DAWSON & ASSOCIATES

APPRAISAL OF SEARSPORT DEEPENING PROJECT

Prepared for Isleboro Island Trust

May 9, 2014

APPRAISAL OF SEARSPORT DEEPENING PROJECT

EXCUTIVE SUMMARY

Dawson & Associates has reviewed the U.S. Army Corps of Engineers' April 2013 Draft Feasibility Report & Environmental Assessment for enlarging the Federal navigation channel serving Searsport, Maine in order to determine whether the proposed channel enlargement is justified. We also reviewed other publicly available and pertinent documents.

After thorough review of all aspects of the main report and its appendices along with other literature relating to the project, both project economics and recent environmental findings appear to impact project justification, and as a minimum, warrant further study or alteration. Specifically, we found three issues that could impact the study results. The most significant finding in our assessment is that a non-structural alternative could accommodate most of the desired future fleet. This report also notes questions regarding the assumptions made on possible fleet mixes between the with- and without-project conditions. Additionally, given concerns expressed at the April 8, 2014 public meeting in Belfast, Maine about the potential for mercury contamination, additional analysis and coordination is warranted as part of the Corps' study process.

BACKGROUND

This section describes the existing federal navigation project and compares it to the Corps' proposed channel enlargement.

Existing Federal Project

Searsport Harbor is located on Penobscot Bay, about halfway up the Maine coast. The eastern side of the harbor, known as Mack Point, is served by the federal channel and contains two piers. The federal channel is less than a mile long and has an authorized depth of -35 feet mean lower low water (MLLW). See figure 1.

The channel experiences minimal shoaling and since construction in 1964, accretion has filled portions of the channel to -33 feet MLLW – now the controlling depth. Neither the port nor the Corps of Engineers has been successful in obtaining maintenance dredging funds – a 100% federal cost – to remove the accumulated 37,100 cubic yards of accretion.

The tide range at Mack Point is about 10.2 feet. To accommodate tide riding, one pier has a dock depth of 37 feet for tankers. The other has a berth with a depth of 40 feet for bulk and break bulk ships to accommodate deeper draft vessels. Both provide the designed three feet of underkeel clearance in the berths although in some instances it is less.

Figure 1

The faint red lines delineate the existing federal project.

Recommended Project

Based on the Corps' April 2013 feasibility study report, the estimated $11 million project calls for deepening the existing authorized project from -35 feet MLLW to -40 feet MLLW. The 3,500-foot long channel would be extended seaward to the 40-foot contour adding another 2,000 feet to its length. In addition, a maneuvering area would be provided parallel to the eastern dock.
In association with the channel enlargement, the non-federal sponsor or its agents would dredge two berths (one at the liquid pier and one at the cargo pier) to -43 feet MLLW to accommodate deeper draft vessels and provide 3 feet of underkeel clearance in the berths. See figure 2.

The dredged material would be disposed on Penobscot Bay bottom at a designated open water disposal site with no confining or capping structure. The disposal site is about six miles from the project area.

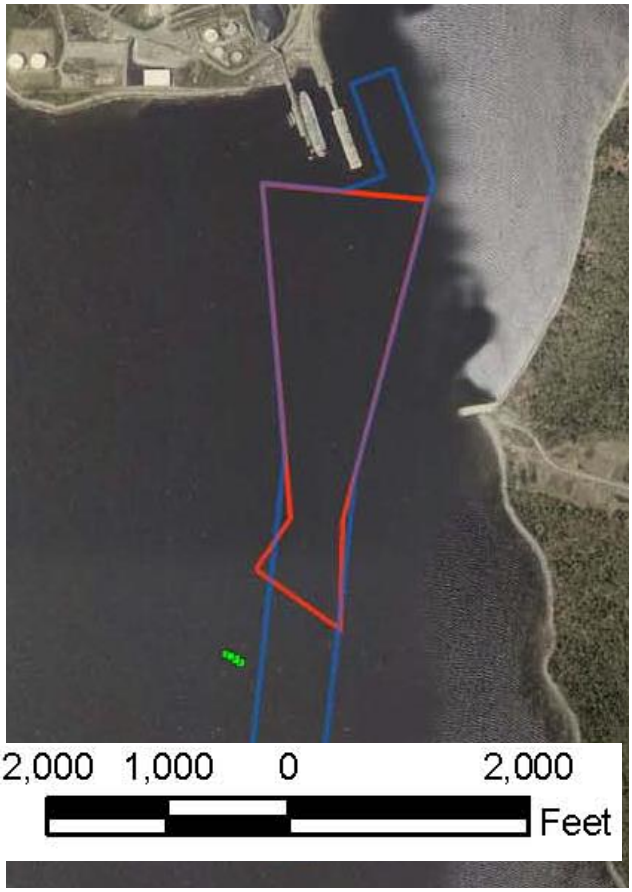

Figure 2

The blue and purple lines represent the location of the recommended deepening project while the red and purple represent the existing project.

PROJECT ECONOMICS

This section discusses the Corps of Engineers' procedures for evaluating the economic justification for approving enlargement of federal channels. These analyses involve two primary projections: (1) future tonnages through the port and (2) the size (primarily draft) of the future fleet using the port.

