Mitigation Monitoring Report

Year 1-2006

Lasell Island Dredge Project
Permit # WL-0062 Lasell Island LLC
Penobscot Bay Maine

Compensation for Impacts to 18,800 sf of eelgrass (*Zostera marina*)

Submitted to:

Maine Land Use Regulatory Commission
and
U. S. Army Corps of Engineers

Submitted by:

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1.0 Background

Chris Page, a landowner on Lasell Island in Penobscot Bay (Figure 1) applied for and received permit #WL-0062 from Maine's Land Use Regulatory Commission (LURC) and the U.S. Army Corps of Engineers (ACE) to dredge a portion of "Half Gallon Cove".

In brief, the dredge project involved extending the existing pile supported pier an additional 50' and dredging a 100' fairway and turning basin within the cove to a depth of -9'. The dredge footprint encompassed approximately 63,200sf and approximately 16,400 cubic yards (Figure 2).

Approximately 21,000sf of eelgrass (Zostera marina) bed was present in the cove in 2002. This meadow was judged to be sparse to medium density with common bare patches up to 100sf in area. As a condition of the permits a mitigation plan was accepted that called for compensation for the disturbance of eelgrass (18,800sf) by immediately transplanting the eelgrass bed to the dredged area within the cove using an experimental large sod transplant technique. The goal of the mitigation plan was to maintain an eelgrass area within the cove that functions in a similar manner as the existing area. This was to be accomplished by establishing a stable and persistent eelgrass bed at a comparable leaf cover and greater area of bottom covered; thereby compensating for the existing eelgrass bed within the dredge footprint. The plan provided for at least a 2:1 compensatory mitigation (of the wetland functions and values that would be impacted by the dredging) as required by LURC Standards (10.17 Sec.B §7.b. (5)(a)) or 37,600sf. The success criteria for the purposes of this project were 85% of the target bed acreage and 85% of the percent leaf cover.

A contingency replanting plan was to be used if the sod transplanting did not meet the success criteria after 3 years; or if after Year 1 or Year 2 monitoring it is the opinion of Lasell Island LLC and the chief monitor that the sod transplants will not meet the success criteria after 3 years.

Prock Marine began dredging in March of 2003. These operations were conducted outside the eelgrass bed and consisted of dredging at the mouth of the cove and along the northern edge of the dredge area. Update letters to agencies (Letters to P. Tischbein, ACE, 1/20/04 and B. Galbraith, LURC, 2/6/04) informed the agencies of the progress of the dredging activities and status of the eelgrass in the cove. A pre-dredge survey of the existing eelgrass bed was completed in 2003 as required by the mitigation plan. The site was also visited in July of 2003 to assess the condition of the eelgrass during the growing season. These surveys showed that the eelgrass bed documented in 2002 had been severely impacted in 2003. Little of the bed remained and the plants appeared stressed. The reasons for the reduction in eelgrass at the site from the original survey in May 2002 are not completely clear. However, the small areas of eelgrass left at the site were not enough to test the experimental large sod transplant technique. The decision was made to use the contingency TERFS replanting method (Transplanting Eelgrass Remotely with Frames Systems). The dredging was completed during the winter of 2003/4 (except for blasting of ledge), and the project was finished in the winter of 2004/5 (blasting). After consultation with ACE we decided to wait until all dredge activities were concluded and begin the replanting in 2005.

