Massachusetts Department of Fish and Game

In-Lieu Fee Program

Marine Habitat Enhancement, Yarmouth MA Artificial Reef

Implemented by the Division of Marine Fisheries

DFG ILF Project Number: ILF4-CSTL-IL05
Army Corp Permit #: NAE - 2012 - 00311
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Submitted to:

The Massachusetts In Lieu Fee Program

Administered by the Department of Fish and Game

Dan McKiernan, Director

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Project Overview

The Massachusetts Department of Fish and Game (DFG) In-Lieu Fee Program (ILFP) funded The Division of Marine Fisheries (DMF) to enhance marine subtidal habitat in Nantucket Sound in 2019. The project proposal submitted by DMF to the DFG ILFP was finalized on March 28, 2018. DMF proposed this project to the ILFP as a pilot project to examine structured habitat enhancement projects as a cost-effective option to generate mitigation credits to address subtidal habitat impacts. The marine habitat enhancement/artificial reef site located 2.2 miles off the coast of Yarmouth in Nantucket Sound (Figure 1) was permitted in 2014 under the Corps General Permit number NAE-2012-00311. This project is expected to generate at least 0.35 acres of marine subtidal artificial reef habitat by deploying a minimum of two thousand (2000) cubic yards of materials in dispersed patches within a designated site. Funding for this project was awarded to DMF in May 2019. This report covers the first year of the project, through calendar year 2019. Due to scheduling conflicts and weather, the deployment of materials was not completed until January 16, 2020 and the follow-up side scan survey of the site to document material placement was completed on January 23, 2020. Deployment documentation and side scan survey results are included in this report. Project monitoring will continue for five years and be included in subsequent annual project reports, to end in 2024.

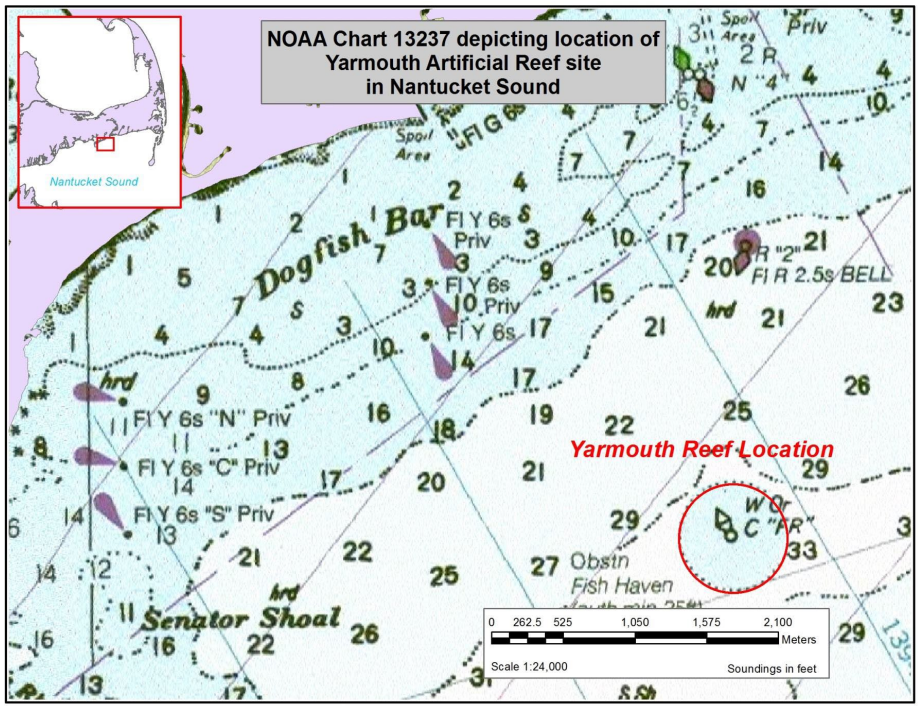

Figure 1. Location of Permitted Artificial Reef.