Procedures for evaluating improvements to deep draft navigation projects are based significantly on comparing the decreases in transportation costs against the cost of channel and berth enlargement; and associated mitigation for environmental impacts.

Benefits, referred to as transportation savings, are generally achieved (1) by ships being able to load deeper or (2) through larger ships using the project. Although larger ships have a higher hourly cost of operation, the fewer number of trips create the savings achieved by these economies of scale.

Because the economic justification of the project is based upon several assumptions, these assumptions are critical to the study. The presentation below discusses the various assumptions.

Components of Economic Analysis

The Corps predicts the future fleet that would use the channel enlargement and compares the number of vessel trips using the existing fleet in the without-project condition against the number of trips in the with-project condition for the projected volumes of material to be imported. Vessel operating costs are applied to the length of each trip and the vessel speed to calculate a trip cost.

Cargo volume projections are based on projected populations and business activities.

Vessel operating costs are proprietary and maintained by the Corps' Institute of Water Resources. The Corps also maintains the vessel characteristics which are the ship draft, beam and length by dead weight ton categories. Instead of using the latter, the Searsport study used vessel characteristics from a Danish source[1] which is reasonably similar.

The design draft is a key factor in this analysis. While a ship experiences several degrees of motion, the usual procedure is to assign a design draft to a given deadweight tonnage category of a ship and add the requisite underkeel clearance. In Searsport's case, this is three feet. If full draft is not available due to channel depth, the tons per inch characteristic of the vessel is used by the Corps to calculate the impact of light loading.

Existing Vessel Traffic

The federal channel serves the two piers at Mack Point. The piers are the State of Maine's public general purpose cargo pier (two berths) and the Sprague Energy liquid pier (two berths) used by Sprague and Irving Oil Company.

The vast majority of the port's traffic is imports and only imports would benefit from the proposed deepening. Oil and gasoline make up 70 to 80 percent of the port's total annual tonnage. The remainder is comprised by bulk and break-bulk commodities which include road salt, wood pulp, clay, chemicals, and gypsum.

Nearly half of all vessel calls to Searsport originate in Canada, largely reflecting shipments of petroleum products. Approximately 20% of vessel origins are from New England ports, primarily Portland, Portsmouth and Boston. These are also oil shipments. About 12% of vessel origins are from South American ports, primarily Brazil, Chile and

[1] Propulsion Trends in Tankers, MAN Diesel A/S, Copenhagen, Denmark, 2007, and Propulsion Trends in Bulk Carriers, MAN Diesel A/S, Copenhagen, Denmark, 2007, www.manbw.com/technical papers.

Venezuela. Fewer than 10% are from European ports and these represent bulk commodities.

Impact of Tide Range

The tide range is a significant factor in this analysis for two reasons. First, the tide range at Searsport is unusually large for a port project. Perhaps more significant is that the project length – the distance a ship would have to ride the tide - is extremely short. This is important because the authorized channel depth is at mean lower low water and thus the rest of the tide cycle is above that. The amount of contiguous time available to ride the tide decreases for increased ship drafts. However, it is only about two-thirds of a mile to travel the length of the project.

Because the authorized channel depth of 35 feet has not been maintained, accretion has limited the "controlling" depth to 33 feet. Under these conditions, ships with drafts of greater than 30 feet are able to access the harbor through most of the astronomical (as opposed to wind influenced) tidal cycle, using the tide for underkeel clearance.

Under existing conditions, an average of 71 vessel calls per year arrive with drafts of 30 feet or greater. Of these, 59 per year arrive with drafts between 30 and 35 feet. The other 12 arrive with drafts between 35 and 41 feet.

Under the currently authorized depth, arriving ships (after expending fuel during the voyage) would need to have a draft of 32 feet or less upon arrival in order not to face a tide-induced delay.

Searsport experiences a diurnal tide with a range of approximately 10.2 feet. Thus with the authorized channel depth of -35 feet MLLW, theoretically a ship could arrive drawing 42 feet.

However, for that to be practical, the depth at the pier would need to be 45 feet as required by local regulations calling for three-foot underkeel at the dock. This increased depth is needed to accommodate the time to unload the vessels. According to the report, the typical tanker remains at the dock for about 30 hours to offload, while the typical bulker remains at the dock for 65 to 70 hours (about three days).

Light Loading

Some of the larger oil tankers which call on Searsport arrive light loaded due to calling on other regional ports and offloading some product before proceeding to Searsport. As the feasibility study notes, "This practice depends on many factors including market demand and vessel routing concerns, and may continue to occur in the future to some

degree regardless of the channel depth at Searsport." Thus this traffic may not benefit from the project.

Cargo Tonnage Projections

The economic analysis is hinged to a projection of tonnage that would go through the port over the 50-year period of economic analysis. This amount has been reduced to the assumed level of tonnage that could be subject to being carried in larger vessels. The tonnages and the size of ships determine the number of vessel calls for the existing and future project.

