TOWN OF PLYMOUTH CAPITAL IMPROVEMENT PLAN REQUEST
FY25 SPRING ANNUAL TOWN MEETING

Department:	Harbormaster - Police	**Priority #:**	1
Project Title and Description:	Town Wharf Rehabilitation	**Total Project Cost:**	$900,000

Department/Division Head: Chad Hunter - Harbormaster

Check if project is: New ■ Resubmitted ☐ **Cost estimate was developed**: Internally ☐ Externally ■

For project re-submittals, list prior year(s):

List any funding sources and amounts already granted: Will seek grant funds to offset costs. Without grant award, this project would be funded by the waterways account.

Basis of Estimated Costs (attach additional information if available)			**If project has impact on 5 Year Plan and future operating budgets, insert estimated amounts.**		
Capital:	**Cost**	**Comments**	**Fiscal Year:**	**Capital**	**Operations & Maintenance**
Planning and Design			***FY26***		
Labor and Materials	$743,900	Phase 1	***FY27***		
Administration			***FY28***		
Land Acquisition			***FY29***		
Equipment			***FY30***		
Other	$80,000	Engineering oversight			
Contingency	$74,390	10%			
Total Capital	$900,000	(rounded up from $898,290)			

Project Justification and Objective: Town Wharf is a hub for commercial activitity in Plymouth Harbor. Based on the most recent inspection, we were provided with a phased apporach to protect and preserve our investment. This maintenance is critical to the Blue economy in Plymouth.

For Capital Project Requests:
Will this project be phased over more than one fiscal year? If yes, enter it on the 5 Year Plan Yes ■ No ☐
Can this project be phased over more than one fiscal year? Yes ■ No ☐

For Capital Equipment Requests:
☐ Check if equipment requested is replacement and enter the year, make & model, VIN and present condition of existing equipment

What is the expected lifespan of this new/replacement equipment:

Attach backup information, estimates, or justification to support this request.

TOWN OF PLYMOUTH
HARBORMASTER
185 WATER STREET PLYMOUTH, MA
(508) 830-4182 / HARBORMASTER@PLYMOUTH-MA.GOV

MEMORANDUM

TO: SANDRA STRASSEL – PROCUREMENT OFFICER

FROM: CHAD HUNTER, HARBORMASTER

SUBJECT: CAPITAL REQUEST – TOWN WHARF MAINTENANCE

DATE: OCTOBER 31, 2023

Sandra,

We would like to respectfully request $900,000 from the waterway uses account to perform much needed maintenance to Town Wharf. This project is being phased, and we are looking to complete phase one of three at this time (inspection report attached).

This maintenance request was based on a routine five-year inspection of Town Wharf performed by GEI Engineering in 2022-23. Some critical items were completed in the spring of 2023 to prevent disruptions and keep access to the pier open.

For this phase, we will be submitting the project to the Seaport Economic Council (SEC) for consideration. If there is an award, a portion of the project could be funded by SEC offsetting the costs to the Town. If the award is not successful, we would like to utilize the waterways fund to move forward with this phase.

Town Wharf is the economic hub in Plymouth Harbor providing critical ship to shore access and supporting many different uses, such as whale watches, charter boats, lobster fishery, shellfish landings, tuna landings, tall ships and recently cruise ships. The Town Wharf supports local tourism and fisheries landings in excess of $10m dollars in value each year.

We would look to minimize impacts to any user groups and conduct the work over the winter (24/25) when many of the uses are done for the season.

Respectfully submitted,
Chad Hunter – Plymouth Harbormaster

Cc. Police Chief -Dana Flynn, DMEA Director -David Gould

Memo

To: David Gould

From: Russell Titmuss

c:

Date: October 31, 2023

Re: 2023 Inspection Repair Options
Plymouth Town Wharf Repairs
Plymouth, MA
GEI Project No. 2203521

This memo is a supplement to GEI memo dated February 15, 2023 (attached) to update the cost estimates for repair of the Town Wharf. It is assumed that all of the repairs would be completed in phases over the course of approximately three years. Costs have been escalated 5% each year.

