

# ASSESSMENT AND REPORT ON “SAMPLING AND TESTING SEARSPORT HARBOR FEDERAL NAVIGATION PROJECT SEARSPORT, MAINE” – MARCH, 2015

Prepared for:  
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## 1.0 INTRODUCTION:

The New England District (NAE) of the U.S. Army Corps of Engineers (USACE) evaluated the suitability of sediments from the Searsport Harbor Federal Navigation Project (FNP) for unconfined open water disposal at a site in Penobscot Bay. During the project review process, public concerns were raised on the subject of the potential for this dredging project to introduce sediment-associated contaminants, now buried, to the environment during dredging or open water disposal of dredge spoils. The objective of this effort, summarized in the Battelle (2015) report, was to respond to these public concerns, and to provide the Maine Department of Environmental Protection (MaineDEP) with additional data to inform their consideration of the necessary water quality certification, which would need to be in place before the FNP could proceed. From January 12-15, 2015, sediment cores were recovered from 10 stations within the FNP area, sediment grab samples were collected from three stations within the proposed open water dredge spoil disposal site, the Penobscot Bay Disposal Site (PBDS), and water samples were collected from an additional five stations in Searsport Harbor. This assessment considers only the sediment samples (cores and grab samples). All sediment samples were subjected to a range of physical and chemical analyses to determine grain size, total solids, total organic carbon, concentrations of a range of polycyclic aromatic hydrocarbons (PAHs), and a range of metals. The report compares the concentrations of PAHs and metals determined in these sediments to “reporting limits” (see report p. 9, Table 3-1), set by the USACE. According to the USACE, reporting limits (RL) are “...set between the lowest technically feasible quantitation level for routine analytical methods (Method Detection Limit) and available background concentrations at reference areas in the vicinity of the disposal sites.” (EPA/USACE, 2004). While the RL approach is intended for use in assessing whether or not dredge materials intended for open water disposal are more contaminated than sediments already in the

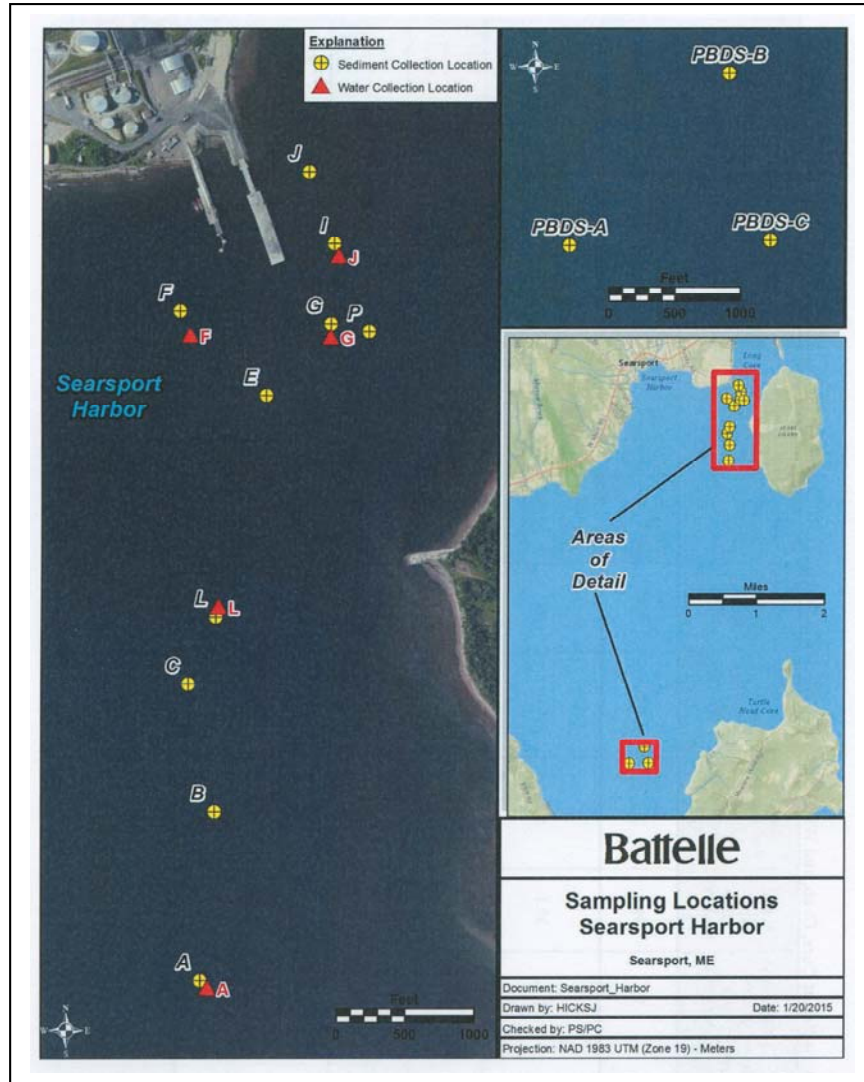
vicinity of the planned disposal site, they are not equivalent to effect range low (ERL) concentrations for PAHs or metals (Long et al., 1995; EPA, 2002) in terms of assessing the likely impacts of these contaminants on indigenous biota. It should be noted that for all PAHs and metals included in this report, the RL concentrations are lower than (i.e., more conservative) than ERL concentrations (based on data listed in report p. 9, Table 3-1). For reference, the ERL concentrations for those contaminants quantified in the report are summarized in Table 1. On May 8<sup>th</sup>, 2015 this report was provided to me by Ms. Kim Tucker, along with the request to review its findings and provide an assessment of the sampling methods, the results of the report, and the conclusions based thereon.

