Keats Landing
Ports Load Limit Safety Assessment

February 15, 2019

Prepared for:

Sunshine Coast Regional District
1975 Field Road
Sechelt, BC
V0N 3A1

Attention: Ben Smale, P.Eng, Asset Management Coordinator

Prepared by:

Herold Engineering Limited
3701 Shenton Road
Nanaimo, BC
V9T 2H1

Herold Project #: 4551-002

HEROLD ENGINEERING

www.heroldengineering.com

PORT LOADS SAFETY ASSESSMENT

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SUBMITTAL DATE:

February 15, 2019

Herold Project No. 4551-002

Prepared by:

Shannon Summersides, EIT

Reviewed by:

Jeff Duncan, P. Eng

Executive Summary

The scope of the assignment includes above water assessment of the Keats Landing port facility and subsequent condition assessment report. The report includes health and safety considerations and loading rated capacities for the overall structure, as well as residual life estimates for individual members.

The assessment was conducted on November 13, 2018. The purpose of the assessment was to document the overall physical condition of the facility through review of provided reference material (previous inspection reports/drawings) and visual and tactile inspection of accessible elements from above water.

The port facility is in overall serviceable condition. Assessment results indicate that remedial work is recommended throughout the facility.

There are several repairs which are recommended to be addressed within the next year as follows:

- Replace two handrail spans.
- Replace one handrail post.
- Replace two sections of timber guard, and repair one section.
- Replace two pilecaps, and repair 10 pilecaps.
- Repair nine bearing piles.
- Replace eight fender piles.
- Repair two batter piles.
- Re-instate one missing cross brace.

There are three bearing piles recommended to be replaced in the reference material, there are also six which require repairs. The condition was not confirmed by Herold Engineering on-site due to accessibility.

There are minor repairs to the gangway which are also recommended.

The float has a significant list, and has been reported previously in the reference material as having damage to the substructure. There is evidence of water ingress to the substructure.

A dive inspection is recommended within the next year to ascertain the condition of the submerged elements of the float, as well as verify the condition of submerged elements previously noted for remediation.

The following recommendations pertain to Health and Safety at the facility:

- Safety ladder spacing and signage does not conform to WorkSafe BC regulations.
- Handrails do not conform to OH&S standards. The existing handrails are climbable, and have openings larger than 102mm at a deck elevation that exceeds 610mm.

The load rating was established using The Canadian Highway Bridge Code (CAN/CSA S16-14), and assumes that all recommended repairs have been completed prior to qualification of the rating. The approach structure has been rated for single unit vehicle use (CL3-W) to a maximum gross vehicle weight (GVW) of 7,500kg. Recommended signage has been included in the report body. The gangway and float are typical Transport Canada construction, and have been historically rated to a maximum area load of 1.2kPa.

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KEATS LANDING PORT FACILITY
STRUCTURE CONDITION INSPECTION AND REPORT
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1 Introduction

Facility: Keats Landing, B.C., Port Facility

Inspected by: Herold Engineering Limited, Shannon Summersides, EIT
Westcoast Diving Contractors Limited, John Dekker

Date: November 13, 2018

1.1 Purpose of Assignment

The inspection was conducted to identify members either requiring repairs or showing signs of deterioration. The following report provides information regarding maintenance, repair, replacement, and health & safety on a 10 year forecasted time period, allowing for a prioritized repair program to be implemented. Other items noted during the inspection will be reported only in terms of general overall condition.

The inspection included detailed above water visual / tactile inspection of the following facility components:

- Abutment headwall
- Handrails
- Guard
- Cleats
- Safety ladders
- Deck planks
- Stringer
- Cross Bracing
- Wales
- Pilecaps
- All Piles (from above water)

Items inspected specific to floats:

- Gangways and connections
- Bullrails
- Rub boards
- Floatation (from above water)
- Mooring system (piles, anchor chains, from above water)

It is to be noted that the facility was inspected in 2015 by Pelagic Technologies Inc. (Pelagic). This assessment included the following activities:

- Above-water and underwater visual inspection of timber piles, diagonal and horizontal bracing.
- Visual, sounding, and coring/drilling inspection of the pile tops, corbels, pilecaps, and stringers above water.
- Underwater visual inspection of submerged structural float components, including flanges, flange connections blocks, hardware, and floatation.

