JACOBS®

Crescent Harbor Lightering Float Condition Assessment

Condition Summary Report

Version 1.0

January 21, 2020

City and Borough of Sitka, Alaska

Crescent Harbor Lightering Float Condition Assessment

Project No:	W3X90900
Document Title:	Condition Summary Report
Document No.:	BI1023190117BAO
Revision:	Final
Date:	January 21, 2020
Client Name:	City and Borough of Sitka, AK
Project Manager:	George Newman, PE, PMP
Author:	Mark Parent, PE, SE Ryan Breen, PE John Owens, PE
File Name:	Sitka Lightering Float Condition Report_01.21.2020

Jacobs Engineering Group Inc.

949 East 36th Avenue, Suite 500
Anchorage, Alaska 99508
United States
T +1.907.762.1343

www.jacobs.com

Contents

Acronyms and Abbreviations

ACI	American Concrete Institute
ADCI	Association of Diving Contractors International
AISC	American Institute of Steel Construction
ASCE	American Society of Civil Engineers
CBS	City and Borough of Sitka
(E)	existing
ft	feet
HID	high-intensity discharge
Jacobs	Jacobs Engineering Group
MOP	Manual of Practice
NEC	National Electrical Code
OCPD	overcurrent protection device
PE	Professional Engineer
ROM	rough order of magnitude
SE	Structural Engineer

1. Introduction

1.1 Project Background

This report was produced for the City and Borough of Sitka (CBS), Alaska to provide an overall condition assessment of the Crescent Harbor Lightering Float. The condition assessment includes a general evaluation of the constituent elements of the structures, recommendations for repair or replacement of elements that are nearing or exceeded their service life, a rough order of magnitude (ROM) cost estimate for recommended repairs and maintenance, and an estimated remaining service life for the remaining elements. Detailed designs and load ratings are not included in the scope of this project.

1.2 Inspection Methodology

Prior to the on-site investigation, Jacobs Engineering Group Inc. (Jacobs) engineers conducted preliminary research by reviewing the existing design documents available for the subject facilities to gain a detailed understanding of the structural systems, load paths, and construction materials. After the preliminary document research and trip planning, a team of engineers mobilized to Crescent Harbor and performed field investigations on October 1, 2019 through October 4, 2019. A team of engineer-divers performed all below-water investigations while a structural engineer and an electrical engineer evaluated the above-deck features.

The investigation of the Lightering Float included the following inspection tasks:

- Level I visual and tactile underwater inspection of the concrete floats and galvanized steel piles.
- Level II underwater cleaning inspections on 10 percent of the concrete floats and galvanized steel piles.
- Topside inspection of the concrete floats, timber rails, and connection hardware.
- Inspection of the two access gangways.
- Photographs to document general conditions and significant defects.

Element-level damage ratings and overall system condition assessment ratings are assigned based on the guidelines within American Society of Civil Engineers (ASCE) Manual of Practice (MOP) 130, “Waterfront Facilities Inspection and Assessment.” Descriptions of the overall system assessment ratings are presented below in Figure 1 and damage ratings for timber elements are shown in Figure 2.

1.2.1 Underwater Inspection

The underwater inspection was performed by a three-person engineer-diver team led by a Professional Engineer who is also a commercial diver certified by the Association of Diving Contractors International (ADCI). The other two members of the dive team were the Dive Supervisor and Technician-Diver, both of whom are also ADCI certified. The Jacobs dive inspection team members have successfully completed structural inspection training for engineer-divers to accurately report structural damage and deficiencies, and all Jacobs Professional Engineer-Diver Team Leaders have more than 10 years of experience performing underwater structural inspections of waterfront structures.

The members of the inspection team were equipped and trained, and all diving operations were conducted, in accordance with the Occupational Safety and Health Administration Commercial Diving Operations Standard (29 Code of Federal Regulations 1910, Subpart T), ADCI Consensus Standards for Commercial Diving and Underwater Operations, and Jacobs’ Commercial Diving Safe Work Practices Manual (2016).

Commercial scuba diving equipment, including full face masks with through-water communications and high-pressure primary and bailout tanks, was utilized to perform the inspection. The diving operations were staged from the topside of the Lightering Float and the city-owned vessel “Stray Current.”

Figure 1: Overall System Condition Assessment Ratings

Rating		Description
6	Good	No visible damage or only minor damage noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs are required.
5	Satisfactory	Limited minor to moderate defects or deterioration observed but no overstressing observed. No repairs are required.
4	Fair	All primary structural elements are sound but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load-bearing capacity of the structure. Repairs are recommended, but the priority of the recommended repairs is low.
3	Poor	Advanced deterioration or overstressing observed on widespread portions of the structure but does not significantly reduce the load-bearing capacity of the structure. Repairs may need to be carried out with moderate urgency.
2	Serious	Advanced deterioration, overstressing, or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible, and loading restrictions may be necessary. Repairs may need to be carried out on a high-priority basis with urgency.
1	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, and load restrictions should be implemented as necessary. Repairs may need to be carried out on a very high-priority basis with strong urgency.

Source: ASCE MOP 130 Waterfront Facilities Inspection and Assessment

Figure 2: Damage Ratings for Timber Elements

Damage Rating		Existing Damage[a]	Exclusions [Defects Requiring Elevation to the Next Higher Damage Rating(s)]
NI	Not Inspected	• Not inspected, inaccessible, or passed by[b]	
ND	No Defects	• Sound surface material	
MN	Minor	• Checks, splits, and gouges less than 0.5 in. wide • Evidence of marine borers or fungal decay	Minor damage not appropriate if • Loss of cross section • Marine borer infestation • Displacements, loss of bearing, or connections
MD	Moderate	• Remaining diameter loss up to 15% • Checks and splits wider than 0.5 in. • Cross-section area loss up to 25% • Corroded hardware • Evidence of marine borers or fungal decay, with loss of section	Moderate damage not appropriate if • Displacements, loss of bearing or connections
MJ	Major	• Remaining diameter loss 15 to 30% • Checks and splits through full depth of cross section • Cross-section area loss 25 to 50%; heavily corroded hardware • Displacement and misalignments at connections	Major damage not appropriate if • Partial or complete breakage
SV	Severe	• Remaining diameter loss more than 30% • Cross-section area loss more than 50% • Loss of connections and/or fully nonbearing condition • Partial or complete breakage	

Source: ASCE MOP 130 Waterfront Facilities Inspection and Assessment

1.3 Lightering Float Description

The Crescent Harbor Lightering Float is a concrete float consisting of a 10-foot (ft)-wide x 180-ft-long section which transitions to a 14-ft-wide x 60-ft-long section at the northern end. There are two gangways for accessing the float. The Lightering Float was relocated to Crescent Harbor from its original location below the O'Connell Bridge in 2002.

1.4 Cost Estimate

The ROM cost estimate for recommended repairs and maintenance of the Lightering Float identified in this report is presented in Appendix A. The estimated construction cost is $243,184.

1.4.1 Estimate Methodology

This cost estimate is considered a bottom rolled up type estimate with cost items and breakdown of Labor, Materials and Equipment.

For the development of this cost estimate, there may be systems that have yet to be defined enough on which to base a scope of work for estimating purposes. Jacobs estimating provides parametric costing based on a unit of measurement (i.e., cost per square foot or cost per unit). The cost is assigned per unit and typically is developed by averaging similar projects and analysis of historic costs. Using this approach, estimators strive to generate a basic system design fitting the parameters of the structure and its proposed function.

