Menemsha Commercial Fishing Dock

Chilmark, MA

Waterfront Inspection & Assessment Report

March 2022

Submitted to:

Town of Chilmark

P.O. Box 119

401 Middle Road

Chilmark, MA 02535

Submitted by:

CHILDS ENGINEERING

WATERFRONT STRUCTURAL ENGINEERING

34 William Way
Bellingham, MA 02019

(508) 966 9092

childseng.com

Menemsha Commercial Fishing Dock

Chilmark, MA

Waterfront Inspection & Assessment Report

Submitted by:

Childs Engineering Corporation

34 William Way

Bellingham, MA 02019

508-966-9092

www.childseng.com

Submitted to:

Town of Chilmark

P.O. Box 119

401 Middle Road

Chilmark, MA 02535

Childs Project: 2982-22.00

Inspection Dates: March 10, 2022

TABLE OF CONTENTS

1.0 Introduction

Childs Engineering was tasked with performing a modified routine waterfront facilities inspection and assessment of the Menemsha Commercial Fishing Dock by the Town of Chilmark. Childs conducted the inspection of the facility using a team of four engineers, led by a Massachusetts registered professional engineer on March 10, 2022. The inspection included a topside inspection, underwater inspection, and survey of the facility and its associated structural elements. The purpose of the inspection was to assess the general condition of the steel sheet pile bulkhead, timber wharf structure, and utilities supporting the facility to determine the remaining useful life and recommend repair or replacement options as appropriate based on the results of the assessment. This report outlines the conditions encountered during the inspection, our assessment of their remaining usefulness, and recommended repairs to any deficiencies found along with rough cost estimates for those repairs. Included with this report are photos and figures outlining the general and specific conditions encountered. The limits of our inspection were from the concrete bridge abutment on Basin Road, adjacent to the Town owned building with address 52 Basin Road, continuing northwest to the end of the steel sheet pile bulkhead just behind the Menemsha Beach stone berm. The newer concrete floating docks manufactured by Bellingham Marine were not included in the inspection.

2.0 Facility

The Menemsha Commercial Fishing Dock facility is located on the Northeast side of the Menemsha Harbor, in Chilmark, MA on Martha's Vineyard Island. Many structural elements are combined to create a facility with the current operational capabilities for docking of the local fishing fleet, charter vessels, and transient vessels. The facility provides easy to use access for these vessels as well as basic utilities such as fuel, water, electricity, and sewage pump out. The facility, which has existed for generations, was constructed in its current form in 1987. This current form of this facility includes a steel sheet pile bulkhead supporting the land behind which replaced an aging timber bulkhead. Seaward of the sheet pile bulkhead is a timber wharf with top deck located roughly 3.5 feet below the top of the sheet pile. The timber deck is supported by timber pile caps and round timber support piles. On the inshore end, the pile caps are connected to the sheet pile using a steel channel welded to the bulkhead and a ¾ inch diameter through bolt. Greenheart timber piles are used for the fendering system on the outshore side.

Additional structural elements include a 17 foot long section of timber bulkhead that was recently repaired by adding new timber elements. A timber pile supported fueling pier extends out from the overall structure. Utilities are also located throughout the facility for vessel access.

Recent repairs include replacing the bolts connecting the timber pile caps to the steel sheet pile, which was completed in 2020. The area behind the timber bulkhead was excavated and new pressure treated timber was installed inshore of the bulkhead. It appears that timber decking and fender piles are also replaced on an as needed basis. Additional upgrades have included installation or modification to the electrical and pump out utilities. For more information on layout and orientation of the structures, please refer to Appendix B.

3.0 Assessment and Terminology

To conduct the inspection, Childs Engineering employed methods outlined in the ASCE Waterfront Facilities Inspection and Assessment manual (ASCE MOP-130). The inspection was routine in nature to provide general assessments but with modifications to gather additional information to accommodate future project plans. The modified routine inspection included Level I, II, and III inspection efforts which are comprised of (I) a visual inspection of 100% of all exposed structures, (II) visual and tactile inspection of 10% of the structures by cleaning or removing marine growth to inspect raw elements, and (III) nondestructive testing of at least 5% of the structure by taking ultrasonic steel thickness measurements and electrical potential measurements. The utility inspection was conducted on all accessible elements in the form of a cursory structural inspection which does not include opening, cycling, or testing for function. During the assessment phase, all structural elements were assigned ratings based on the following table to help classify the current conditions in an easy-to-understand system:

Assessment Ratings	Description
"Good"	No problems or only minor problems noted. Structural elements may show some very minor deterioration, but no significant reduction in structural capacity.
"Satisfactory"	Minor to moderate defects and deterioration observed, but no significant reduction in structural capacity.
"Fair"	All primary structural elements are sound; but minor to moderate defects and deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the structural capacity.
"Poor"	Advanced deterioration or overstressing observed on widespread portions of the structure. Some reduction in structural capacity.
"Serious"	Advanced deterioration, overstressing or breakage may have significantly affected the load bearing capacity of primary structural components. Local failures are possible.
"Critical"	Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur.

4.0 Inspection Findings

4.1 Summary of Findings

The inspection found that the Menemsha Commercial Fishing Dock as a whole is in **fair** condition with minor to moderate defects located throughout the facility and more advanced deficiencies found in isolated areas (see Photo 1 through 3). While many different structural elements are combined to comprise the Commercial Fishing Dock facility, a few isolated areas and structural elements govern the overall structural stability. The steel sheet pile and cap, which provide a border for the harbor and support the land behind to provide a foundation for adjacent buildings, are in **fair** condition with widespread minor to moderate deterioration and localized areas of advanced deterioration that do not currently compromise the overall structure or operational capabilities. The timber bulkhead is in **poor** condition due to the holes in the exterior timber face and unknown extent of recent repairs. Overall, the timber wharf is in **poor** condition with widespread structural deficiencies. The area of concern regarding the timber wharf is the connection at the inshore end of the timber pile caps to the steel sheet pile. These connections appear to have moderate to advanced corrosion. The fuel pier overall is in **satisfactory** condition with no defects noted. A cursory structural inspection was performed on the utilities which appear to be in **satisfactory** condition. Overall, we estimate that the existing structures have a remaining lifespan of 10 to 15 years if repair and preventative maintenance projects are completed. Additional lifespan lengthening project could be undertaken to increase the useful life of the facility, but the costs would likely be high compared to the overall return on value.

4.2 Timber Bulkhead

The timber portion of the bulkhead is located at the southern end of the facility from station (Sta.) 0+00 to Sta. 0+17. This section is comprised of 3 inch by 9 inch vertical tongue-in-groove boards supported by two 12 inch by 8 inch wales, one at the top of the structure and the other near mean low water (MLW). Overall, the timber bulkhead is in **poor** condition with widespread fungal decay of the timber boards. The exterior vertical boards typically exhibit large holes near MLW and in the tidal zone (see Photo 4). The recent repairs to this section of bulkhead included digging behind the bulkhead to install horizontal 4 inch by 8 inch pressure treated timbers. It was noted that before the repairs were completed sinkholes were forming behind the bulkhead. The new horizontal boards are in satisfactory condition, but the inspection was limited to what was visible through the holes in the exterior timber bulkhead. While this repair will likely hold for some time, it is recommended to view this as a temporary measure until more permanent repairs can be made to the entire facility.

4.3 Steel Sheet Pile Bulkhead

The steel portion of the bulkhead is comprised of steel sheet pile supporting a concrete filled steel cap. The steel bulkhead is roughly 641 feet long and ranges in height from 6 feet to 17 feet. There was no evidence of an interior or exterior tieback or wale system for the bulkhead. The steel sheet pile and cap are generally in **fair** condition with moderate defects noted (see Photo 5). While the original steel shape designation could not be determined and assumed to no longer be a regularly supplied shape, based on field measurements it is estimated that the shape is similar to a modern-day Bethlehem PZ27 or Frodingham 4N. The steel sheet pile has no protective coating or cathodic protection system and has moderate corrosion throughout the height of the sheets and isolated areas of severe corrosion with thin steel or holes present. In the water column to the mudline, the steel surface is wavy with light pitting (see Photo 6). The ultrasonic thickness readings indicate that below the water there is no major section loss on the majority of the surface area with measurements ranging between 0.450 to 0.550 inches and 0.350 to 0.390 inches on the flange and web respectively. There is a band of moderate to severe corrosion approximately 1 foot below MLW to the top of the timber deck curb. Ultrasonic thickness readings in this area indicate that section loss is taking place with estimated loss of 25%. This area was least accessible due to the presence of the timber wharf. This band of more advanced corrosion is also where the timber pile cap connections are located. The more advanced corrosion is likely due to the close contact with the timber wharf which has prevented moisture from escaping the surface of the sheet pile. It is typical for a steel structure to exhibit the heaviest corrosion just below and just above MLW due to the near constant presence of salt water and the higher oxygen content of the water at the surface.