The facility was inspected by Pelagic in 2009 as well. Reference drawings indicating noted bearing, fender and mooring pile, as well as the timber float substructure conditions were provided to Herold Engineering. It is assumed that this reporting was conducted via an underwater inspection.

Damages reported in these reference documents have been included in the following report.

It is to be noted that Herold Engineering did not conduct an underwater investigation, and several items were not closely inspected due to accessibility. As such, several damages, identified by Pelagic, were not confirmed during the assessment. Damages and recommendations from the 2015 and 2009 inspections have been incorporated into the following report.

1.2 Scope of Work

The inspection and assessment of the facility components was completed to the standards set out below. The inspection work included all facility components noted in Section 1.1. The condition assessment and residual life estimates were based on previous experience. The load rating and capacity calculations were conducted following the methods described in the reference material noted below and good engineering practice. All recommendations related to health and safety were provided based upon current WorkSafe BC and Nation Fire Protection Association (NFPA) regulations, as well as our experience with facilities similar in form and function.

1.3 Reference Material

- Procedures for Inspection and Assessment of Fixed Timber Docks – 1994 September – 4th Edition by R.G. Sexsmith Ltd.
- Standard Practice Manual for Underwater Investigations by the American Society of Civil Engineers, Ports and Harbours Committee, May 2000.
- Canadian Highway Bridge Design Code CAN/CSA S6-14.
- NFPA 303. Fire Protection Standard for Marinas and Boatyards. 2011.
- WorkSafeBC Occupation Health and Safety Regulations for Wharves, Docks and Mooring Floats. Accessed: December 11, 2018. Located: https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-24-diving-fishing-and-other-marine-operations#6AE649CBFEFA441986BB7877A8901131
- 2015 Pelagic Technologies Inc. Inspection Report
- 2009 Pelagic Technologies Inc. Reference Drawings

1.4 Methodology

Herold Engineering Limited (Herold Engineering) completed the above water portion of the inspection, as well as report preparation. Westcoast Diving Contractors Limited (WDC) provided a work boat to access portions of the facility.

The above water inspections involved a visual assessment of the structural condition, and select hammer soundings of timber elements. Refer to Section 4 for inspection results, as well as Appendix D for detailed remediation recommendations.

Load capacity calculations were completed using the prescribed method in CAN/CSA S6-14. Residual life estimates for various elements were completed using guidelines provided in the reference material noted in Section 1.3. The findings are based on "as found" conditions at the time of the inspection and any provided reference documentation, refer to Section 5.

2 Description

2.1 Location

Keats Landing Port Facility is located on west side of Keats Island, approximately 30 kilometers northwest of Vancouver, B.C.

2.2 Geometry

The overall geometry of the facility's main components is as follows:

Approach	-	4.9m x 65.2m
Wharfhead	-	15.2m x 16.3m
Gangway	-	1.2m x 10.9m
Float	-	4.3m x 15.2m

The general layout of the facility is as per the Herold Engineering Drawings 4551-002 S01 and S02 located in Appendix C.

2.3 Reference System

The reference system used for this report is as per the drawings found in Appendix C. For the purpose of this report, the approach, wharfhead, gangway and float all run north to south.

Along the approach and wharfhead the pile bents are numbered from the abutment (Bent 0) to the wharfface (Bent 20). The pile rows are lettered from west to east as Gridlines A through to F.

There is one float at the facility, accessed via a steel truss gangway with timber deck typical of Transport Canada marine facilities of this nature. The float is moored by three mooring dolphins. The south dolphin is comprised of four timber piles, while the two north dolphins have three timber piles each.

It was noted that another gangway and float system are located to the west of the approach. It is understood this infrastructure is not within the scope of this project, and therefore it was not inspected.

The general arrangement of the facility is shown in Photograph 1, located in Appendix A.

2.4 Approach & Wharfhead

The approach and wharfhead generally consist of timber construction.

Topside elements include handrails and guard timbers which are along either side of the approach (Gridlines A-C), as well as along the south (Bent 14) of the wharfhead between

the gangway and the approach. There are intermittent pedestrian guards located along the approach deck to delineate a walking area, as well as a timber guard around the wharfhead perimeter. There is a life ring in the southeast corner of the wharfhead, as well as a single safety ladder along the seaward face of the wharfhead. There are five mooring cleats around the wharfhead perimeter.