**Table 1** - Concentrations of metals and organic contaminants in sediments at the effect range low (ERL) concentration (Long et al., 1995; U.S. EPA, 2002).

Contaminant	ERL concentration (dry weight)
<i>Metals</i>	
Arsenic (As)	8.2 µg/g
Cadmium (Cd)	1.2 µg/g
Chromium (Cr)	81 µg/g
Copper (Cu)	34 µg/g
Lead (Pb)	47 µg/g
Mercury (Hg)	0.15 µg/g
Nickel (Ni)	21 µg/g
Zinc (Zn)	150 µg/g
<i>Polycyclic Aromatic Hydrocarbons (PAHs)</i>	
Acenaphthene	16 ng/g
Acenaphthylene	44 ng/g
Anthracene	85 ng/g
Fluorene	19 ng/g
2-Methyl Naphthalene	70 ng/g
Naphthalene	160 ng/g
Phenanthrene	240 ng/g
Benzo(a)anthracene	261 ng/g
Benzo(a)pyrene	430 ng/g
Chrysene	384 ng/g
Dibenzo(a,h)anthracene	63 ng/g
Fluoranthene	600 ng/g
Pyrene	665 ng/g
Low MW PAH	552 ng/g
High MW PAH	1,700 ng/g
Total PAH	4,000 ng/g