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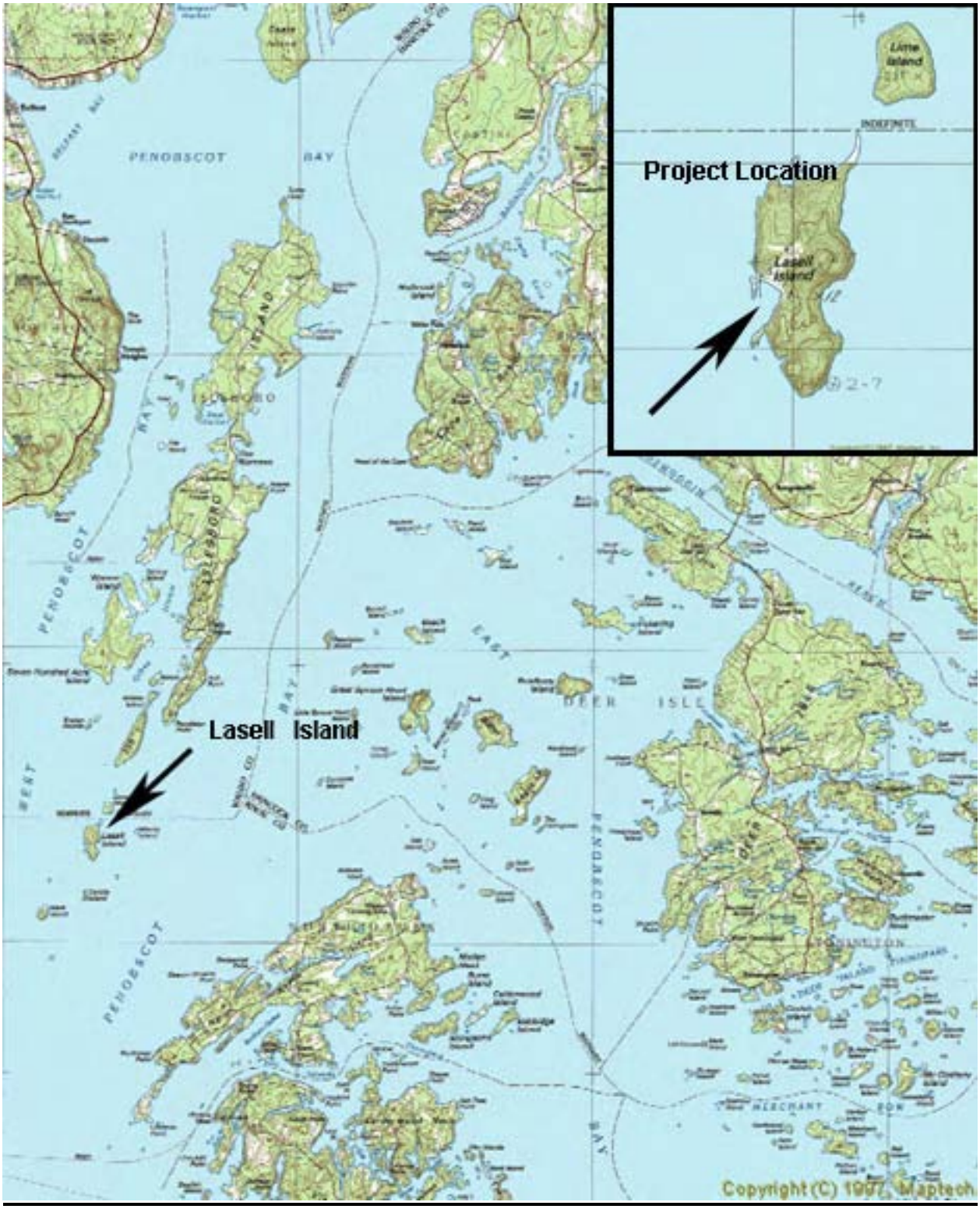