Methods

Securing a Qualified Contractor

On August 30, 2019 DMF initiated a sealed bid Request for Response (RFR) through the Commonwealth's COMM Buys procurement system requesting qualified contractors to perform all necessary services to procure and deploy a minimum of 2000 cubic yards of approved artificial materials to a designated area within the licensed Yarmouth reef site (Appendix A). Two bids were received by the September 27 deadline (Appendix B). Robert B. Our Co. produced the lowest bid at $246,277.00.

Budget Amendment

The awarded low bid proposal exceeded the proposed project budget by $66,277. To address this difference, some budget funds were reallocated to allow for more of the total project funding to go towards the deployment cost. Line item budget adjustments are included in red in the Calendar Year (CY)

2019 budget update (Table 1). Additionally, on October 21, 2019, DMF submitted an adaptive management measure request to DFG's ILFP for an additional $50,000 for the project. Following review of the budget modification by the U.S. Army Corps of Engineers (Corps) and Inter-Agency Review Team (IRT), the additional $50,000 in ILF funding was approved as reflected in the amended Accounting and Reporting Procedures and Requirements for the project established by DFG on December 19, 2019 (Appendix C).

Contract Management

A signed contract from Robert B. Our Co. was received on November 6, 2019 (Appendix D). From November 7 through December 13, Robert B. Our Co. transported thirty-two truckloads of granite block totaling 890 tons (390 cubic yards) and one hundred-sixteen loads of precast concrete structure totaling 280 tons (1700 cubic yards) from Cape Cod over land to the Taunton River in Mount Hope Bay, Fall River for barge loading at a marine terminal. In total, more than 2100 cubic yards of material totaling 1169 tons were procured for reefing (Appendix E). The volume of materials required three full barge deliveries to the reef site.

Material Deployments

The first material deployment occurred on January 6, 2020 from a single barge. The DMF RV Alosa was on-site prior to deployment to confirm deployment location with the contractor and to ensure the project remained in compliance with all permit conditions. Once on-site, the contractor deployed an anchor and mooring from the barge to maintain position on site during deployment (Figure 2). The mooring remained on-site for use during subsequent deployments. Two additional barge loads were deployed concurrently on January 14, 2020 completing all material deployments for the project.

Figure 2. Material Deployment on January 6, 2020.

Side Scan Sonar Surveys

A pre-deployment side scan survey was completed on November 5, 2019. A post-deployment side scan survey was completed on January 23, 2020, nine days after all materials were deployed. Data from pre and post-deployment side scan surveys were analyzed for the project's performance and design and construction metrics (Figure 3). Forty percent of the project's mitigation credits are based on the