The condition of the steel above water varies by location. Between Sta. 0+17 to 0+80 there is moderate pitting with no major section loss. From Sta. 0+80 to 3+30, the steel shows signs of the most advanced deterioration and is in poor condition with heavy corrosion byproduct on the surface of the steel in isolated areas throughout this section (see Photos 7 and 8). The corrosion byproduct is most prevalent on the webs and on the knuckles. Removing the corrosion by product, the steel is wavy with heavy pitting and isolated areas of corrosion holes. The corrosion holes are typically found near the outfall pipes that penetrate the bulkhead (see Photos 9, 10, and 11). Three large holes were found easily be removing the steel corrosion on the sheets, it is anticipated that if a thorough cleaning were to be completed, the holes would grow in size and quantity in this stretch of bulkhead. The holes were found at Sta. 1+05, 1+42, and 2+15. It is presumed that the more advanced corrosion in this area is due to the increased moisture levels on the surface of the steel due to the near constant presence of vessels berthed as well as from the water circulation lines. The water circulation lines are used to service Larsen's Fish Market and Menemsha Fish Market. The circulation lines pump water into the

buildings and dump the water back into the harbor. The constant wetting of the steel surface and lack of protective coating has provided an environment that promotes corrosion. From Sta. 3+30 to the end of the bulkhead at 6+58 the steel has minor to moderate corrosion and pitting but no major corrosion holes found. The corrosion byproduct buildup is minor to moderate indicating no major section loss has occurred.

The cap on top of the steel sheet pile consists of a steel W-shape welded to the top of the sheets with the top portion filled with concrete. The cap is 18 inches wide and 7.5 inches tall and is presumed to be a W18x60 section. The cap is typically in **fair** condition with minor to moderate corrosion throughout but no major deterioration (see Photo 12). The W-shape has knife edging and section loss in isolated areas typically found near the wooden access stairs or where stairs were located in the past (see Photo 13). The concrete on the cap is sound with minor deterioration on the edges and transverse cracking but no major spalling (see Photo 14).

Based on the inspection findings, the steel sheet pile bulkhead will continue to function as intended for a minimum of 10 years if isolated repairs are made and inspections are conducted on a regular basis to ensure all significant defects are located prior to compromising the structure. More significant repairs and preventative maintenance would need to be conducted to extend the life of the sheet pile to 20 years. Please refer Section 5 for more specific recommendations.

4.4 Timber Piles

The timber piles support the Commercial Fishing wharf on the outshore face by connecting to the outshore end of the pile caps below the decking. The 10-inch diameter CCA treated piles make up 96 pile bents starting near Sta 0+00 that are spaced approximately 7 feet apart. The piles are generally in **satisfactory** condition with no major defects found. The piles in the water column are typically between ⅛ inch and ¼ inch soft and have only minor marine borer damage that accounts for no significant reduction in cross sectional area (see Photos 15).

Timber fender piles are located in line with every support pile between Sta. 0+00 to 4+98 and every other bent between Sta. 4+98 to 6+58. The greenheart fender piles are in satisfactory condition with minor defects noted. The number and location of how the fender piles are connected to the pier structure varies but typically includes one, two, or three ¾ inch diameter bolts connecting the fender pile to the adjacent support pile (see Photo 16). It is assumed that the connection hardware is replaced on an as needed basis when a pile or bolt becomes broken. The greenheart piles are tapered and typically have ⅛ inch to ¼ inch softness (see Photos 17). There are isolated locations with marine borer damage on the piles in the tidal zone or below water. While most piles appear to have

been replaced, piles that appeared to be older had more section loss due to marine borer damage and should be replaced as needed.

The timber piles will continue to provide useful life to the facility with minimal repairs needed for an estimated 10 to 15 years. It is expected that within that 10 to 15 year remaining life cycle, some maintenance will be required such as replacing connection hardware.

4.5 Pile Caps

The timber pile caps run transverse between the outshore piles and the steel sheet pile bulkhead. The pile caps are split caps which consist of two 4 inch by 12 inch timber members installed on opposite sides of the support piles and through bolted with two ¾ inch diameter galvanized bolts and plate washers. The caps also act as the stringers, or joists for the timber decking (see Photo 18). The timber pile caps are in **satisfactory** condition with minor defects noted. The defects include isolated locations of fungal decay and dry rot on the ends of the caps (see Photo 19). The deterioration extends towards the bolts and could compromise the connections. The fungal decay was found in several bents but most notably on the pile cap for Bent 8. The inshore end of Bent 8 is not supported by the typical sheet pile bracket or a pile, it is instead connected to Bent 5 and has dry rot at this end which has begun to impact the bolted connection to Bent 5 (see Photo 20 and 21). Bent 8 also partially supports Bent 6, which is connected to Bent 9 using a typical butt-end connection detail (see Photos 22 through 25). The steel angles and connection hardware for the Bent 6 to 9 connection exhibit moderate corrosion and fungal decay of the timber members. Due to the configuration of the pile caps in this area, if the Bent 8 to 5 or Bent 6 to 9 pile cap connection were to fail, a moderate sized portion of the pier would become inadequately supported causing a reduction in capacity of the wharf.

The pile caps are typically connected on the inshore end to the sheet pile with a welded steel channel and a through bolt (see Photos 26 through 28). These brackets are in **poor** condition with moderate defects throughout the facility and localized severe defects noted. While there is currently no evidence of overstressing of the brackets, they appear to be nearing the end of their useful life. The defects include corrosion on all channels with isolated knife edging and section loss causing corrosion holes in isolated areas. It is estimated that the original thickness of the steel channels was ¼ inch, our field measurements indicate that typical existing thicknesses range from ⅛ inch to $^{3}/_{16}$ inch thick. The original thickness of ¼ inch is generally considered to be too thin for the marine environment because, while it may provide enough structural capacity initially, it lacks the ability to maintain structural capacity as the thickness is reduced due to corrosion. Typically, an original thickness of ⅜ inch to ½ inch is more appropriate for the marine

environment. The welds between the channel member and steel sheet pile are in fair condition with corrosion found (see Photo 29). In general, the through bolt connections are in satisfactory condition with no section loss or corrosion and were replaced in 2020, however between Bents 37 and 39 the nuts on the through bolts appear to not have been installed. Childs did not conduct a structural analysis to determine the working load capabilities of the channel members but the reduction in the thickness is a cause for concern; we believe this to be the weak link for the entire waterfront facility due to the likelihood of a reduction in capacity. We estimate that the brackets supporting the pile caps have a remaining lifespan of 5 years or less in isolated locations.

4.6 Timber Deck

The 3 inch by 8 inch timber decking runs longitudinally along the wharf (see Photo 30). The decking is generally in **poor** condition with fungal decay found throughout that has caused minor section loss (see Photo 31). The fungal decay also makes the deck slippery when it is wet. It appears that the decking is replaced on an as needed basis, evident by the occasional newer deck board located on the wharf. The limiting factor for the decking's capabilities to support load is the spacing at which they are supported. Typical pier design has the decking supported by stringers spaced 16 to 30 inches on center, this type of construction exists on the fueling pier. The main wharf structure decking is only supported by the timber split caps spaced roughly 6 feet on center. The capacity of the installed decking is most likely less due to the support spacing and fungal decay but does not currently warrant a posted load reduction given that the pier typically only sees pedestrian traffic. Reorientation of the decking to be properly supported would be an extensive undertaking requiring the entire timber wharf to be reconstructed and is therefore not currently recommended. We do not recommend that the deck be used to store heavy loads due to the support spacing.

