

Benthic mat pilot project for Forge Pond -- Littleton sites					
	Site address	93 Matawanakee Trail	59 Matawanakee Trail	1 Chipmunk Lane	49 Matawanakee Trail
	Participants	Phil Souza and Susan Paul-Souza	Steve and Becky Hadden	Michael and Suzie Livingston	Dave and Patty Barr
Installation					
	Date of installation	6/8/2022	6/14/2022	7/9/2022	7/18/2022
	Benthic mat material	Burlap (plan to leave in place) and relocate at 6-8 weeks	Burlap (plan to leave in place)	Burlap (plan to leave in place)	Single polyethylene tarp
	Benthic mat size	592 sq ft	592 sq ft	592 sq ft	320 sq ft (40 ft x 8 ft)
	Benthic mat length (parallel to shore)	37 ft	37 ft	37 ft	8 ft
	Benthic mat length (perpendicular to shore)	16 ft	16 ft	16 ft	40 ft
	Sketch provided?	Yes	Yes	Yes. As pictured in the sketch, the mat is on the west side of the dock, our boat is always moored to the east side of the dock.	Yes
	Anchor mechanism	25 burlap bags ("sandbags") filled with 17 pounds of ½-inch washed pea gravel, placed around the edges and over the mat area about every 6 or 7 feet.	25 burlap bags ("sandbags") filled with 17 pounds of ½-inch washed pea gravel, placed around the edges and over the mat area about every 6 or 7 feet.	Burlap bags ("sandbags"), each half-filled with ½-inch washed stone, secured to the edges of the mat area with jute twine about every 4 or 5 feet.	20 sandbags made of woven polypropylene, each containing 10 lb of sand. Sandbags were placed every 5 ft along the edges of the tarp and were roped together to make sure they could all be recovered when the mat is removed.
	Lake bottom	Muddy with some rock. No obstructions.	Muddy. No obstructions.	Gentle grade/slope; mostly sandy/silty/gravel bottom; no obstructions	Gentle grade/slope; muddy; no obstructions
	Water depth -- shallowest	3 ft	4 ft	2 - 3 ft	4 ft
	Water depth -- deepest	7 ft	7 ft	5 - 6 ft	6 ft

	Plants present at time of installation	Milfoil, fanwort	Celery grass, variable milfoil, and other plants. See photos	Celery grass, variable milfoil, and other plants. See photos provided.	Fanwort, coontail, variable pondweed, wild celery.
	Density of plant growth (light, moderate, dense)	Moderate	Moderate	Moderate	Dense
	Installation procedures used	Mat placed about 10' from shore and unrolled completely into the lake (16') for a distance of approximately 26' from shore. Stone in burlap sand bags (each 15-18 pounds) placed on the mat at intervals of 7-8' to secure the mat to the lake bottom. Marker buoys anchored by concrete blocks placed at the two deeper corners of the mat.	We stitched bags of stone to the two outer corners before going in the water with the mat. To each of those corners we attached a 15-foot length of sturdy jute twine. Once unrolled in the water, the giant burlap sheet was hard to control. We positioned the two near-shore corners and placed stone bags along that edge. We pulled the sheet out flat by backing into deeper water on a paddleboard while pulling on the 15-foot twines. Marker buoys are tied to the two twines.	Installation was comparatively straightforward. Three lengths of burlap were stitched together along their long edges to create the 37 x 16 foot mat. "Ties" made from jute twine were added at regular intervals at the corners and along the edges where the stone bags were to be attached. The mat was brought into the water and bags were secured to the deep-water corners and placed. The shallow water corners then had bags attached and the mat was stretched toward shore. Then, bags were attached at each tie location starting in deeper water, and the mat pulled taught progressively until the shallow edge of the mat was secured. The installation was accomplished by two people with relative ease.	Mat was installed about 50 ft from the shoreline, extending out 40 ft away from the shore. Had assistance from 3 friends. Three people held the mat in place and the fourth person took the sandbags off a floating kayak and placed them on top of the mat, in the appropriate places.

