

## 5. Repair Recommendations

Based on the findings from the inspection reports, the team has worked to develop eleven (11) potential projects that address critical repairs needed to restore and support ongoing operations as well as improvements to existing infrastructure that can support the expansion of operations with minimal capital investment. Class 5 conceptual estimates with an expected accuracy range of +50% to -30%, appropriate for early-stage planning were developed through collaborative work using Engineer input, estimator judgment, and high-level assumptions to define scope and costs. As the project scope evolves, the estimate should be refined to improve accuracy. All pricing is based on 2025 labor and material costs and does not include escalation for work performed in the future years and tariff impact. Details of the cost estimate methodology and assumptions used are included in Attachment 8.2 for Berths 5-8 and Attachment 8.5 for the Graving Basins and Finger Piers.

### 5.1. Berths 5-6

#### 5.1.1. Pavement Settlement Repair

During site inspections at Berths 5-6, it was identified that the pavement behind the wharf has settled due to soil erosion. Work to stabilize the soil and prevent further pavement settlement includes the following scope:

1. Furnish and install sheet pile walls.
2. Furnish and install concrete beams.
3. Excavate and control density fill.
4. Repair damaged pavement caused by sheet pile wall construction.

#### 5.1.2. Wharf Repairs

The objective of this project will be to repair the damaged concrete at various areas around Berths 5-6, restoring the structure to the original design intent. The scope of work includes the following:

1. Repair concrete damage at diagonal struts on each side of the waterside rail beam.
2. Repair concrete damage at the waterside and landside crane beams.
3. Replace missing and damaged timber piles with concrete piers at timber pile supported deck at Berth 5.
4. Replace bollard and repair concrete-supporting bollard.
5. Repair damaged concrete at the underdeck soffit and above deck.



## 5.2. Berths 7-8

### 5.2.1. Broken Beam Retrofit

Structural inspections determined that the sagging slab at the southern limit of Berth 7 is caused by beam failure below. Additionally, there are many damaged and missing timber piles, so the substructure does not provide adequate support. Immediate action should be taken to restore the beam to its original position and strength. Two alternative projects have been recommended. Alternate 1 is a repair concept which consists of the following scope of work:

1. Repair the broken beam by installing piles at (3) locations, installing support beams, and jacking the beam and slab to a level position.
2. Add non-shrink grout for permanent beam support.
3. Replace the missing and damaged timber piles.

Alternate 2 is a rebuild concept consisting of the following scope of work:

1. Demolish the section of slab affected by the broken beam.
2. Construct a new wharf deck, assuming 9,000 square feet of concrete-pile supported wharf deck.

### 5.2.2. Seismic Tie Beam Support Stabilization

The tie beam support at Berths 7-8 is overstressed due to missing and damaged adjacent piles. Additionally, some settlement was observed at the pavement surface. The scope of work to stabilize the seismic tie beam supports includes the following:

1. Furnish and install steel pipe piles and support steel beams.
2. Furnish and install steel beams and slab jacking.
3. Add non-shrink grout for permanent beam support.
4. Repair deck reinforcing and install grout or concrete.
5. Perform corrosion damage repair for the concrete tie-beam and seismic tie beam.

### 5.2.3. Pavement Settlement Repair

The pavement failure at Berths 7 and 8 is caused by soil erosion behind the wharf. Liftech performed work in 2010 that identified segments of at the wharf that require soil settlement stabilization to prevent further pavement settlement at the landside edge of the inner wharf. The scope of work includes the following:

1. Furnish and install sheet pile walls.
2. Furnish and install concrete beams.
3. Excavate and control density fill.
4. Repair damaged pavement caused by sheet pile wall construction.

It should be noted that these repairs are less urgent than those at Berths 5-6 due to the area at Berths 7-8 being more protected and not widely used.

### 5.2.4. Wharf Repairs

A project to address general wharf repairs at Berths 7-8 would address areas around the structure:

1. Remove and dispose of some existing bollards, all existing fenders, and all temporary bullrails.
2. Furnish and install new fenders and bollards.
3. Repair damaged wharf deck and repair/replace damaged piles at the traffic loading areas.
4. Furnish and install sheet piles.