Finally, pricing is geographically adjusted to reflect local labor and material rates and job site conditions and requirements. As the design process progresses and more detailed project information becomes available, the parametric costing can be replaced with a detailed takeoff and estimated accordingly.

1.4.2 Estimate Classification

This cost estimate is considered a Budget or Class 5 estimate as defined by the Association for the Advancement of Cost Engineering International (AACEI) (see Appendix A for further detail).

Project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. This estimate is based on material, equipment, and labor pricing as of October 2019.

This cost estimate is based on the use of conceptual and stochastic costs and detailed items using separate Labor, Materials and Equipment costs. The estimate uses parametric costs where design information or details are insufficient to allow a detailed item method.

2. Existing Conditions

The overall condition of the Lightering Float is fair. There is moderate concrete spall at a panel joint, some pile guides installed upside down, moderate to major connection hardware corrosion, and moderate damage to various timber elements.

2.1 Concrete Floats

There is one topside spall with exposed and corroded reinforcing steel located on the northern edge of Float 6 at the east end that measures 44 inches long x 8 inches wide x 8 inches deep (see Photographs 1 and 2; photographs are presented in Section 4). The concrete floats typically exhibit moderate scaling on topside and underside with pitting up to 3/8 inch deep (Photographs 3 and 4).

The timber rail to concrete float connection hardware typically exhibits moderate corrosion. There is an area of 20 percent timber section loss on the eastern face of Float 2 extending from the northern edge 5 ft to the south. There is a missing timber chock at the southeast corner of the northern section and the lower timber member at this location is severely deteriorated (Photograph 5). The connection hardware at this location exhibits severe corrosion.

The timber rail to concrete float connection hardware on the southern section (Floats 8 through 22) exhibits moderate to major corrosion on the eastern side where exposed. Most of the connection hardware on the eastern side is covered by the plastic fender. The connection hardware on the western side ranges from minor to major corrosion (Photograph 8).

The timber chock and upper rail at the southeast corner of the southern section (Float 22) is split and the vertical connection hardware is loose at this location (Photograph 6).

The rubber ‘D’ fender on the east side of Floats 7 and 8 is detached at both ends for approximately 20 inches at each end (Photograph 7). The rubber ‘D’ fender connection hardware exhibits major corrosion.

2.2 Float Piles and Pile Guides

The galvanized steel lightering float piles do not exhibit any significant corrosion or damage (Photograph 10). The piles are cathodically protected with one anode on each pile. The anodes are installed near the mudline, approximately 36 ft below the tops of the piles, and the anode at Pile 1 is partially buried. The anodes are 24 inches long with approximately 5-inch x 5-inch section remaining. The anode connection hardware exhibits minor corrosion (Photograph 11).

The pile guides are in fair to satisfactory condition. The pile guides are installed upside down at Piles 3, 5, 7, and 9 (Photograph 12). The level of surface corrosion damage ranges from minor to moderate (Photograph 13). Minor movement of the piles was evident when load from the lightering float was applied.

2.3 Gangways

The north and south gangways do not have significant deterioration or damage. The south gangway exhibits light surface corrosion on the railings (Photographs 14 and 15).

2.4 Electrical Systems and Lighting

The Lightering Float electrical system consists of a feeder from a nearby local utility distribution transformer powering a service disconnect with meter, feeders to the lightering floats, lighting branch circuits, and receptacle branch circuits. There is also a circuit that extends from the lightering floats back to shore, powering a portable shack in the parking area of Harrigan Centennial Hall.

The service disconnect with meter is enclosed in a commercial grade pedestal and shows minimal corrosion. The receptacle outlets, receptacle branch circuit overcurrent protection devices (OCPDs), and pole lighting OCPDs are combined into two shore power pedestals that are located near the two gangway landings.

Feeder and branch cables lack support in locations where the routing conduit is broken or unfastened (Photographs 16 through 18). Feeder and branch cables also have insufficient support at transitions of conduit and are subject to chafing, especially where cables are encrusted with marine life (Photographs 19 through 21.

Lighting on the floats is provided by pole-mounted luminaires along the floats and low-mounted walkway lights in the shore power pedestals. The pole-mounted luminaires and shore power pedestals each incorporate their own individual photocell lighting control. The luminaires are high-intensity discharge (HID) source units. The luminaires show little or no corrosion and are generally in good condition.

Shore power receptacles on the floats are 30-amp rated and mounted on either side of the two shore power pedestals. The receptacle connectors show evidence of rough usage (Photograph 22) and minor arcing at the terminals.

3. Conclusions and Recommendations

The following repair and maintenance recommendations are based on existing conditions at the time of Jacobs' inspections. Please contact George Newman of Jacobs in the event of any change in conditions or questions about our findings.

In accordance with the ASCE Waterfront Facilities Inspection and Assessment MOP, the next underwater inspection of the Lightering Float should take place within four years, which is the maximum recommended inspection interval for concrete and protected steel structures that are in fair condition in an aggressive marine environment. Should an adverse event occur, such as a vessel impact or seismic event, an interim underwater inspection may be warranted.

3.1 Concrete Floats

The concrete floats are in fair condition. The concrete scaling on the topside and underside is not a significant structural concern. However, there are various concrete, timber, and connection hardware defects that should be repaired. The spall with corroded reinforcement steel on the northern edge of Float 6 (Photographs 1 and 2) should be repaired by removing the unsound concrete, cleaning the exposed reinforcement, and placing an epoxy grout suitable for marine applications to prevent further deterioration of the steel reinforcement.

The missing timber chock and the severely deteriorated lower timber member located at the southeast corner of Float 7 (Photograph 5) should be replaced, along with the connection hardware.

The split timber chock and vertical connection hardware at the southeast corner of the south section (Float 22; Photograph 6) should be replaced.

The rubber 'D' fender and connection hardware on the east side of Floats 7 and 8 (Photograph 7) should also be replaced.

3.2 Float Piles and Pile Guides

The galvanized steel Lightering Float piles are in good condition. There is significant remaining section on the pile anodes, and therefore they do not yet require replacement.

The pile guides are in fair to satisfactory condition. The pile guides installed improperly (Photograph 12) should be addressed by drilling new weep holes in the bottom of the tubular members to prevent water from pooling within. The new holes should be drilled using the existing holes in the top as guides. The bare steel or damaged galvanized surfaces at the weep holes should be repaired with zinc-rich paint suitable for marine environments.

3.3 Gangways

The gangways are in good condition. No action is required at this time.

3.4 Electrical Systems and Lighting

The Lightering Float electrical system needs significant repairs. The scope of these repairs will necessitate upgrade of existing related equipment to the latest National Electrical Code (NEC) requirements. Benefits of the recommended repairs and upgrades include improved public safety and system reliability, increased system useful life, and reduced maintenance. The circuit that powers the shack in the parking area of Harrigan Centennial Hall also has some code issues to be resolved. The outbuilding electrical recommendations are independent of each other and may be obviated if a different means of electrical supply for the outbuilding were implemented or the outbuilding were used in a different way.

3.4.1 Lightering Float Service and Feeder Ground Fault Protection

Replace the service and feeder OCPDs with ground fault protection equipped units in accordance with the NEC 2017 Article 555.3. The new requirement is for protection not exceeding 30 milliamps.

3.4.2 Lightering Float Receptacles Ground Fault Protection

Replace the shore power receptacles and OCPDs with ground fault protection equipped units in accordance with the NEC 2017 Article 555.3.

3.4.3 Lightering Float Conduit

Replace the broken and unfastened conduit on the lightering floats (Photographs 16, 17 and 18).

