blood/Sediment	MeHg/MeHg	ES13	91.7	11.8	7.77	7.77	
Black Duck Tissue/Sediment	MeHg/MeHg	Mendall Marsh	1016	19	52	52	41
Black Duck Tissue/Sediment	MeHg/MeHg	Mendall Marsh	702	23	30	30	
Eel/Sediment	MeHg/MeHg	OV-05	578	0.753	767	767	42
Eel/Sediment	MeHg/MeHg	OV	349	1.14	308	308	
Eel/Sediment	MeHg/MeHg	OV-04	208	1.62	129	129	
Eel/Sediment	MeHg/MeHg	OB-03	544	8.02	67.8	45	
Eel/Sediment	MeHg/MeHg	OB-03	333	15.5	21.5		
Eel/Sediment	MeHg/MeHg	OB-01	457	9.61	47.6	44.7	
Eel/Sediment	MeHg/MeHg	OB-01	622	14.9	41.9		
Eel/Sediment	MeHg/MeHg	BO-04	451	18.3	24.7	24.7	
Eel/Sediment	MeHg/MeHg	BO-03	371	18.7	19.8	19.8	
Eel/Sediment	MeHg/MeHg	OB-05	757	15.4	49.0	19.1	
Eel/Sediment	MeHg/MeHg	OB-05	451	20.0	22.6		
Eel/Sediment	MeHg/MeHg	OB-05	498	31.7	15.7		
Eel/Sediment	MeHg/MeHg	OB-05	433	34.2	12.7		
Lobster/Sediment	MeHg/MeHg	L10-46, 53, 58, 75, 76	210	11.45	18		20
Lobster/Sediment	MeHg/MeHg	L10-47, 70, 71	471	48.9	9.6		
Lobster/Sediment	MeHg/MeHg	L10-49, 50, 51, 61, 64, 65	291	53.2	5.5		
Lobster/Sediment	MeHg/MeHg	L10-59, 68, 69	429	32.6125	13		
Lobster/Sediment	MeHg/MeHg	L10-60, 62, 72, 73, 77	477	51.2	9.3		
Lobster/Sediment	MeHg/MeHg	L8-73	799	10.4	77		
Lobster/Sediment	MeHg/MeHg	L8-74, 75	578	3.82	151		
Lobster/Sediment	MeHg/MeHg	L8-76	429	8.565	50		
Lobster/Sediment	MeHg/MeHg	L8-77, 79, 81, 82, 83	176	9.52	18		
Lobster/Sediment	MeHg/MeHg	L8-90	285	37.4	7.6		
Lobster/Sediment	MeHg/MeHg	L9-13, 14, 68	348	14.1	25		
Lobster/Sediment	MeHg/MeHg	L9-15, 66, 67, 74	198	13.3	15		
Lobster/Sediment	MeHg/MeHg	L9-16, L10-45, 55, 57, 67	204	10.8	19		
Lobster/Sediment	MeHg/MeHg	L9-17, 18	242	11	21		
Lobster/Sediment	MeHg/MeHg	L9-69, 72, 73, 78	208	24.85	8.4		
Lobster/Sediment	MeHg/MeHg	L9-70, 75, 79	315	11.6	27		
Lobster/Sediment	MeHg/MeHg	L9-71, 76	364	11.9	31		
Lobster/Sediment	MeHg/MeHg	L9-80	459	7	70		
Lobster/Sediment	MeHg/MeHg	Penobscot-09-02-B	5420	2.40	2259		