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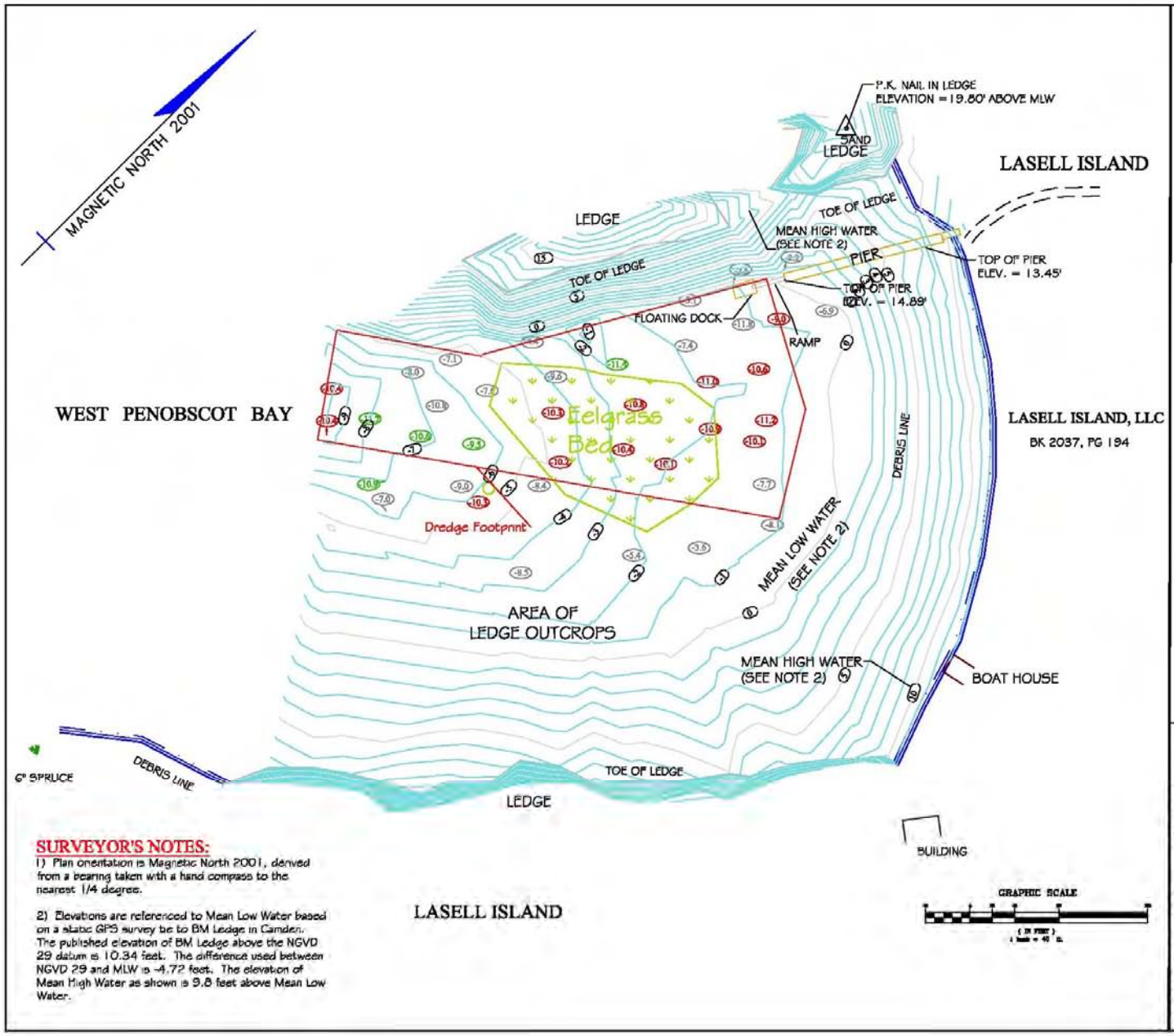

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fromCoffin Engineering Plan:
Preliminary Pre-Dredge Survey for Permit Consultants on Lasell Island

Figure 2. Final proposed dredge footprint for Lasell Island LLC, Lasell Island, Penobscot Bay, Maine. 100' fairway and turning basin.
Dredge area = 63,200sf
Dredge depth= -9'
Eelgrass impact= 18,800 sf.

2.0 REPLANTING IN 2005

Dr. Fred Short of the University of New Hampshire (UNH) consulted with Moody Mountain Environmental and was on site for plant collection and planting. Planting, done by Dr. Short, UNH graduate students and Paul C. Leeper of Moody Mountain Environmental, occurred on four days in July (July 25-29) and on three days in October (October 10-12). Divers collected individual eelgrass rhizomes by hand from the donor bed off of Lime Island (Figure 1). The rhizomes were transported to the project site and stored in seawater. The plant material was attached to the frames (Photo 1) and placed on the bottom (Photos 2).