4.7 Deck Curb

The timber deck curbs run longitudinally along the deck and are constructed of 8 inch by 6 inch timber members supported by 2 inch by 8 inch blocking spaced approximately every 6 feet on center. On the outshore edge of the wharf the deck curb and blocking are through bolted into the timber decking, and on the inshore edge the curb and blocking are through bolted into a 4 by 4 inch board running inshore of the timber decking. Overall, the deck curb is in is in **fair** condition with minor to moderate defects noted. The defects include fungal decay throughout the facility (see Photo 32). The fungal decay is mostly on the ends of the timber sections. The curb connections on the outshore edge are in satisfactory condition, the connection bolts have moderate corrosion with section loss and no threads visible (see Photo 33). The curb connections on the inshore

edge are in poor condition because the bolts were not aligned with the 4 inch by 4 inch connection board, and are on the edges or not connected to board (see Photo 34).

4.8 Timber Wale

The timber wale is a 4 inch by 8 inch member running longitudinally inshore of the timber support piles at approximately MLW. The wale overall is in **critical** condition with major defects noted. The wale is missing large sections throughout the wharf, and the portions of the wale that are present have severe deterioration with major section loss (see Photo 35). The purpose of the wale is to provide longitudinal bracing between piles. Based on our understanding of the design intents of the wharf, the bracing was providing little lateral support and is therefore not a high priority to repair.

4.9 Fuel Pier

The purpose of the Fuel Pier is to support the fuel pumps and provide temporary docking for vessels during refueling. The pier is of typical light duty pier design and construction, consisting of 8 pile bents with 12 inch diameter timber support piles, 3 inch by 10 inch transverse split pile caps supporting the 3 inch by 10 inch longitudinal timber stringers, and 2 inch by 8 inch transverse timber decking. The greenheart timber support piles also provide fendering capabilities in conjunction with the two 3 pile clusters on the outshore end of the pier. The Fuel Pier is in **satisfactory** condition overall with no defects noted. All timber elements are sound with minor weathering that does not constitute any significant section loss or expected reduction in capacity (see Photo 36 and 37).

4.10 Utilities

The Commercial Wharf has a variety of utilities to support the permanent or transient vessels that use the facility. A cursory structural inspection was performed on the utilities, and they were found to generally be in **satisfactory** condition. The utilities consist of outfall pipes for the water circulation system for the fish market, outfall drains, flexible pipes, fuel lines, water lines, electrical power lines, and pump out pipes. The outfall drains, circulation systems, and the flexible pipes extend through the steel sheet pile bulkhead under the cap. It appears that several of the lines have been abandoned in place or removed. As mentioned in section 4.3, the water circulation lines are directly responsible for increased corrosion in isolated areas of the sheet pile (see Photos 38 and 39). Basic recommendations would be to prevent the water from splashing against the sheet pile continuously to reduce corrosion of the sheet pile.

The water and power supply lines run the length of the wharf supported by reinforcing steel welded to the top of the sheet pile. This reinforcing is heavily corroded and broken in several locations. Also supported by the reinforcing steel is the pump out

line providing access to the pump out station by Edson Pumps (see Photo 40). The pump out station empties into an underground tank located across Basin Road. The fuel pier in front of the Texaco station near Sta 4+47 supports two fuel pump stations with all the associated fuel and electrical lines extending into the bulkhead near the corner of the sheet pile. The pedestals between Sta. 5+00 and 6+58 were recently installed and in satisfactory condition (see Photo 41). Two large electrical transformers are located behind the sheet pile providing electrical service to the wharf and adjacent floating docks (see Photo 42).

5.0 Recommendations

5.1 Summary of Recommendations

While the overall facility will continue to function as intended with minimal repairs in the near future, it is recommended that repairs be completed to ensure the operational capabilities of the facility do not become compromised. This section will review repairs that are required to maintain the structure, repairs required to extend service life, and possible options for future replacement projects. Repairs that should be completed as soon as practicable include:

- Replacing the Bent 8 to 5 and 6 to 9 connections.
- Patching holes in the sheet pile.
- Modifying the water circulation systems to divert water away from the sheet pile or other structural elements.

Additional repairs are recommended in the near future such as replacing pile cap brackets and will be discussed in detail in this section. As stated previously, the estimated lifespan of the facility without major upgrades is 10 to 15 years assuming the repairs listed above are made as well as other necessary, but more cost consuming repairs discussed further in the following sections of this report. All cost estimates provided are for future budgetary guidance only and are not based on actual repair designs or current market conditions.

5.2 Timber Bulkhead

The recent repairs to the bulkhead have extended its useful life. These repairs however should be considered temporary until a replacement project can be undertaken. We recommend the timber bulkhead be replaced with a new steel bulkhead as part of a larger project to upgrade the facility. Until such time that the timber bulkhead can be replaced, we recommend that loading immediately behind the bulkhead be limited to pedestrians only and that it continues to be inspected for further deterioration or possible movement.

5.3 Steel Sheet Pile

Multiple options are available for possibly increasing the lifespan of the steel sheet pile bulkhead but as stated previously, we recommend that the holes be patched as soon as possible and that all water circulation systems be modified to divert water away from the bulkhead and any other structural element. This effort will reduce the corrosion impacts to the bulkhead. Patching the sheet pile holes would entail removing all deteriorated steel and welding a new steel plate onto the sheet pile. We estimate that this type of repair will be roughly $600/sqft. Any areas in or above the tidal zone that remain in a state of constant wetting should be cleaned of all corrosion or marine growth and coated with a marine grade underwater epoxy to provide corrosion protection. If the lifespan of the bulkhead were required to reach to the 20-year mark, we would also recommend that the band of corroding steel from roughly 1 foot below MLW to the deck curb be coated with this same epoxy.

Additional repairs to increase life expectancy of the bulkhead include providing preventative maintenance in the form of corrosion protection. Cleaning the bulkhead through sandblasting and spraying on a marine grade coating will provide extensive protection against corrosion but at a significant cost. We estimate that the cost for cleaning and coating sheet pile is currently $90/sqft. This estimate puts the cleaning and coating project in the range of $500,000 plus the cost of removing the timber wharf decking to access critical areas. This protection method difference from the epoxy mentioned in the previous paragraph which is generally used for small locations and applied using hand tools. The spray on coating is more like a paint and is sprayed on over large areas. Additional corrosion protection to be considered is the addition of a sacrificial anode cathodic protection system below MLW. A sacrificial anode will act similar to boat zincs, which will protect exposed metal by allow itself to be consumed prior to the exposed metal. Rough installation costs for installing anodes on a bulkhead are $1,600/anode which would need to be installed by a diver. Overall project estimates reach $130,000 to install anodes along the entire length. This step would extend the life of the bulkhead but may not provide the best return on value, especially considering that the height of the bulkhead below water is limited in many locations and therefore protective area is limited.

5.4 Timber Piles

We recommend continuing to replace the timber fender piles on an as needed basis. The timber support piles under the wharf show little signs of deterioration and do not warrant repairs at this time. The anticipated lifespan of the existing timber piles is 10 to 15 years.

5.5 Pile Caps

We recommend the pile caps be repaired prioritizing the steel channels where the timber connects to the bulkhead. The timber shows signs of deterioration on the ends with fungal decay but overall, the timber does not warrant short term repairs. The steel channels that connect to the sheet pile bulkhead show signs of advanced deterioration and section loss. We recommend replacing the steel channels with a similar support connection. The effort may require removal of some deck boards or completion by a diver depending on contractor access. A cost for this is currently unknown due to the many variables of construction. We estimate the bulk cost of the steel to be in the range of $10,000 to $20,000 but acknowledge that the majority of the cost will be in labor. It would also be recommended to apply underwater epoxy on all new welds. We recommend the connection between Bents 5 and 8 and Bents 6 and 9 be replaced to ensure that corner is stabilized. To accomplish this, it will likely be easiest to replace the timber caps in entirety. These repairs can be done in the short term to ensure this corner of the wharf is stable. The anticipated lifespan of the existing timber pile caps and steel connections is 5 years.

5.6 Timber Deck

We recommend continuing to replace the timber deck boards on an as needed basis. The timber deck boards show visible signs of fungal decay throughout. A short-term repair would be to pressure wash the deck to remove the fungus on the surface to prevent the slipperiness when the deck gets wet. The anticipated lifespan of the existing timber decking is 5 to 10 years.

5.7 Deck Curb

We recommend the timber deck curb be repaired by replacing the timber sections topside on an as needed basis. The connections should be replaced within the short team to prevent the curb from coming loose. Currently the inshore timber curb is poorly connected to the 4 inch by 4 inch board underneath. We recommend that the 4 inch by 4 inch board be replaced with a larger section to ensure the timber curb is connected to the wharf. The anticipated lifespan of the existing timber curb is 5 to 10 years.