Table 8 Preliminary Cost Estimates (Berths 5-8)

<u>Location</u>	<u>Description</u>	<u>Schedule</u>	<u>Cost Total (Rounded)</u>
<b>Berths 5-6</b>	<u>Project 1</u> Pavement Settlement Repair at Wharf Interface	<ul style="list-style-type: none"> <li>Furnish and install sheet pile walls</li> <li>Furnish and install concrete beams</li> <li>Excavate and control density fill</li> </ul> • Repair damaged pavement caused by sheet pile wall construction	Within 1 year \$1,600,000
	<u>Project 2</u> Wharf Repairs	<ul style="list-style-type: none"> <li>Repair concrete damage at diagonal struts on each side of the waterside rail beam</li> <li>Repair concrete damage at the waterside and landside crane beams</li> <li>Replace missing and damaged timber piles with concrete piers at timber pile supported deck at Berth 5</li> <li>Replace bollard and repair concrete-supporting bollard</li> <li>Repair damaged concrete at the underdeck soffit and above deck</li> </ul>	Within 6-10 years \$66,400,000
	<b>Berths 5-6 Subtotal</b>		<b>\$68,000,000</b>
<b>Berths 7-8</b>	<u>Project 3</u> Broken Beam Retrofit	<ul style="list-style-type: none"> <li>Alternate 1: Repair Broken Beam by installing piles on either side and directly beneath broken beam, installing support beams, and jacking the beam and slab to a level position. Add non-shrink grout for permanent beam support and replace missing and damaged timber piles</li> <li>Alternate 2: Rebuild wharf deck by demolishing the section of slab affected by the broken beam and constructing a new wharf deck</li> </ul>	Within 1 year \$1,200,000 (repair) or \$5,000,000 (rebuild)
	<u>Project 4</u> Seismic Tie Beam Support Stabilization	<ul style="list-style-type: none"> <li>Furnish and install steel pipe piles and support steel beams</li> <li>Furnish and install steel beams and slab jacking</li> <li>Add non-shrink grout for permanent beam support</li> <li>Repair deck reinforcing and install grout or concrete.</li> <li>Perform corrosion damage repair for the concrete tie-beam and seismic tie beam</li> </ul>	Within 2 years \$4,600,000
	<u>Project 5</u> Pavement Settlement Repair at Wharf Interface	<ul style="list-style-type: none"> <li>Furnish and install sheet pile walls</li> <li>Furnish and install concrete beams</li> <li>Excavate and control density fill</li> </ul> • Repair damaged pavement caused by sheet pile wall construction	Within 2 years \$1,100,000
	<u>Project 6</u> Wharf Repairs	<ul style="list-style-type: none"> <li>Remove and dispose of some existing bollards, all existing fenders, and all temporary bullrails</li> <li>Furnish and install new fenders and bollards</li> <li>Repair damaged wharf deck and repair/replace damaged piles at the traffic loading areas</li> <li>Furnish and install sheet piles</li> </ul>	Within 6-10 years \$130,000,000
	<b>Berths 7-8 Subtotal</b>		<b>\$136,900,000</b>
	<b>Total Costs</b>		<b>\$204,900,000<sup>†</sup></b>

<sup>†</sup>Total cost assumes repair for broken beam retrofit, not rebuild



## 5.3. Graving Basins

### 5.3.1. Project 1: Safety Improvements

A safety improvements project would address load restrictions at areas where exterior columns are severely damaged and potential environmental and safety hazards, including large holes in the deck not properly covered, and large quantities of paints, solvents, and other environmentally hazardous chemicals stored with no visible methods of containment. The scope of this project includes the following:

1. Crib the edge beams at locations where columns are severely damaged, consisting of 12x12 mass timber members, with two beams per vertical column that will comply with applicable load restrictions.
2. Install steel covers at holes located towards the south ends of the basin fingers and securely barricade the structures where the south ends are completely open.
3. Implement short-term actions by restricting access to areas where there is storage of paints, solvents, and other chemicals. Long-term environmental survey and waste disposal will require the development of an environmental assessment report to quantify existing contamination throughout the structures and plan for removal.

### 5.3.2. Project 2: Mooring and Fender System Upgrades

A project to upgrade the existing mooring and fender systems at the graving basins will eliminate the usage of exterior columns as mooring/fendering points, thus preventing future damage. The scope of this project includes the following:

1. Remove existing mooring bits no longer in use and install (16) 50-ton capacity bits per basin at the same locations.
2. Install (16) 5x10 ft floating foam fenders per basin that are anchored to the top of the deck diaphragm.

