

**Northeastern University
Proposed Marine Science Center Expansion
Response to Questions from 12/11/18 Board of Selectmen Meeting**

We have received a detailed list of questions about the proposed expansion to the Marine Science Center. The below responses seek to clarify information that may have been misinterpreted or misunderstood.

Because the project remains at an early concept stage, some details will not be available until the design is finalized. However, as the size of the project is a focus of inquiry, and the size of the expansion is directly related to the work that we propose on site, the response below is focused on factors driving the size of the proposed additional square footage.

1. Who will be working in the new space why do they need 55,000 to 60,000 sq. ft.?

Personnel Type	Existing	Existing + Proposed*
Faculty (PI)	20	40
Postdocs	11	22
Technicians/Staff	15	30
PhD Students	38	76
Three Seas Program	20	40
Undergraduate Interns	10	20
*Assumes 4.7 FTE per PI	114	228

The Institute would focus its research efforts on three main themes: (1) Global Change Science and Modeling, (2) Security and Sustainability of Coastal Resources, and (3) Environmental Sensing. Faculty will collaborate on a variety of topics ranging from greener shoreline protection strategies and habitat restoration to the genomic signatures of climate change and their impacts on ecologically and commercially important species. This work will take place in 5 research disciplines: (1) Genomics, (2) Ecology and Evolution, (3) Environmental Science, (4) Biogeochemistry and Environmental Chemistry, and (5) Computation.

The table below summarizes net assigned square footage (NASF) for research AND office space for each proposed scheme. Also shown is the NASF (research + office) per new FTE. We use an FTE value of 114 even though new Core Facilities will support all (existing + new) FTE researchers.

	Net Assigned Square Footage		
MURPHY BUNKER ADDITION	SCHEME A	SCHEME B	SCHEME C
Research	22,990	20,130	17,470
	Net NSF per FTE (N = 114)		
	SCHEME A	SCHEME B	SCHEME C
	201.67	176.58	153.25
EDWARDS ADDITION	SCHEME A	SCHEME B	SCHEME C
Research	-	-	3,740
	Net NSF per FTE (N = 114)		
	SCHEME A	SCHEME B	SCHEME C
	-	-	33
GRAND Total Research NSF	22,990	20,130	21,210
Grand Total Research NSF/FTE	201.67	176.58	186.05

What is the difference between "wet" and "dry" labs?

There has been some confusion regarding what "wet" means in terms of research space. First, one can define biogeochemistry, genomics, and environmental chemistry as "wet" bench work even though seawater is not being delivered to the area. Second, "wet" can refer to active use of seawater in research or teaching labs. We consider biogeochemistry, genomics, and environmental chemistry as "wet" bench work along with the seawater research labs.

What is the expected student population and space needed?

Our proposed student population will comprise 76 PhD students and 40 Masters/undergraduate students. Presently, we have two classrooms (one in Murphy Bunker and one in the trailers) and one small meeting room. We presently have no formal teaching labs. We do the best that we can by leveraging faculty research labs and sea tables to support activities that would be much better served by teaching labs. Our proposed program would result in three classrooms (one that currently exists in Murphy Bunker, and two additional classrooms, the location of which depends on the selected Scheme). Our estimates on square footage per student for teaching assume 116 students. Our estimates for meeting rooms assume a population of 114 added to the 114 already working at the campus.

In general, we expect our courses to cover existing topics (e.g., experimental design and statistics, marine invertebrate zoology and botany, oceanography) and new topics (e.g., biogeochemistry, fisheries science, ecological and evolutionary genomics, coastal dynamics).

The table below summarizes NASF and NASF per FTE for teaching and meeting space. Our calculations assume 116 personnel for teaching and 114 personnel for meetings.