5.8 Timber Wale

We recommend the timber wale and connections be replaced in-kind throughout the length of the wharf. In its current state the wale is providing little benefit to the wharf structure. This repair is low priority at this time and should be completed when other work is done to save on cost.

5.9 Fuel Pier

We have no recommended repairs for the Fuel Pier at this time. The Fuel Pier showed little signs of deterioration and appears to be functioning as intended. As mentioned above it is recommended the fender piles, deck boards, and deck curb be replaced in-kind on an as needed basis. The anticipated lifespan of the Fuel Pier is 15 years.

5.10 Utilities

There are no known deficiencies with the utilities and therefore we do not have recommendations for repairs to them. It is likely that in isolated locations, the support rebar will break and require replacing to continue to support the water, electrical, and pump out lines. This should be done on an as needed basis.

5.11 Future Upgrade options

Prior to the conclusion of the lifespan of the facility, upgrades should be planned and implemented. Additional upgrades to the facility would be major undertakings that should take into consideration future use plans, sea level rise scenarios, and storm resiliency measures. Current projections, which were updated in February 2022 through the *Global and Regional Sea Level Rise Scenarios for the United States* report issued by NOAA indicate that the mean sea level (MSL) will rise between 1.3 and 2.4 feet by year 2050 depending on the model scenario[1]. This information should be utilized to determine all future plans for the waterfront area of Menemsha including this facility. Multiple options are available for replacing the overall Commercial Fish Dock facility and explained in brief in the following paragraphs, rough sketches for the possibilities are included in Appendix B of this report and include:

- Replacing the aging bulkhead with a new steel sheet pile bulkhead. Similar to the 1987 project to install the current bulkhead, the new sheet pile would be driven just outshore of the existing bulkhead and the annular space between the two would be filled. The top height of the new bulkhead should work in conjunction with the Town's master plan for combatting sea level rise and should be designed to accommodate increase wave forces from storms that will occur more frequently as predicted. Increasing the height of the bulkhead may require the addition of a deadman tieback system for the bulkhead which would increase costs. Current estimates for replacing the bulkhead are between $3,000 and $5,000/LF making the overall cost for a

[1] NOAA. (2022) Global and Regional Sea Level Rise Scenarios for the United States

new bulkhead up to $3.3 million. This cost may vary greatly depending on final construction details and market value for bulk steel.

- Replacing the timber wharf with concrete or aluminum floating docks along the entire length. It is recommended that concrete or aluminum be used to provide increase durability for floats occupied year-round. This option will allow for changes in sea level trends while maintaining an adaptive vessel access platform. The estimated cost for aluminum framed floats is $70 to $90/sqft while the estimated cost for concrete floats is $125 to $175/sqft. The roughly 6,850 square feet of timber wharf to be replaced would cost between $480,000 and $1.2 million.

- Replace the existing timber wharf with a new wharf structure. Modifications of a new wharf structure would take into account sea level rise to allow for ease of vessel loading in the near term and future use. This option would allow the Town to maintain the existing appearance of the harbor, which is understood to be a driving factor in future decisions.

- Replacing the existing wharf in conjunction with the sheet pile bulkhead and installing a new bulkhead with “wharf” topping. This method would utilize a new steel sheet pile bulkhead with a timber deck built on top to give the visual appearance of the historic timber wharf.

These options are examples meant to start the conversation regarding future upgrade plans and can be refined to fit into the Town’s changing master plan. Extensive permitting at the local, state, and federal levels would be required to seek approvals for any of these options outlined above. At a minimum, approvals from the local Conservation Commission, MassDEP Chapter 91, Massachusetts Environmental Protection Agency (MEPA), and Army Corps of Engineers (USACE) would be required. Current lead times for projects of similar scope see permitting taking between 12 and 24 months to obtain. Additional costs beyond engineering design that should be taken into consideration are wave modeling and soil testing.

6.0 Summary

The Menemsha Commercial Fishing Dock facility is in fair condition overall. The inspection showed normal wear for the age of the structure plus additional degradation due to applied environmental changes such as the water circulation lines. Generally, minor to moderate defects and deterioration were observed, with only localized areas of moderate to advanced deterioration. The steel channels and the southern end pile cap connections being the items and areas of most concern. As discussed above the short-term repairs would help maintain the 10 to 15 year projected lifespan but not greatly

extend the life beyond that. A capital plan to provide repairs to the facility should be discussed. If the repairs are not made within the timeframes discussed above, more advanced deterioration can be expected. We therefore recommend the repairs mentioned be considered in order to create a long-term plan moving forward that works for the Town of Chilmark.

Childs Engineering Corporation appreciates the opportunity to present our findings and recommendations from our recent investigation. If you have any questions or comments on this report, please don't hesitate to contact the undersigned.

Andrew R. Nilson, P.E.
Project Manager
508 966 9092 x 27
nilsona@childseng.com

APPENDIX A
Photographs

Photo 1 – Typical portion of the wharf in fair condition.

Photo 2 – General view of the wharf construction.

Photo 3 – Typical view of the steel sheet pile bulkhead.

Photo 4 – Holes in the timber bulkhead in the tidal zone with new timber visible behind.

Photo 5 – Close up of typical sheet condition with surface corrosion and wavy steel.

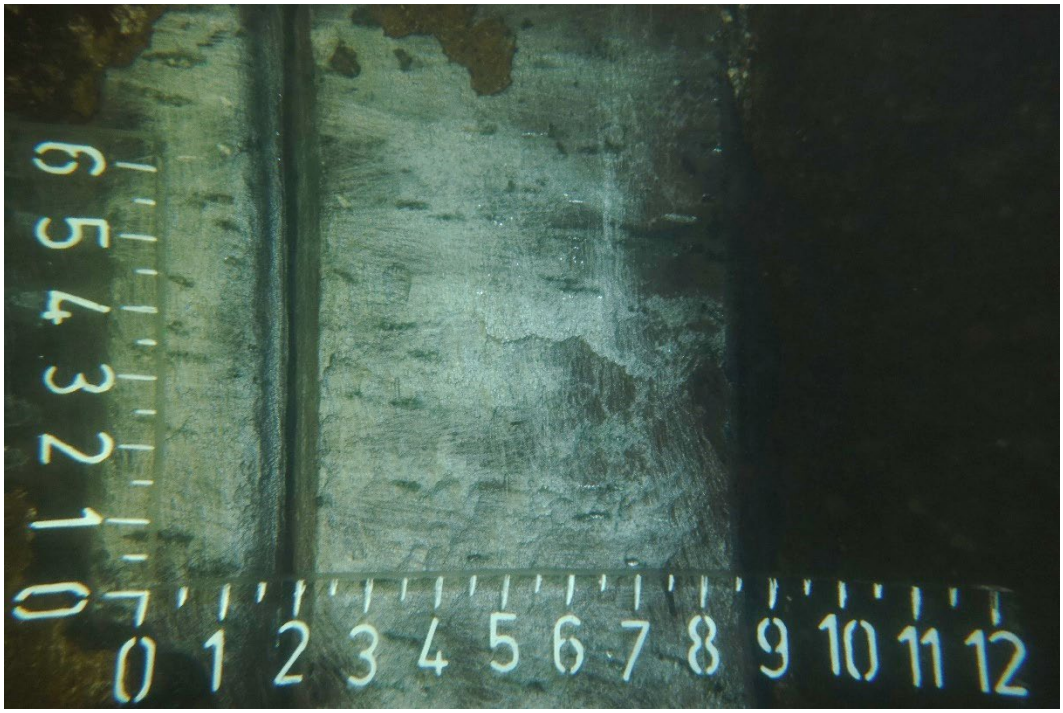


Photo 6 – Underwater view of the cleaned sheet pile with wavy steel.

Photo 7 – Close up of the sheet pile with heavy corrosion byproduct.

Photo 8 – Cleaned area of the sheet pile with wavy steel and heavy corrosion byproduct.

Photo 9 – Corrosion hole above an outfall pipe.

Photo 10 – Close up of corrosion hole in the sheet pile with filter fabric visible

Photo 11 – Larger corrosion hole in the sheet pile web.

Photo 12 – Typical view of the steel sheet pile cap.

Photo 13 – Steel sheet pile cap with severe knife edging.

Photo 14 – The concrete with minor deterioration.