The approach and wharfhead are constructed of timber decking which is supported by timber stringers, pilecaps and bearing piles. Bearing piles at Bent 1 to Bent 6 are embedded in concrete footings. The approach is braced transversely along each bent by timber cross bracing, and longitudinally from Bents 0-8 with timber wales. There are batter piles running east to west and north to south at all four corners of the wharfhead. There is evidence of ongoing repairs/remediations to the superstructure and substructure which include:

- Metal strapping and/or banding at the top of the pile.
- Corbel block installations between bearing piles and pilecaps.

Fendering along the wharfhead includes two fender piles at each of the two offshore corners of the wharfhead, as well as single fender piles along the north, west, and east faces of the wharf at the bearing pile locations. The fender piles are stiffened by timber fender chocks.

The abutment (Bent 0) is comprised of a cast in place concrete mass footing. The approach stringers are resting directly on the concrete footing.

Typical member sizes and spans are as follows:

Handrails	-	38mm x 140mm
	-	38mm x 89mm top-rail
	-	38mm x 140mm mid-rail (upper and lower)
	-	89mm x 89mm x 1.524m post
Approach Decking	-	102mm x 305mm treated, spanning approx. 610mm
Wharfhead Decking	-	75mm x 305mm treated, spanning approx. 610mm
Approach Guard	-	191mm x 191mm
Pedestrian Guard	-	Two -102mm x 152mm x 2794mm long
Wharfhead Guard	-	191mm x 241mm
Approach Risers	-	38mm x 191mm and 305mm long
Wharfhead Risers	-	102mm x 203mm x 305mm long
Stringers	-	152mm x 292mm creosote treated
Pilecaps	-	272mm x 305mm creosote treated
All Piles	-	Size 36 (305Ø) creosoted treated
Cross Bracing	-	152mm x 203mm
Wales	-	140mm x 191mm

2.5 Gangway

A steel truss gangway is located on the southeast corner of the wharfhead between 14E and 14F. The gangway provides access to the timber float.

The truss is comprised of L89x64x6 steel angle top chord and L51x51x6 steel angle bottom chord, with C75x6 steel channel sections for vertical and cross beam members. The gangway deck is comprised of 38mm x 292mm timber decking with asphalt shingles to provide an anti-slip. One side of the deck has 38mm x 38mm timber ladder treads. There is a timber landing pad with guide angles secured to the float deck.

2.6 Float

The float is comprised of timber bullrails supported on timber risers and decking. There are guard timbers around the pile wells, as well as timber rubboards along the edges of the float. The pile wells do not contain the mooring piles at the float edges (i.e. open mooring wells).

As per the 2015 Pelagic report, the float substructure consists of treated timber cross-ties, joists, stringers, and flanges. The floatation is reported as fiberglass pontoons.

The float is moored using three mooring pile dolphins: south, northeast, and northwest. The south dolphin is comprised of four timber piles, while the northern dolphins have three timber piles each. Steel cables connect the piles at the top of each dolphin. There is one safety ladder located on the northeast corner of the float.

Typical component sizes and spans are as follows:

Decking	-	38mm x 305mm
Bullrails	-	89mm x 140mm
Risers	-	89mm x 140mm x 305mm long
Pile Well Guards	-	89mm x 140mm
Rubboards	-	75mm x 305mm
Mooring Piles	-	Size 36 (305Ø) creosoted treated

Per the 2015 Pelagic report the following float substructure framing was reported as follows:

Edge Stringer	-	140mm x 190mm
Joists	-	89mm x 140mm
Cross-Tie	-	140mm x 292mm
Flange	-	152mm x 330mm
Flange Splice Block	-	152mm x 178mm

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3 Health & Safety Background

Legacy marine facilities of this kind (i.e. Transport Canada, DFO) have a typical construction and arrangement which is somewhat consistent along BC's west coast. The majority of marine facilities do not meet the following regulations. It is at the discretion of the owners of the facility as to the stringency with which the following requirements/guidelines are followed.

Based on the overall condition of the facility, several of the following specification may be attainable, if desired, during a major upgrade which is projected to be required within the next 3-5 years.

3.1 OH&S Requirements

3.1.1 Ladders

Fixed ladders must be provided at every dock for access to and egress from the water and must:

- Be spaced at intervals not exceeding 30 meters.
- Extend from the top of the dock to at least 1 meter below the lowest water level.
- Be maintained free of barnacles and marine growth, and
- Have their location identified by high visibility paint on the curb or bullrail.