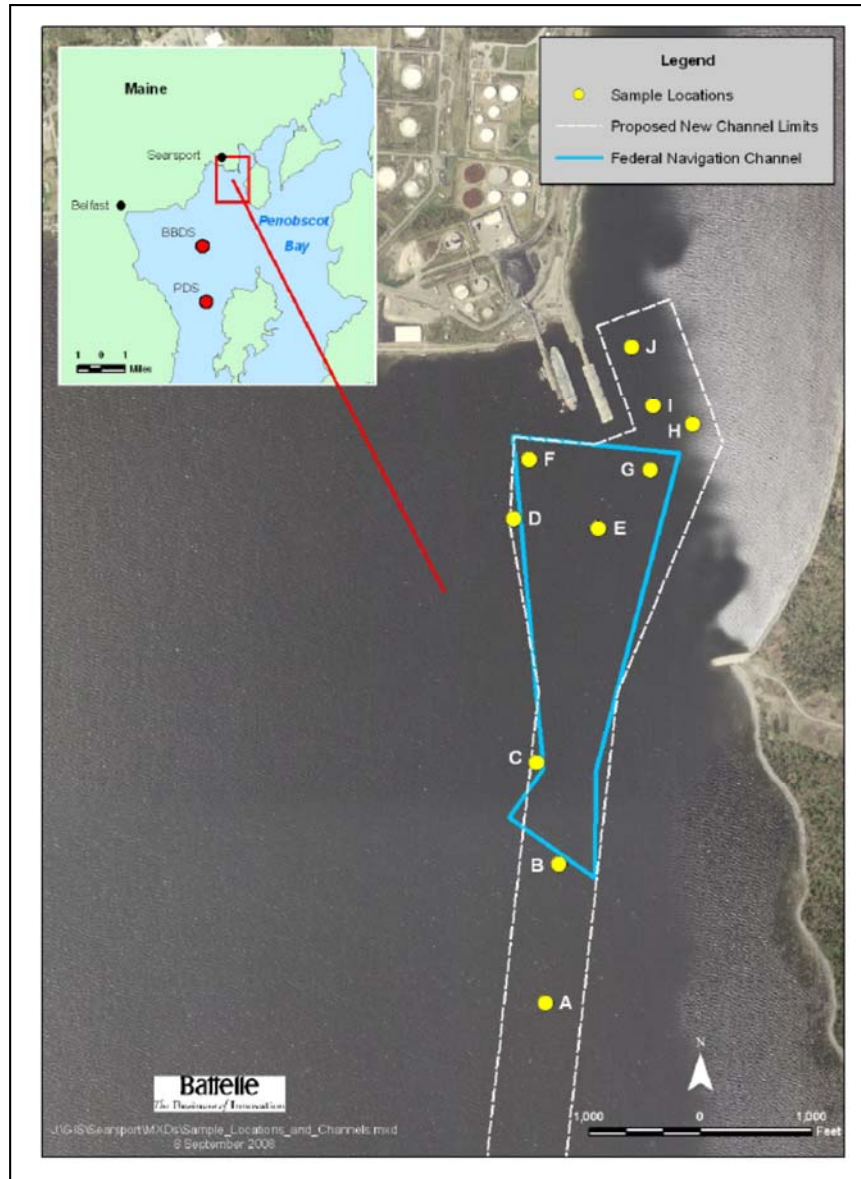
## 2.0 REVIEW OF FIELD SAMPLING AND SEDIMENT TESTING:

Ten sediment coring stations were sampled from within the proposed FNP boundaries in Searsport Harbor (Fig. 1). Additionally, reference sediment grab samples were collected from three stations within the PBDS (Fig. 1). In this case, the field sampling program was not adequate, and appears to be nearly identical to the sediment coring work documented in the Battelle report from 2008 (Battelle, 2008) (apparent by comparing Figs. 1 and 2 herein). The report notes that some 43 sediment cores were collected in total, but that only 10 of these met the requirements for length of recovery (recovery of



**Figure 1** – Locations of sediment cores and grab samples collected by Battelle relative to the existing piers at Mack Point, Searsport Harbor, ME (Battelle, 2015).

greater than 60% of total penetration depth). If possible, six to eight additional sediment coring stations should be sampled, to represent the area between station E to the north and L to the south; the area beyond station A, to cover the full length of the proposed FNP channel; and the area to the east of stations L, C, B, and A to cover the eastern margin of the proposed FNP channel. The report notes that all sampling and core processing methods utilized were consistent with a sampling and analysis plan (SAP; Battelle, 2015) submitted by Battelle to the USACE, and is in compliance with guidelines provided in the *Final Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters* (EPA/USACE, 2004; hereafter referred to as RIM, 2004). As outlined in Table 2, each core was sectioned into various numbers and thicknesses of intervals for contaminant analyses, each interval ranged in thickness from 0.6 to 4.7 feet, and each interval (regardless of its thickness) was homogenized to produce a single sample (20 samples in total). There are no explanations given as to **(1)** why various cores had different numbers of intervals analyzed, or **(2)** why various cores



**Figure 2** – Locations of sediment cores previously collected by Battelle relative to the existing federal navigation channel, and the proposed extended navigation channel (Battelle, 2008).