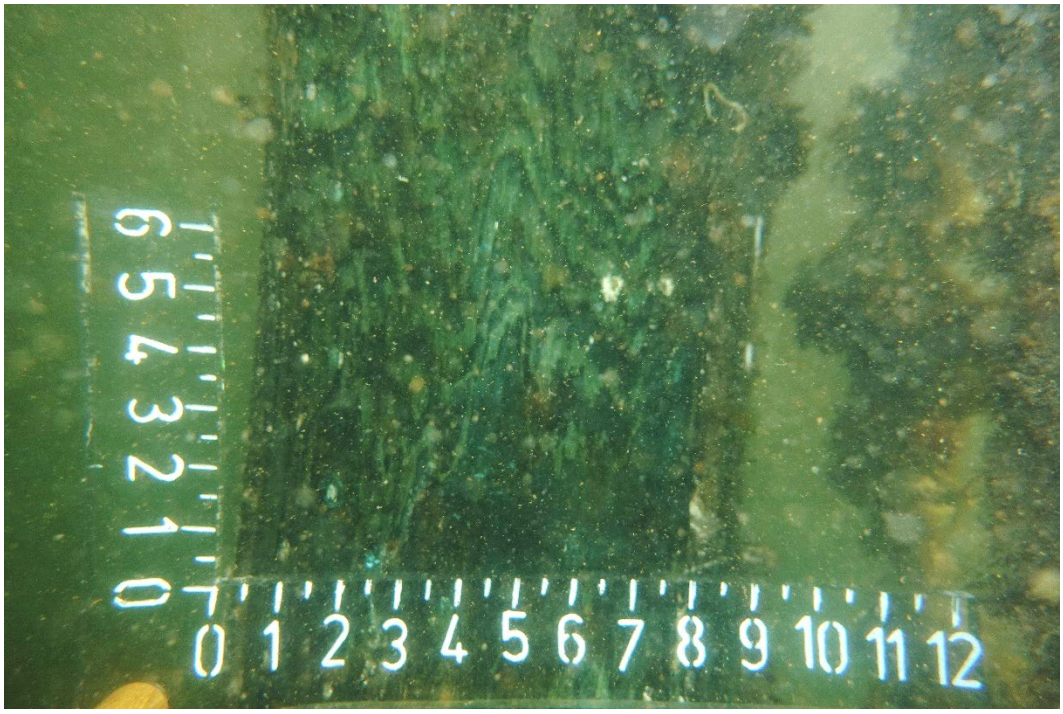


Photo 15 – Underwater view of the timber support piles.

Photo 16 – Timber fender pile connection to the piles supporting the wharf.

Photo 17 – Underwater view of the greenheart fender piles.


Photo 18 – Underdeck view of the timber split cap.

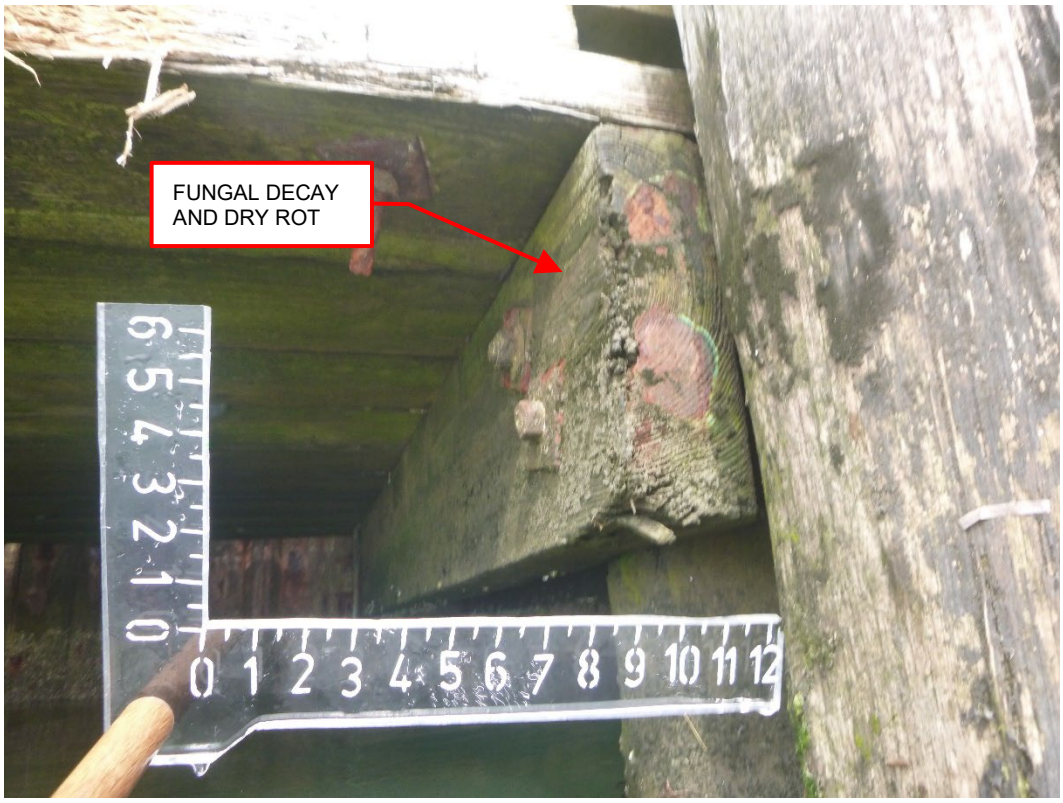


Photo 19 – Fungal decay on the end of the timber pile cap.

Photo 20 – Fungal decay extending into the connection between Bents 5 and 8.

Photo 21 – Fungal decay extending into the connection between Bents 5 and 8.

Photo 22 – Close up of the back of the butt connection between Bents 6 and 9.

Photo 23 – Close up of the butt connection between Bents 6 and 9.

Photo 24 – Close up of the butt connection between Bents 6 and 9.

Photo 25 – Underdeck view of the timber split cap.

Photo 26 – Typical view of the steel channel connecting to the sheet pile.

Photo 27 – Through-bolts connecting the pile cap to the channel.

Photo 28 – Corrosion on the inside of the channel looking up.

Photo 29 – Close up of the steel channel to sheet pile weld.

Photo 30 – Timber decking running longitudinally along the wharf.

Photo 31 – Close up of the fungal decay on the timber decking.

Photo 32 – Close up of the fungal decay on the curb.

Photo 33 – Typical corrosion on the underside of the deck curb connection bolts.

Photo 34 – The inshore deck curb connections do not go through the 4 inch by 4 inch board.

Photo 35 – Close up of the severe deterioration of the wale.


Photo 36 – Overall view of the Fuel Pier.

Photo 37 – Overall view of the Fuel Pier.

Photo 38 – Intake and outfall pipes through the sheet pile.