C-2
SUMMARY OF TABLE FOR HISTORICAL BSAFS - METHYL MERCURY

SUMMARY OF BIOTA - SEDIMENT ACCUMULATION FACTOR EVALUATION

Pairing (A/B)	Constituent	Exposure Area	Biota Median (A) [ng/g]	Sediment Median (B) [ng/g]	BSAF [-]	Median Exposure Area BSAF	Median Study Area BSAF
Lobster/Sediment	MeHg/MeHg	S-02-02, S-03-01	272	0.5	604		
Mummichog/Sediment	MeHg/MeHg	BO-02	289	20.3	14.2	14.2	24
Mummichog/Sediment	MeHg/MeHg	BO-03	202	8.12	24.9	24.9	
Mummichog/Sediment	MeHg/MeHg	BO-04	149	6.14	24.3	24.3	
Mummichog/Sediment	MeHg/MeHg	BO-05/BO-01	300	3.82	78.5	78.5	
Mummichog/Sediment	MeHg/MeHg	OB-03	81.9	15.5	5.28	5.3	
Mummichog/Sediment	MeHg/MeHg	OB-03-SN	398	1.01	394	394	
Mummichog/Sediment	MeHg/MeHg	W-21	324	36.4	8.90	8.9	
Smelt/Sediment	MeHg/MeHg	ES-13	60.0	1.82	33.0	25.4	14
Smelt/Sediment	MeHg/MeHg	ES-13	60.0	3.36	17.8		
Smelt/Sediment	MeHg/MeHg	ES-04, 07, 10, 14	35.5	2.10	16.9	14.9	
Smelt/Sediment	MeHg/MeHg	ES-04, 07, 10, 14	35.5	2.74	12.9		
Smelt/Sediment	MeHg/MeHg	OB-04	124	4.71	26.3	32.2	
Smelt/Sediment	MeHg/MeHg	OB-04	124	3.25	38.1		
Smelt/Sediment	MeHg/MeHg	ES-02, 05, 06, 09, 11, OB-01	74.0	5.74	12.9	15.0	
Smelt/Sediment	MeHg/MeHg	ES-02, 05, 06, 09, 11, OB-01	74.0	4.30	17.2		
Smelt/Sediment	MeHg/MeHg	OB-03, OB-05	88.5	6.41	13.8	16.4	
Smelt/Sediment	MeHg/MeHg	OB-03, OB-05	88.5	4.64	19.1		
Smelt/Sediment	MeHg/MeHg	OB-01, OB-02	65.5	6.57	9.98	11.18	
Smelt/Sediment	MeHg/MeHg	OB-01, OB-02	65.5	5.29	12.4		
Smelt/Sediment	MeHg/MeHg	ES-02, 03, 04, 05, 06, 09, 11, 12, 13, 14, 15, FP, OB-01, 02, 04	51.0	15.8	3.22	3.22	
Smelt/Sediment	MeHg/MeHg	ES-02, 03, 05, 09, 11, 12, 13, 14, 15, FP, OB-03, 04, 05	60.2	26.5	2.27	4.03	
Smelt/Sediment	MeHg/MeHg	ES-02, 03, 05, 09, 11, 12, 13, 14, 15, FP, OB-03, 04, 05	60.2	10.4	5.79		
Tomcod/Sediment	MeHg/MeHg	Riverwide	101	4.9	21.0	21.0	21

Notes:
ng/g = nanograms per gram
BSAF = Biota-Sediment Accumulation Factor
Marsh River locations excluded from median study area BSAFs.