3.1.2 Lifesaving Equipment

Appropriate lifesaving equipment must:

- Be provided and maintained for the rescue of any worker in danger of drowning, and
- Be positioned at intervals not exceeding 50 meters in conspicuous locations as near as practicable to the danger area.

Throwing lines fitted to lifebuoys or similar equipment must be of suitable size and length and made of buoyant material

Lifesaving equipment includes lifebuoys, throwing bags, grapples, boat hooks or other equipment appropriate to the circumstances.

3.1.3 Curbs, Bullrails, Guardrails, and Barriers

A curb or bullrail must be installed along the open sides of each float, dock, wharf, pier and similar other area where mobile equipment might be used.

Each curb and bullrail must be of substantial construction and be at least 250mm high.

Where practical, guardrails meeting the requirements of Part 4 (OH&S General Conditions) must be installed at:

- Dangerous breaks in the continuity of the wharf, dock or pier and
- Dangerous corners, edges and other parts of a wharf, dock, or pier.

See section 3.1.5 for Part 4 (General Conditions) requirements (below).

Moveable warning barriers may be used where the use of standard guardrails is impractical.

Effective warning barriers must be installed across the entrances of barge and ship loading ramps when ramps are not in use.

3.1.4 Markings

Where circumstances require, curbs, bullrails, guardrails, and barriers must be painted solid yellow, yellow and black stripes or checkers, or yellow against a suitable contrasting background.

Retroreflective paint or patches must be applied to curbs, bullrails, guardrails, and barriers where mobile equipment is operated at night

3.1.5 Fall Protection (OH&S Part 4 – General Conditions)

An area accessible to workers/users must have guards or guardrails installed in any of the following circumstances:

- If a raised floor, open-sided floor, mezzanine, gallery, balcony, work platform, ramp, walkway, or runway is 1.22 meters or more above the adjacent floor or grade level;
- On both sides of any walkway over or adjacent to any substance which is a hazard if a worker fell in, or on it, or which is over machinery or work areas;
- Around the perimeter of any open container or containment area such as an open vat, bin, tank or pit which is 1.22 meters or more in depth and which has sides that do not extend at least as high as required for a guardrail above the adjacent grade or work surface;

3.2 Fire Protection

The placement of fire-extinguishing equipment shall be planned in cooperation with the authority having jurisdiction and the local responding fire departments at least annually in order to accommodate changing conditions and personnel responsible for fire control in the facility.

The placement of portable fire extinguishers on piers and along bulkheads where vessels are moored or are permitted to be moored shall meet the following criteria:

- Extinguishers listed for Class A, B, and C fires shall be installed at the pier/land intersection on a pier that exceeds 7.62m in length.

- Additional fire extinguishers shall be placed such that the maximum travel distance to an extinguisher does not exceed 22.86 meters.

All portable fire extinguishers shall be maintained in accordance with Chapter 6 of NFPA 10, Standard for Portable Fire Extinguishers, and shall be clearly visible and marked.

4 Inspection Results

The results of the on-site inspection are based mainly on visual inspections and sounding timber with a hammer.

While all the piles were inspected, these inspections are somewhat limited in detecting mechanical damage and all damage due to marine borers.

The general condition of the various elements is as indicated below. For information on specific components, see Appendix D.

The following is an explanation of the rating scale used in Section 4 as it relates to the estimated time before the next required repair to a specific item.

Very Poor:	Immediate repair is required. Element is near failure or is missing.
Poor:	Less than 1 year. Closely monitored for additional deterioration.
Fair:	1 to 3 years
Good:	3 to 10 years

4.1 Approach and Wharfhead

General views of the approach, wharfhead, and floats are shown on Photograph 1.

4.1.1 Topside

Generally the topside elements (handrails, guard timber, and decking) are in fair to good serviceable condition, with moderate amounts of mechanical damage.

There is one handrail, one top-rail, and one post recommended for replacement, as well as two sections of guard timber. One guard is recommended for repair.

The deck boards are generally in good serviceable condition, with minor deterioration due to abrasion and weathering. Ongoing monitoring is recommended.

The mooring cleats are in good serviceable condition with only moderate surface corrosion.