3.4.4 Lightering Float Conductor Routing

Reroute the feeder and branch circuit power cable conductors to be under the floats for protection from damage in accordance with the NEC 2017 Article 555.13.

Replace the feeder and branch circuit conductors as required to facilitate replacement of the damaged conduit and rerouting of the conductors to be underneath the floats.

3.4.5 Lightering Float Lighting

Replace the pole-mounted HID source luminaires with LED source luminaires to eliminate relamping maintenance and reduce energy use. Consider consolidated lighting controls.

3.4.6 On-Shore Outdoor Receptacle

Replace the on-shore outdoor wet location receptacle located near the parking area of Harrigan Centennial Hall with a ground fault protection equipped unit or install a ground fault protected branch OCPD for the receptacle in accordance with NEC 2017 210.8(B)(4) (Photograph 24).

3.4.7 Outbuilding Grounding

Equip the feeder supplied outbuilding (shack) (Figure 23) with a grounding electrode in accordance with NEC 2017 250.32 (A). The existing (feeder) circuit that supplies the structure feeds a small load-center branch circuit panel inside the outbuilding (Photographs 24 and 25). Alternatively, the shack power supply could be rewired as a branch circuit with local disconnect switch.

3.4.8 Outbuilding Feeder Wiring

Replace the cord and plug feeder for the outbuilding (shack) with permanent wiring in accordance with NEC 2017 400.12(1 & 7), alt. Temporary Attractions 525.20(E). The outbuilding plug connector is apparently left in place for long periods as it has accumulated spider webs and plant debris (Photograph 25). This structure is a relocatable building with a base frame notched for forklift transport – it is not a vehicle or travel trailer. This existing implementation is a permanent installation for electrical code considerations. The feeder cord is easily subject to physical damage if building is (re)located anywhere that extends the supply cord away from the supply receptacle.

4. Photographs

Photograph 1: View of the Lightering Float looking south with spall in the foreground.

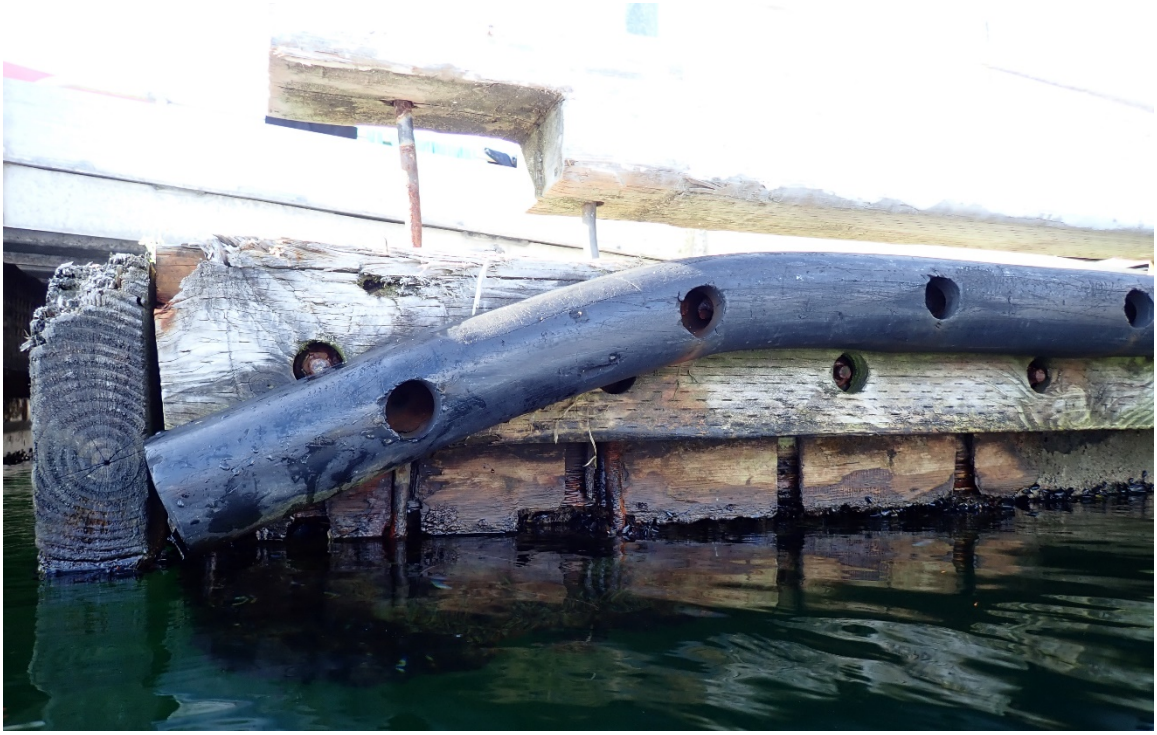
Photograph 2: Close up view of spall with exposed reinforcement on north edge of Float 6.

Photograph 3: View of scaling on topside of north gangway float.

Photograph 4: View of topside scaling on south section of Lightering Float.

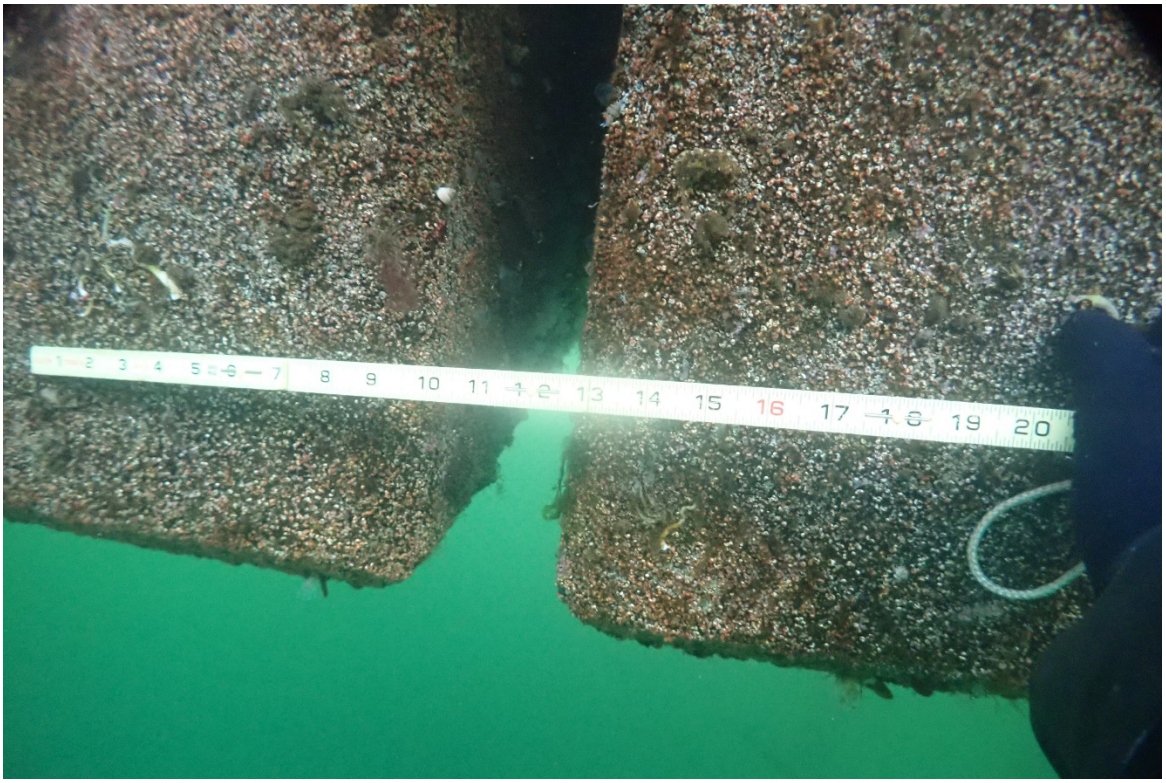
Photograph 5: View of the missing timber chock at southeast corner of Float 7.