Photo 1. Eelgrass plant material being attached to frames on Lasell Island in 2005. F. Short 7/05

Photo 2. TERFS frame with attached eelgrass on the bottom. PCL7/05

The July plantings were set within the dredge footprint. These frames were collected in October after 10 weeks and forty (40) of the frames were replanted outside of the dredge footprint. These plantings were allowed to overwinter and the frames were collected during the summer of 2006. It was felt that, because there wasn't much of the growing season left in 2005, the plants had a greater chance of success overwintering in the frames.

3.0 MONITORING

Preliminary monitoring of the July set was completed on August 25, 2005. All the frames were observed by a diver and six (6) frames (5% of the total) were chosen at random to be sampled using the stem count method. In general the plants appeared to be healthy and growing and the ties were decomposing. The counts revealed an average of 26 stems (39% of the 72 rhizomes attached) per frame (Table 1). Dr. Short (pers.comm.) stated that these results were expected and encouraging.

Table 1. Data from preliminary monitoring of TERFS transplanted eelgrass in a cove on Lasell Island, Penobscot Bay, Maine in August 2005.

Frame	# Shoots	Vigor	Bioturbation	Ties Dissolved
1	35	Good	Yes Hermit crabs	80%
2	33	Good	Yes Hermit crabs	80%
3	23	Good	Yes Hermit crabs	80%
4	20	Good	Yes Hermit crabs	80%
5	30	Good	Yes Hermit crabs	80%
6	27	Good	Yes Hermit crabs	80%

Monitoring in 2006 consisted of observation dives on the following dates:

- June 16
- August 24
- September 10

and a complete mitigation monitoring event on October 6.

During the observation dives the general health and condition of the eelgrass was judged and evidence of natural spreading and ingrowth of the plants was noted. During all visits the overall health of the eelgrass bed was judged to be good with individual plant stem condition ranged from poor to excellent (Photos 3, 4, and 5). Poor plants typically had small shoots with few blades that were damaged or short and thin. These plants had no evidence of rhizome spread.

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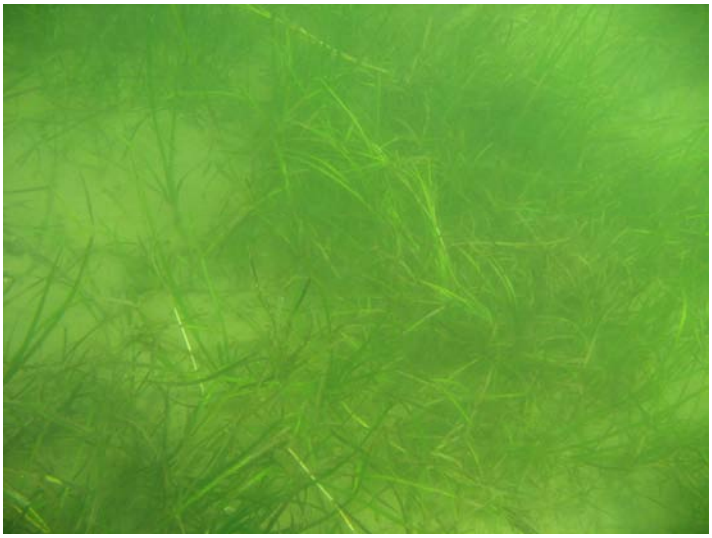
Excellent plants typically had large shoots with numerous long, healthy blades and spreading rhizomes were present.