SHORT TERM (First Year)	TOTAL QTY	*Unit*	2023-Unit $	Item Total $
Pile Caps & Piles				
Remove Existing Pile Cap Timbers - Main Pier	3,024	BFM	$10.50	$31,800
NEW Pile Cap (12x12)	3,024	BFM	$24.36	$73,700
Post Piles	23	EA	$6,090.00	$140,100
Patch/Replace Deck Panels	2	EA	$6,090.00	$12,200
Remove & Reinstall Concrete Deck Panels	65	EA	$1,260.00	$81,900
Concrete Panel Connection Hardware	134	EA	$1,218.00	$163,300
General Repairs For ALL Options				
Cross Bracing & Long Bracing	684	BFM	$27.41	$18,800
Hardware	30	EA	$913.50	$27,500
Batter Pile Hardware (If not prev. repaired)	19	EA	$913.50	$17,400
Replace All Ladders (4?)	4		$609.00	$2,500
Wave Fence Slats (3x10)	15		$974.40	$14,700
Mobilization	**1**	**LS**	$80,000.00	$80,000
Site Preparation	**1**	**LS**	$80,000.00	$80,000
SUB-TOTAL				$743,900
Contingency			10.00%	$74,390
TOTAL FOR CONSTRUCTION				**$818,290**
Allowance for Engineering				$80,000
TOTAL				**$900,000**

MID TERM (Year 2)	NET QTY	*Unit*	2024-Unit $	Item Total $
Pile Caps & Piles				
Remove Existing Pile Cap Timbers - Main Pier	4,452	BFM	$11.03	$49,100
NEW Pile Cap (12x12)	4,452	BFM	$25.58	$113,900
Post Piles	23	EA	$6,394.50	$147,100
Patch/Replace Deck Panels	-	EA	$6,394.50	$0
Remove & Reinstall Concrete Deck Panels	163	EA	$1,323.00	$215,700
Concrete Panel Connection Hardware	326	EA	$1,278.90	$417,000
General Repairs For ALL Options				
Cross Bracing & Long Bracing	684	BFM	$28.78	$19,700
Hardware	30	EA	$959.18	$28,800
Batter Pile Hardware (If not prev. repaired)	19	EA	$959.18	$18,300
Replace All Ladders (4?)	-		$639.45	$0
Wave Fence Slats (3x10)	15		$1,023.12	$15,400
Mobilization		**LS**	$130,000.00	$130,000
Site Preparation		**LS**	$130,000.00	$130,000
SUB-TOTAL				$1,285,000
Contingency			10.00%	$128,500
TOTAL			**TOTAL =**	$1,413,500
Allowance for Engineering				$85,000
TOTAL				**$1,498,500**

LONGER TERM	NET QTY	*Unit*	2025-Unit $	Item Total $
Pile Caps & Piles				
Remove Existing Pile Cap Timbers	18,564	BFM	$11.58	$215,000
Split Pile Cap Timbers - Main Pier & Edge Caps	18,564	BFM	$26.86	$498,600
Post Piles	23	EA	$6,714.23	$154,500
Patch/Replace Deck Panels	-	EA	$6,714.23	$0
Remove & Reinstall Concrete Deck Panels	82	EA	$1,389.15	$114,000
Concrete Panel Connection Hardware	164	EA	$1,342.85	$220,300
General Repairs For ALL Options				
Cross Bracing & Long Bracing	684	BFM	$30.21	$20,700
Hardware	30	EA	$1,007.13	$30,300
Batter Pile Hardware (If not prev. repaired)	19	EA	$1,007.13	$19,200
Replace All Ladders (4?)	-		$671.42	$0
Wave Fence Slats (3x10)	15		$1,074.28	$16,200
Mobilization		**LS**	$130,000.00	$130,000
Site Preparation		**LS**	$130,000.00	$130,000
SUB-TOTAL				$1,548,800
Contingency			10.00%	$154,900
TOTAL			**TOTAL =**	$1,703,700
Allowance for Engineering				$90,000
TOTAL				**$1,793,700**

[RJT : admin initials]

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Memo

To: David Gould

From: Steve Hennessy

c: Russell Titmuss

Date: February 15, 2023

Re: 2023 Inspection Repair Options
Plymouth Town Wharf Repairs
Plymouth, MA
GEI Project No. 2203521

This memo sets out an initial finding's summary for Town Wharf Pier in Plymouth Harbor. It is an update of our January 17, 2023, memo with added detail and estimated repair costs.

GEI Consultants (GEI) recently inspected the pier on December 13 and 19, 2022 on behalf of the Town. The purpose of this inspection by GEI was to document the existing conditions at the Town Wharf and provide recommendations for any necessary repairs. The last inspection of this pier was in 2012 by GEI (as Bourne Consulting Engineering). The inspection was not 100% completed on the two days above but some items of concern were noted and brought to the Town's attention. The inspection has since been completed (on January 12, 2023) but the final report is still in progress. This memo provides initial estimates for the number of repairs and potential costs pending completion of the final report.