Photograph 6: View of the split upper rail and chock at the southeast corner of Float 22.

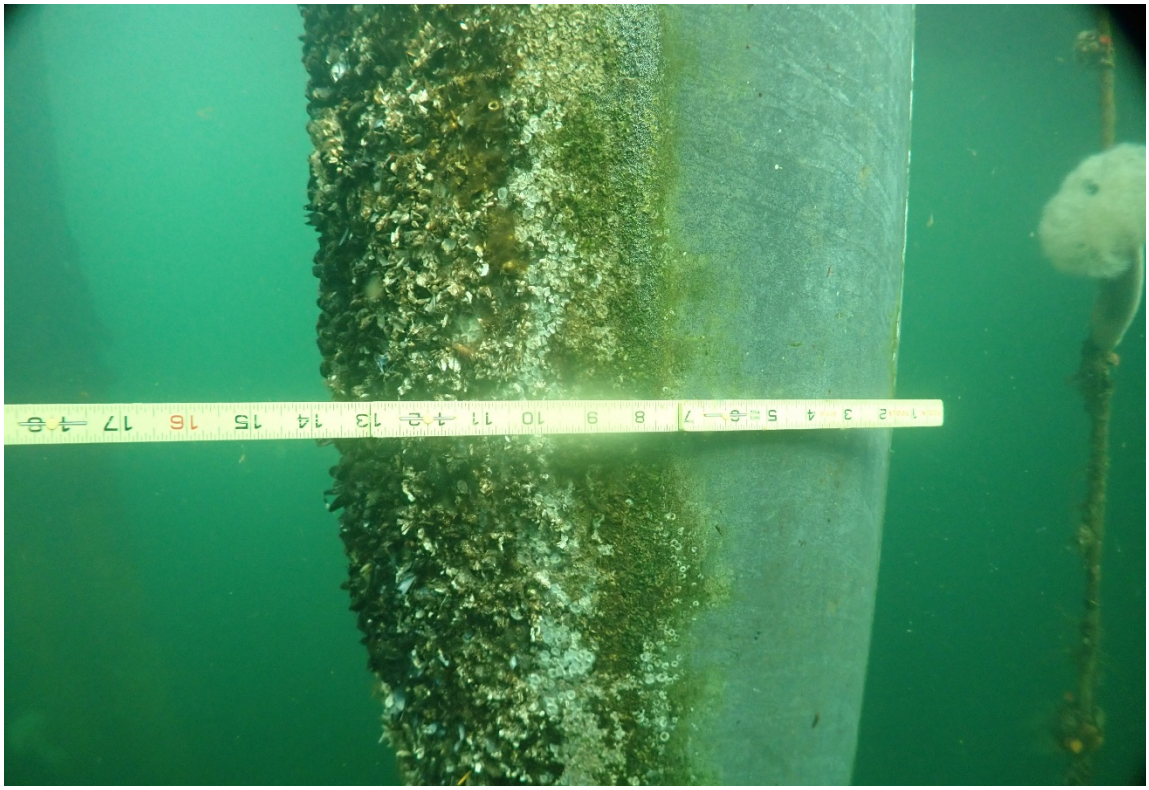


Photograph 7: View of the detached rubber 'D' fender at the southeast corner of Float 7.

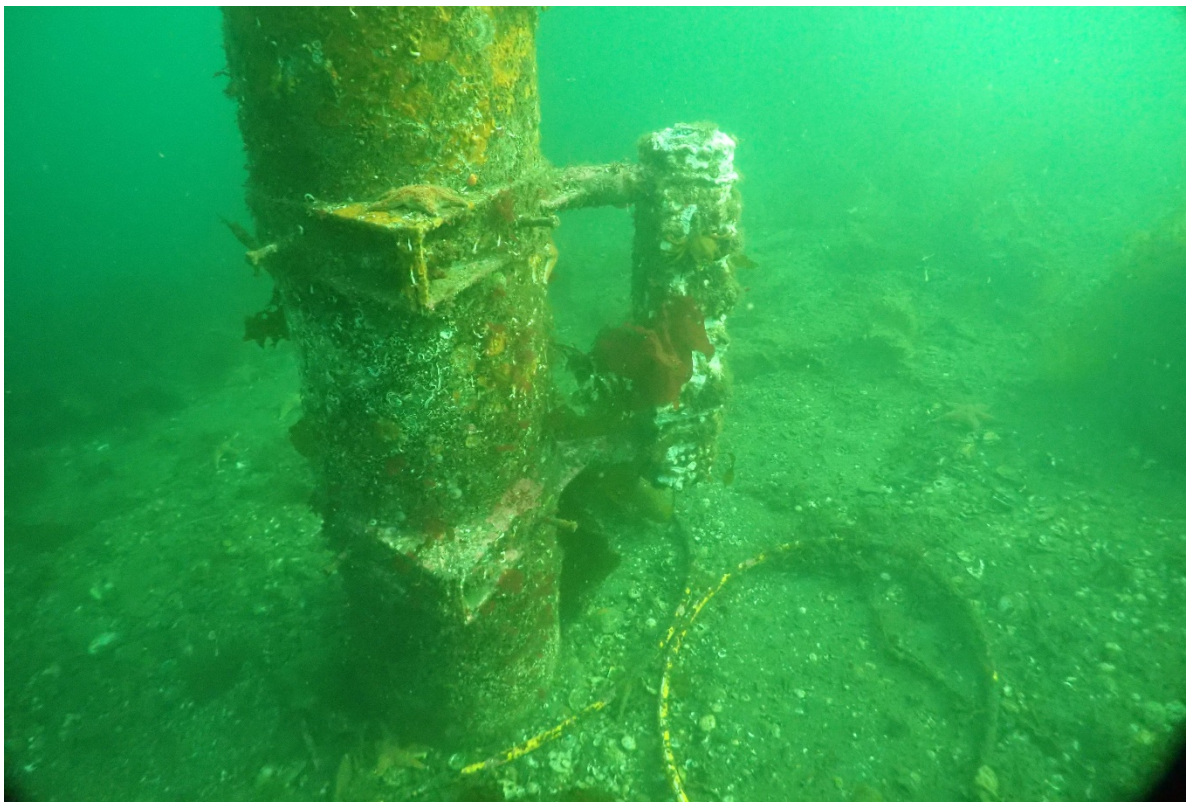
Photograph 8: View of typical conditions on the western fascia of the Lighter Float.