Prepared by/Date: JPM 6/22/17
Checked by/Date: NSR 6/22/17

ATTACHMENT D
Summary Tables for Error Propagation Calculations

D-1

Median Study Area BSAF: Error Propagation Summary

Species	Anayte	Study Area BSAF Median	Standard Error	Standard Deviation	*n*	Discrete Study Area BSAF Medians					
						Standard Error Calculation BSAFs					Excluded[1] BSAFs
Black Duck (Blood)	Mercury	0.69	0.17	0.37	2	0.95	0.43				--
	Methyl Mercury	55	31	41	2	84	26				--
Black Duck (Tissue)	Mercury	0.42	0.23	0.12	2	0.33	0.50				--
	Methyl Mercury	30	26	0.80	2	30	31				--
Blue Mussel	Mercury	0.26	0.33	0.52	4	0.38	0.15	0.090	1.22		--
	Methyl Mercury	5.2	2.3	3.6	4	5.2	0.90	5.2	9.8		--
Eel	Mercury	0.97	0.55	0.76	3	0.97	2.01	0.53			--
	Methyl Mercury	62	35	39	2	89	34				--
Lobster	Mercury	0.36	0.38	0.67	5	0.36	0.64	0.36	0.33	1.90	--
	Methyl Mercury	27	4.4	7.0	4	14	25	30	27		248
Mummichog	Mercury	0.39	0.19	0.27	3	0.61	0.12	0.18			3.8
	Methyl Mercury	4.0	1.3	1.5	2	1.9	4.0				386
Nelson's Sparrow	Mercury	9.5	27	38	3	6.0	73	9.5			--
	Methyl Mercury	649	220	305	3	221	649	811			--
Polychaete Worm	Mercury	0.28	0.11	0.19	5	0.19	0.28	0.34	0.059	0.57	--
	Methyl Mercury	0.66	0.49	0.87	5	0.15	0.66	0.74	0.083	2.2	--
Red-winged Blackbird	Mercury	2.0	1.7	--	1	2.0					--
	Methyl Mercury	111	140	--	1	111					--
Smelt	Mercury	0.10	0.067	0.12	5	0.36	0.10	0.17	0.071	0.10	--
	Methyl Mercury	7.9	4.6	8.2	5	25	5.5	12	5.1	7.9	--
Spider	Mercury	0.35	0.80	1.1	3	0.30	2.2	0.35			--
	Methyl Mercury	18	5.9	8.2	3	4.5	19	18			--
Terrestrial Insect	Mercury	0.090	0.040	0.046	2	0.026	0.090				2.6
	Methyl Mercury	4.0	3.2	4.4	3	1.5	10	4.0			--
Tomcod	Mercury	0.28	0.023	--	1	0.28					--
	Methyl Mercury	21	1.6	--	1	21					--

Notes

[1]Locations were excluded from the error propagation analysis, to prevent skewed data, due to atypical sediment concentrations that returned elevated BSAFs.

-- Not Applicable

Prepared By: NTG 07/07/17

Checked By: KPH 07/10/17

D-1a
2016 Terrestrial Insect BSAF Error
Mercury

Location	Insects (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
W-17-High-2016	30.4 ng/g		1267 ng/g		
W-17-Mid-2016	30.4 ng/g		1179 ng/g		
W17-N	30.4 ng/g		476 ng/g		
W-17 (Median)	30.4 ng/g	55	1179 ng/g	0.026	0.048
W-65-High	222 ng/g		84 ng/g		
W-65-Low	222 ng/g		33 ng/g		
W-65-Mid	222 ng/g		226 ng/g		
Mendall Marsh SE (Median)	222 ng/g	0	84 ng/g	2.6	2.3
W-21-UM-Central-C	47.5 ng/g		617 ng/g		
W-21-UM-West-A	47.5 ng/g		434 ng/g		
Mendall Marsh SW (Median)	47.5 ng/g	5.4	526 ng/g	0.090	0.022
Reference					
ADD-01	16.8 ng/g		29.6 ng/g		
ADD-02	16.8 ng/g		32.6 ng/g		
ADD (Median)	16.8 ng/g	14	31.1 ng/g	0.54	0.46

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-1b
2016 Terrestrial Insect BSAF Error
Methyl Mercury

Location	Insects (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
W-17-High-2016	56.7 ng/g		38.0 ng/g		
W-17-Mid-2016	56.7 ng/g		5.15 ng/g		
W17-N	56.7 ng/g		86.8 ng/g		
W-17 (Median)	56.7 ng/g	21	38.0 ng/g	1.5	0.56
Mendall Marsh SE (Median)	91.2 ng/g	48	9.02 ng/g	10	5.3
W-21-UM-Central-C	26.8 ng/g		12.01 ng/g		
W-21-UM-West-A	26.8 ng/g		1.22 ng/g		
Mendall Marsh SW (Median)	26.8 ng/g	5.7	6.62 ng/g	4.0	0.87
Reference					
ADD-01	18.6 ng/g		1.19 ng/g		
ADD-02	18.6 ng/g		4.11 ng/g		
ADD (Median)	18.6 ng/g	6.2	2.65 ng/g	7.0	2.3

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-2a
2016 Spider BSAF Error
Mercury