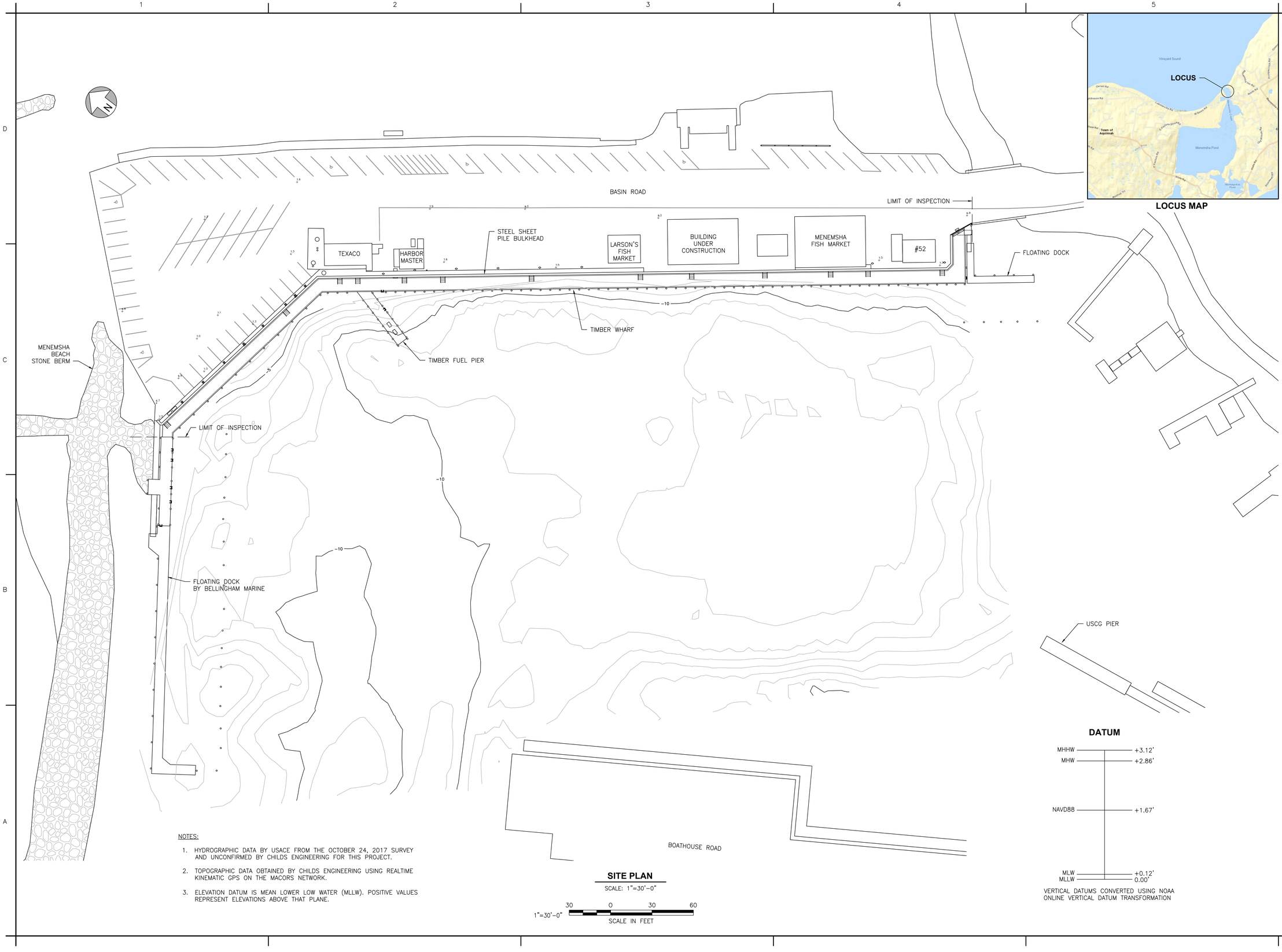
Photo 39 – Intake and outfall pipes through the sheet pile.

Photo 40 – Pump out station behind the bulkhead.

Photo 41 – Shore power pedestal.

Photo 42 – Electrical transformer providing power to the floating docks.

APPENDIX B
Drawings



LOCUS MAP

NOTES:

1. HYDROGRAPHIC DATA BY USACE FROM THE OCTOBER 24, 2017 SURVEY AND UNCONFIRMED BY CHILDS ENGINEERING FOR THIS PROJECT.
2. TOPOGRAPHIC DATA OBTAINED BY CHILDS ENGINEERING USING REALTIME KINEMATIC GPS ON THE MACORS NETWORK.
3. ELEVATION DATUM IS MEAN LOWER LOW WATER (MLLW). POSITIVE VALUES REPRESENT ELEVATIONS ABOVE THAT PLANE.

SITE PLAN

SCALE: 1"=30'-0"

1"=30'-0" 30 0 30 60

SCALE IN FEET

DATUM

MHHW	+3.12'
MHW	+2.86'
NAVD88	+1.67'
MLW	+0.12'
MLLW	0.00'

VERTICAL DATUMS CONVERTED USING NOAA ONLINE VERTICAL DATUM TRANSFORMATION

CHILDS ENGINEERING
34 WILLIAM WAY, BELLINGHAM, MA 02019 U.S.A.
Phone: (508) 966-9002
E-mail: mail@childseng.com

Mark	Description	Date	Appr.

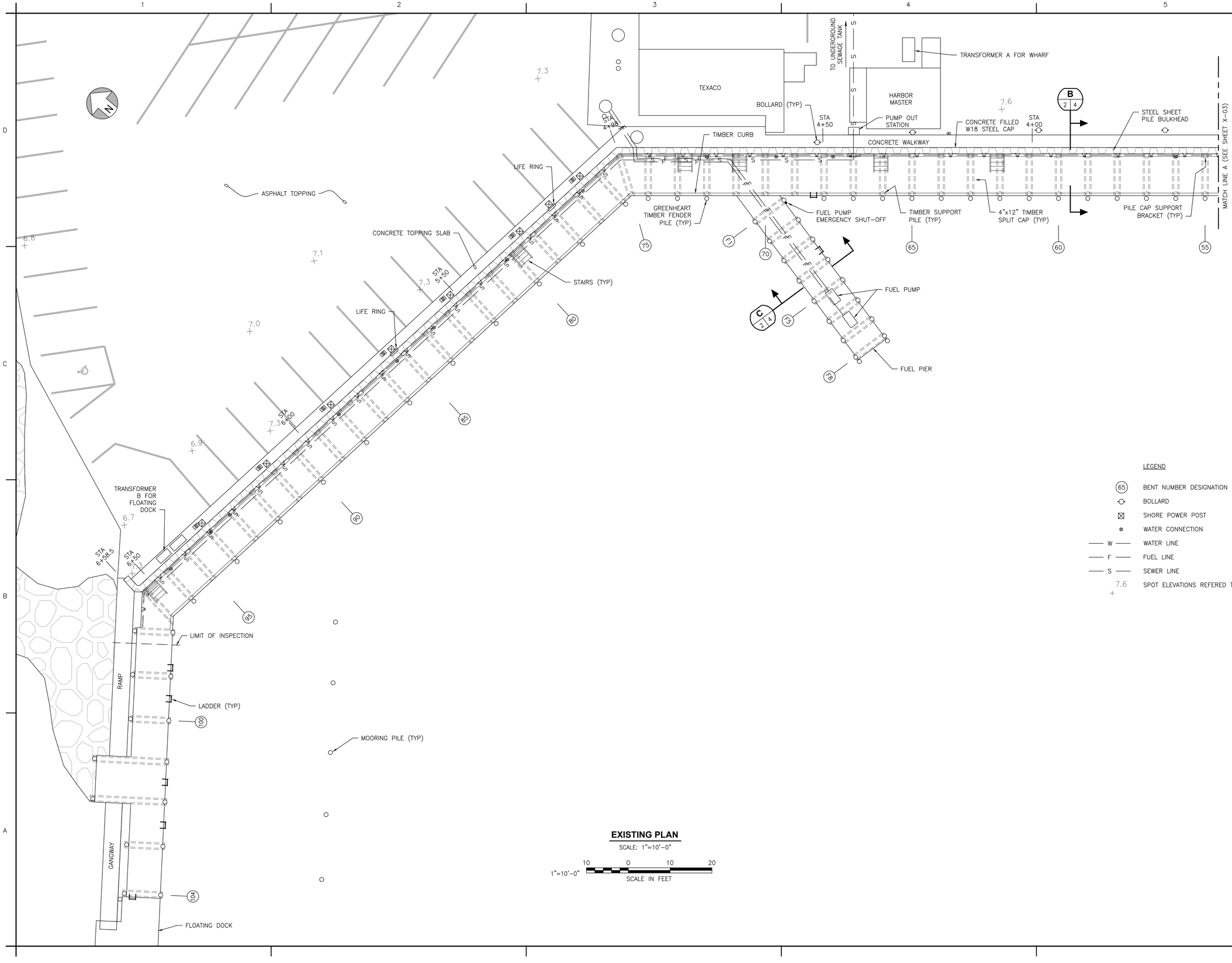
Date: 03/28/22
Design file no.: 298222 X-01
Scale: 1"=30'-0"
Designed by: ARN
Det. by: TEQ
Ckd. by: ARN
Reviewed by: ARN

MENEMSHA DOCK REPLACEMENT PHASE 1
CHILMARK, MA

SITE PLAN

Sheet reference number: X-01
Sheet 1 of 5

QUINNT K:\2982-22.00 MENEMSHA DOCK REPLACEMENT PHASE I - CHILMARK\CADD\CURRENT WORKING DWGS\298222 X-01 SITE PLAN.DWG Mar 28, 2022 - 3:29pm



EXISTING PLAN

SCALE: 1"=10'-0"

1"=10'-0" 10 0 10 20

SCALE IN FEET

LEGEND

- (65) BENT NUMBER DESIGNATION
- BOLLARD
- SHORE POWER POST
- WATER CONNECTION
- W — WATER LINE
- F — FUEL LINE
- S — SEWER LINE
- 7.6 + SPOT ELEVATIONS REFERED TO MLLW