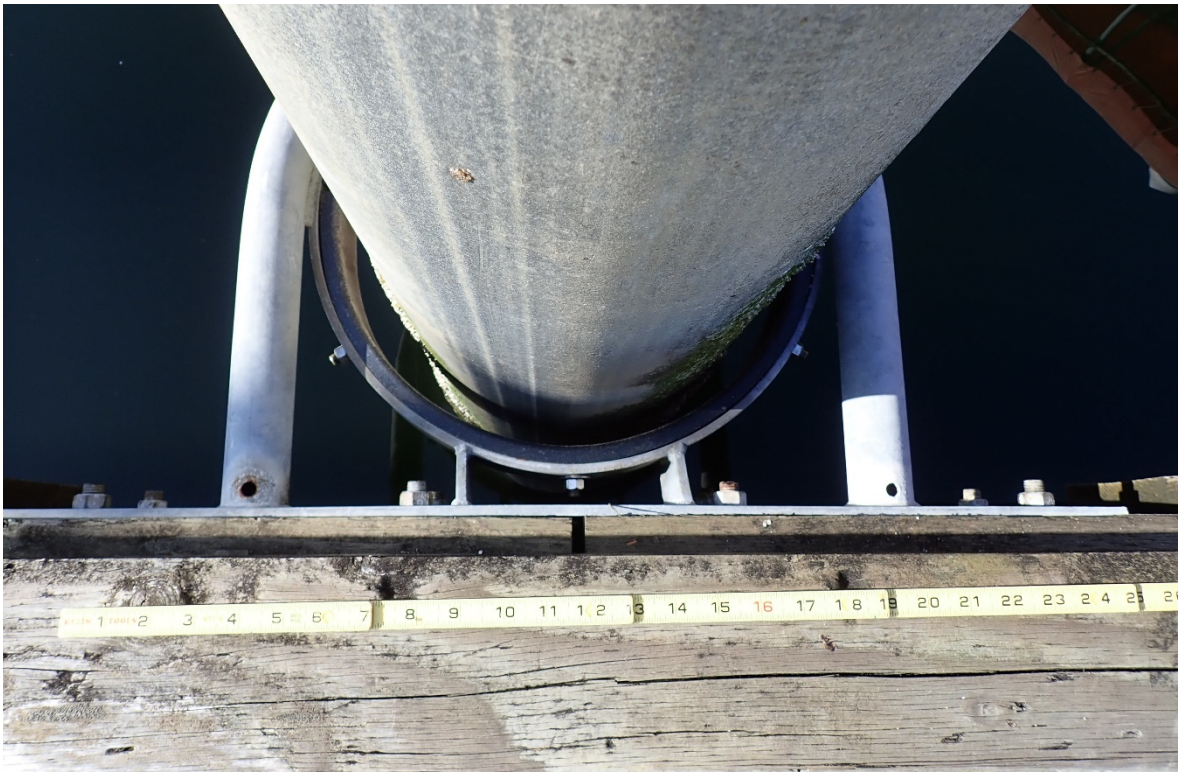
Photograph 9: View of typical concrete float condition below water.



Photograph 10: View of typical galvanized steel pile condition below water.



Photograph 11: Underwater view of typical anode and bracket on a Lightering Float pile.



Photograph 12: View of pile guide installed upside down with weep holes on top surface.

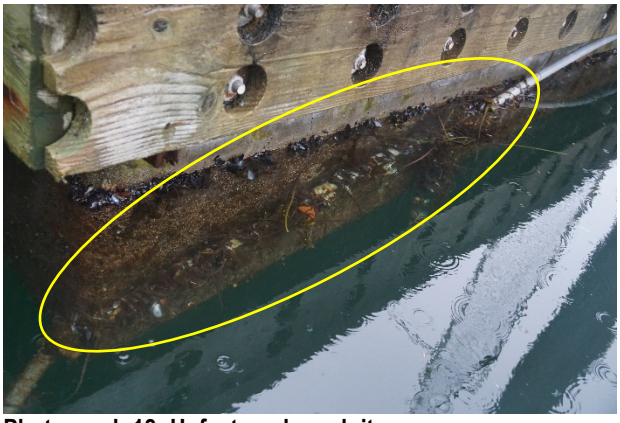
Photograph 13: Moderate corrosion at pile guide.

Photograph 14: View of South Gangway with light surface corrosion on rails.

Photograph 15: View of the North Gangway abutment and connection hardware.

Photograph 16: Unfastened conduit.

Photograph 17: Unfastened conduit.



Photograph 18: Unfastened conduit.

Photograph 19: Cable unsupported and subject to chafing.

Photograph 20: Cable weighted by encrusted marine life.

Photograph 21: Cable weighted by encrusted marine life and subject to chafing.

Photograph 22: Worn receptacle.

Photograph 23: Harrigan Centennial Hall parking area outbuilding (shack).

Photograph 24: Receptacle feeding outbuilding.

Photograph 25: Outbuilding feeder plug with spider webs and plant debris accumulation.

Appendix A
Cost Estimate

Summary Report

Project type:
Job Size:
Duration:

Project Name: Lightering Dock Condition Assessment Repairs Rev 0
Project Number:
Design Stage: Preliminary

Estimator: Nick Cavalleri/RDD
Rev/Date: 0 / Oct 29, 2019
Estimate Class: 5

Area	Bid Item	Description	Takeoff Quantity	Labor Cost/Unit	Equip Cost/Unit	Material Cost/Unit	Total Cost/Unit	Direct Total	Grand Total Price	Grand Total with Markups
02		*Lightering Dock*								
	02.01	Concrete Floats	1.00 LS	10,229.60 /LS	2,680.00 /LS	16,750.00 /LS	29,659.60 /LS	29,660	69,375.88 /LS	69,376
	02.02	Float Piles and Pile Guides	1.00 LS	538.40 /LS	280.00 /LS	250.00 /LS	1,068.40 /LS	1,068	2,550.03 /LS	2,550
	02.03	Electrical System and Lighting	1.00 LS	28,112.78 /LS	7,220.00 /LS	37,500.00 /LS	72,832.78 /LS	72,833	171,258.78 /LS	171,259
		02 Lightering Dock	**1.00** *LS*	*38,880.78 /LS*	*10,180.00 /LS*	*54,500.00 /LS*	*103,560.78 /LS*	*103,561*	*243,184.69 /LS*	*243,185*

Estimate Totals

Description	Amount	Totals	Hours	Rate
Labor	98,586		540.000 hrs	
Material	121,840			
Subcontract				
Equipment	22,758		236.000 hrs	
Other				
Total Construction Cost	**243,184**	**243,184**		

Detail Report

Project type:
Job Size:
Duration:

Project Name: Lightering Dock Condition Assessment Repairs Rev 0
Project Number:
Design Stage: Preliminary