Location	Spider (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
W-17-High-2016	263 ng/g		1267 ng/g		
W17-N	263 ng/g		476 ng/g		
W-17 (Median)	263 ng/g	63	871 ng/g	0.30	0.19
W-65-High	205 ng/g		84 ng/g		
W-65-Low	205 ng/g		33 ng/g		
W-65-Mid	205 ng/g		226 ng/g		
Mendall Marsh SE (Median)	205 ng/g	0	84 ng/g	2.2	1.9
Mendall Marsh SW	219 ng/g	24	617 ng/g	0.35	0.038
Reference					
ADD-01	31.4 ng/g		29.6 ng/g		
ADD-02	31.4 ng/g		32.6 ng/g		
ADD (Median)	31.4 ng/g	4.6	31.1 ng/g	1.0	0.16

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-2b
2016 Spider BSAF Error
Methyl Mercury

Location	Spider (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
W-17-High-2016	282 ng/g		38.0 ng/g		
W17-N	282 ng/g		86.8 ng/g		
W-17 (Median)	282 ng/g	100	62.4 ng/g	4.5	1.6
Mendall Marsh SE	174 ng/g	22	9.02 ng/g	19	2.5
Mendall Marsh SW	217 ng/g	39	12.0 ng/g	18	3.2
Reference					
ADD-01	22.9 ng/g		1.19 ng/g		
ADD-02	22.9 ng/g		4.11 ng/g		
ADD (Median)	22.9 ng/g	10	2.65 ng/g	8.7	3.8

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-3a
2016 Nelsons Sparrow BSAF Error
Mercury

Location	Sparrow (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
W17-N	5000 ng/g		476 ng/g		
W-17-High-2016	5000 ng/g		1267 ng/g		
W-17-Low	5000 ng/g		471 ng/g		
W-17-Mid-2016	5000 ng/g		1179 ng/g		
W17 (Median)	5000 ng/g	958	828 ng/g	6.0	2.3
W-65-High	6130 ng/g		84 ng/g		
W-65-Low	6130 ng/g		33 ng/g		
W-65-Mid	6130 ng/g		226 ng/g		
Mendall Marsh SE (Median)	6130 ng/g	536	84 ng/g	73	63
W-21-UM-Central-C	5840 ng/g		617 ng/g		
W-21-UM-East-C	5840 ng/g		752 ng/g		
W-21-UM-West-A	5840 ng/g		434 ng/g		
W-21-High	5840 ng/g		929 ng/g		
W-21-Low	5840 ng/g		705 ng/g		
W-21-Mid	5840 ng/g		869 ng/g		
W-65-High	5840 ng/g		84 ng/g		
W-65-Low	5840 ng/g		33 ng/g		
W-65-Mid	5840 ng/g		226 ng/g		
Mendall Marsh SW (Median)	5840 ng/g	511	617 ng/g	9.5	2.3
Reference					
ADD-01	467 ng/g		29.6 ng/g		
ADD-02	467 ng/g		32.6 ng/g		
ADD (Median Sediment)	467 ng/g	55	31.1 ng/g	15	2.0

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-3b
2016 Nelsons Sparrow BSAF Error
Methyl Mercury

Location	Sparrow (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
W17-N	4777 ng/g		86.8 ng/g		
W-17-High-2016	4777 ng/g		38.0 ng/g		
W-17-Low	4777 ng/g		4.88 ng/g		
W-17-Mid-2016	4777 ng/g		5.15 ng/g		
W17 (Median)	4777 ng/g	915	21.6 ng/g	221	252
W-65-Mid	5856 ng/g		9.02 ng/g		
Mendall Marsh SE (Median)	5856 ng/g	512	9.02 ng/g	649	57
W-21-UM-Central-C	5579 ng/g		12.0 ng/g		
W-21-UM-East-C	5579 ng/g		2.19 ng/g		
W-21-UM-West-A	5579 ng/g		1.22 ng/g		
W-21-High	5579 ng/g		27.0 ng/g		
W-21-Low	5579 ng/g		4.59 ng/g		
W-21-Mid	5579 ng/g		4.74 ng/g		
W-65-High	5579 ng/g		9.02 ng/g		
W-65-Mid	5579 ng/g		9.02 ng/g		
Mendall Marsh SW (Median)	5579 ng/g	488	6.88 ng/g	811	437
Reference					
ADD-01	446 ng/g		1.19 ng/g		
ADD-02	446 ng/g		4.11 ng/g		
ADD (Median Sediment)	446 ng/g	53	2.65 ng/g	169	118