	Net Assigned Square Footage		
MURPHY BUNKER ADDITION	SCHEME A	SCHEME B	SCHEME C
Classrooms	-	1,600	-
Teaching Labs	2,820	2,820	1,560
Meeting Rooms	3,280	1,810	1,810
TOTAL	6,100	6,230	3,370
	Net NSF per FTE		
	SCHEME A	SCHEME B	SCHEME C
	53.08	53.98	29.33
EDWARDS ADDITION	SCHEME A	SCHEME B	SCHEME C
Classrooms	-	-	1,600
Teaching Labs	-	-	1,560
Meeting Rooms	-	-	-
TOTAL	-	-	3,160
	Net NSF per FTE		
	SCHEME A	SCHEME B	SCHEME C
	-	-	27.72
GRAND Total Teaching NASF	6,100	6,230	6,530
Grand Total Teaching NASF/FTE	53.08	53.98	57.04

How many would be seated classroom style, would any be labs, and what kind of labs? What is the ft² per student in class?

As described above, two new lecture style classrooms are proposed, each designed to serve 20-25 students. The seawater teaching lab and the general use teaching lab are also designed to serve 20-25 students.

Please also account for the stated FAQ number of 20 faculty currently; on the Marine and Environmental Science webpage for NU we could see only 11 tenured/tenure track, 1 research faculty, and 2 part time lecturers.

The faculty working at the Marine Science Center are not solely from Marine and Environmental Sciences (several are also from Civil and Environmental Engineering). Web pages are undergoing revision and should not be used as an indicator of who is actually working at the MSC.

How is the current space used?

Murphy Bunker has 31,083 GSF and 13,202 NASF. The table below summarizes NASF for appropriate categories and NASF/FTE. In all cases existing FTE is 114 except for Grad Student/Postdoc seating in trailer, where existing FTE = 49. In all calculations, lab space and office space in support of research are summed together. We view the greenhouse (NASF = 1,445) as a special research resource and do not calculate NASF/FTE.

EXISTING FACILITIES	Murphy Bunker		Edwards Building		Trailers	
	NSF	per FTE	NSF	per FTE	NSF	per FTE
Research	6,776	59.44	8,563	75.11	1,714	34.98
Teaching and Meeting	1,945	17.06	222	1.95	796	6.98
Admin and Support	-	-	695	6.10	-	-
Storage	4,481	39.31	200	1.75	-	-
TOTAL	13,202	115.81	9,680	84.91	2,510	41.96

What is the expected difference between peak population and average daily population?

A peak day would translate to 228 people. It is more difficult to determine an average day. Our current peak population is 114 people. On average, 20-30 people use the MSC shuttle per day, so we estimate our average daily current population to be 60 to 70 people. The proposed doubling of our program suggests that 120 to 140 people would be present on an average day.

What about a cafeteria? Auditorium? Conference Center?

There will be no café or food retail space of any kind. We have programmed two small kitchenettes, as is typical for these facilities. There is no auditorium planned. Scheme A does have flexible classroom space with movable partitions creating a flex classroom / meeting space for approximately 50 people. We are not planning a conference center for our Nahant campus. By “convening experts,” we do not mean doing so under the mantle of a conference as implied above. Any conference style activities would take place on the Boston campus, which was the case when we held our Urban Coastal Sustainability Conference in 2012.

Do current MSC tenure/tenure track faculty teach only on Nahant or do they also teach elsewhere?

Professors do the majority of their teaching on the Boston Campus.

Why is a uniform 1300 ft² per faculty used?

This is not a uniform calculation. Please see personnel and program breakdowns above.

What are anticipated traffic and parking impacts?

The initial traffic study was undertaken in early November 2018 during perceived normalized traffic patterns. This was done so summer beach traffic would not dilute the percentage of traffic ultimately destined for the Marine Science Center. Northeastern has agreed to work with the Town to perform two additional studies in the spring and summer to further develop these assessments.

As currently calculated, the traffic entering the Marine Science Center gate represents only 2% of the traffic arriving or departing Nahant at the causeway. We anticipate that this number will be smaller during the spring and summer studies. Northeastern would like to reduce the available parking on site as much as possible. We are willing to consider alternative solutions such as shuttles from the Boston Campus or offsite parking facilities such as the Wonderland Station lots to further reduce required parking on site. No parking structure is being considered.