	Any problems with installation?	Visibility was poor, the water was cold (72 deg F) and buoyancy made it difficult to stay down to position the mat and secure it with the stone bags. Mat was installed as planned in spite of the above difficulties.	Installation was difficult. We weren't able to paddle hard enough with the paddleboard to pull the sheet out straight. We then pulled the tarp out by holding breath and working under water. We did not get the tarp fully stretched tight as we spread it out.	None.	No visibility underwater. Also, the installation was about a month later than I had wanted to do it, so there was a lot of plant growth under the mat location. This made the mat billow up in the center. Another time, could eliminate this by putting another row of sandbags along the middle of the mat.
	DEP file number sign posted? "Mass DEP 204-0962"	Yes	Yes	Yes	Yes
1-month update after installation					
	Date of report	7/12/2022	7/14/2022	Late July	8/15/2022
	Any change in the condition of the mat	More pliable, seemed softer, no tears or fibers seen.	No	No	Mat is all still intact.
	Any issues in maintaining position of the mats or hold-down equipment	No	No. It has stayed in place. 25 bags of stone seem ample to hold it down.	The mat has remained in place, no evidence of its being moved by currents or boating activity.	One edge floated up along the first 10 feet on the shore end of the mat. The sandbags slid off the mat along this section. Sandbags restored to positions that hold the mat down.
	Plants growing adjacent to the mats. Any change from prior to installing mats?	Density and height of plants adjacent to the mat increased slightly.	Density & height of plants near mat has increased. Now 3 to 4 feet high.	Plants are growing vigorously along the mat borders and elsewhere.	Fanwort, coontail, variable pondweed, wild celery. Plants are a bit more dense than when the mat was installed.
	Plants growing on the mats	None	None	There is no plant growth where the mat is positioned	None

	Any other notable conditions related to the mats (e.g., siltation on the mats)	A thin layer of silt has deposited on the surface of the mat	A thin layer of brown silt has accumulated on the mat.		Mat has green scum on the top.
2-month update after installation					
	Date of report	8/19/2022	8/14/2022	Late August	
	Any change in the condition of the mat	No	No	No	
	Any issues in maintaining position of the mats or hold-down equipment	None. The mat was in the same place as first installed.	No. The mat hasn't moved.	No -- the mat remains in place.	
	Plants growing adjacent to the mats. Any change from prior to installing mats?	Plants surrounding the mat continue to grow. Area under the mat was weed free.	Plants near the mat continue to thrive, now reaching nearly to the surface.		
	Plants growing on the mats	None	None.	Plant growth is suppressed despite low water levels.	
	Any other notable conditions related to the mats (e.g., siltation on the mats)	Silt continues to deposit on the mat and makes it difficult to see the mat clearly	Brown silt continues to accumulate on the mat. It's hard to see the mat now.		
	General notes			Conditions are the same as previous month. The pictures provided are from this time period.	
3-month update after installation					
	Date of report		9/15/2022	Late September	
	Any change in the condition of the mat		No change. Mat seems to be in good condition.	No	
	Any issues in maintaining position of the mats or hold-down equipment		No issues. Mat has stayed in place as initially deployed.	The mat has kept its position.	

	Plants growing adjacent to the mats. Any change from prior to installing mats?		Plant growth around the mat is very heavy, except on the shore-side where winter drawdowns minimize plant growth.		
	Plants growing on the mats		Found 1 plant rooted on the mat; pulled it out by hand.	There are a handful of plants growing where the mat is located but they appear to be coming up through the seams where the sections of burlap were stitched together.	
	Any other notable conditions related to the mats (e.g., siltation on the mats)		The layer of silt on the mat is uniformly thick. Mat is easy to feel but hard to see under the silt.		
4-month update after installation					
	Date of report		10/4/2022	Late October	
	Any change in the condition of the mat		No change. Mat seems to be in good condition everywhere.		
	Any issues in maintaining position of the mats or hold-down equipment		No issues. The 25 17-pound bags of stone are much heavier than needed.		
	Plants growing adjacent to the mats. Any change from prior to installing mats?		Plant growth around the mat is very heavy, many now reach the surface.		
	Plants growing on the mats		Found 3 plants rooted on the mat; pulled them out by hand.		
	Any other notable conditions related to the mats (e.g., siltation on the mats)		The layer of silt on the mat is quite heavy; stirs up very easily.		
	General comments			No change from last month.	