The feasibility study based its Searsport commodity tonnage projection benefits on those ships that have arrived with calling drafts greater than 30 feet. Cargo volumes were kept constant over the 50-year period of analysis based on 2006 cargo volumes. Volumes in 2006 included 1,600,000 tons of petroleum and petroleum products, and 400,000 tons of bulk cargo. Total volumes from 2006 were used because those volumes reflect economic conditions prior to the severe recession of 2007 – 2009 and were considered to be better indicators of long-term trends.

While the analysis projects that the port's total petroleum volumes will equal 1.6 million tons per year, the analysis concluded that 700,000 tons, or 44 percent of future petroleum product volumes will be brought on vessels which would benefit from channel deepening.

Similarly for bulk cargo, the benefits from reducing waterborne transportation costs are calculated on 300,000 tons, or 75 percent of the port's total bulk tonnage that are brought on vessels currently using the channel to capacity.

Existing Fleet

Irving Oil currently brings petroleum products to Searsport on double-hulled tankers which average 35,000–40,000 DWT (deadweight tons), are 600–700 feet long, 90–100 feet wide, and have operating drafts up to 35 feet. The tankers used by Sprague tend to be somewhat larger, up to 55,000 DWT with operating drafts up to 36 feet and maximum drafts up to 40 feet. Sprague Energy does not light load its vessels as regularly, nor do the bulk cargo shippers.

The bulk carriers which call on Searsport Harbor range in size depending on the carrier and the commodity, but can be as large as 42,000 DWT. The current average-size vessel using the channel to capacity, based on waterborne commerce data, is 35,000 – 45,000 DWT.

Authorized Project Fleet

For the without-project condition (channel depth of 35 feet), the average fleet size is estimated to be about 35,000 DWT, with most of the increased channel depth being used to reduce the significant tidal delays currently experienced.

The differences between the existing fleet (average 35,000-45,000 DWT) and the authorized project fleet (35,000 DWT) is an unexplained inconsistency.

Future With-project Fleet

With increased channel depths, the Corps projects that the average bulk carrier size for vessels using the channel to capacity will increase to between 40,000 and 60,000 DWT.

The Corps assumed that actual vessel sizes would be distributed around the average vessel size and that the upper end of the distribution would likely include the design vessel or similarly-sized vessels.

Design Vessel

The Corps also developed a "design vessel" that would represent the largest vessels that would use the pier facilities. It is not clear, but apparently the beam and length were used to help design the channel width and turning basin (which is part of the channel). The Corps used two types of design vessels in their study – tanker and bulk cargo. Local pilots initially provided data for a 65,000 DWT tanker having a beam of 106', length of 700', and draft of 42' and a 80,000 DWT bulk cargo vessel having a beam of 116', length of 760', and draft of 45'. Eventually, the bulk cargo vessel was upgraded to a length of 800'.

Construction Cost Considerations

Analysis showed that material on the harbor bottom is primarily marine clay. Some glacial till is located along the eastern and northeastern edge of the project. The glacial till is very dense with numerous cobbles and boulders. Dredging till is characterized as being potentially difficult.

ENVIRONMENTAL IMPACTS

Environmental Assessment Versus and Environmental Impact Statement

For major projects, the Corps prepares an Environmental Impact Statement pursuant to 33 Code of Federal Regulations (CFR) 230.6 for Federal actions requiring a feasibility report for authorization and construction. The District commander may consider an Environmental Assessment if early studies and coordination show that the project is unlikely to significantly impact the quality of the human environment (33 CFR 230.6).

If environmental impacts are found to be significant according to criteria in 40 CFR 1508.27, the proposed project would be modified to reduce the impact or a Notice of Intent would be published in the *Federal Register*, and an Environmental Impact Statement would be prepared prior to implementing the Recommended Alternative.

New Issue - Mercury

The former HoltraChem site on the Penobscot River is the source of mercury contamination that has migrated into Penobscot Bay. Litigation has been in process for several years. Sediment samples for the case came from Penobscot Bay. As recently as February 22, 2014, areas just above Searsport have been closed to lobster fishing due to mercury contamination in lobsters and other species.

The Penobscot River Mercury Study notes:

> Phase I of the study has shown that the lower Penobscot River and Bay are contaminated with industrial mercury, and that mercury concentrations in some of the biota in these contaminated areas are high enough to be of concern for both the organisms themselves and for human consumption. Most of the mercury in the biota is methyl Hg, a very toxic form of mercury. Methyl mercury biomagnifies in food chains and we found that the biota with the highest mercury concentrations were at the top or near the top of food chains…The reason that methyl Hg concentrations are high in the upper levels of the aquatic and wetland food chains is that methyl Hg concentrations in river sediments and in the riparian wetlands, which are closely connected to the river, are high in methyl Hg concentration.
>
> The lower river is contaminated with industrial mercury from a point above the HoltraChem site southward and into Penobscot Bay… South of Fort Point Cove mercury concentrations dissipate, but are still above background concentrations at our farthest southward sampling point, an east-west sampling transect offshore of Rockland.
>
> …methyl Hg concentration in the surface sediments and wetland soils is the key in determining the supply of methyl Hg to the food chain. [2]