4.1.2 Abutment

The abutment is in overall good condition. The stringers are resting directly on the concrete and there is evidence of water seepage along the face of the abutment. The stringers may

deteriorate at a more rapid rate due to moisture ingress. Ongoing monitoring is recommended.

4.1.3 Stringers

Not all of the stringers (Bents 2 – 20) could be inspected, due to access. The stringers appear to be in overall good condition, with minor to moderate biological growth along the exterior surfaces.

Ongoing monitoring of the stringers is recommended.

4.1.4 Pilecaps

Not all of the pilecaps could be inspected due to accessibility. Generally, the pilecaps are in overall good to fair condition, with minor to moderate biological growth along the exterior surfaces of the members. There are two pilecaps which are recommended for replacement, as well as ten recommended to be repaired.

4.1.5 Bearing Piles

The bearing piles are in overall fair to good condition. The assessment of the bearing piles was limited to visual inspections due to accessibility. Several previous pile repairs were noted, including the installation of steel collars and/or corbel block repairs between the pile and pilecap.

The 2015 Pelagic report recommended three piles for replacement and six piles requiring minor repairs/remediations. There are three piles, identified in the 2009 Pelagic drawings as having 20-30%, 40-50%, and 80-90% cross-sectional loss (CSL) respectively. This has likely increased since the time of the inspection. These findings were not confirmed by Herold Engineering, due to limited access (i.e. underwater inspections).

Herold Engineering identified nine bearing piles recommended for remediation. It is recommended that a detailed dive inspection, including coring of the tops of the elements, be schedule within the next two years to ascertain the condition of the submerged length and internal cross section respectively.

4.1.6 Cross-Bracing

The cross bracing at the facility is in overall fair condition.

Several replacements, recommended by Pelagic (2009 and 2015) have been completed at the facility. There is one cross brace that is missing and is recommended for installation.

4.1.7 Batter Piles

The batter piles are in overall good-fair condition.

There is one connection that has failed at the top of the bearing pile, which is recommended for re-instatement. One other repair to the batter piles is also recommended.

The 2009 Pelagic drawings indicate that two of the batter piles have 40-50% and 60-70% CSL. It is likely this deterioration has increased since the 2009 assessment. It is recommended that a dive inspection be conducted to verify the reported condition.

4.1.8 Fender System

The fendering system on the wharfhead is in overall poor condition.

The fender piles typically are in overall poor condition, with eight piles recommended for replacement. The fender chocks have moderate-severe splitting and CSL due to biological damage and moisture ingress. The chocks are recommended to be replaced in their entirety within the next 1-3 years. Since the fendering system is no longer used to berth/moor vessel and is sacrificial in nature, ongoing monitoring, replacement or removal upon failure is acceptable.

4.2 Soundings

Sounding were taken around the wharfhead and approach perimeter. The soundings may be used to identify any scouring, undermining, and/or sediment transport that may be happening at the facility. It is recommended that sounding measurements be taken during scheduled maintenance and inspections to monitor the condition of the seabed.

Table 4.2.1 Wharf and Approach Sounding (m)

Location	2018*
2C	4.57m
3C	6.40m
7C	7.32m
14A	8.94m
14F	9.14m
20A	13.11m
20F	13.11m

**The measurements reported above are from the top of the deck to the seabed.*

4.3 Gangway

The gangway is in overall good to fair condition.

The steel elements are recommended to have the coating reinstated at several locations. The steel gangway and roller assembly has added a significant weight to the float at the seaward end, and is likely contributing to the freeboard differential along the float edges.

The gangway and landing pad have moderate biological growth, power-washing of the gangway and landing pad is recommended.

4.4 Main Float

The float is in overall fair to poor condition.

There is significant biological growth along the float superstructure timbers. Power-washing of the superstructure is recommended.

The 2015 Pelagic inspection indicates that the flange splice blocks are deteriorating, with evidence of biological damage and hardware corrosion.

There is vegetative growth and biological damage to the timber superstructure, which is indicative of water ingress of the substructure.