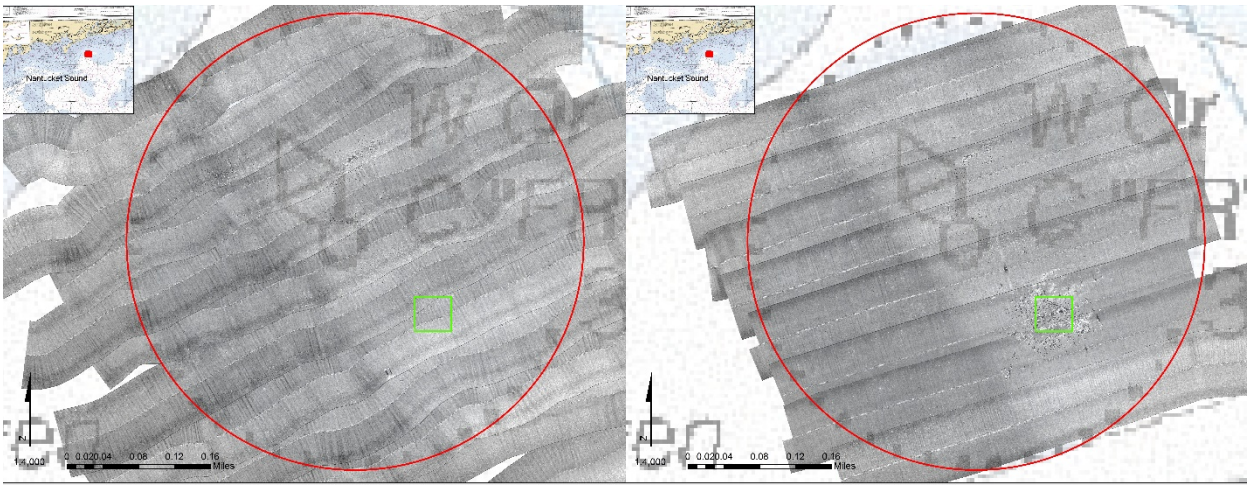

Figure 3. Pre (left) and post (right) side scan survey images. Green box outlines proposed ILF reef area.

successful location and placement of materials as described by side scan survey results before and after deployment. An additional ten percent of design and construction credits will be awarded after if a five-year side scan sonar survey demonstrates that materials have remained in place. Additional detail of the methods, results, and findings from side scan surveys conducted for this project can be found in the 2020 Side Scan Sonar Survey Report (Appendix F).

Monitoring

Monitoring to measure ecological performance standards is scheduled to commence in the spring of 2020 in accordance with the proposed monitoring schedule (Table 2).

Results

Three deployments consisting of 2210 cubic yards of materials were successfully positioned on the Yarmouth artificial reef site on January 6 and January 14, 2020 at a cost of $246,277.

Digitization of post-deployment survey imagery identified 512 features (greater than 1 ft^2 in size) within the 1.1-acre proposed ILF site totaling 14,426 ft^2 (0.33 acres). The full footprint of materials deployed, including all features within and outside the 1.1-acre proposed site, totaled 1,292 features, covering 30,838 ft^2 (0.71 acres) in area. The size of individual mapped polygons ranged from 1 to 2,009 ft^2, averaging 28 ft^2. The quantity of materials identified in the pre-deployment survey within the proposed (27 features totaling 87 ft^2 (0.002 acres) and actual (121 features totaling 484 ft^2 (0.011 acres) deployment areas were subtracted from post-deployment data to calculate the total area of new structure to determine project credits, resulting in adjusted amounts of 14,339 ft^2 (0.33 acres) of new structure area within the ILF proposed footprint and 30,354 ft^2 (0.7 acres) of total actual area covered by deployed materials.

Material distribution was proposed as a 2:1 ratio of undisturbed area to new structure at the project location. Acreage of deployed structure (0.33) to undisturbed area (0.77) within the proposed site achieved a ratio of 2.2:1. Deployments outside the proposed area occurred in all directions surrounding the proposed location and exhibited similar structural patch densities. Additional detail from the side scan survey results is included in Appendix F.

Bottom elevation analysis of track data clearly depict a change in elevation resulting from deployment. Analysis of the post-deployment bottom elevation range across the deployment area exhibited a change

of 3.24 feet, closely approximating the proposed 3.5 ft. height off bottom projected for material deployments. This is consistent with previous reef deployments of similar materials into Nantucket Sound (i.e. 2016 Harwich Reef deployment) and is within the preferred habitat elevation range of targeted species such as black sea bass, tautog, and scup.

CY2019 Budget Update (through January 31, 2020)

In calendar year 2019 and through January 31, 2020, the ILF Yarmouth reef project expended a total of $252,294 of the $275,097 total project budget (92% of project funding). Payment for material deployment ($246,277) represents 98% of all project expenses to date. Table 1 provides a breakdown of the expenses from CY2019 compared to the approved 5-year budget. The total cumulative charges include a final $55,277 payment to the contractor upon deployment completion in January 2020, under CY2020 expenses. The remaining balance for the project is $22,804. A line item adjustment category has been added to Table 1 to include estimated adjustments needed over the duration of the project to keep the project within the proposed budget. DMF may need to utilize other internal funding sources to address potential shortfalls in the project budget to ensure that it remains on track through project completion in 2024.

Table 1. Budget summary table.