[2] Penobscot River Mercury Study, Update to the Phase I Report, May, 2009, pp. vii-viii

The Corps' April 2013 environmental assessment acknowledges the presence of mercury in project sediment:

> On April 30 and May 1, 2008, 10 sediment core samples were collected in Searsport Harbor within the proposed project area. The four composite sediment and six reference site samples were also analyzed for eight metals: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), and zinc (Zn) [p 20] … Metals were detected in all harbor composite and reference site samples (Table EA-9). Concentrations of most metals were generally below the sediment quality guidelines, especially at harbor locations (Table EA-9). For example, metals concentrations were below the sediment quality guidelines in all harbor composites except for chromium in harbor composite ABC and nickel in harbor composites ABC, DF and EGHI. Chromium and nickel concentrations were also above the sediment quality guidelines in the reference site samples, as were mercury concentrations (Table EA-9).[3]

There is no further discussion of mercury contamination in the Corps report.

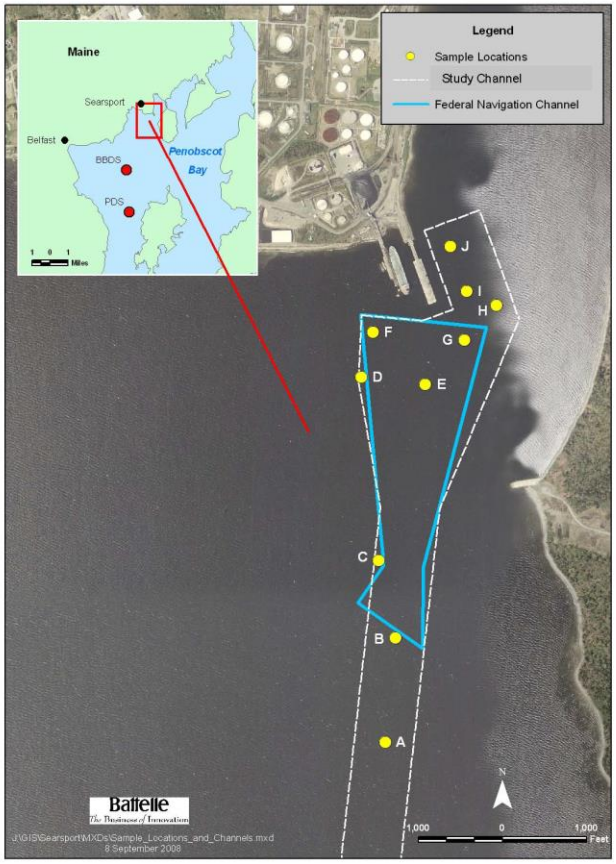

Figure 3

2008 sediment sampling locations

[3] Public Review Draft, Environmental Assessment Finding of No Significant Impact & Clean Water Act § 404 (b) (1) Evaluation, April 2013. Pp. EA20, EA23-EA24.

EVALUATION OF PROJECT ECONOMICS AND ENVIRONMENTAL CONCERNS

This section is an evaluation of the project economics that could impact either the project cost or project benefits. A discussion of the environmental concerns has been added because it relates to technical and policy issues that also affect the project justification.

There are two main issues:

(1) The need for the project
(2) Contaminated sediment.

There are several other issues that are discussed with an assessment of their impact on the project. All of the issues discussed below could have impact upon economic justification of the project.

Need for Project Enlargement

As discussed, the non-Federal sponsor, its agents, and the Corps have arrived at a need to accommodate ships ranging from 40,000 to 60,000 DWT with 80,000 DWT being the largest expected. Corps guidance indicates that these size ships can be accommodated at the authorized channel depths through tide riding for the deepest drafts (see table 1 below).[4] The table shows that for tanker and product tanker, the vast majority have drafts of 43 feet or less.

The design ship presented for tankers has a draft of 42 feet at 65,000 DWT. In the report, the bulk cargo design ship is 80,000 DWT with a draft of 45 feet. The report indicates these ships represent the extreme end of those carrying the 20-30% of the tonnage and come from South America and Europe. These trips would expend a sizable volume of fuel en route and arrive at less than design draft.

If the channel were maintained to its authorized depth of -35 feet MLLW ships could arrive at higher tides with drafts up to 42 feet as long as the berth depth is maintained to -45 feet. According to USACE guidance, a 43-foot draft class tanker is rated at 95,000 DWT and a product tanker at 62,000 DWT. Depending on the length of the voyage, it is reasonable to assume that the ship would consume fuel equivalent to about a foot's worth of draft. In that case arriving at 42 feet could represent a design draft of 43 feet.

[4] Engineering and Design - Hydraulic Design of Deep Draft Navigation Projects, May 2006, U.S. Army Corps of Engineers.

Under this assumption, the stated goals of the port users (the companies indicated they would not increase beyond 55,000 – 60,000 DWT vessels) could potentially be met by maintaining the channel at its currently authorized depth, increasing the depth of the births, and taking advantage of the tide.

The alternative of increasing the depth at the berths to 45 feet (which is the limit allowable for the existing pier foundations) could meet the project requirements without further channel dredging and therefore be defined as a non-structural alternative. It was not discussed in the feasibility report. With the concern over mercury, this alternative should be considered.