This memo includes a summary of conditions observed in order of importance, and assessment of alternative repair options based on the future intended use of the Plymouth Town Wharf. It also includes a discussion of potential longer term repair options with estimated costs.

Inspection Findings Summary:

General Description

The Town Wharf facility comprises the Main Wharf and the Southern Extension (Finger Pier).

The Main Wharf has a total of 31 bents. Each bent comprises:

- 11 vertical timber bearing piles – Rows A to L (I is not used)
- Odd numbered bents have a single batter pile at Row A
- Even numbered bents have two batter piles at Rows A and L
- 2 timber fender piles at Rows A and L
- 12" x 12" timber pile cap running across all bearing piles with a ship lap joint at Row F
- Timber cross bracing

The Southern Extension has a total of 9 bents. Each bent comprises:

- Two timber batter piles
- Two 6" x 12" timbers as a split pile cap
- Timber cross bracing

Areas of Immediate Concern for Safety

Areas marked on the attached plan shall be blocked off immediately with lightweight jersey barriers or by other means. See Attachment 1 for locations.

1. ***Main Wharf - Timber Pile Cap in Bent 4 between Piles E and F to the ship lap joint is significantly hollowed out and the side faces of the pile cap are deformed.***

2. ***Southern Extension - Split pile cap on Bent 9 is broken due to impact damage.***

Timber Pile Caps:

Pile caps were sounded with a hammer as well as visually inspected. A number of pile caps were noted as hollow. These areas were noted as "visually" or "acoustically" hollow. Areas that were visually confirmed to be hollow, through excessive cracks, end deterioration, and organic growth, were also tested acoustically for comparison to other areas identified to be "acoustically hollow". Further investigation of the acoustically hollow pile caps was performed by taking timber cores with a ¼ inch increment borer. There were eight (8) areas that had severe deterioration as determined visually (see red areas on Attachment 2). Many of the bents had end rot/deterioration ranging from 4" to 18" in from the end. The end rot deterioration becomes critical when it reaches approximately 8 inches in from the end of the pile cap. These locations are noted in the table below but additional locations are likely to need repair over the coming years.

Defect	Actual Number of defects found by inspection[1]
Hollow	19 to 23
End Rot/Deterioration	17

[1] – Count is number of pile cap spans

Timber Piles:

Piles were inspected above and below water. Pile inspection included vertical bearing piles, fender piles and batter piles, with associated hardware connections to the piles. The 2012 inspection found evidence of deterioration due to marine borers and the affected piles were repaired. This marine borer activity has continued to deteriorate the piles below MHW and piles with severe marine borer activity and those noted to be visually and/or acoustically hollow above MLW are listed in the table below. Batter pile hardware was severely impacted at many locations, with severe marine borer activity hollowing the tops of the batter piles where they are connected to the bearing piles.

Defect	Actual Number of defects found by inspection
Piles with severe marine borer activity	23
Batter pile hardware	19

Cross Bracing:

Cross bracing was inspected at low tide when the majority of the bracing was exposed. Deterioration of lower bracing members, hardware and connections to the piles were the main areas of concern for affected bracing. Upper bracing and hardware was in fair condition.

Defect	Actual Number of defects found by inspection
Lower bracing connection	30
Bracing members	684 BFM

Concrete Deck Panels:

Concrete panels were inspected from below deck and topside of the deck. Topside conditions included moderate wear and chipping of the panels, without structural implications. Areas were observed to have growth between the panels, along the pile cap which suggests organic matter on top of or entering the timber pile cap below. The southeast most corner panel was observed to have a crack, as well as extended gaps between the surrounding panels, similar to that observed by impact damage.

Wave Fence:

The wave fence was generally in good condition. Fifteen (15) wave fence slats were missing or disconnected from the three wales present at the time of survey.

Defect	Actual Number of defects found by inspection
Missing slats	15

Estimated Immediate Repair Cost

Two defects of major concern were identified as described above under the inspection findings:

1. ***Main Wharf - Timber Pile Cap in Bent 4 between Piles E and F to the ship lap joint is significantly hollowed out and the side faces of the pile cap are deformed.***

   The proposed immediate repair to this area would be to "sister" new 6"x 12" pile caps on each side of the existing 12"x 12" pile cap. The new timber would need to run for at least one span and would require blocking pieces to transfer the load into the existing piles.

   Estimated cost of this repair is $36,000.

2. ***Southern Extension - Split pile cap on Bent 9 is broken due to impact damage.***

   The proposed immediate repair is replacement of the damaged timber.

   Estimated cost of this repair is $9,000.