The mooring piles are in overall fair-good condition. UHMW strips have been installed along the intertidal length. This is a good measure for reducing damage due to abrasion. However, it provides access for marine borers, and the area around the UHMW strips is recommended to be monitored for damage. There is no timber spreader beam between the two northern mooring dolphins, as is typical for this arrangement. Since the pile wells are not restraining the piles, consideration of a stiffening element such as a spreader beam is recommended

Table 4.4.1 Main Float Freeboard Measurements (mm)

Description	2018*
Northwest	432
West @ gangway	305
Northeast	356
Southwest	406
East @ gangway	208
Southeast	330

**Freeboard measurements are reported from the top of deck to the water line.*

The float is listing significantly at the gangway roller on the east side. It is recommended that a dive inspection be conducted to determine the condition of the timber elements of the substructure. If the timber substructure is not significantly damaged (mechanical and/or biological decay) additional floatation is recommended to be installed to correct the differential freeboard. Consideration may also be given to replacing the steel roller assembly at the seaward end of the gangway to reduce the dead load on the float.

4.5 Health and Safety

The following health and safety items were noted during the inspection:

4.5.1 Ladders

- Ladders along the float and the approach and wharfhead are spaced at intervals exceeding 30 meters.
- The ladder location is not identified with signage and/or high visibility paint on either side of the guard on the wharfhead.
- No underwater inspection was conducted to confirm acceptable length of ladder below low water and/or whether the ladders have been cleaned of barnacles and marine growth.

4.5.2 Lifesaving Equipment

- The life ring is mounted to the wharf handrails and is clearly identifiable when at the facility.

4.5.3 Curbs, Bullrails, Guardrails, and Barriers

- The float bullrail/riser arrangements do not meet minimum height requirements of 250mm consistently at the facility.

4.5.4 Fall Protection

- Handrails do not conform to current standards. The existing handrails are climbable, and have openings larger than 102mm at a deck elevation that exceeds 610mm.

Should the SCRD feel that OH&S requirements are to be followed, it is recommended that timber pickets be installed with a maximum clear spacing of 102mm to the inside face of the handrails. Alternatively, chain link fencing may also be used.

4.5.5 Lighting

- There are three light posts along the east side of the approach.

4.5.6 Fire Protection

- No observed portable fire extinguishers and/or fire protocols at the facility.

4.5.7 Navigation

- No immediate hazards to navigation were identified.

5 Load Rating & Residual Life Estimates

5.1 Load Rating

There is no current posted load rating for the approach, wharfhead, gangway, and float at the facility.

5.1.1 Approach & Wharfhead

For the approach and wharfhead the load rating calculations were completed in accordance with the prescribed method in CAN/CSA S6-14 for calculating maximum gross vehicle weight (GVW) for different analysis vehicle model configurations as required (Section 14).

The vehicle loading models applied to the structure are in accordance with CAN/CSA S6-14 and are defined as follows:

CL2-W (Two Unit Vehicle)

• Axle 1	-	.08 W	=	50 kN (5,097 kg)
• Axle 2	-	.20 W	=	125 kN (12,742 kg)
• Axle 3	-	.20 W	=	125 kN (12,742 kg)
• Axle 4	-	.28 W	=	175 kN (17,839 kg)
TOTAL				**475 kN (48,420 kg)**

CAN/CSA defines the following as Two Unit Vehicles:

- Tractor – Semitrailer
- Car - Trailer
- Truck – Trailer
- Other vehicles consisting of two units

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CL3-W (Single Unit Vehicle)

- Axle 1 - .08 W = 50 kN (5,097 kg)
- Axle 2 - .20 W = 125 kN (12,742 kg)
- Axle 3 - .20 W = 125 kN (12,742 kg)

TOTAL **300 kN (30581 kg)**

CAN/CSA defines the following as Single Unit Vehicles:

- Trucks
- Buses
- Cars
- Other vehicles consisting of a single unit

Bending, shear and compressive capacities were determined using methods prescribed in Section 14 of CAN/CSA S6-14. Member sizes and spacing were taken from drawings provided and confirmed by field measurements. The analysis was done based on as-found conditions on-site at the time of the inspection. Structural capacities assume that the recommended repairs have been completed.

A maximum GVW for individual elements was determined using the methods described in Section 14 of CAN/CSA S6-14. This method is used for standardized posting of commercial vehicle weight limits on structures. The analysis involves determining a Live Load Capacity Factor, (F), based on the elements dead load effect (self-weight), live load effect (vehicle loading), and the evaluated member capacity. This Live Load Capacity Factor corresponds to a posting limit for a specified vehicle model.