Estimator: Nick Cavalleri/RDD
Rev/Date: 0 / Oct 29, 2019
Estimate Class: 5

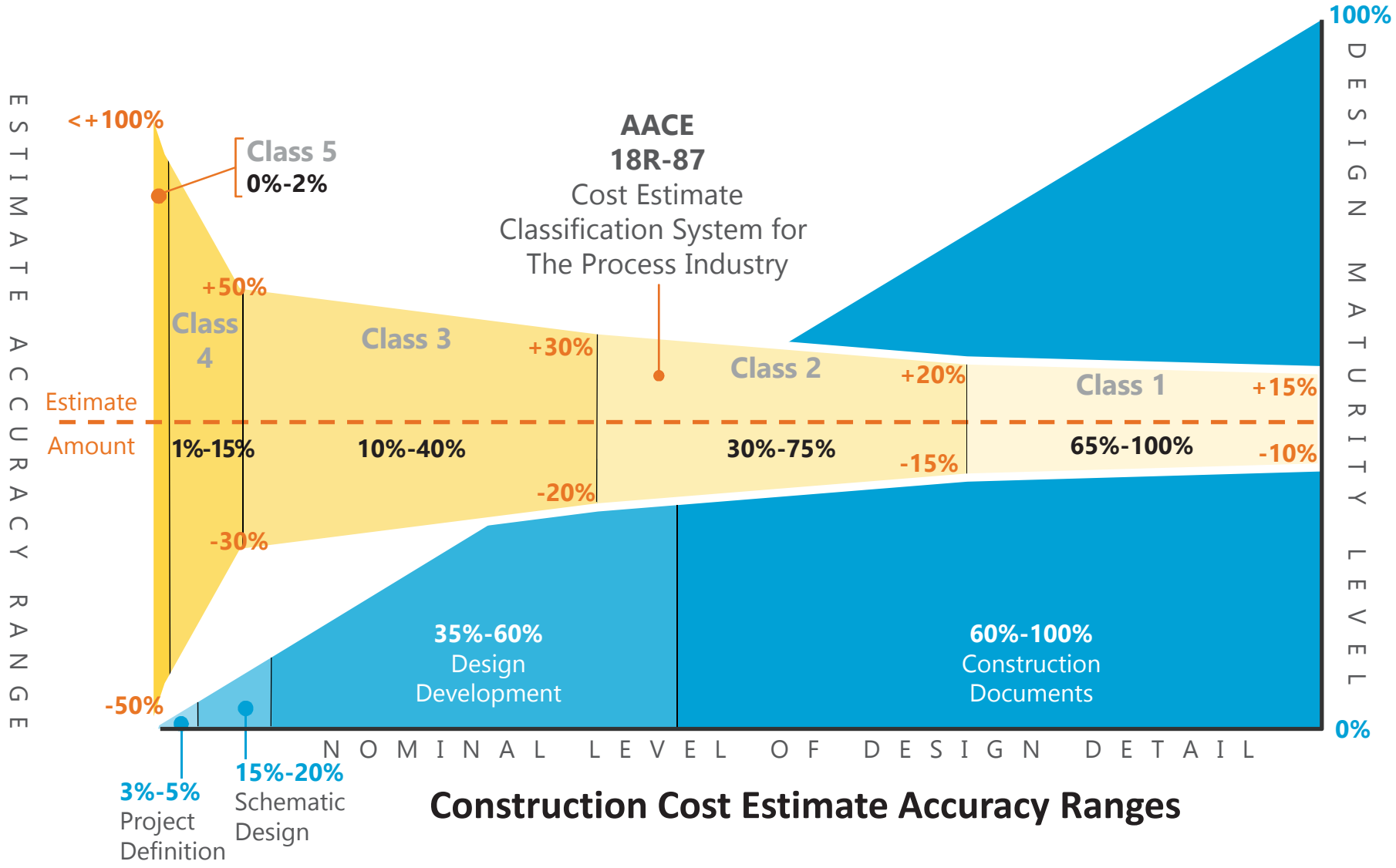
Area	Bid Item	WorkActiv	Description	Takeoff Quantity	Labor Cost/Unit	Equip Cost/Unit	Material Cost/Unit	Total Cost/Unit	Direct Total	Grand Total Price	Grand Total with Markups
02			***Lightering Dock***								
	02.01		**Concrete Floats**								
		02.01.01	*Float 6 Concrete Spalling Repair*								
			Clean and Prepare Spalling Areas for Repair	1.00 ls	269.20 /ls	140.00 /ls	250.00 /ls	659.20 /ls	659	1,554.47 /ls	1,554
			Place and Finish Repair with Marine Suitable Epoxy Grout	1.00 ls	269.20 /ls	140.00 /ls	500.00 /ls	909.20 /ls	909	2,113.36 /ls	2,113
			02.01.01 Float 6 Concrete Spalling Repair	**1.00** *LS*	*538.40 /LS*	*280.00 /LS*	*750.00 /LS*	*1,568.40 /LS*	*1,568*	*3,667.83 /LS*	*3,668*
		02.01.02	*Float 7 Missing Timber Chock and Deteriorated Lower Timbers*								
			Float 7 Replace Missing Timber Chock and Remove and Replace Deteriorated Lower Timbers, Including Hardware	1.00 ls	4,845.60 /ls	1,200.00 /ls	7,500.00 /ls	13,545.60 /ls	13,546	31,736.22 /ls	31,736
			02.01.02 Float 7 Missing Timber Chock and Deteriorated Lower Timbers	**1.00** *LS*	*4,845.60 /LS*	*1,200.00 /LS*	*7,500.00 /LS*	*13,545.60 /LS*	*13,546*	*31,736.22 /LS*	*31,736*
		02.01.03	*Float 22 Replace Split Timber Chock*								
			Float 22 Remove and Replace Split Timber Chock and Vertical Connection Hardware	1.00 ls	1,615.20 /ls	400.00 /ls	3,500.00 /ls	5,515.20 /ls	5,515	12,814.34 /ls	12,814
			02.01.03 Float 22 Replace Split Timber Chock	**1.00** *LS*	*1,615.20 /LS*	*400.00 /LS*	*3,500.00 /LS*	*5,515.20 /LS*	*5,515*	*12,814.34 /LS*	*12,814*
		02.01.04	*Floats 7 and 8 Replace Rubber "D" Fender*								
			Floats 7 and 8 Remove and Replace Rubber "D" Fender and Hardware	1.00 ls	3,230.40 /ls	800.00 /ls	5,000.00 /ls	9,030.40 /ls	9,030	21,157.49 /ls	21,157
			02.01.04 Floats 7 and 8 Replace Rubber "D" Fender	**1.00** *LS*	*3,230.40 /LS*	*800.00 /LS*	*5,000.00 /LS*	*9,030.40 /LS*	*9,030*	*21,157.49 /LS*	*21,157*
			02.01 Concrete Floats	**1.00 LS**	**10,229.60 /LS**	**2,680.00 /LS**	**16,750.00 /LS**	**29,659.60 /LS**	**29,660**	**69,375.88 /LS**	**69,376**
	02.02		**Float Piles and Pile Guides**								
		02.02.01	*Drill New Weep Holes in Bottom of Pile Guides*								
			Drill New Holes in Bottom of Pile Guides Where Required	1.00 ls	538.40 /ls	280.00 /ls	250.00 /ls	1,068.40 /ls	1,068	2,550.03 /ls	2,550
			02.02.01 Drill New Weep Holes in Bottom of Pile Guides	**1.00** *LS*	*538.40 /LS*	*280.00 /LS*	*250.00 /LS*	*1,068.40 /LS*	*1,068*	*2,550.03 /LS*	*2,550*
			02.02 Float Piles and Pile Guides	**1.00 LS**	**538.40 /LS**	**280.00 /LS**	**250.00 /LS**	**1,068.40 /LS**	**1,068**	**2,550.03 /LS**	**2,550**
	02.03		**Electrical System and Lighting**								
		02.03.01	*Lightering Float Service and Feeder Ground Fault Protection*								
			Replace the Service and Feeder OCPDs with Ground Fault Equipped Units	1.00 ls	2,367.39 /ls	560.00 /ls	5,000.00 /ls	7,927.39 /ls	7,927	18,432.69 /ls	18,433