3-11. Design Ship.

a. The design ship or ships are selected on the basis of economic studies of the types and sizes of the ship fleet expected to use the proposed navigation channel over the project life. For project improvement studies, a thorough review and analysis of ships presently using the project should be included as a part of the study. Projections of ship fleet data, usually needed, account for expected ship construction trends. An example tabulation of merchant ships segregated into different categories by ship draft and cargo capacity in deadweight tons is presented in Table 3-2. This table shows that tankers and bulk carriers comprise the main ship types above Panamax draft of about 12.2 m (40 ft).

Table 3-2
Liquid Bulk Merchant Fleet of the World Categorized According to Draft Class
(To convert feet to meters, multiply by 0.3048)

Draft Class (ft)	Total Count	Total dwt	Total DWT Cumulative Percentage	Tankers		Product Tankers		LPG[1] Carriers		LNG[2] Carriers		Crude Oil Tankers		Chemical/Oil Tankers		Chemical Tankers	
				Count	Avg dwt	Count	Avg dwt	Count	Avg dwt	Count	Avg dwt	Count	Avg dwt	Count	Avg dwt	Count	Avg dwt
<10	295	1,612,207	0.5	166	3410	43	16,253	30	3902					13	6224	43	3472
10	140	319,473	0.6	58	1484	46	3649	8	1338					5	1212	23	2121
11	116	306,738	0.7	62	2678	28	3719	11	1038	1	463			3	1725	11	1774
12	147	286,470	0.8	93	2321	17	1995	19	720					6	1053	12	1392
13	279	419,481	0.9	134	1696	23	2415	69	971	3	992			9	1320	41	1337
14	333	542,653	1.1	170	1900	29	1545	66	1257					6	1571	62	1330
15	345	747,974	1.4	221	2247	27	2481	53	1839					11	2317	33	1862
16	303	727,593	1.6	190	2345	35	2896	38	2295			1	2000	7	2631	32	2283
17	312	910,151	1.9	159	2891	37	3064	62	3122					6	3165	48	2595
18	306	1,117,165	2.2	138	3582	31	4774	40	3452					16	3193	81	3527
19	268	1,009,730	2.6	154	3572	38	4012	46	4274			1	3395	9	3703	20	3693
20	231	1,048,847	2.9	95	4492	29	5408	24	5481	21	2692	1	4999	10	4270	51	4500
21	270	1,407,631	3.4	115	5092	38	5454	29	4954	1	9090	1	4999	27	4944	59	5484
22	277	1,639,346	3.9	112	5691	56	6446	29	4807			1	4986	22	6506	57	6201
23	250	1,982,690	4.5	67	6353	44	12,972	14	5881	2	10,979	2	17,500	21	6999	100	7000
24	137	1,095,598	4.9	39	7524	29	9897	17	5994			1	12,615	13	8100	38	7772
25	123	1,128,899	5.2	15	9998	21	10,825	21	6586	2	12,839			27	9096	37	9244
26	130	1,387,620	5.7	21	9900	40	13,387	8	7115					19	10,084	42	9422
27	87	990,191	6.0	11	11,542	13	12,198	20	11,062	1	21,301			16	11,740	26	10,549
28	101	1,507,759	6.5	17	16,629	23	16,390	19	8448	3	41,131			14	14,894	25	14,227
29	134	2,095,506	7.2	17	15,402	19	18,116	6	11,560			30	18,946	24	13,360	38	13,976
30	125	2,303,890	7.9	19	16,559	48	21,020	16	13,748	3	28,412			16	17,482	23	17,191
31	123	2,894,830	8.8	24	21,948	56	22,421	11	15,218	12	41,738	1	59,543	4	16,875	15	21,147
32	84	1,965,446	9.5	6	23,702	30	27,829	25	17,472					9	21,710	14	25,441
33	98	2,813,581	10.4	2	23,979	46	31,084	7	24,588	2	34,887	1	35,679	10	24,399	30	27,140
34	92	2,839,038	11.3	22	30,044	50	31,803	7	24,483	1	27,235			4	31,026	8	33,150
35	153	5,188,065	13.0	18	33,300	80	32,190	12	31,773	3	61,632	7	40,156	10	36,288	23	34,927
36	321	11,921,363	16.8	26	35,755	188	33,922	40	43,367	16	65,018	14	45,991	9	40,931	28	29,542
37	215	8,625,276	19.6	6	44,531	146	36,210	9	41,550	20	69,953	3	70,726	8	32,378	23	35,966
38	98	4,818,287	21.1	11	38,933	35	39,548	11	35,114	25	71,158	8	63,891	4	41,869	4	40,509
39	139	7,172,298	23.4	10	47,201	58	47,928	18	45,957	13	71,161	25	61,834	11	41,521	4	41,391
40	219	12,682,801	27.5	27	50,604	99	52,276	2	50,786	4	73,145	56	77,375	27	45,783	4	44,469
41	104	5,899,624	29.4	3	58,941	56	53,405	23	49,821	1	80,239	19	75,819	2	32,719		
42	126	8,520,599	32.1	10	76,452	49	56,472	6	50,191			58	78,395	3	46,965		
43	97	7,383,320	34.5	3	94,995	26	62,172	12	50,091			55	87,858			1	48,581
44	90	7,224,193	36.8	11	94,506	21	63,828	5	57,533	1	83,020	49	88,587	2	44,983	1	42,825
45	94	7,946,303	39.4	18	75,507	12	82,965	5	57,110			59	89,933				
46	60	5,529,881	41.2	8	87,285	7	77,664	1	43,386			43	97,152	1	67,031		
47	55	5,234,185	42.9	5	98,373	5	84,851					45	95,957				
48	51	5,422,759	44.6	3	95,193	5	106,634					43	107,070				
49	61	6,508,458	46.7	3	117,460	2	105,251					56	106,171				
50	35	4,301,177	48.1	1	141,861	3	99,515					31	124,541				
51	41	5,119,042	49.7	5	131,648	3	117,148					33	124,526				
52	5	562,011	49.9	2	156,522	2	82,658									1	83,651