Line Item	Approved 5-Year Budget	Additional Approved funding	CY2019 Expenses	CY 2020 Expenses (through 1/31/20)	Cumulative Charges	Remaining Balance	Line Item Budget Adjustments
SCUBA air tank fills	$2,160	$0	$800	$0	$800	$1,360	
Field Supplies for monitoring	$3,500	$0	$0	$0	$0	$3,500	($1,000)
Boat fuel and maintenance	$10,500	$0	$961	$82	$1,043	$9,457	($5,277)
Gear maintenance	$5,000	$0	$0	$0	$0	$5,000	($1,500)
Monitoring supplies	$11,000	$0	$4,173	$0	$4,173	$6,827	($4,000)
Vehicle travel and lodging	$2,750	$0	$0	$0	$0	$2,750	($1,500)
Material Deployment Contract	$180,000	$50,000	$191,000	$55,277	$246,277	($16,277)	
Dive pay	$10,187	$0	$0	$0	$0	$10,187	($3,000)
Total	$225,097	$50,000	$196,934	$55,359	$252,294	$22,804	($16,277)

Requirements/Performance Standards

The project's objective is to enhance subtidal hard bottom habitat in Nantucket Sound (ILF South Coastal Service Area). DMF proposed to create 0.35 acres of structured bottom habitat on 1.1 acre of ocean bottom using a minimum of 2000 cubic yards (54,000 ft^3) of material deployed to the permitted Yarmouth reef site. A secondary purpose of this project is to determine if structured habitat enhancement (i.e. artificial reefs) are a viable option for generating mitigation credits for permitted impacts to subtidal habitats.

Success Criteria (performance standards):

Design and construction performance metrics for this project define success as materials deployed to the site as specified in the design, with 40% of the design and construction credits released upon the completion of a post-construction side scan survey (Table 2). Material deployments enhanced 14,339 ft^2 (0.33 acres) of structured habitat within the proposed area and an additional 16,015 ft^2 (0.37 acres) of habitat outside the proposed project location. In total, the project enhanced 30,354 ft2 (0.70 acres) of structured habitat within the permitted area.

Summary and Conclusions

MA DMF has completed the first year of the ILF Yarmouth Artificial Reef Habitat Enhancement Project. More than 2000 cubic yards of granite and repurposed concrete material were deployed to the permitted reef site, enhancing approximately 2.1 acres of marine subtidal habitat through placement of 0.70 acres of subtidal structured habitat; 0.33 acres of subtidal structured bottom habitat within the proposed footprint and an additional 0.37 acres of habitat outside the proposed footprint. Material deployments within the proposed site enhanced subtidal habitat without exceeding a 2:1 ratio of open space to structure. An additional 0.37 acres of structured habitat outside the proposed site was also enhanced, extending out from the proposed site in all directions and in similar configurations. All materials remained within the permitted artificial reef site. A total of 0.70 acres of structured habitat enhancement is being submitted for consideration for calculating project credits. The goals of the project were to enhance 1.1 acres of subtidal habitat through placement of 0.35 acres of structure with potential credits of 0.366 (using multiplier of 1:3). The actual deployment will enhance a larger area of marine subtidal habitat than originally proposed (see Table 2).

No supplemental deployments are expected for this project. Planned monitoring for ecological performance is expected to begin in the spring of 2020; however, this monitoring may be delayed due to fieldwork restrictions enacted due to the COVID-19 pandemic. Monitoring will become a priority once restrictions are lifted.

Lessons Learned

Future consideration of artificial reef habitat enhancement projects to mitigate for permitted impacts to subtidal habitats should consider the following lessons learned from this pilot project.

- Over-land transportation of materials represents a considerable project expense.