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-4a
2016 Red-winged Blackbird BSAF Error
Mercury

Location	Blackbird (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
W-17-Mid-2016	2500 ng/g		1179 ng/g		
W-17-High-2016	2500 ng/g		1267 ng/g		
W-17 (Median)	2500 ng/g	2089	1223 ng/g	2.0	1.7

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-4b
2016 Red-winged Blackbird BSAF Error
Methyl Mercury

Location	Blackbird (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
W-17-Mid-2016	2388 ng/g		5.15 ng/g		
W-17-High-2016	2388 ng/g		38.0 ng/g		
W-17 (Median)	2388 ng/g	1996	21.6 ng/g	111	140

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-5a
2016 Polychaete BSAF Error
Mercury

Location	Polychaete (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BO-04	185 ng/g	38	980 ng/g	0.19	0.039
OB-05	215 ng/g	9.1	755 ng/g	0.28	0.012
MMPOLY (Mendall Marsh)	190 ng/g	53	554 ng/g	0.34	0.096
ES-13 (South Verona)	24.7 ng/g	13	416 ng/g	0.059	0.032
ES-FP (Fort Point)	24.5 ng/g	6.0	48.1 ng/g	0.57	0.14
Reference					
FRB-01	3.180 ng/g	0	7.53 ng/g	0.63	0

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-5b
2016 Polychaete BSAF Error
Methyl Mercury

Location	Polychaete (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BO-04	8.3 ng/g	0.53	54.3 ng/g	0.15	0.0098
OB-05	12.7 ng/g	0.46	19.3 ng/g	0.66	0.024
MMPOLY (Mendall Marsh)	9.9 ng/g	2.3	13.4 ng/g	0.74	0.17
ES-13 (South Verona)	2.4 ng/g	0.898	28.8 ng/g	0.083	0.031
ES-FP (Fort Point)	5.75 ng/g	3.3	2.57 ng/g	2.2	1.3

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-6a
2016 Black Duck Blood BSAF Error
Mercury

Location	Duck Blood (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BU-24R	504 ng/g		82 ng/g		
FF-03H	504 ng/g		83 ng/g		
MMPOLY	504 ng/g		554 ng/g		
MM-62	504 ng/g		714 ng/g		
MM-65	504 ng/g		821 ng/g		
MM-71	504 ng/g		1040 ng/g		
W-17-Intertidal	504 ng/g		518 ng/g		
W-17-Low	504 ng/g		471 ng/g		
W-21-High	504 ng/g		929 ng/g		
W-21-Intertidal	504 ng/g		543 ng/g		
W-21-Low	504 ng/g		705 ng/g		
W-21-Mid	504 ng/g		869 ng/g		
W-21-UM-Central-C	504 ng/g		617 ng/g		
W-21-UM-East-C	504 ng/g		752 ng/g		
W-21-UM-South	504 ng/g		267 ng/g		
W-21-UM-West-A	504 ng/g		434 ng/g		
W-65-High	504 ng/g		84 ng/g		
W-65-Intertidal	504 ng/g		42 ng/g		
W-65-Low	504 ng/g		33 ng/g		
W-65-Mid	504 ng/g		226 ng/g		
Mendall Marsh (Median)	504 ng/g	103	531 ng/g	0.95	0.25
EC-39ABC	377 ng/g		896 ng/g		
EC-39ABC	377 ng/g		578 ng/g		
ES-02	377 ng/g		961 ng/g		
ES-13	377 ng/g		416 ng/g		
ES-15	377 ng/g		151 ng/g		
GP-36ABC	377 ng/g		883 ng/g		
VE-52	377 ng/g		96.3 ng/g		
W-61-High	377 ng/g		594 ng/g		
W-61-Intertidal	377 ng/g		1163 ng/g		
W-61-Low	377 ng/g		927 ng/g		
W-61-Mid	377 ng/g		1483 ng/g		
South Verona (Median)	377 ng/g	48	883 ng/g	0.43	0.09
Reference					
FRB-01	43.5 ng/g	8.5	7.53 ng/g	5.8	1.1