(Continued)

Table 1

For tankers and product tankers, those with drafts of 43 feet or less represent the DWT limits of the future fleet and thus can be accommodated through tide riding.

Need for Additional Environmental Analysis

Given concerns expressed at the April 8, 2014 hearing in Belfast, Maine and the potential for Mercury[5] contamination, it is recommended that the Corps of Engineers conduct additional analysis and coordination as part of its feasibility report process before making a final decision on the project.

Sampling stopped short of the southern end of the proposed project limits which would be closer to the source (see figure 4). In addition, the outline of the project only shows the limits of the 40-foot depth and not the surrounding extended areas that have to be dredged to provide a stable slope, The graphic shows the entrance channel being 650 feet. However, to account for the 1H:3V slope the channel disturbance would extend 15 feet or further on either side depending on the natural depth contour. The sampling does not account for that.

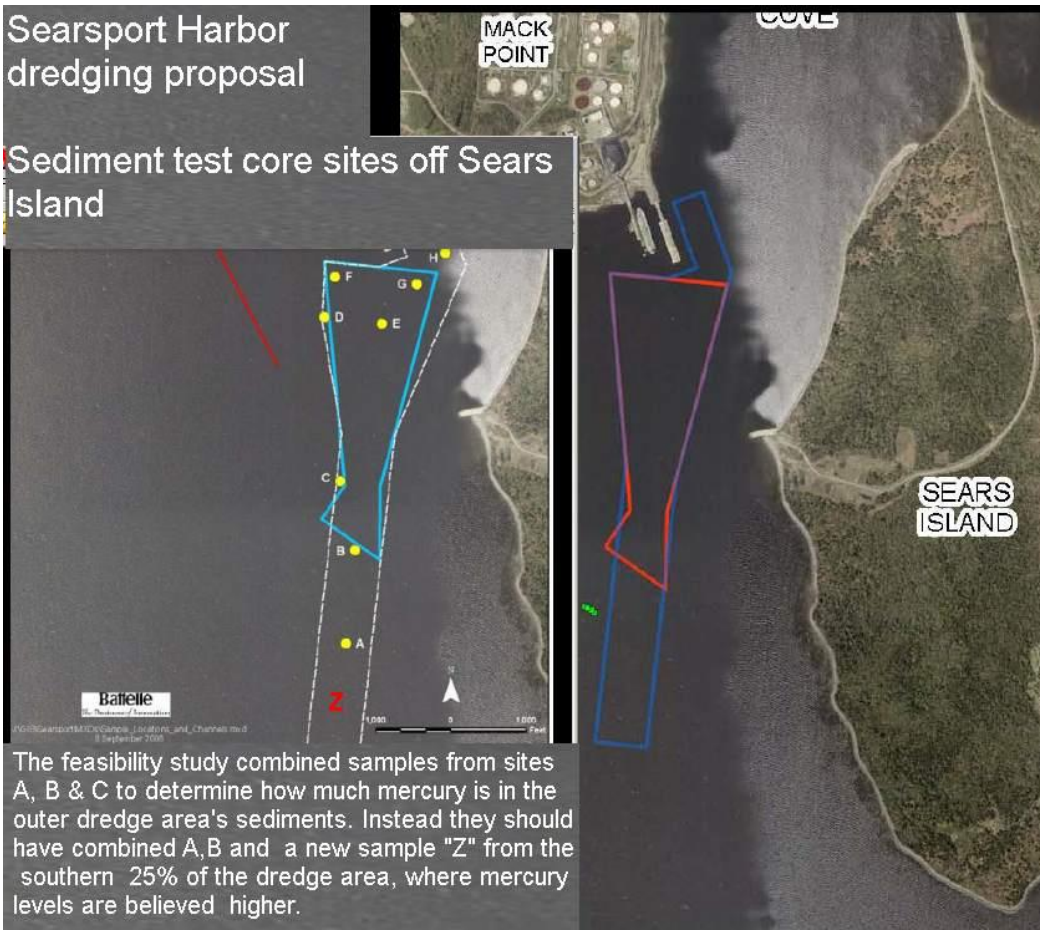

Figure 4
The above is from http://penbay.net/fopb_dredge/sed_test_fail.jpg embedded in the Penobscot Bay Blog dated October 7, 2013.