2nd installation of mat (moving the mat)					
	Date of installation	8/19/2022			
	Benthic mat material	Burlap (plan to leave in place) and relocate at 6-8 weeks			
	Benthic mat size	592 sq ft			
	Benthic mat length (parallel to shore)	37 ft			
	Benthic mat length (perpendicular to shore)	16 ft			
	Sketch provided?	Yes			
	Anchor mechanism	25 burlap bags ("sandbags") filled with 17 pounds of ½-inch washed pea gravel, placed around the edges and over the mat area about every 6 or 7 feet.			
	Lake bottom	Muddy with some rock and dense weeds			
	Water depth -- shallowest	3 ft			
	Water depth -- deepest	7 ft			
	Plants present at time of installation	Milfoil, fanwort			
	Density of plant growth (light, moderate, dense)	dense			
	Installation procedures used	Mat was pulled over from original location about 10' from shore into adjacent location in front of the house. Stone in burlap sand bags (each 15-18 pounds) placed on the mat at intervals of 7-8' to secure the mat to the lake bottom. Marker buoys anchored by concrete			

		blocks placed at the two deeper corners of the mat.			
	Any problems with installation?	none			
1-month report after moving mat					
	Date of report	10/2/2022			
	Plants growing in the previous mat location. Any change from time of mat removal?	No plant growth observable in area where mat was first located. Water still turbid and visibility poor.			
	Plants growing adjacent to the new mat location. Any change from prior to mat installation?	Plant growth observable in areas surrounding both mat locations. Low water level appears to have worsened the situation.			
	Condition of the lake bottom at the new mat location (bottom material, plant debris)	Lake bottom was very soft and difficult to walk in. Decomposition of leaves?			
	Plants growing at the mat location	Some plant growth under new mat location but difficult to photograph.			
	Density of plant growth at mat location (light, moderate, dense)	Plant growth dense in pockets but not consistent across the entire area.			
Removing the mat					
	Date of mat removal	Mat is burlap and will not be removed.	Mat is burlap and will not be removed.	Mat is burlap and will not be removed.	8/21/2022
	Any change in the condition of the mat				Mat is all still intact.
	Any issues in maintaining position of the mats or hold-down equipment				Not since last report.

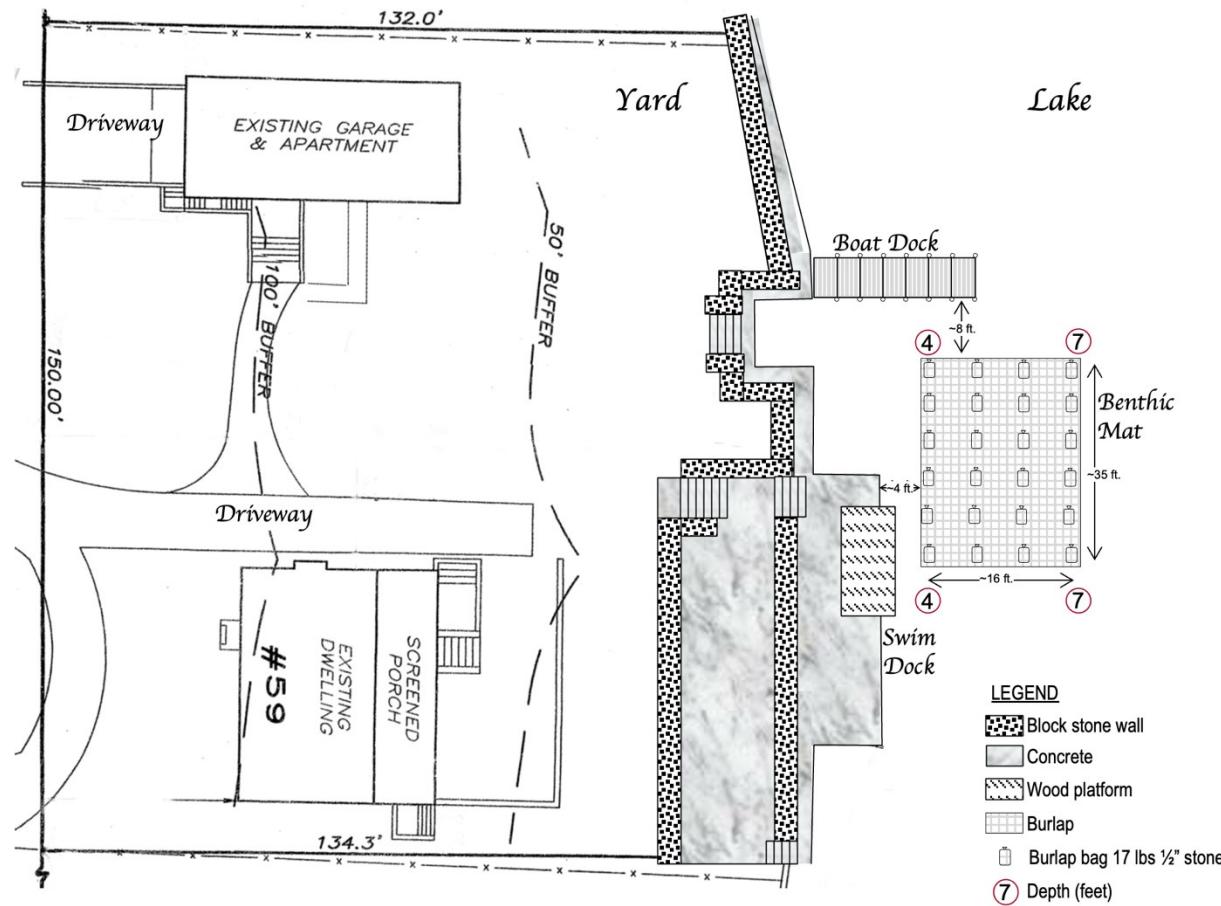
	Plants growing adjacent to the mats				Fanwort, coontail, variable pondweed, wild celery. Very dense. Plants all the way to the surface.
	Plants growing on the mats				None
	Any other notable conditions related to the mats (e.g., siltation on the mats, mat degradation, etc)				Mat has green scum on the top.
	Any issues with removal				No problems. Put sandbags on kayak which allowed mat to be removed by one person.
	Condition of the lake bottom under the mat, after the mat has been removed. (bottom material, any plants, plant debris)				Nearly all of the plants that were under the mat when it was installed were gone. No plant debris remaining. Very few plants left in the area under the mat.
	Plants adjacent to the mat. Any change from prior to installing the mat.				Plants more dense and taller over the month that the mat was in place.
1-month report after mat removal					
	Date of report				9/15/2022
	Plants growing adjacent to the mat location. Any change from prior to mat installation?				Fanwort, coontail, variable pondweed, wild celery. Plant growth about the same as when the mat was removed.
	Condition of the lake bottom at the mat location (bottom material, plant debris)				A few small plants.