Repair Options

Repair Options for the Town Wharf need to be considered in the context of remaining life of the timber piles and the total replacement cost of the structure:

Timber Pile Life

The existing timber piles were installed around 1952 and are now approximately 70 years old. This is well beyond the projected life of timber piles installed today. However, there are a total of approximately 400 piles supporting the existing pier and only 23 piles have been identified as requiring repair. Other relevant information comes from the replacement of the T Wharf 5 years ago. The piles supporting the T Wharf were in fair condition and dated from 1935 making them 83 years

old. Based on this information, it is not unreasonable to project a remaining life for the piles of around 15 years with the expectation that some repairs will be needed periodically.

At the time of the last inspection (10 years ago), 31 piles were identified for repair. This inspection identified 23 piles for repair. Assuming 25 to 30 piles will require repair every 5 years over the next 15 years provides a basis for continued maintenance.

Total Replacement Cost

If the existing pier is replaced in kind with similar materials, the total replacement cost is estimated to be approximately $12 million. This cost does not include engineering and permitting which would add another $1.5 million. If the pier were to be replaced, alternative layouts could be investigated which might reduce the footprint and therefore the cost. However, the existing pier provides much needed working space on the tightly constrained waterfront and a major reduction in footprint is considered unlikely.

If the materials are restricted to treated timber piles, timber framing and precast concrete deck, the estimated projected life of a new pier is approximately 40 years. This projected life could be extended by considering other materials but at higher cost.

Short Term Repairs (within one to two years)

The defects identified in this inspection should be repaired within the next 1 to 2 years. If the repairs are not performed within the next year, periodic inspections should be performed to ensure that conditions do not change sufficiently to cause a safety hazard. Some load limitation should also be considered if repairs are not performed in the short term.

Pile Cap Repairs

The deterioration of the pile caps as noted above is the biggest cause for concern and this deterioration will continue to worsen rapidly. Once the center of the pile cap starts to rot, the core remains damp and rot spreads quickly. It is likely that repeated repairs will be necessary until most of the pile caps have been repaired. The time between inspection and repair cycles should be planned to be not more than every 5 years.

Two options have been considered for repair of the pile caps:

Sistering Pile Caps

"Sistering" consists of fastening new 6"x 12" pile caps on each side of the existing 12"x 12" pile caps. This will allow repairs to be completed without removing the existing concrete deck panels. The lifespan of the repaired pile caps is somewhat difficult to predict because the rotten existing 12" x 12" pile cap will remain sandwiched between the new pile caps and the new timber is likely to have a shorter life as a result. The likely lifespan of this repair is not more than 15 years.

Replacing Pile Caps

A better repair would replace the existing 12"x 12" pile caps but this would require removal of the concrete deck panels. This approach would cause more disruption to pier users while the repairs are performed but it would allow for complete replacement of deteriorated piles. This approach would provide a longer lasting repair and should be investigated as a potential phased approach for pier repair/replacement. GEI will provide review of this option and others in our report which is currently in preparation.

Pile Repairs

The pile repairs included in the estimates assume that piles will be posted as performed for the last round of pier repairs in 2017.

Other Miscellaneous Repairs

Replacement of hardware, bracing members and reconnection of the batter piles by blocking would all be performed similar to the last round of pier repairs.

Short Term Repairs are assumed to be limited to only those defects clearly visible at the time of the inspection.

Estimated cost of these short term repairs is $750,000 to $800,000. A breakdown is provided in the attached tables.

Mid Term Repairs (within the next 5 years)

Mid Term repairs are assumed to be similar to the repairs listed under Short Term Repair above. Mid Term Repairs would repair visible and "acoustically" hollow members together with similar quantities of pile, batter pile, bracing and wave fence repairs as performed for the short term repairs. The estimated cost of this work is $1.2 million in 2023 costs. A breakdown is provided in the attached tables. It should be noted that the breakdown shows all repairs up to this point (short term and mid term) and the work required in this year is the difference between the total cost of short term repairs and the total cost of mid term repairs.

Longer Term Repairs (10 years +/-)

Longer Term Repairs are assumed to consist of completing the repair or replacement of all remaining pile caps together with similar quantities of pile, batter pile, bracing and wave fence repairs as performed for the short term repairs. The estimated cost of this work is $1.6 million. A breakdown is provided in the attached tables. It should be noted that the breakdown shows all repairs up to this point (short term, mid term and longer term) and the work required in this year is the difference between the total cost of mid term repairs and the total cost of longer term repairs.

Total cost up to this stage is estimated to be approximately $3.5 million.