- Estimating project costs should be based on the weight of the materials and not volume. One cubic yard of granite weighs 10 times more than a cubic yard of repurposed concrete and is considerably more costly to move.
- Future efforts involving the comparison of pre- and post-deployment survey tracks would benefit from using the same survey vessel and using autopilot for navigation to standardize data collection.
- Broadcast dispersal of materials off a barge is an effective and efficient method for enhancing structured habitat in patches as proposed in this project.
- An established buffer zone both around the proposed deployment site and within the permitted site is an effective strategy for ensuring deployed materials remain within the permitted area when utilizing a broadcast dispersal deployment method.
- The size of the equipment to be used for material deployments needs to be factored into the selection of the size of the project area. In this case, one barge (40 ft x 120 ft) and tug (20 ft x 70 ft) occupied a substantial amount of the area over the proposed site. Equipment size was responsible for the dispersion of materials over a larger area than anticipated.
- Delays are inevitable. Equipment availability and weather were the primary factors in delaying the proposed deployment date by over five weeks. Extended delays can potentially impact project authorization timelines or TOY permit restrictions and should be expected when planning the project.
- Site markers placed on the corners of the proposed deployment area can move over time. On the date of deployment one marker was missing from the site and another marker had moved several meters off station. On-site verification of location on deployment day between the proponent and the contractor is critical to ensure appropriate placement of materials on location

Acknowledgements

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Table 2. Goals, Performance Standards, Metrics and Mitigation Credit Release Schedule

Type of mitigation	**Project Area**[1]		**Enhanced Habitat Area**[1]		**Potential Credits**[1]
Artificial Reef Habitat	2.1 acres		Reef structure – 0.7 acres Undisturbed sandy bottom – 1.4 acres Total enhanced area = 2.1 acres		0.70 wetland credits [*multiplier 1:3 for 2.1 acres of enhanced marine subtidal habitat]* Proposed 2020 credit release = 0.28 (40%)
Performance Standards & metrics	**% total Credit**	**Credit amount**		**Timeline -credit release**	**Comments**
Design & Construction Parameters:	**50%**	**0.35**			Designed to maximize its potential to function effectively as sub-tidal structured habitat
Materials deployed to site as specified in design	40%	0.28	2019 / 2020	Post-construction 0.7 *0.4 = 0.28	Upon completion of post-construction (year 0) side scan sonar survey
Material remains within proposed site and remains stable in accordance with permit conditions	10%	0.07	2024	Post 5-year monitoring report	Upon completion of 5-year side scan sonar survey
Monitoring: Conducted as per monitoring plan					**Submitted annually**
Ecological Performance: Diversity	**25%**	**0.175**			Monitoring results show evidence of similarity of species diversity
Species diversity – mobile species	12.5%	0.0875	2020-2024	Percent similarity exceeds 60% in two monitoring periods	The resident mobile species assemblage on the reef shall have species richness similar to natural reefs within the region
Species diversity – sessile species	12.5%	0.0875	2020-2024	Percent similarity exceeds 60% in two monitoring periods	The resident sessile species assemblage on the reef shall have species richness similar to natural reefs within the region
Ecological Performance: Production	**25%**	**0.175**			Monitoring results show evidence of multiple size classes of predator and prey species
Size/age class similarity of mobile species – upper-level consumers	12.5%	0.0875	2020-2024	Percent similarity exceeds 60% in two monitoring periods	Mobile species size class distribution on the artificial reef shall be similar to natural reefs within the region
Size/age class similarity of sessile species – benthic community/ lower level producers	12.5%	0.0875	2020-2024	Percent similarity exceeds 60% in two monitoring periods	The relative abundance of the top 10 sessile species on the artificial reef shall be similar to the top 10 sessile species on natural reefs within the region
Total Credit Potential	**100%**	**0.70**		**2020-2024**	**Wetlands Mitigation Credits**

[1] The project proposal and mitigation plan estimated a lower potential credit of 0.366 based on a mitigation multiplier of 1:3 for a 1.1 acre enhanced habitat area (0.35 acres of reef structure, 0.75 acres open sandy bottom). The actual deployment resulted in enhancing a larger habitat area with 0.7 acres of structure placed in a configuration consistent with the project design criteria. Proposed credits account for the footprint of material as it was deployed and a total enhanced habitat area of 2.1 acres.