The evolution of the Urban Coastal Sustainability Initiative

The evolution of the Urban Coastal Sustainability Initiative, launched in 2012, into the Coastal Sustainability Institute has been a long and complex process. Until formal planning for a new research facility began in January 2017, much of our efforts were driven by internal factors that had to be resolved before formal discussions began with the Town. This being said, several general conversations with former Town Manager Jeff Chelgren took place, including Geoff Trussell and John Tobin attending the October 4, 2016 Board of Selectmen's Meeting. COS Dean Murray Gibson and Director Geoff Trussell also met with Susan Solomon to discuss our goals on June 27, 2013. At that time, she did not raise the community concerns outlined in this document. At that time, our thinking was still very much in the conceptual phase but we did discuss adding to our research infrastructure in Nahant to support the initiative.

MSC and university researchers collaborate with a variety of scientists and researchers who are not based at the Boston or Nahant campuses. These kinds of collaborations occur without the need to be "place-based." The Nahant campus operates on a different premise than the Burlington campus, which is focused on national security, defense, homeland security, and resilience research that is meant to be co-located and collaborative with government and industry partners. Any comparison between Burlington and Nahant is inapt.

Why has NU MSC not removed obsolete piping to prevent ongoing industrial pollution of our local environment? If it is not obsolete, why has NU apparently doubled up the use of the pipes?

What is the status of existing and proposed seawater pipes at the campus?

The new pipes were installed as part of the 2012 upgrade and the original pipes were meant to provide a backup system during routine maintenance on the new pipes. Unfortunately, the old pipes soon became inoperable in part because of excessive biofouling and have been dormant for quite some time. None of the pipes have delivered or are delivering “industrial pollution.” A permit is required to remove the old pipes and our intent is to perform this operation when installation of the proposed new system occurs.

In the Payette plans, how much of the building is on top of as opposed to nestled below ground against the existing bunker?

Scheme A: 33,000 GSF above bunker (East) – 27,000 GSF partially buried (East)

Scheme B: 37,000 GSF above bunker (17,650 on East and 19,350 on West) – 18,000 fully buried (East)

Scheme C: 28,650 GSF above bunker (17,650 on East and 11,000 on West) – 15,300 fully buried

13,000 GSF New Building behind Edwards

How will the goals for screening and removal of invasive species be accomplished?

Selection of appropriate plant species will be based on the landscape architect’s considerable experience with coastal environments. New plantings will be specified of sufficient maturity to endure environmental conditions. Consideration will be made as to the time of year of initial planting to permit sufficient growth prior to harsh winter conditions. Plantings which fail to take hold or die after initial planting will be removed and replaced as part of a broader invasive species management plan. Species selection must also promote meaningful site restoration and enhance wildlife habitat that will serve to increase species diversity on-site.

What has been the basis for ecological analysis of the site?

The purpose of the ecological analysis of the project area has been undertaken to document existing vegetation communities, habitat cover types, wildlife habitat features, and wildlife habitat utilization. We plan to continue to gather information and listen to the public to aid in a project design and development that avoids, minimizes, and mitigates potential impacts to wildlife and wildlife habitat. The project will implement Best Management Practices during construction which will include consideration of scheduling of certain site activities during known nesting seasons. Compliance with all Environmental Permits during construction will require continued monitoring of work occurring nearby wetlands and coastal zones mitigating impact to wildlife within those protected areas.

How might Northeastern and Nahant strengthen a mutually beneficial partnership as part of this building project?

We would like to work with the Selectmen and the Town to ensure the project's implementation mitigates project impacts and the end result is a project and program shared with the Town.

How will the project mitigate and improve marine conditions for lobstermen?