CHILDS ENGINEERING
34 WILLIAM WAY, BELLINGHAM, MA 02019 U.S.A.
Phone: (508) 966-9092
E-mail: mail@childseng.com

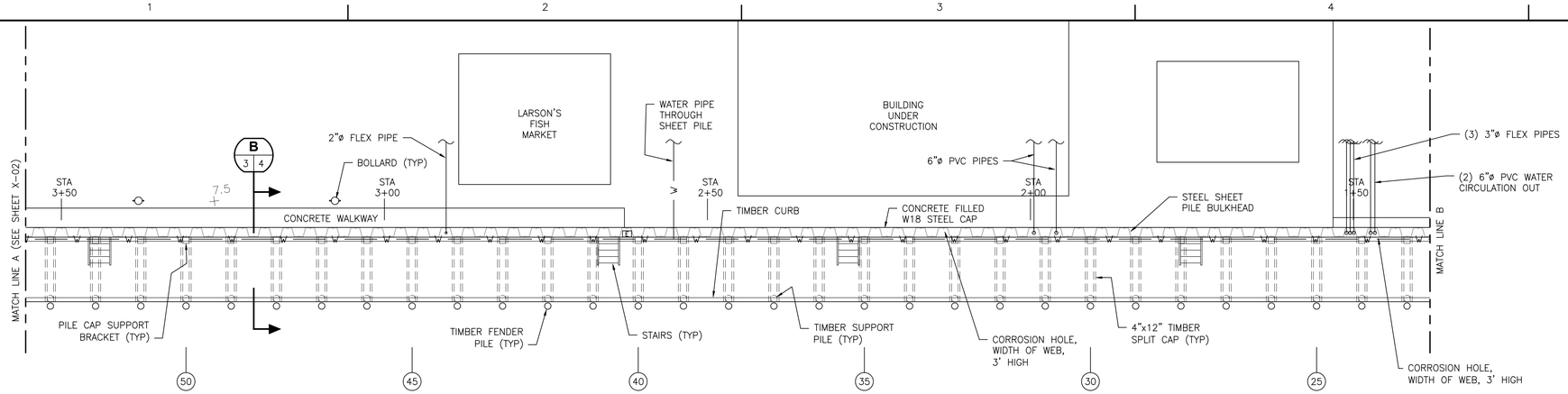
Mark	Description	Date	Appr.

Date: 03/28/22
Design file no.: 298222 X-02
Scale: 1"=10'-0"
Designed by: ARN
Drawn by: TEQ
Chk'd by: ARN
Reviewed by: ARN

MENEMSHA DOCK REPLACEMENT PHASE 1
CHILMARK, MA

EXISTING CONDITIONS PLAN

Sheet reference number: X-02
Sheet 2 of 5

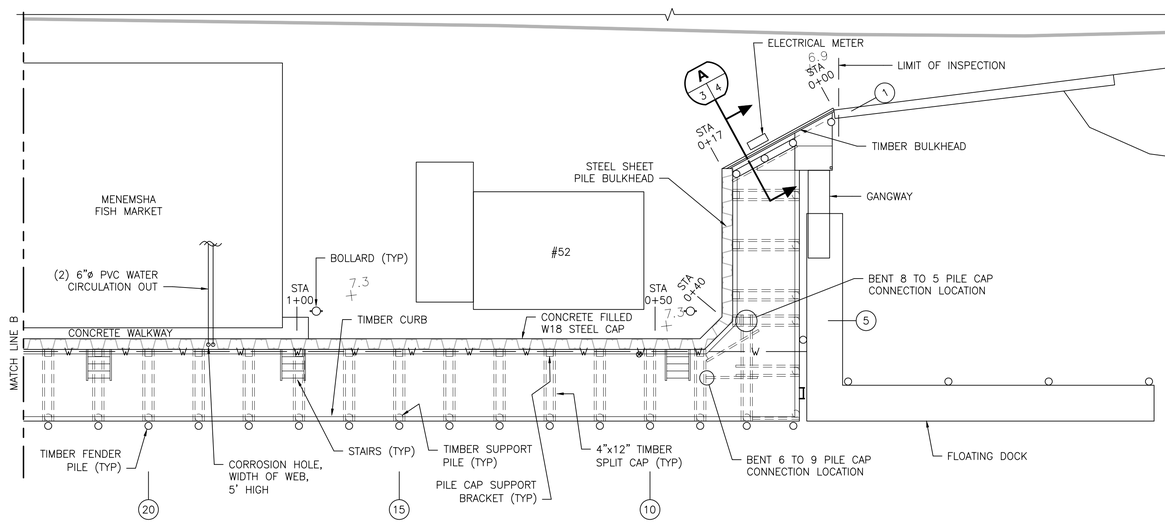


EXISTING PLAN

SCALE: 1"=10'-0"

1"=10'-0" 10 0 10 20

SCALE IN FEET



EXISTING PLAN

SCALE: 1"=10'-0"

1"=10'-0" 10 0 10 20

SCALE IN FEET

LEGEND

- (35) BENT NUMBER DESIGNATION
- BOLLARD
- SHORE POWER POST
- WATER CONNECTION
- W — WATER LINE
- F — FUEL LINE
- S — SEWER LINE
- 7.6 + SPOT ELEVATIONS REFERED TO MLLW

CHILDS ENGINEERING
34 WILLIAM WAY, BELLINGHAM, MA 02019 U.S.A.
Phone: (508) 966-9002
E-mail: mail@childseng.com

Mark	Description	Date	Appr.

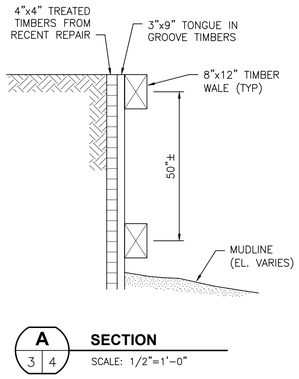
Designed by: ARN	Cad by: ARN	Date: 03/28/22	Scale: 1"=10'-0"
Det. by: TEQ	Reviewed by: ARN	Design file no: 298222 X-03	