Photo 3. Eelgrass transplanted in 2005 as it appears in June 2006 outside the dredge area in a cove on Lasell Island, Penobscot Bay, Maine. PCL 6/06

Photo 4. Example of sparse transplanted eelgrass in good condition growing within the dredge area in a cove on Lasell Island, Penobscot Bay, Maine. PCL 6/06

Photo 5. Example of dense transplanted eelgrass growing outside the dredge area in a cove on Lasell Island, Penobscot Bay, Maine. PCL 6/06



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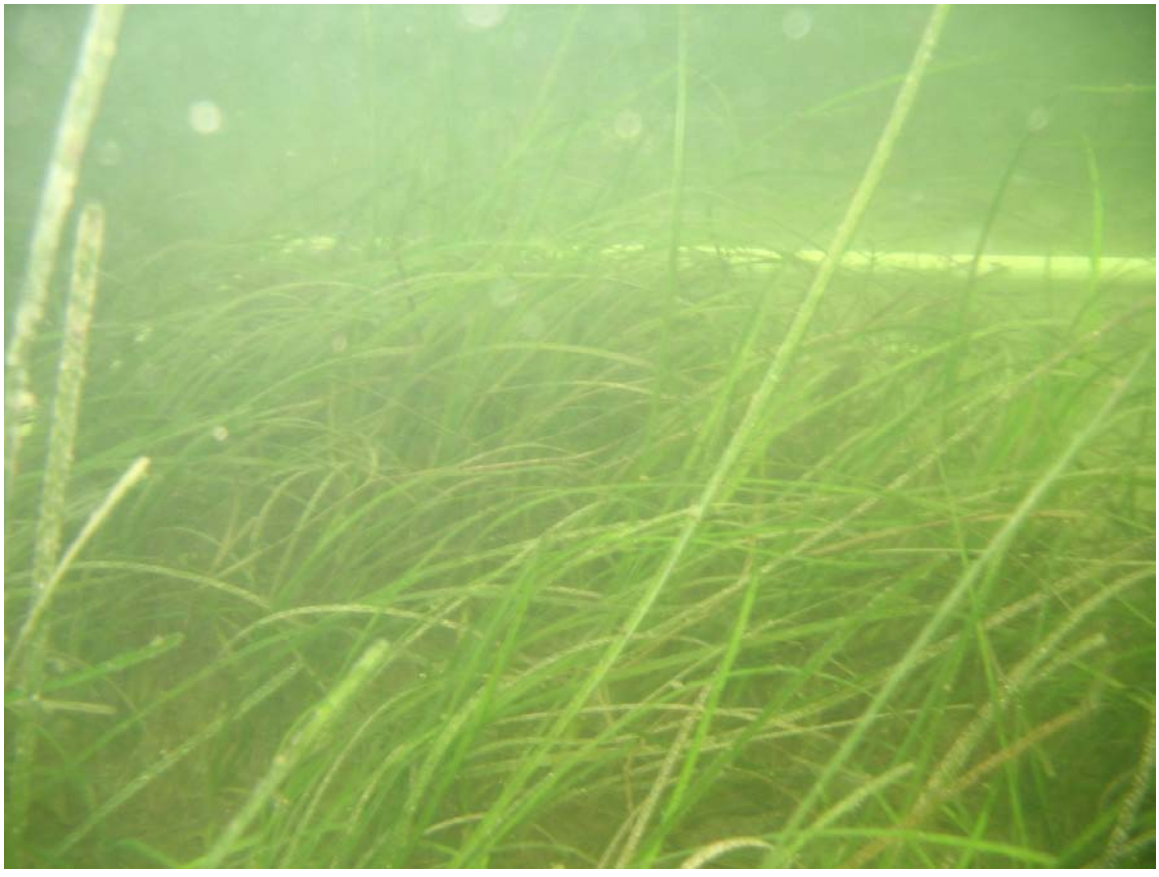
The methods for the Year 1 monitoring are described in the Mitigation Plan (Moody Mountain Environmental, 2/11/03) and are outlined below. Three (3) random transects (Figure 3) were established in the project site, the start and end points being entered into a Garmin 3006 GPS plotter. A sinking line was attached to floats and anchors and strung between transect points. A diver videotaped each transect and took additional still photographs along each transect. Eelgrass leaf cover was estimated using methods outlined in Duarte and Kirkman (2001). A $1m^2$ quadrat was used to estimate percent cover; three (3) replicates were completed at three (3) random sites along each transect for a total of 27 cover estimates. Finally the extent of the eelgrass established in the project area was estimated by observation during low tides and measuring distances to visible benchmarks (pier, rock outcrops etc.)