[5] As with "Federal/federal," Mercury is used both upper- and lower-case. Suggest going with only one.

While Sears Island and the causeway appear to direct the Penobscot River mercury laden flows to the east of the harbor, tidal influenced circulation indicates that sediments could be introduced into the project area (see figure 5).

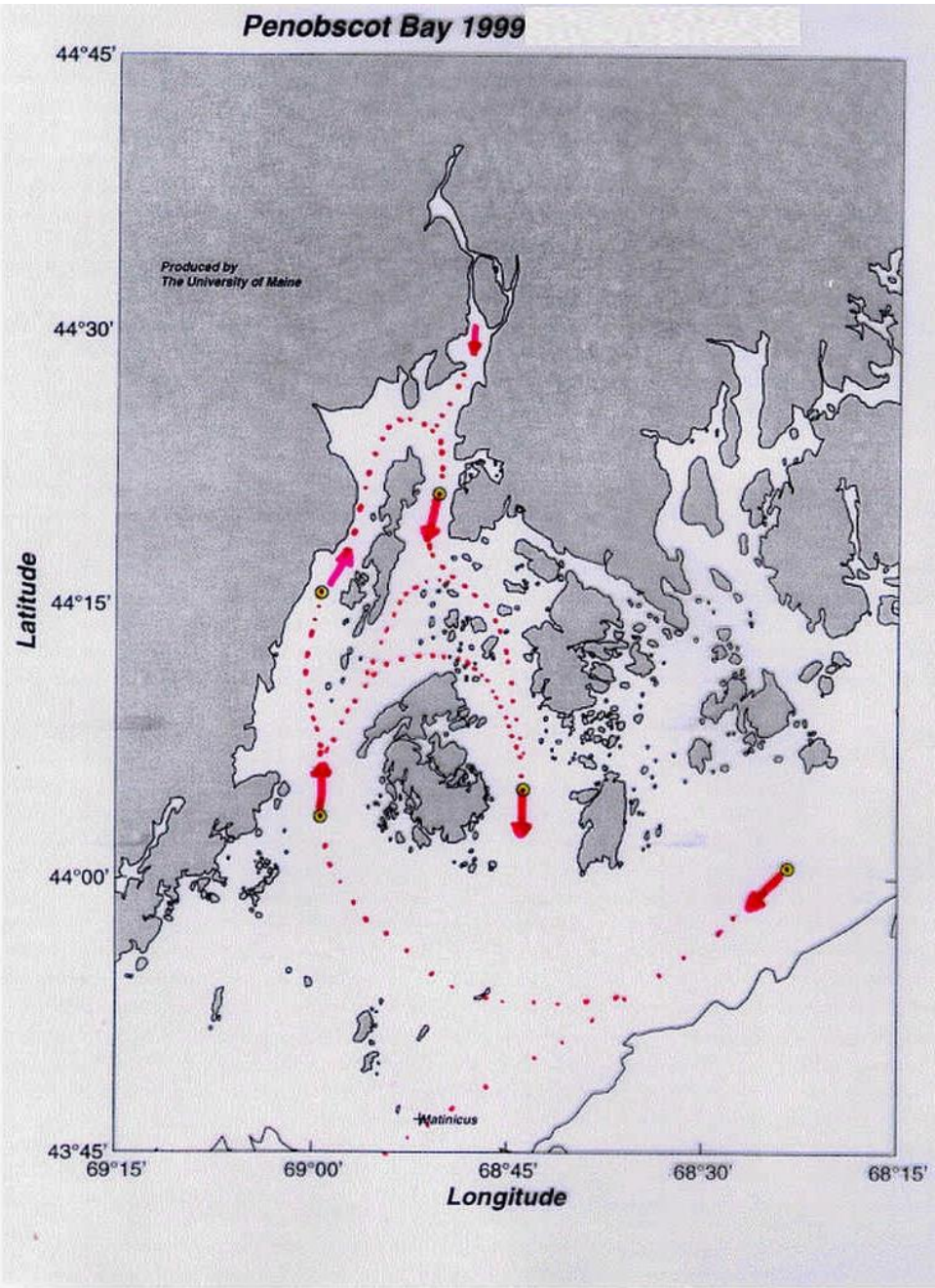

Figure 14. Mean depth-averaged circulation pattern in Penobscot Bay.

Figure 5

This shows the Penobscot Bay Circulation near Sears Island

(http://penobscotbay.blogspot.com/2013/10/sears-island-testing-biota-for.html).

The issue appears to be the placement of potentially polluted sediment. If mercury from within the project exceeds the thresholds allowable for open water disposal as presented in the Corps and EPA's *Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters*, April 2004, a far more expensive disposal would be required.

Issues that Could Impact Study Results

There are several issues that have the potential to decrease the project's benefit-to-cost ratio.