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-6b
2016 Black Duck Tissue BSAF Error
Mercury

Location	Duck Tissue (Median)	Biota Standard Error	Sediment		BSAF	BSAF Standard Error
Site						
BU-24R	177 ng/g		82 ng/g	Mercury		
FF-03H	177 ng/g		83 ng/g	Mercury		
MMPOLY	177 ng/g		554 ng/g	Mercury		
MM-62	177 ng/g		714 ng/g	Mercury		
MM-65	177 ng/g		821 ng/g	Mercury		
MM-71	177 ng/g		1040 ng/g	Mercury		
W-17-Intertidal	177 ng/g		518 ng/g	Mercury		
W-17-Low	177 ng/g		471 ng/g	Mercury		
W-21-High	177 ng/g		929 ng/g	Mercury		
W-21-Intertidal	177 ng/g		543 ng/g	Mercury		
W-21-Low	177 ng/g		705 ng/g	Mercury		
W-21-Mid	177 ng/g		869 ng/g	Mercury		
W-21-UM-Central-C	177 ng/g		617 ng/g	Mercury		
W-21-UM-East-C	177 ng/g		752 ng/g	Mercury		
W-21-UM-South	177 ng/g		267 ng/g	Mercury		
W-21-UM-West-A	177 ng/g		434 ng/g	Mercury		
W-65-High	177 ng/g		84 ng/g	Mercury		
W-65-Intertidal	177 ng/g		42 ng/g	Mercury		
W-65-Low	177 ng/g		33 ng/g	Mercury		
W-65-Mid	177 ng/g		226 ng/g	Mercury		
Mendall Marsh (Median)	177 ng/g	170	531 ng/g	Mercury	0.33	0.32
EC-39ABC	441 ng/g		896 ng/g	Mercury		
EC-39ABC	441 ng/g		578 ng/g	Mercury		
ES-02	441 ng/g		961 ng/g	Mercury		
ES-13	441 ng/g		416 ng/g	Mercury		
ES-15	441 ng/g		151 ng/g	Mercury		
GP-36ABC	441 ng/g		883 ng/g	Mercury		
VE-52	441 ng/g		96.3 ng/g	Mercury		
W-61-High	441 ng/g		594 ng/g	Mercury		
W-61-Intertidal	441 ng/g		1163 ng/g	Mercury		
W-61-Low	441 ng/g		927 ng/g	Mercury		
W-61-Mid	441 ng/g		1483 ng/g	Mercury		
South Verona (Median)	441 ng/g	98	883 ng/g	Mercury	0.50	0.14
Reference						
FRB-01	44.8 ng/g	8.9	7.53 ng/g	Mercury	5.9	1.2

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-6c
2016 Black Duck Blood BSAF Error
Methyl Mercury

Location	Duck Blood (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
MMPOLY	396.9 ng/g		13.40 ng/g		
W-17-Intertidal	396.9 ng/g		3.77 ng/g		
W-17-Low	396.9 ng/g		4.88 ng/g		
W-21-High	396.9 ng/g		27.04 ng/g		
W-21-Intertidal	396.9 ng/g		4.04 ng/g		
W-21-Low	396.9 ng/g		4.59 ng/g		
W-21-Mid	396.9 ng/g		4.74 ng/g		
W-21-UM-Central-C	396.9 ng/g		12.01 ng/g		
W-21-UM-East-C	396.9 ng/g		2.19 ng/g		
W-21-UM-South	396.9 ng/g		5.94 ng/g		
W-21-UM-West-A	396.9 ng/g		1.22 ng/g		
W-65-Intertidal	396.9 ng/g		0.35 ng/g		
W-65-Mid	396.9 ng/g		9.02 ng/g		
Mendall Marsh (Median)	396.9 ng/g	81	4.74 ng/g	84	47
ES-02	296.9 ng/g		37.99 ng/g		
ES-13	296.9 ng/g		28.75 ng/g		
ES-15	296.9 ng/g		4.66 ng/g		
W-61-High	296.9 ng/g		8.33 ng/g		
W-61-Intertidal	296.9 ng/g		9.57 ng/g		
W-61-Low	296.9 ng/g		32.18 ng/g		
W-61-Mid	296.9 ng/g		11.38 ng/g		
South Verona (Median)	296.9 ng/g	38	11.38 ng/g	26	15