Various regulatory agencies – such as the Division of Marine Fisheries, the Environmental Protection Agency, and the Department of Environmental Protection have determined that our current and proposed system are negligible in terms of temperature and habitat effects. This conclusion is also supported by a 35+ year long-term monitoring study of benthic habitats inside and outside of Shag Rocks that delineate the southern end of Bathing Beach Cove.

We have proposed to collaborate with local lobstermen to establish and operate a lobster hatchery. Our intent is to operate the hatchery indefinitely and to forge a strong partnership with local lobstermen, as is the case for researchers and fishers in Maine. The costs of constructing the hatchery would be supported by the project and annual operation would be supported by the Institute's operating budget. We are grateful to the lobstermen that have raised many important issues (e.g., the potential thermal effects of our discharge system) and the data we have collected since March 2018 indicate reveal that thermal impacts are negligible.

Why build on the Bunker instead of just around Edwards?

As noted in the December 11th presentation, the Edwards building is not structurally capable of accommodating additional floors and site constraints do not allow for meeting the full program on that part of the site. In fact, the option including Edwards (Scheme C) uses the greatest amount of land area of all of the options.

NU states that the seawater temperature was monitored at the outflow and elsewhere, and determined that there was no effect on the surrounding water temperature. Were those measurements taken in winter or summer, and does the season matter? When and in what form will the measurements be made publicly available?

Measurements were taken continuously from March to December 2018 at various locations requested by the regulatory agencies. NU plans on including these data in the Notice of Intent.

If baby lobsters are being killed (macerated per G. Trussell) by the seawater system at present, as NU stated, what else is being affected? Has the habitat been altered in such a way that the added baby lobsters would not survive long enough to grow to harvestable size? What about the impact of other creatures in the ecosystem? How does the idea of replacing killed lobsters with lab-grown ones mesh with the ideals of a coastal sustainability institute in your view?

Various regulatory agencies – such as the Division of Marine Fisheries, the Environmental Protection Agency, and the Department of Environmental Protection have determined that the effects of our proposed system are negligible in terms of temperature and habitat effects. Our initial calculations of lobsters ultimately lost from the system was based on a flow rate of 2,400 gallons per minutes and a value of 43.7 larvae per 1,000 m³ of seawater (the highest value we

could find in the literature). This translates into 102,927 larvae lost per year. Estimated survival of lobsters from egg to market size is between .004 to .02%, suggesting that a loss of 102,927 larvae would result in a loss of, at most, 21 market sized lobsters after the 5-8 year growth interval. Our revised intake rate of 600 gallons per minute would translate into 25,732 lobster larvae, or 5 market sized lobsters, being lost from the system. Our proposal to build a hatchery that produces 90,000 Stage IV larvae that have a survival rate of ~.05% would translate into 45 market sized lobsters being added to the system per year. We see this solution as significant enhancement to the fishery that, when coupled with the positive environmental implications of our research activities, is consistent with our sustainability mission.

How many square feet would a hatchery require? Where would it be and what would it look like?

We have not finalized design of the hatchery but do not expect it to require more than 500 square feet. It would be housed within the existing south gunport of Murphy Bunker.

What is the town's assurance that promises made to the town about the project would be binding and not change? And would you also provide a binding assurance that you would attempt no further building?

We would be willing to discuss restrictions (beyond the contemplated additions) that would limit further construction to improvements or replacements for buildings and structures that are already established.

Coastal communities face numerous threats posed by extreme weather and sea level rise, collapsing fisheries, invasive species, and coastal pollution. The mission of the Coastal Sustainability Institute is to create new knowledge and develop innovative solutions that promote cleaner, safer and smarter coastal communities. Together, the Marine Science Center and Nahant are on the front line of these threats, creating a compelling opportunity to effectively leverage the interdisciplinary expertise of scientists, engineers and policy makers to solve these major challenges now and in the future. We believe that Nahant's location at the epicenter of these challenges and Northeastern's commitment to use-inspired research will create a legacy of knowledge that benefits coastal communities here and around the world.