MENEMSHA DOCK REPLACEMENT
PHASE I
CHILMARK, MA

EXISTING CONDITIONS PLAN

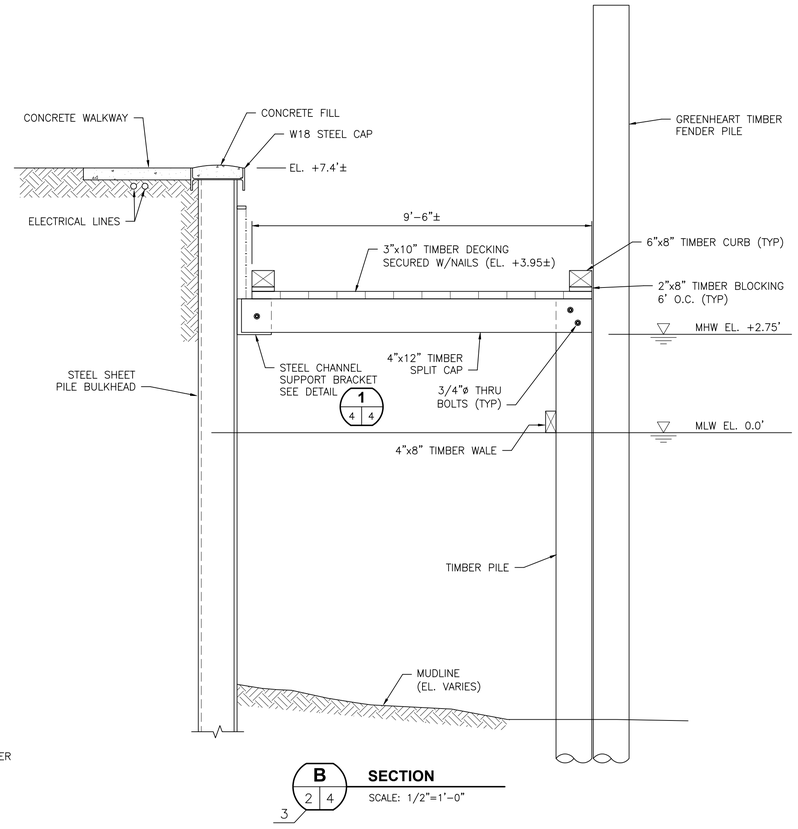
Sheet reference number: X-03

Sheet 3 of 5



A 3 | 4 **SECTION**

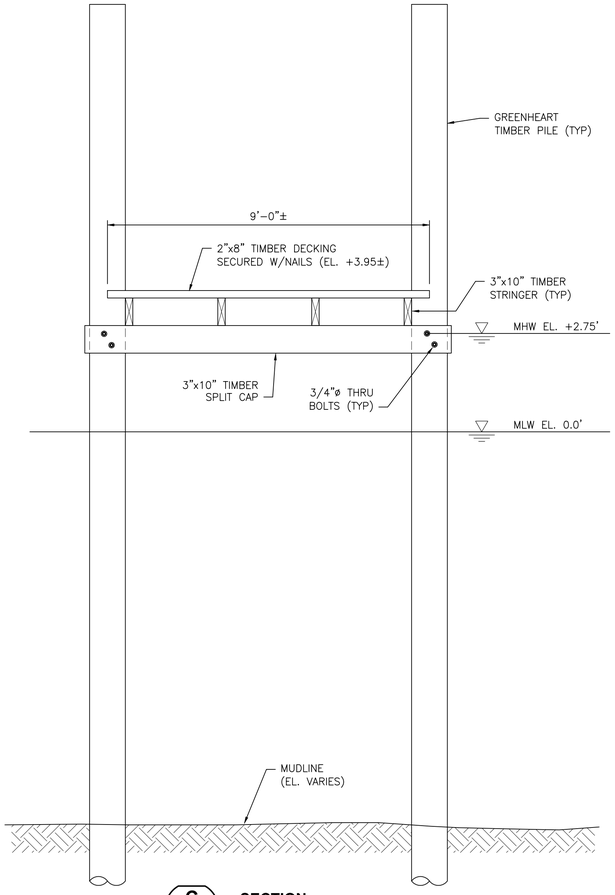
SCALE: 1/2"=1'-0"



B 2 | 4 **SECTION**

3

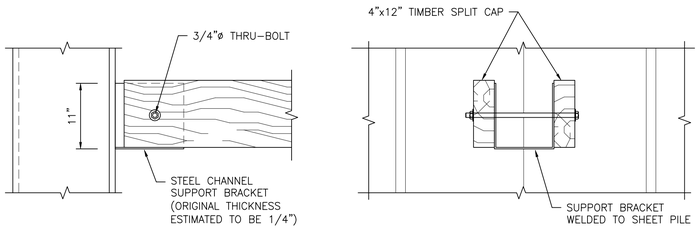
SCALE: 1/2"=1'-0"



C 2 | 4 **SECTION**

SCALE: 1/2"=1'-0"

PLAN



ELEVATION SECTION A–A

1 4 | 4 **PILE CAP SUPPORT BRACKET**

SCALE: 1"=1'-0"

CHILDS ENGINEERING
34 WILLIAM WAY, BELLINGHAM, MA 02019 U.S.A.
Phone: (508) 966-9002
E-mail: mail@childseng.com

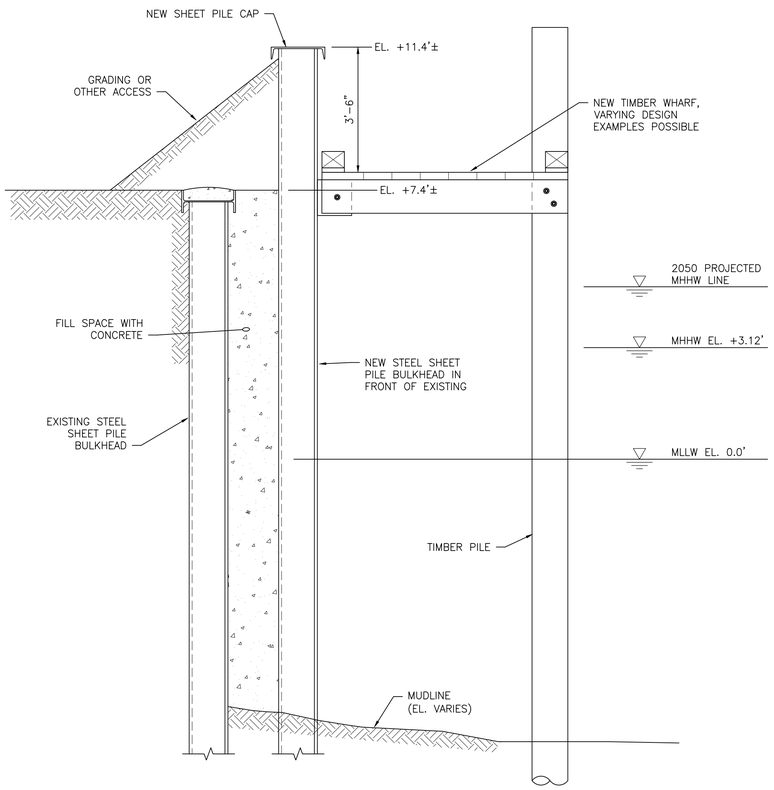
Mark	Description	Date	Appr.

Designed by: ARN	Drawn by: TEQ	Date: 03/28/22	Scale: AS NOTED
Det. by: ARN	Reviewed by: ARN	Design file no. 298222 X-04	

MENEMSHA DOCK REPLACEMENT PHASE 1
CHILMARK, MA

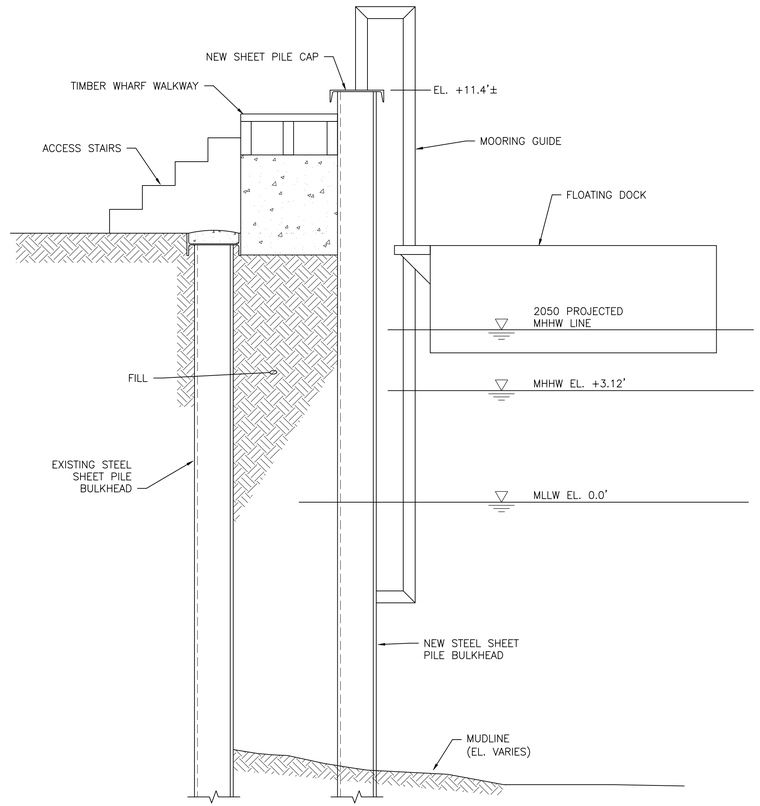
EXISTING SECTIONS

Sheet reference number:
X-04
Sheet 4 of 5



SECTION- NON-ENGINEERED UPGRADE CONCEPT 1

SCALE: 1/2"=1'-0"



SECTION- NON-ENGINEERED UPGRADE CONCEPT 2

SCALE: 1/2"=1'-0"

1/2"=1'-0" 2 0 2 4

SCALE IN FEET

CHILDS ENGINEERING
34 WILLIAM WAY, BELLINGHAM, MA 02019 U.S.A.
Phone: (508) 966-9002
E-mail: mail@childseng.com

Mark	Description	Date	Appr.

Designed by: ARN	Date: 03/28/22		
Det. by: TEQ	Cad by: ARN	Design file no.: 298222 X-05	Scale: AS NOTED
		Reviewed by: ARN	

MENEMSHA DOCK REPLACEMENT
PHASE 1
CHILMARK, MA

PROPOSED
DESIGN CONCEPTS

Sheet reference number:
X-05
Sheet 5 of 5