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-6d
2016 Black Duck Tissue BSAF Error
Methyl Mercury

Location	Duck Tissue (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
MMPOLY	142 ng/g		13.40 ng/g		
W-17-Intertidal	142 ng/g		3.77 ng/g		
W-17-Low	142 ng/g		4.88 ng/g		
W-21-High	142 ng/g		27.04 ng/g		
W-21-Intertidal	142 ng/g		4.04 ng/g		
W-21-Low	142 ng/g		4.59 ng/g		
W-21-Mid	142 ng/g		4.74 ng/g		
W-21-UM-Central-C	142 ng/g		12.01 ng/g		
W-21-UM-East-C	142 ng/g		2.19 ng/g		
W-21-UM-South	142 ng/g		5.94 ng/g		
W-21-UM-West-A	142 ng/g		1.22 ng/g		
W-65-Intertidal	142 ng/g		0.35 ng/g		
W-65-Mid	142 ng/g		9.02 ng/g		
Mendall Marsh (Median)	142 ng/g	136	4.74 ng/g	30	33
ES-02	353 ng/g		37.99 ng/g		
ES-13	353 ng/g		28.75 ng/g		
ES-15	353 ng/g		4.66 ng/g		
W-61-High	353 ng/g		8.33 ng/g		
W-61-Intertidal	353 ng/g		9.57 ng/g		
W-61-Low	353 ng/g		32.18 ng/g		
W-61-Mid	353 ng/g		11.38 ng/g		
South Verona (Median)	353 ng/g	79	11.38 ng/g	31	19

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-7a
2016 Lobster BSAF Error
Mercury

Location	Lobster (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Odom Ledge	206.5 ng/g	55	568 ng/g	0.36	0.12
South Verona	366.0 ng/g	74	568 ng/g	0.64	0.18
Cape Jellison	179.5 ng/g	21	503 ng/g	0.36	0.061
L9-45 (Turner Point)	164.0 ng/g	13	497 ng/g	0.33	0.054
HB-01 (Haborside)	101.5 ng/g	7.9	53.5 ng/g	1.9	0.15

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-7b
2016 Lobster BSAF Error
Methyl Mercury

Location	Lobster (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Odom Ledge	162 ng/g	43	11.6 ng/g	14	3.7
South Verona	286 ng/g	58	11.5 ng/g	25	10
Cape Jellison	140 ng/g	16	4.69 ng/g	30	5.3
L9-45 (Turner Point)	128 ng/g	10.0	4.72 ng/g	27	4.9
HB-01 (Haborside)	79.4 ng/g	6.2	0.320 ng/g	248	19

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-8a
2016 Mummichog BSAF Error
Mercury

Location	Mummichog (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BO-04	71.15 ng/g	16	117.07 ng/g	0.61	0.14
OB-05	89.05 ng/g	5.3	755 ng/g	0.12	0.0070
OB-01	134 ng/g	0	745 ng/g	0.18	0
Mendall Marsh SE	159 ng/g	40	42.2 ng/g	3.8	0.95
Reference					
FRB-01	7.96 ng/g	0.56	7.53 ng/g	1.1	0.074

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-8b
2016 Mummichog BSAF Error
Methyl Mercury

Location	Mummichog (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BO-04	61.4 ng/g	14	32.6 ng/g	1.9	6.7
OB-05	76.8 ng/g	4.5	19.3 ng/g	4.0	0.23
OB-01	116 ng/g	0	NA ng/g	NA	NA
Mendall Marsh SE	137 ng/g	31	0.354 ng/g	386	86
Reference					
FRB-01	6.86 ng/g	0.48	0.122 ng/g	56	4.0

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-9a
2016 Rainbow Smelt BSAF Error
Mercury

Location	Smelt (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
OB-05	201 ng/g	0	554 ng/g	0.36	3.0E-05
OB-04	54.9 ng/g	8.3	568 ng/g	0.10	0.015
OB-01	90.8 ng/g	11	544 ng/g	0.17	0.020
ES-13	38.4 ng/g	0	544 ng/g	0.071	5.7E-06
ES-FP	55.4 ng/g	7.1	559 ng/g	0.099	0.013
Reference					
FRB-01	6.64 ng/g	0.25	7.53 ng/g	0.88	0.033