**Table 2** – Sediment core intervals and corresponding thicknesses subjected to contaminant analyses.

Core	Interval thicknesses (ft.)	Core	Interval thicknesses (ft.)
A	0-1	G	0-1; 3-5
B	0-1; 1-3	I	0-1
C	0-1; 3-5	J	0-1; 2-2.6
E	0-1; 1-3	L	0-1; 1-3; 3-5
F	0-1; 3-4	P	0-1; 1-5.7; 5.7-6.7

had intervals sectioned at different thicknesses. A total of six sediment grab samples were collected from the PBDS, two from each of the three stations. The two samples from each station were combined

and homogenized, to form a single composite sample, one representing each of the three stations. These samples were analyzed in the same fashion as the core samples. This process, as outlined in the report, calls into question the validity of the reports results, in summary:

- (1)** The inclusion of at least one “standard” interval thickness (0-1 ft.) for each core is an improvement over previous sediment characterizations here. However, there is no explanation given of the basis for determining any of the interval thicknesses for these cores (0-1 ft. or others). The amount of dilution that a single homogenized and/or composited sample might experience (in terms of contaminant concentrations) is primarily a function of the thickness (or amount) of sediment that is homogenized to produce that one sample. And since the interval thicknesses vary widely (0.6, 1.0, 2.0, and 4.7 ft.) for various cores, the amount of dilution would also vary. This approach cannot possibly result in representative results.
- (2)** Direct comparison of contaminant data from the homogenized sediment core samples to the PBDS sediment grab samples in an effort to assess whether the PBDS open water disposal site is appropriate (i.e., equal to or more contaminated than the sediment proposed to be dredged) is not scientifically sound. As noted, the homogenized sediment core samples were produced by the inclusion of sediments over between 0.6 and 4.7 feet of individual sediment cores, whereas the grab samples were discrete, homogenized and composited sediments collected from the surface (to no greater than 0.5 ft. depth) of the PBDS. No justifications are provided to explain why the same sampling, and sample processing protocols were not used for these two groups of samples, despite the fact that the PBDS samples were collected for the *purpose of direct comparison* to the sediment core samples of sediment proposed to be dredged. Consequently, determination of the appropriateness of the PBDS site for open water disposal of FNP dredged sediment cannot be supported by these data.
- (3)** The homogenization of sediment samples over various large core interval thicknesses is not an accurate approach to assess the true distributions and concentrations of sediment-associated contaminants. Instead of producing a profile showing where contaminants are distributed within the sediment, and constraining their true range of concentrations, the large-interval homogenization approach serves to dilute (often significantly) the true contaminant concentrations, and alters their apparent distributions. In spite of these elements of bias, the contaminant data in this report, as summarized in Table 3, clearly show that both the sediment planned to be dredged and the sediment currently in place at the PBDS, are both significantly contaminated. Every sediment core sample (20 total) from stations within the FNP area contain several metals at concentrations above the USACE RL, and 19 of these samples also have at least one metal at concentrations that exceed the ERL. An additional 10 samples from the FNP area also contain multiple PAH compounds above the USACE RL, with three of these samples containing at least one PAH compound that exceed the ERL. All three of the PBDS samples include both multiple PAH compounds and multiple metals that exceed the USACE RL. And, all three of these samples also contain two metals (As, Ni) that exceed the ERL. Based on these data, the sediments within both the FNP area and the PBDS are contaminated, and any additional sampling and sediment characterization that would seek to provide accurate profiles of the distributions and concentrations of these contaminants would *undoubtedly* reveal higher levels of contamination in discrete sediment layers, both within the FNP area and the PBDS.

**Table 3** – Sediment core and PBDS sediment grab samples with contaminant concentrations which are either above the USACE reporting limits (RL) [as listed in report p. 9, Table 3-1], are above the effect range low (ERL), or both.

Station (interval, ft.)	Contaminants above RL concentrations	Contaminants above ERL concentrations*
A (0-1)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a) anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Acenaphthylene, Arsenic, Mercury, Nickel
B (0-1)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a) anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Arsenic, Nickel
B (1-3)	Arsenic, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
C (0-1)	Naphthalene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a) anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Arsenic, Nickel
C (3-5)	Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
E (0-1)	Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic
E (1-3)	Arsenic, Chromium, Copper, Lead, Nickel, Zinc	Arsenic
F (0-1)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Acenaphthene, Fluorene, Arsenic, Mercury, Nickel
F (3-4)	Arsenic, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
G (0-1)	Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Arsenic, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
G (3-5)	Arsenic, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
I (0-1)	Naphthalene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a) anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
J (0-1)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a) anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Napthalene, Acenaphthylene, Acenaphthene, Fluorene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic, Mercury
J (2-2.6)	Naphthalene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	None