			02.03.01 Lightering Float Service and Feeder Ground Fault Protection	**1.00** *LS*	*2,367.39 /LS*	*560.00 /LS*	*5,000.00 /LS*	*7,927.39 /LS*	*7,927*	*18,432.69 /LS*	*18,433*
		02.03.02	*Lightering Float Receptacles Ground Fault Protection*								
			Replace Lightering Float Receptacles with Ground Fault Protection Equipped Units	1.00 ls	1,183.70 /ls	280.00 /ls	2,000.00 /ls	3,463.70 /ls	3,464	8,098.56 /ls	8,099
			02.03.02 Lightering Float Receptacles Ground Fault Protection	**1.00** *LS*	*1,183.70 /LS*	*280.00 /LS*	*2,000.00 /LS*	*3,463.70 /LS*	*3,464*	*8,098.56 /LS*	*8,099*
		02.03.03	*Lightering Float Conduit*								
			Replace Broken and Unfastened Conduit	1.00 ls	1,775.54 /ls	280.00 /ls	2,500.00 /ls	4,555.54 /ls	4,556	10,717.02 /ls	10,717
			02.03.03 Lightering Float Conduit	**1.00** *LS*	*1,775.54 /LS*	*280.00 /LS*	*2,500.00 /LS*	*4,555.54 /LS*	*4,556*	*10,717.02 /LS*	*10,717*
		02.03.04	*Lightering Float Conductor Routing*								
			Reroute Feeder and Branch Circuit Power Conductors Under Floats	1.00 ls	8,877.72 /ls	1,400.00 /ls	8,500.00 /ls	18,777.72 /ls	18,778	44,642.77 /ls	44,643
			02.03.04 Lightering Float Conductor Routing	**1.00** *LS*	*8,877.72 /LS*	*1,400.00 /LS*	*8,500.00 /LS*	*18,777.72 /LS*	*18,778*	*44,642.77 /LS*	*44,643*
		02.03.05	*Lightering Float Lighting*								
			Replace Pole Mounted HID Luminaires with LED	1.00 ls	11,836.96 /ls	4,000.00 /ls	15,000.00 /ls	30,836.96 /ls	30,837	72,490.19 /ls	72,490
			02.03.05 Lightering Float Lighting	**1.00** *LS*	*11,836.96 /LS*	*4,000.00 /LS*	*15,000.00 /LS*	*30,836.96 /LS*	*30,837*	*72,490.19 /LS*	*72,490*
		02.03.06	*On-Shore Outdoor Receptacles*								
			Replace the On-Shore Outdoor Wet Location Receptacle with Ground Fault Protection Equipped Unit	1.00 ls	295.92 /ls	140.00 /ls	500.00 /ls	935.92 /ls	936	2,181.13 /ls	2,181
			02.03.06 On-Shore Outdoor Receptacles	**1.00** *LS*	*295.92 /LS*	*140.00 /LS*	*500.00 /LS*	*935.92 /LS*	*936*	*2,181.13 /LS*	*2,181*
		02.03.07	*Outbuilding Grounding*								
			Install a Gounding Electrode to Outbuilding Feeder	1.00 ls	591.85 /ls	280.00 /ls	1,500.00 /ls	2,371.85 /ls	2,372	5,480.06 /ls	5,480
			02.03.07 Outbuilding Grounding	**1.00** *LS*	*591.85 /LS*	*280.00 /LS*	*1,500.00 /LS*	*2,371.85 /LS*	*2,372*	*5,480.06 /LS*	*5,480*
		02.03.08	*Outbuilding Feeder Wiring*								
			Replace Cord and Plug Feeder with Permanent Wiring	1.00 ls	1,183.70 /ls	280.00 /ls	2,500.00 /ls	3,963.70 /ls	3,964	9,216.36 /ls	9,216
			02.03.08 Outbuilding Feeder Wiring	**1.00** *LS*	*1,183.70 /LS*	*280.00 /LS*	*2,500.00 /LS*	*3,963.70 /LS*	*3,964*	*9,216.36 /LS*	*9,216*
			02.03 Electrical System and Lighting	**1.00 LS**	**28,112.78 /LS**	**7,220.00 /LS**	**37,500.00 /LS**	**72,832.78 /LS**	**72,833**	**171,258.78 /LS**	**171,259**
			02 Lightering Dock	**1.00** ***LS***	***38,880.78 /LS***	***10,180.00 /LS***	***54,500.00 /LS***	***103,560.78 /LS***	***103,561***	***243,184.69 /LS***	***243,185***