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-9b
2016 Rainbow Smelt BSAF Error
Methyl Mercury

Location	Smelt (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
OB-05	159 ng/g	0	6.35 ng/g	25	7.0
OB-04	43.4 ng/g	6.5	7.89 ng/g	5.5	1.7
OB-01	71.7 ng/g	8.8	5.95 ng/g	12	3.9
ES-13	30.3 ng/g	0	5.94 ng/g	5.1	1.5
ES-FP	43.7 ng/g	5.6	5.55 ng/g	7.9	2.8

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-10a
2016 American Eel BSAF Error
Mercury

Location	Eel (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
BO-05	1370 ng/g	0	1793 ng/g	0.76	0
OB-05	461 ng/g		755 ng/g		
W-63-High	461 ng/g		36.8 ng/g		
W-63-Intertidal	461 ng/g		1123 ng/g		
W-63-Low	461 ng/g		229 ng/g		
W-63-Mid	461 ng/g		215 ng/g		
OB-05 (Median)	461 ng/g	40	229 ng/g	2.0	2.2
FF-08F	394 ng/g		745 ng/g		
FF-09F	394 ng/g		62 ng/g		
FF-10F	394 ng/g		770 ng/g		
OB-01 (Median)	394 ng/g	0	745 ng/g	0.53	0.21

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-10b
2016 American Eel BSAF Error
Methyl Mercury

Location	Eel (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
BO-05	1201 ng/g	0	13.5 ng/g	89	0
OB-05	404 ng/g		19.3 ng/g		
W-63-High	404 ng/g		0.397 ng/g		
W-63-Intertidal	404 ng/g		19.2 ng/g		
W-63-Low	404 ng/g		3.85 ng/g		
W-63-Mid	404 ng/g		11.9 ng/g		
OB-05 (Median)	404 ng/g	35	11.9 ng/g	34	14
OB-01 (Median)	345 ng/g	0	NA ng/g	NA	NA

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-11a
2016 Atlantic Tomcod BSAF Error
Mercury

Location	Tomcod (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BO-04	308 ng/g	36	-- ng/g		
OB-05	152 ng/g	16	-- ng/g		
OB-01	174 ng/g	19	-- ng/g		
ES-13	103 ng/g	19	-- ng/g		
ES-FP	64.9 ng/g	12	-- ng/g		
Penobscot River	155 ng/g	12	543 ng/g	0.28	0.023
Reference					
FRB-01	36.5 ng/g	0	7.53 ng/g	4.8	0

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-11b
2016 Atlantic Tomcod BSAF Error
Methyl Mercury

Location	Tomcod (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
BO-04	245 ng/g	29	-- ng/g		
OB-05	121 ng/g	13	-- ng/g		
OB-01	138 ng/g	15	-- ng/g		
ES-13	81.9 ng/g	15	-- ng/g		
ES-FP	51.6 ng/g	9.4	-- ng/g		
Penobscot River	123 ng/g	9.8	5.95 ng/g	21	1.6

Prepared By: NTG 07/07/17
Checked By: KPH 07/10/17

D-12
2016 Blue Mussel BSAF Error
Mercury and Methyl Mercury

Location	Mussel (Median)	Biota Standard Error	Sediment	BSAF	BSAF Standard Error
Site					
ES-15	56.85 ng/g	3.5	151 ng/g	0.38	0.023
ES-13	60.9 ng/g	3.7	416 ng/g	0.15	0.0089
ES-03	77.5 ng/g	6.2	863 ng/g	0.09	0.0072
ES-FP	58.9 ng/g	4.9	48.1 ng/g	1.2	0.10
Site					
ES-15	24.3 ng/g	1.5	4.66 ng/g	5.2	0.32
ES-13	26.0 ng/g	1.6	28.8 ng/g	0.90	0.055
ES-03	33.1 ng/g	2.7	6.40 ng/g	5.2	0.42
ES-FP	25.1 ng/g	2.1	2.57 ng/g	9.8	0.81

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