L (0-1)	Naphthalene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Arsenic, Nickel
L (1-3)	Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
L (3-5)	Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
P (0-1)	Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
P (1-5.7)	Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc	Arsenic, Nickel
P (5.7-6.7)	Arsenic, Chromium, Copper, Lead, Nickel, Zinc	Nickel
PBDS-A	Naphthalene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Arsenic, Nickel
PBDS-B	Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene, Arsenic, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Arsenic, Nickel
PBDS-C	Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Benzo(g,h,i)perylene, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc	Arsenic, Nickel

\*ERL concentration data for PAH compounds Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, and Benzo(g,h,i)perylene are not available for comparison.

### 3.0 RECOMMENDATIONS:

My recommendations include the following:

- (1) To produce an accurate characterization of the distribution and concentrations of contaminants of concern in the FNP area, the USACE, Maine Department of Transportation (MaineDOT) and MaineDEP should commission a study similar in execution as that conducted by the Penobscot River Mercury Study (PRMS), focused on the contaminants of concern (Hg, As, Cd, Cr, Ni, Cu, Ag, Pb, Zn, PAHs, and dioxins). The PRMS approach utilized a core-sectioning approach that was at much higher vertical resolution (1 cm segments from 0-20 cm depth, 2 cm segments from 20-40 cm depth, and 5 cm segments from 40-90 cm depth). Such an approach would provide reliable and representative quantitative information on maximum contaminant concentrations and distributions in sediments to be disturbed or removed by dredging, and properly inform any decisions regarding the appropriate disposal (open water, sanitary landfill) of dredge spoils.
- (2) If the USACE intends to directly compare the concentrations and distributions of sediment-associated contaminants of concern from the FNP area to those of any prospective open water disposal site (PBDS or elsewhere), they should utilize the same methods of sample collection, processing and characterization for *all samples to be compared*. The use of significantly different sampling and sample processing methods, as is the case here, renders any comparisons of resulting data invalid.

(3) When examining the summary data in Table 3, it is clear that based on exceedance of ERL concentrations, the PBDS is contaminated with both Arsenic and Nickel. It is also evident that several FNP area sediment core samples are contaminated with additional PAH compounds and metals as compared to PBDS samples (in terms of ERL exceedance). These include core A (0-1 ft.; Acenaphthylene, Mercury), core F (0-1 ft.; Acenaphthene, Fluorene, Mercury), and core J (0-1 ft.; Napthalene, Acenaphthylene, Acenaphthene, Fluorene, Anthracene, Phenanthrene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Mercury). In other words, even the approach utilized in the Battelle (2015) report reflects that at least some of the FNP area sediment proposed to be dredged are in fact *more polluted than those sediments already in place at the PBDS*. Further, the USACE should re-examine the policy that disposing of known, contaminated sediment derived from dredging or other public work projects at open water locations is permissible if the sediment at the open water disposal site is equally contaminated. Further degradation of the environment, justified on the basis that the environment is already degraded, seems to be very poor public policy.

#### **4.0 SOURCE REVIEWED:**

Battelle, 2015. Sampling and Analysis Plan, Sampling and Testing in Support of Dredged Material Suitability Determination Searsport Harbor Federal Navigation Project, Searsport, Maine.

#### **5.0 REFERENCES:**

Battelle, 2008. Final Report – Field Sampling and Sediment Testing, Searsport Harbor Federal Navigation Project, Searsport, Maine. USACE contract #DACW33-03-D-0004, Duxbury, MA.

Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder, 1995. Incidence of adverse biological effects with ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management*, 19(1): 81-97.

U.S. EPA/U.S. ACE, 2004. *Final Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters*. U.S. EPA, Region I, and U.S. ACE, New England Division, Waltham, MA.

U.S. EPA, 2002. Mid-Atlantic Integrated Assessment (MAIA) Estuaries 1997-98: Summary Report – Environmental Conditions in the Mid-Atlantic Estuaries. Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI. [[http://www.epa.gov/emap2/maia/html/docs/maiasr\\_9798.html](http://www.epa.gov/emap2/maia/html/docs/maiasr_9798.html)].