Phased Repairs

With the understanding that most of the pile caps in the deck will require replacement over the next approximately 10 years a further strategy of performing a phased replacement over the next approximately 6 years has been considered. The total cost of this work would be approximately $3.5 million and it could be phased over two to three contracts.

Some prioritization of the phasing should be directed to providing continued heavy load access to the newly reconstructed T Wharf and to repair the worst areas of deterioration. However, the major benefit of this approach should be economies for the contractor in performing complete repairs over a contiguous area.

[RJT : admin initials]

IMMEDIATE REPAIRS	TOTAL QTY	2022-Unit $	Item Total $
Mobilization			$5,000
Demo			$5,000
Split Pile Cap Timbers - Main Pier	3	$6,525.00	$19,600
Split cap repair	120	$25.38	$3,100
Decking replacement	150	$25.38	$3,900
SUB-TOTAL			$36,600
Contingency		20.00%	$7,400
TOTAL		**TOTAL =**	**$44,000**

SHORT TERM	TOTAL QTY	2022-Unit $	Item Total $
Pile Caps & Piles			
Remove Existing Pile Cap Timbers - Main Pier	3,024	$10.00	$30,300
NEW Pile Cap (12x12)	3,024	$23.20	$70,200
Post Piles	23	$5,800.00	$133,400
Patch/Replace Deck Panels	2	$5,800.00	$11,600
Remove & Reinstall Concrete Deck Panels	65	$1,200.00	$78,000
Concrete Panel Connection Hardware	134	$1,160.00	$155,500
General Repairs For ALL Options			
Cross Bracing & Long Bracing	684	$26.10	$17,900
Hardware	30	$870.00	$26,100
Batter Pile Hardware (If not prev. repaired)	19	$870.00	$16,600
Replace All Ladders (4?)	4	$580.00	$2,400
Wave Fence Slats (3x10)	15	$928.00	$14,000
Mobilization	1	$75,000.00	$75,000
Site Preparation	1	$75,000.00	$75,000
SUB-TOTAL			$706,000
Contingency		10.00%	$70,600
TOTAL		**TOTAL =**	**$776,600**

MID TERM	TOTAL QTY	2022-Unit $	Item Total $
Pile Caps & Piles			
Remove Existing Pile Cap Timbers - Main Pier	7,476	$10.00	$74,800
NEW Pile Cap (12x12)	7,476	$23.20	$173,500
Post Piles	46	$5,800.00	$266,800
Patch/Replace Deck Panels	2	$5,800.00	$11,600
Remove & Reinstall Concrete Deck Panels	228	$1,200.00	$273,600
Concrete Panel Connection Hardware	460	$1,160.00	$533,600
General Repairs For ALL Options			
Cross Bracing & Long Bracing	1,368	$23.20	$31,800
Hardware	60	$870.00	$52,200
Batter Pile Hardware (If not prev. repaired)	38	$870.00	$33,100
Replace All Ladders (4?)	4	$580.00	$2,400
Wave Fence Slats (3x10)	30	$928.00	$27,900
Mobilization	1	$130,000.00	$130,000
Site Preparation	1	$130,000.00	$130,000
SUB-TOTAL			$1,741,300
Contingency		10.00%	$174,200
TOTAL		**TOTAL =**	$1,915,500
DIFFERENCE TOTAL MID TERM - TOTAL SHORT TERM			**$1,138,900**

LONGER TERM	TOTAL QTY	2022-Unit $	Item Total $
Pile Caps & Piles			
Remove Existing Pile Cap Timbers	26,040	$10.00	$260,400
Split Pile Cap Timbers - Main Pier & Edge Caps	26,040	$23.20	$604,200
Post Piles	69	$5,800.00	$400,200
Patch/Replace Deck Panels	2	$5,800.00	$11,600
Remove & Reinstall Concrete Deck Panels	310	$1,200.00	$372,000
Concrete Panel Connection Hardware	624	$1,160.00	$723,900
General Repairs For ALL Options			
Cross Bracing & Long Bracing	2,052	$23.20	$47,700
Hardware	90	$870.00	$78,300
Batter Pile Hardware (If not prev. repaired)	57	$870.00	$49,600
Replace All Ladders (4?)	4	$580.00	$2,400
Wave Fence Slats (3x10)	45	$928.00	$41,800
Mobilization	1	$300,000.00	$300,000
Site Preparation	1	$300,000.00	$300,000
SUB-TOTAL			$3,192,100
Contingency		10.00%	$319,300
TOTAL		**TOTAL =**	$3,511,400
DIFFERENCE TOT LONG TERM - TOT MID TERM - TOT SHORT TERM			**$1,595,900**