	Plants growing at the mat location				Uncertain
	Density of plant growth at mat location (light, moderate, dense)				Light
2-month report after mat removal					
	Date of report				10/8/2022
	Plants growing adjacent to the mat location. Any change from prior to mat installation?				More or less the same as last month. Waded through the area but didn't go underwater. No boats available at this date.
	Condition of the lake bottom at the mat location (bottom material, plant debris)				Unsure -- can't see to the bottom.
	Plants growing at the mat location				Unsure -- can't see to the bottom.
	Density of plant growth at mat location (light, moderate, dense)				Unsure -- can't see to the bottom.
Burlap mats only					
	Did you at any time over the summer see any evidence of the burlap mat disintegrating and having burlap pieces floating away?	No.	During its first summer, my burlap mat did not appear to weaken at all. It's still quite robust as a piece of fabric. There are no loose fragments or edges.	No evidence of disintegration so far.	N/A
	If so, describe the situation. Were you able to collect these pieces and prevent further occurrences?				

End of season					
Was all non-natural material used for the benthic mat installation removed by Oct 15, 2022?		Yes (buoys removed)	Yes (buoys removed)	Yes (buoys removed)	Yes. Everything removed.
Would you put a benthic mat in again, another time?		Yes. Leaving the mat in place.	Yes. It worked and I'd do another. If the first one continues to inhibit weeds where it is, I'd put another adjacent to it to expand the treated area.	Yes. Fully intend to expand coverage, assuming we can.	Probably. For various reasons, we didn't get a chance to take advantage of the area that the mat had cleared this summer, so we'd try it again and see how much it helps us.