The results show that there is approximately 19,300sf of medium to high density eelgrass meadow in the cove (Figure 3). This meadow is primarily located on southern side of the cove although two small patches exist near the pier on the northern side. These are areas outside the dredge window where 40 transplant frames were placed and allowed to overwinter as well as along the southern edge of the dredge area (where approximately one-third of the original 120 frames were located). This calculated area does not include 2200sf of the original eelgrass that was not impacted by the dredging. The estimated leaf cover of the eelgrass meadow is between 40% and 100% (Photos 6).

Photo 6. Example of transplanted eelgrass cover approaching 100% outside of dredge area. PCL 10/06



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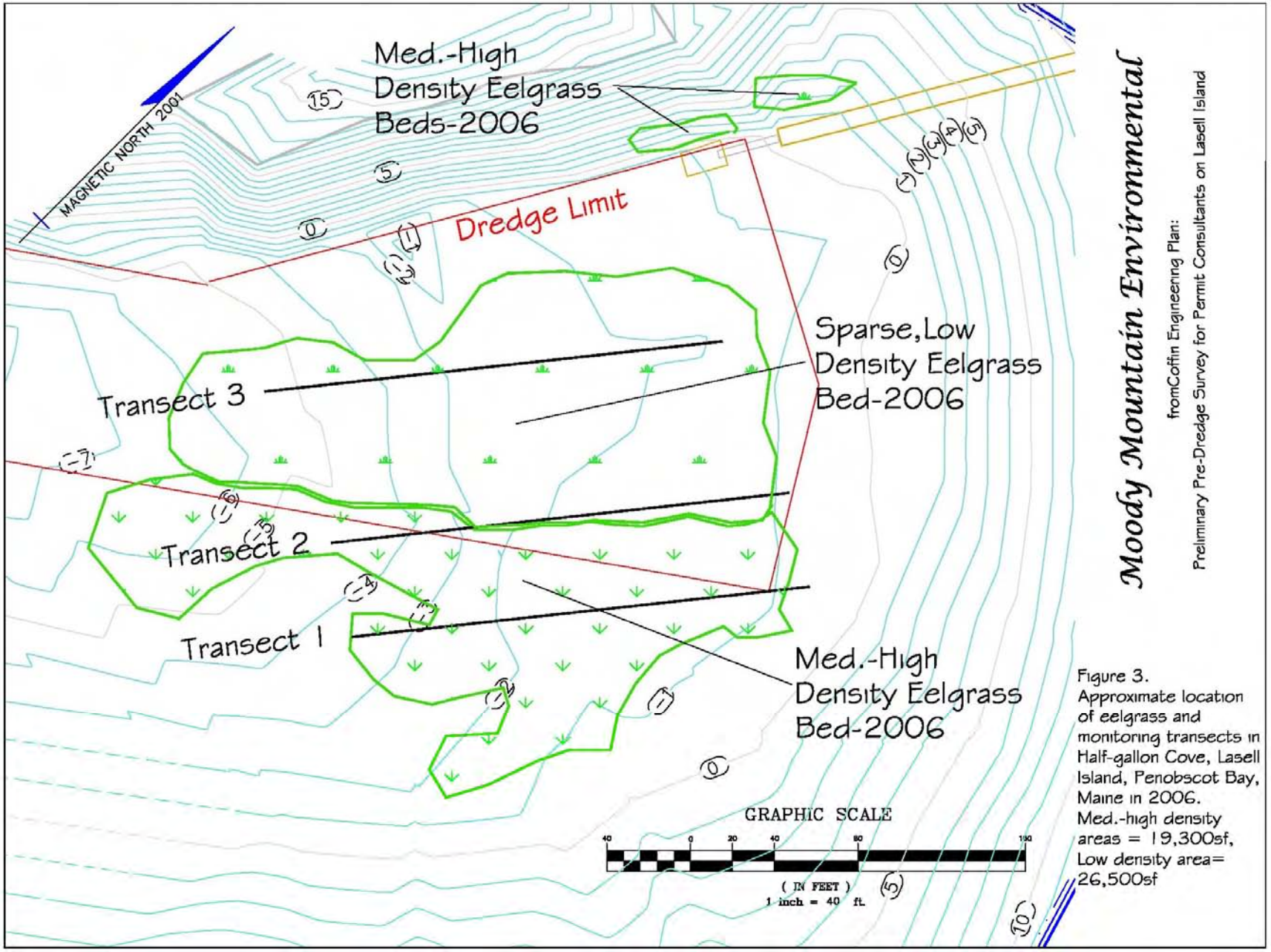