### 5.3.3. Project 3: Concrete Repairs

The Port should plan to fund a project to provide general, non-critical concrete repairs at the graving basins. These repairs will prevent further deterioration of the various concrete elements throughout the structure. The scope of this project includes:

1. Address concrete spalling, cracks, and exposed reinforcing steel of columns with major damage by removing the spalled concrete, cleaning corroded steel, bush-hammering the surrounding concrete, and adding fiberglass formwork (to remain in place) before pouring the new concrete.
2. Full reconstruction of all columns with severe damage.
3. Provide shotcrete repairs to address soffit damage at various locations throughout the finger structures.

It should be noted that M&N recommends that a dive inspection be performed prior to any concrete repair efforts of the graving basin walls to assess the extent of structural damage.



## 5.4. Finger Piers

### 5.4.1. Project 4: Fender System Upgrades

The Port should plan to upgrade the fender systems at both finger pier structures. The scope of this project includes:

1. Install new continuous fendering on both longitudinal faces of the piers to accommodate a wider range of vessel sizes.

### 5.4.2. Project 5: Concrete Repairs

This project will address the corrosion and soffit damage on the deep beams and piles with major damage through non-critical concrete repairs. Its scope includes:

1. Perform beam soffit repairs on the longitudinal and transverse beams to address delaminations and spalling. Concrete repairs should include anodes to prevent future corrosion of reinforcing steel as a result of exposure at high tide levels.
2. Install non-structural fiberglass jackets and grout piles with major damage.
3. Remove and replace center pile severely damaged, likely through impact.
4. Provide composite FRP fender piles at the south end of the finger pier structures to prevent further impact damage to piles.



Table 9 Preliminary Cost Estimates (Graving Basins and Finger Piers)

	Description	Schedule	Cost Total (Rounded)
Graving Basins	<p><u>Project 7</u> Safety Improvements Project</p> <ul style="list-style-type: none"> <li>• Temporary shoring at columns with severe damage ratings</li> <li>• Install steel covers for small holes throughout the structures and barricade open ends of structures</li> <li>• Short term action by restricting access and long-term environmental survey, including development of an environmental assessment report and waste disposal</li> </ul>	Within 2 years	\$250,000
	<p><u>Project 8</u> Mooring and Fender System Upgrades</p> <ul style="list-style-type: none"> <li>• Install (16) (50-ton capacity) bits per basin, including reinforcement of deck area</li> <li>• Install (16), 5x10 ft floating foam fenders at each basin, assume anchoring to the top of the diaphragm</li> </ul>	Within 3-6 years	\$4,500,000
	<p><u>Project 9</u> Concrete Repairs</p> <ul style="list-style-type: none"> <li>• Repair of columns with major damage; removing spalled concrete, cleaning corroded steel, bush hammering the surrounding concrete, fiberglass formwork (to remain in place), and pouring the new concrete</li> <li>• Reconstruction of all columns with severe damage</li> <li>• Shotcrete repairs to address soffit damage throughout structures</li> </ul>	Within 6-10 years	\$4,750,000
	<b>Graving Basin Subtotal</b>		<b>\$9,500,000</b>
Finger Piers	<p><u>Project 10</u> Fender System Upgrades</p> <ul style="list-style-type: none"> <li>• Install new fendering on both longitudinal faces of the piers to provide near and continuous fendering, accommodating a wider range of vessel sizes</li> <li>• Two options were considered: (1) Fiber-reinforced polymer (FRP) composite piles with HDPE-sheath and (2) Steel pipe piles with 50-ft FRP camels and leg fenders at every pile</li> </ul> <p>Note: Cost estimate is average of both options</p>	Within 6-10 years	\$3,100,000
	<p><u>Project 11</u> Concrete Repairs</p> <ul style="list-style-type: none"> <li>• Beam soffit repairs</li> <li>• Replace center pile at south end of finger pier structure</li> <li>• End-of-pier fender system to protect against vessel impacts</li> <li>• Pile repairs: jacket and grout piles with major damage (non-structural fiberglass jackets to remain in place)</li> </ul>	Within 6-10 years	\$10,240,000
	<b>Finger Piers Subtotal</b>		<b>\$13,340,000</b>
	<b>Total Costs</b>		<b>\$22,840,000</b>