59 Matawanakee Trail, Littleton -- Stephen & Rebecca Hadden

Benthic Mat at 59 Matawanakee Trail, Littleton, MA – Summer 2022



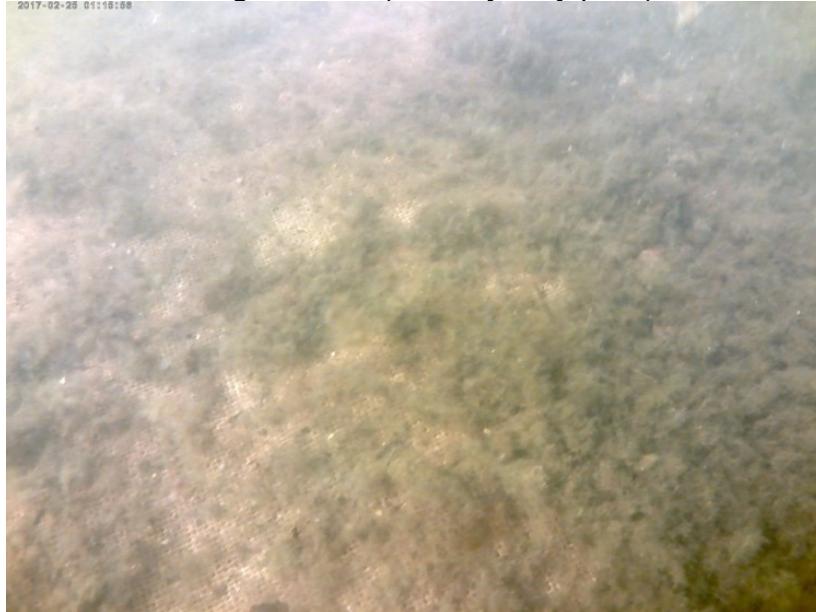
Photos Before Mat Installation
Taken on 6 June 2022



Photos 16 Days After Mat Installation
Taken on 30 June 2022



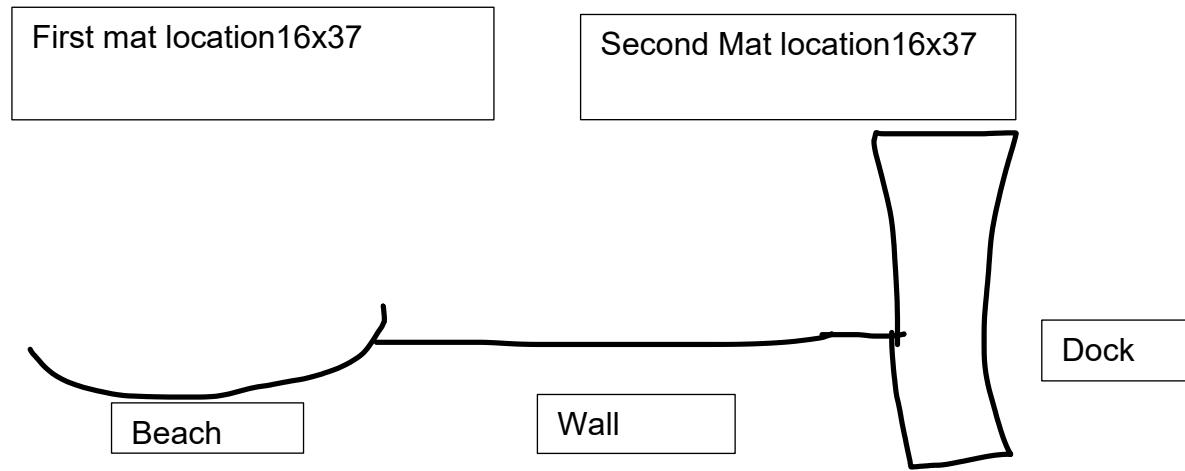
Photos 2 Months After Installation
Taken on 18 August 2022 (visibility very poor)



Weave of mat barely visible under silt.

Plants around mat grow thickly.

Drawing of Mat locations 93 Matawanakee Trail



Installed Mat in first location



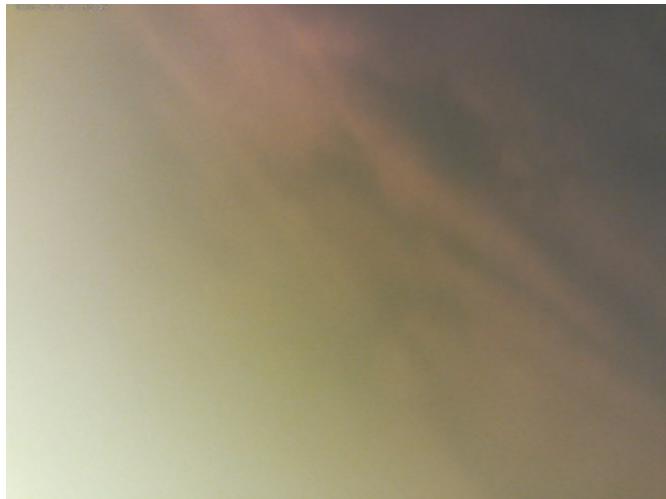
Moving the mat:



Area around old mat location



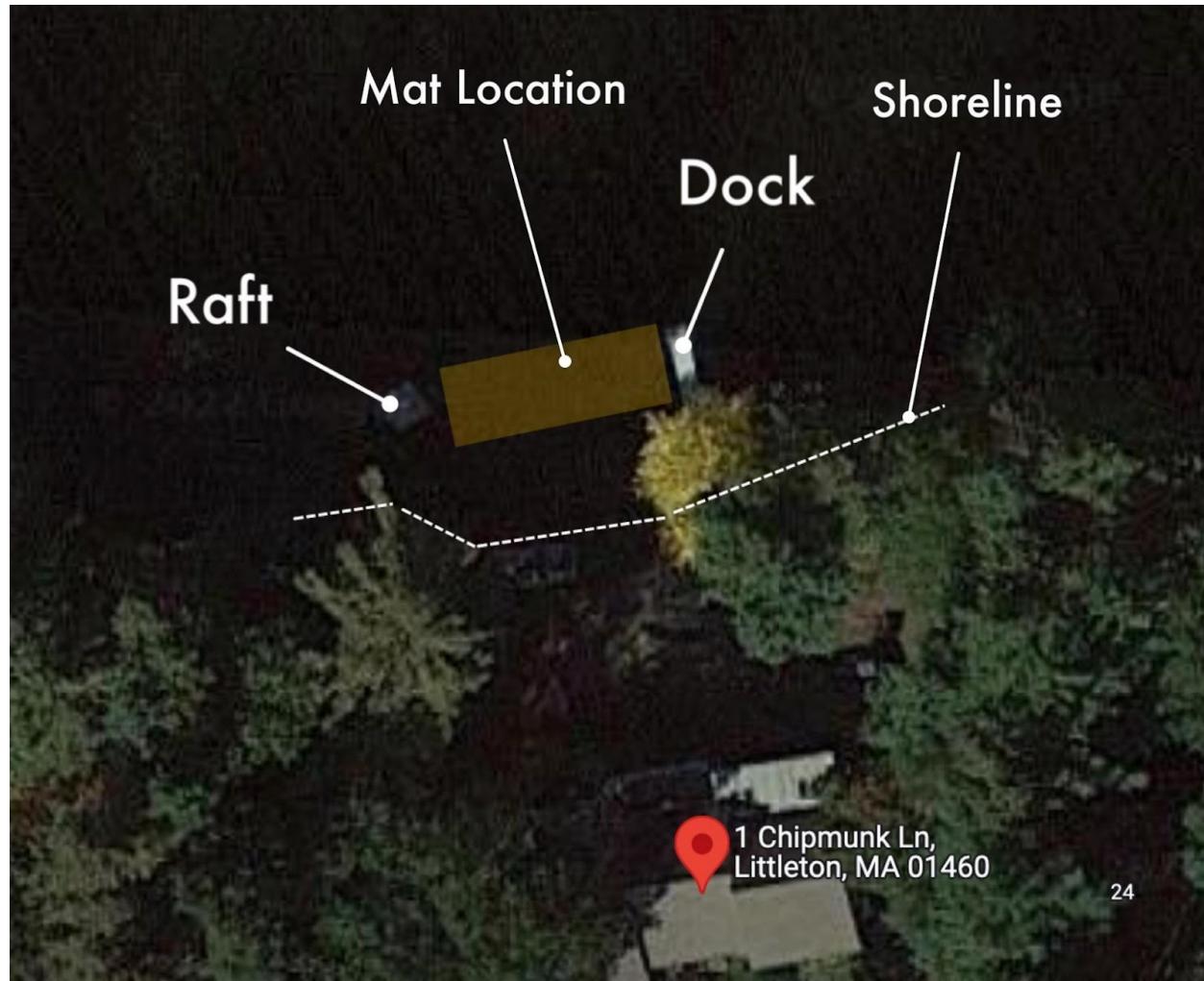
New Mat location prior to placement



New location of mat

1 Chipmunk Lane, Littleton – Michael and Suzie Livingston

Benthic Mat at 1 Chipmunk Lane, Littleton, MA – Summer 2022



Photos Before Mat Installation



Conditions just before installation are obviously poor, but the growth of weeds is evident.