Detail Report

Project type:	Project Name: Lightering Dock Condition Assessment Repairs Rev 0	Estimator: Nick Cavalleri/RDD
Job Size:	Project Number:	Rev/Date: 0 / Oct 29, 2019
Duration:	Design Stage: Preliminary	Estimate Class: 5

Estimate Totals

Description	Amount	Totals	Hours	Rate
Labor	38,881		540.000 hrs	
Material	54,500			
Subcontract				
Equipment	10,180		236.000 hrs	
Other				
Subtotal Direct Costs	**103,561**	**103,561**		
Location Adj. Factor	11,664			30.000 %
Subtotal W/ Adj. Factors	**11,664**	**115,225**		
General Conditions	13,827			12.000 %
Subtotal W/ General Conditions	**13,827**	**129,052**		
Mobilization/Demobilization	10,324			8.000 %
Prime Contractor Overhead	20,906			15.000 %
Prime Contractor Profit	16,028			10.000 %
Bonds & Insurance	3,826			2.170 %
Subtotal W/ Prime Markups	**51,084**	**180,136**		
Contingency	63,048			35.000 %
Subtotal W/ Contingency	**63,048**	**243,184**		
Total Construction Cost		**243,184**		



Construction Cost Estimate Accuracy Ranges

Estimate Class	Class 5		Class 4		Class 3		Class 2		Class 1	
LEVEL OF PROJECT DEFINITION Expressed as a % of complete definition	**0% to 2%**		**1% to 15%**		**10% to 40%**		**30% to 70%**		**50% to 100%**	
END USAGE Typical Purpose of Estimate	**Concept Screening**		**Study or Feasibility**		**Budget Authorization, or Control**		**Control or Bid / Tender**		**Check Estimate or Bid / Tender**	
METHODOLOGY Typical estimating method	**Capacity Factored, Parametric Models, Judgment, or Analogy**		**Equipment Factored or Parametric Models**		**Semi-Detailed Unit Costs with Assembly Level Line Items**		**Detailed Unit Cost with Forced Detailed Take-Off**		**Detailed Unit Cost with Detailed Take-Off**	
EXPECTED ACCURACY RANGE Typical variation in low and high ranges [a]	**L: -20% to -50%**	**H: +30% to +100%**	**L: -15% to -30%**	**H: +20% to +50%**	**L: -10% to -20%**	**H: +10% to +30%**	**L: -5% to -15%**	**H: +5% to +20%**	**L: -3% to -10%**	**H: +3% to +15%**
PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 [b]	**1**		**2 to 4**		**3 to 10**		**4 to 20**		**5 to 100**	
REFINED CLASS DEFINITION	Class 5 estimates are generally prepared based on very limited information, and subsequently have very wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systematic manner. Class 5 estimates, due to the requirements of end use, may be prepared within a very limited amount of time and with very little effort expended - sometimes requiring less than 1 hour to prepare. Often, little more than proposed plant type, location, and capacity are known at the time of estimate preparation.		Class 4 estimates are generally prepared based on very limited information, and subsequently have very wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 5% complete, and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams (PFDs) for main process systems and preliminary engineered process and utility equipment lists. Level of Project Definition Required: 1% to 15% of full project definition.		Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, and/or funding. As such, they typically form the initial control estimate against which all actual costs and resources will be monitored. Typically, engineering is from 10% to 40% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, preliminary piping and instrument diagrams, utility flow diagrams, preliminary piping and instrument diagrams, plot plan, developed layout drawings, and essentially complete engineering process and utility equipment lists. Level Of Project Definition Required: 10% to 40% of full project definition.		Class 2 estimates are generally prepared to form a detailed control baseline against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the "bid" estimate to establish contract value. Typically, engineering is from 30% to 70% complete, and would comprise at a minimum the following: Process flow diagrams, utility flow diagrams, piping and instrument flow diagrams, heat and material balances, final plot plan, final layout drawings, complete engineered process and utility equipment lists, single line diagrams for electrical, electrical equipment and motor schedules, vendor quotations, detailed project execution plans, resourcing and work force plans, etc.		Class 1 estimates are generally prepared for discrete parts or sections of the total project rather than generating this level of detail for the entire project. The parts of the project estimated at this level of detail will typically be used by subcontractors for bids, or by owners for check estimates. The updated estimate is often referred to as the current control estimate and becomes the new baseline for cost/schedule control of the project. Class 1 estimates may be prepared for parts of the project to comprise a fair price estimate or bid check estimate to compare against a contractor's bid estimate, or to evaluate/dispute claims. Typically, engineering is from 50% to 100% complete, and would comprise virtually all engineering and design documentation of the project, and complete project execution and commissioning plans. Level for Project Definition Required: 50% to 100% of full project definition.	
END USAGE DEFINED	Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc.		Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage.		Class 3 estimates are typically prepared to support full project funding requests, and become the first of the project phase "control estimate" against which all actual costs and resources will be monitored for variations to the budget. They are used as the project budget until replaced by more detailed estimates. In many owner organizations, a Class 3 estimate may be the last estimate required and could well form the only basis for cost/schedule control.		Class 2 estimates are typically prepared as the detailed control baseline against which all actual costs an resources will now be monitored for variation to the budget, and form a part of the change/variation control program.		Class 1 estimates are typically prepared to form a current control estimate to be used as the final control baseline against which all actual coasts and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution.	
ESTIMATING METHODS USED	Class 5 estimates virtually always use stochastic estimating methods such as cost/capacity curves and factors, scale of operations factors, Lang factors, Hand factors, Chilton factors, Peters-Timmerhaus factors, Guthrie factors, and other parametric and modeling techniques.		Class 4 estimates virtually always use stochastic estimating methods such as cost/capacity curves and factors, scale of operations factors, Lang factors, Hand factors, Chilton factors, Peters-Timmerhaus factors, Guthrie factors, the Miller method, gross unit costs/ratios, and other parametric and modeling techniques.		Class 3 estimates usually involve more deterministic estimating methods that stochastic methods. They usually involve a high degree of unit cost line items, although these may be at an assembly level of detail rather than individual components. Factoring and other stochastic methods may be used to estimate less-significant areas of the project.		Class 2 estimates always involve a high degree of deterministic estimating methods. Class 2 estimates are prepared in great detail, and often involve tens of thousands of unit cost line items. For those areas of the project still undefined, an assumed level of detailed takeoff (forced detail) may be developed to use as line items in the estimate instead of relying on factoring methods.		Class 1 estimates involve the highest degree of deterministic estimating methods, and require a great amount of effort. Class 1 estimates are prepared in great detail, and thus are usually performed on only the most important or critical areas of the project. All items in the estimate are usually unit cost line items based on actual design quantities.	
EXPECTED ACCURACY RANGE	Typical accuracy ranges for Class 5 estimates are -20% to -50% on the low side, and +30% to +100% on the high side, depending on the technological complexity of the project, appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 3 estimates are -10% to -20% on the low side, and +10% to +30% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 2 estimates are -5% to -15% on the low side, and +5% to +20% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 1 estimates are -3% to -10% on the low side, and +3% to +15% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.	
EFFORT TO PREPARE (for US$20MM project):	As little as 1 hour or less to prepare to perhaps more than 200 hours, depending on the project and the estimating methodology used.		Typically, as little as 20 hours or less to perhaps more than 300 hours, depending on the project and the estimating methodology used.		Typically, as little as 150 hours or less to perhaps more than 1500 hours, depending on the project and the estimating methodology used.		Typically, as little as 300 hours or less to perhaps more than 3000 hours, depending on the project and the estimating methodology used. Bid Estimates typically require more effort than estimates used for funding or control purposes		Class 1 estimates require the most effort to create, and as such are generally developed for only selected areas of the project, or for bidding purposes. A complete Class 1 estimate may involve as little as 600 hours or less, to perhaps more than 6,000 hours, depending on the project and the estimating methodology used. Bid estimate typically require more effort than estimates used for funding or control purposes.	
ANSI Standard Reference Z94.2-1989 name; Alternate Estimate Names, Terms, Expressions, Synonyms:	Order of Magnitude Estimate; Ratio, ballpark, blue sky, seat-of-pants, ROM, idea study, prospect estimate, concession license estimate, guesstimate, rule-of thumb.		Budget Estimate; Screening, top-down, feasibility, authorization, factored, pre-design, pre-study.		Budget Estimate; Budget, scope, sanction, semi-detailed, authorization, preliminary control, concept study, development, basic engineering phase estimate, target estimate.		Definitive Estimate; Detailed Control, forced detail, execution phase, master control, engineering, bid, tender, change order estimate.		Definitive Estimate; Full detail, release, fall-out, tender, firm price, bottoms-up, final, detailed control, forced detail, execution phase, master control, fair price, definitive, change order estimate.	

Estimate Class	Class 5	Class 4	Class 3	Class 2	Class 1
Estimate Input Checklist and Maturity Index	**Class 5**	**Class 4**	**Class 3**	**Class 2**	**Class 1**
GENERAL PROJECT DATA					
Project Scope Description	General	Preliminary	Defined	Defined	Defined
Plant Production / Facility Capacity	Assumed	Preliminary	Defined	Defined	Defined
Plant Location	General	Approximate	Specific	Specific	Specific
Soils & Hydrology	None	Preliminary	Defined	Defined	Defined
Integrated Project Plan	None	Preliminary	Defined	Defined	Defined
Project Master Schedule	None	Preliminary	Defined	Defined	Defined
Escalation Strategy	None	Preliminary	Defined	Defined	Defined
Work Breakdown Structure	None	Preliminary	Defined	Defined	Defined
Project Code of Accounts	None	Preliminary	Defined	Defined	Defined
Contracting Strategy	Assumed	Assumed	Preliminary	Defined	Defined
ENGINEERING DELIVERABLES:	**Class 5**	**Class 4**	**Class 3**	**Class 2**	**Class 1**
Block Flow Diagrams	Started / Preliminary	Preliminary / Complete	Complete	Complete	Complete
Plot Plans		Started	Preliminary / Complete	Complete	Complete
Process Flow Diagrams (PFDs)		Started / Preliminary	Preliminary / Complete	Complete	Complete
Utility Flow Diagrams (UFDs)		Started / Preliminary	Preliminary / Complete	Complete	Complete
Piping & Instrument Diagrams (P&IDS)		Started	Preliminary / Complete	Complete	Complete
Heat and Material Balances		Started	Preliminary / Complete	Complete	Complete
Process Equipment List		Started / Preliminary	Preliminary / Complete	Complete	Complete
Utility Equipment List		Started / Preliminary	Preliminary / Complete	Complete	Complete
Electrical One Line Drawings		Started / Preliminary	Preliminary / Complete	Complete	Complete
Specifications and Datasheets		Started	Preliminary / Complete	Complete	Complete
General Equipment Arrangement Drawings		Started	Preliminary / Complete	Complete	Complete
Spare Parts Lists			Started / Preliminary	Preliminary	Complete
Architectural Details / Schedules		Started	Preliminary / Complete	Complete	Complete
Structural Details		Started	Preliminary / Complete	Complete	Complete
Mechanical Discipline Drawings			Started	Preliminary	Preliminary / Complete
Electrical Discipline Drawings			Started	Preliminary	Preliminary / Complete
System Discipline Drawings			Started	Preliminary	Preliminary / Complete
Civil/Site Discipline Drawings			Started	Preliminary	Preliminary / Complete
Demolition Details		Started	Preliminary / Complete	Complete	Complete