Figure 3. Approximate location of eelgrass and monitoring transects in Half-gallon Cove, Lasell Island, Penobscot Bay, Maine in 2006. Med.-high density areas = 19,300sf, Low density area= 26,500sf

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Approximately 26,500sf of the dredge footprint is also colonized with sparser density of eelgrass (Photos 7). This area has small clumps of eelgrass and individual plants. Percent leaf cover in this area was estimated between 0% and 30%. Most of the small clumps are from the TERFS plantings and the individual plants appear to be colonizing naturally. The plants appear healthy and are spreading via rhizome expansion. Table 2 shows the results of the quadrat sampling. The enclosed CD has edited video showing typical conditions along all three (3) transects.

Photo 7. Example of transplanted eelgrass cover (approx. 10%) inside the dredge area. PCL 10/06

Table 2. Percent cover along three transects in transplanted eelgrass, October 2006, Lasell Island, Penobscot Bay, Maine. Estimates within the 19,300 sf area of medium to high density eelgrass are in BOLD.

Transect-Site	Replicate 1	Replicate 2	Replicate 3	Average
1-1	10%	**90%**	**40%**	**47%**
1-2	**75%**	**90%**	**50%**	**73%**
1-3	**75%**	**100%**	**90%**	**88%**
			Average Transect 1	69%
2-1	20%	0%	0%	7%
2-2	30%	0%	0%	10%
2-3	**60%**	**80%**	**80%**	73%
			Average Transect 2	30%
3-1	0%	0%	5%	1.67%
3-2	10%	0%	5%	5.00%
3-3	5%	5%	0%	3.33%
			Average Transect 3	3%
			Overall Average	34%
			Average Med/High Density Area	75%
			Average Low Density Area	8%

DISCUSSION

The new eelgrass bed after one year comprises over 50% of the success criteria of 37,600sf. Although pre-project percent cover estimates were not possible it appears that the bed appears as dense as, or denser, than the original bed observed in 2002. The TERFS method of transplanting appears to have worked very well outside the dredge window. Over the winter the plants had rooted and spread to such an extent that it was frequently difficult to find and remove the frames. Replanting within the dredge footprint was most successful along the sideslopes in shallow water. It was less successful at full depth although both transplanted and naturally colonizing plants area established and spreading. The dredge area should continue to infill with eelgrass spreading from the transplant sites as well as eelgrass outside the dredge site.

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The reasons for the greater success outside the dredge footprint are somewhat unclear. The dredge footprint area is obviously deeper than the undredged area; and the substrate in the footprint is finer (silty clay) than the original substrate. But the dredge area is shallow enough to support eelgrass (Short pers. comm..) and eelgrass is thriving on the sides of the footprint in the finer substrate. The cove does become turbid, especially during low tide and winds and waves from the south. It may be that turbidity is shading the deeper dredge footprint area to the extent that the success of eelgrass transplants is reduced.

CONCLUSION

The transplant areas within the cove are on target for successful establishment of 37,600sf eelgrass at a comparable leaf cover. No new transplanting is planned at this time. Monitoring will continue in Year 2 (2007).

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