Photos in late August, approx. 6 Weeks After Mat Installation



Considerable weed growth this season due to lower water levels.



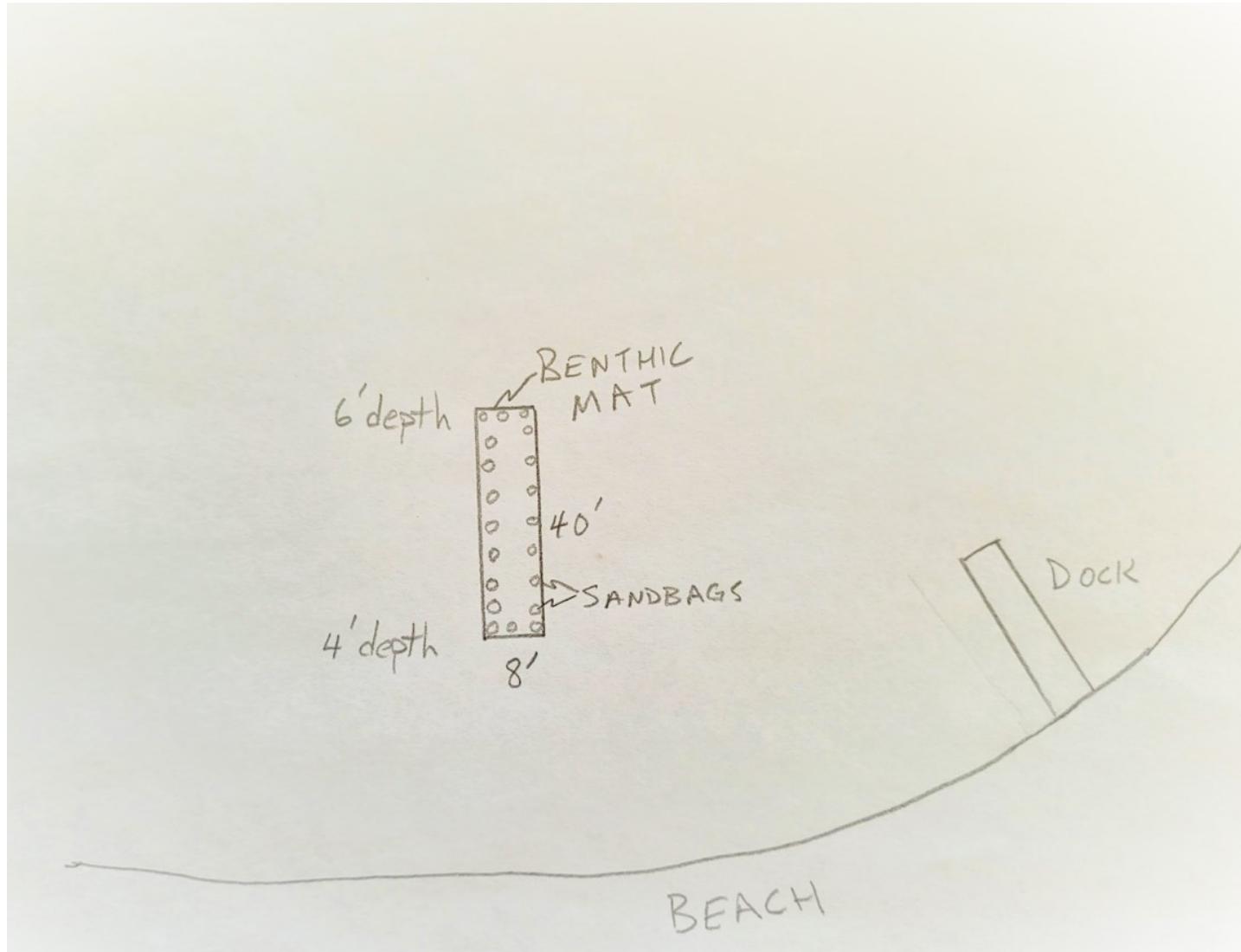
Here the corner of the mat is clearly delineated by the growth of the plants.



Another view where plant growth is plainly suppressed by the benthic mat.

49 Matawanakee Trail, Littleton – David and Patricia Barr

Sketch of mat installation:



Picture before installing mat:



Picture just before removing mat.

Foreground shows benthic mat.

Background shows plant growth next to benthic mat.