- Future Fleet Drafts
  The reasonable premise is that with a deeper channel, larger ships with deeper drafts would call. The magnitude of benefits claimed is a function of the change from the future without-project fleet to the future with-project fleet. The report should provide quantification of draft-DWT combinations used in the analysis and how they were weighted. Without details, Dawson & Associates cannot assess if the without-project fleet is focused to a set of smaller ships than average and/or that the with-project is focused to a set of larger ships than average. Any combination would amplify the benefits.

- Disposal Location Cost Impact
  Page E-26 tables show effects of disposal location. For a 40-ft project with disposal at Penobscot, the annual net benefits are $825,200 yielding a BCR of 2.2:1 while at Rockland: $451,200, 1.35:1. Thus for this project, dredging cost is very sensitive to distance.

- Project Costs
  Table 17 of the main reports (see figure 6) shows the project cost to increase incrementally by $1.3 million when deepening from 37 to 38 feet; $2.4 million, 38 to 39; and $1.4 million, 39 to 40. The volume of material generally increases with each 1-foot increment, but this is not reflected in the table, possibly indicating the 40 foot project cost is underestimated, thus decreasing the benefit-to-cost ratio.

Table 17. Annual Cost of Alternatives, Penobscot Disposal Site

SEARSPORT HARBOR, SEARSPORT, MAINE
Annual Cost of Alternative Plans, Penobscot Disposal Site

	37-Foot Improvement	38-Foot Improvement	39-Foot Improvement	40-Foot Improvement	41-Foot Improvement	42-Foot Improvement
GENERAL NAVIGATION FEATURES (GNF)						
Project Improvement Cost						
First Cost (Incl. IDC)	$6,462,000	$7,757,000	$10,135,000	$11,512,000	$13,698,000	$15,928,000
		1.3	2.4	1.4		
Annual Costs - GNF						
Interest and Amortization (3.75%)	$288,000	$346,000	$452,000	$513,000	$611,000	$710,000
Annual Increased Maintenance Dredging	$14,000	$19,000	$28,000	$36,000	$44,000	$54,000
Total Annual Cost, GNF	$302,000	$365,000	$480,000	$549,000	$655,000	$764,000
LOCAL SERVICE FACILITIES (LSF)						
Berth Deepening, First Costs (Incl. IDC)	$272,000	$336,000	$413,000	$499,000	$553,000	$598,000
Annual Costs - LSF						
Interest and Amortization (3.75%)	$12,000	$15,000	$18,000	$22,000	$25,000	$27,000
Annual Increased Maintenance Dredging	$0	$0	$0	$1,000	$1,000	$1,000
Total Annual Cost - LSF	$12,000	$15,000	$18,000	$23,000	$26,000	$28,000
TOTAL ANNUAL COSTS - GNF & LSF	$314,000	$380,000	$498,000	$572,000	$681,000	$792,000

Figure 6
The row "Project Improvement Cost" shows the incremental increase in cost associated with each successive 1-foot increase in project depth. Each increment should have an increased "delta" between it and the previous increment. Instead, there is a decrease when going from 39 feet to 40 feet.

- Routing versus Light Loading
  According to the report, "The degree to which oil tankers arrive at Searsport below their maximum draft (light loaded) due to inadequate channel depth, versus due to a port rotation in which some product is offloaded at another New England port as part of a regional delivery, was difficult to determine." This is a key assumption and should be verified as it affects about 20 % of the tonnage.

- Accuracy of Dredging Costs
  The proposed dredging maneuvering area east of the State Pier will require removal of as much as 15 feet of dense sand or gravel. The glacial till is very dense with numerous cobbles and boulders. The Corps anticipates that dredging the till will be difficult because during the drilling it was not easily penetrated with a roller bit. Further they reminded the reader that previous expansion of the turning basin to the northeast was not carried to the full depth due to encountering

this till. It is not clear from the report whether this difficulty has been factored into the cost estimate for dredging.

- Tugs
  The reports mention tugs in relationship to the maneuvering area. The role of tugs in port operations was not itemized in the report. They could be part of a non-structural alternative. If they are part of the structural alternatives, it is not known whether their costs are reflected in the economics or if more or larger tugs are needed for the larger ships of the projected future fleet.

- Underkeel Clearance
  The report requires clarification with respect to underkeel clearance. It states, "Since vessels require underkeel clearance of two to three feet, and since the controlling depth in the channel is 33 feet, vessels with drafts greater than 30 feet are considered to be using the channel to capacity." It appears that 3 feet was used but confirmation is in order because a 3-foot clearance would probably produce fewer benefits than a 2-foot clearance.

  A greater underkeel clearance of 10% of the draft could be more appropriate resulting in less benefits for a given depth increase.

CONCLUSION

Although there are economic issues that could potentially lower the benefit-to-cost ratio, the significant finding in this assessment is that a non-structural alternative could accommodate most of desired future fleet, thus revising the proposed project.

The concern over mercury should also be further addressed. Concerns over possible mercury contamination in the sediments to be dredged and where they are placed could have an environmental impact more significant than originally thought and, as such, could lead to the need for an EIS before the report can move forward.