The following table summarize the results of the described CAN/CSA S6-14 Evaluation Method including the characteristic member loading, capacities, Live Load Capacity Factor and maximum GVW for the structural elements on the approach and wharfhead.

Table 5.1.1 Approach & Wharfhead Load Rating Results

Element	Reliability Factor (β)	Dead Load Factor (α_D)	Dynamic Load Factor	Live Load Factor (α_L)	Live Load Type	Maximum Live Load Shear (kN)	Maximum Dead Load Shear (kN)	Maximum Material Resistance Shear (kN)	Live Load Capacity Factor (F)
Decking	2.5	1.25	1.105	1.35	CL2-W	32.6	0.083	19.6	0.60
	2.5	1.25	1.105	1.35	CL3-W	23.3	0.083	19.6	0.83
	Reliability Factor (β)	**Dead Load Factor (αD)**	**Dynamic Load Factor**	**Live Load Factor (αL)**	**Live Load Type**	**Maximum Live Load Flexure (kN·m)**	**Maximum Dead Load Flexure (kN·m)**	**Maximum Material Resistance Flexure (kN·m)**	**Live Load Capacity Factor (F)**
Decking	2.5	1.25	1.105	1.35	CL2-W	10	0.013	6.66	0.67
	2.5	1.25	1.105	1.35	CL3-W	7.1	0.013	6.66	0.94
	Reliability Factor (β)	**Dead Load Factor (αD)**	**Dynamic Load Factor**	**Live Load Factor (αL)**	**Live Load Type**	**Maximum Live Load Shear (kN)**	**Maximum Dead Load Shear (kN)**	**Maximum Material Resistance Shear (kN)**	**Live Load Capacity Factor (F)**
Stringer	3.0	1.14	1.063	1.49	CL2-W	85.4	2.25	35.4	0.39
	3.0	1.14	1.063	1.49	CL3-W	85.4	2.25	35.4	0.39

	Reliability Factor (β)	Dead Load Factor (αD)	Dynamic Load Factor	Live Load Factor (αL)	Live Load Type	Maximum Live Load Flexure (kN·m)	Maximum Dead Load Flexure (kN·m)	Maximum Material Resistance Flexure (kN·m)	Live Load Capacity Factor (F)
Stringer	3.0	1.14	1.063	1.49	CL2-W	80.1	2.4	47	0.55
	3.0	1.14	1.063	1.49	CL3-W	80.1	2.4	47	0.55
	Reliability Factor (β)	**Dead Load Factor (αD)**	**Dynamic Load Factor**	**Live Load Factor (αL)**	**Live Load Type**	**Maximum Live Load Shear (kN)**	**Maximum Dead Load Shear (kN)**	**Maximum Material Resistance Shear (kN)**	**Live Load Capacity Factor (F)**
Pilecap	3.25	1.16	1.063	1.56	CL2-W	143.3	26.1	64.4	0.27
	3.25	1.16	1.063	1.56	CL3-W	102.4	26.1	64.4	0.37
	Reliability Factor (β)	**Dead Load Factor (αD)**	**Dynamic Load Factor**	**Live Load Factor (αL)**	**Live Load Type**	**Maximum Live Load Flexure (kN·m)**	**Maximum Dead Load Flexure (kN·m)**	**Maximum Material Resistance Flexure (kN·m)**	**Live Load Capacity Factor (F)**
Pilecap	3.25	1.16	1.063	1.56	CL2-W	69	6.4	89.4	1.2
	3.25	1.16	1.063	1.56	CL3-W	49.3	6.4	89.4	1.6
	Reliability Factor (β)	**Dead Load Factor (αD)**	**Dynamic Load Factor**	**Live Load Factor (αL)**	**Live Load Type**	**Maximum Live Load Compression (kN)**	**Maximum Dead Load Compression (kN)**	**Maximum Material Compressive Resistance (kN)**	**Live Load Capacity Factor (F)**
Bearing Pile	3.5	1.18	1.063	1.63	CL2-W	222.9	33	142.6	0.49
	3.5	1..18	1.063	1.63	CL3-W	159.2	33	142.6	0.69

Table 5.1.2 Approach & Wharfhead Load Rating Governing Condition

Load Type	Element	Failure Mode	Posting Factor (P)	Maximum GVW (kg)
CL2-W	Pilecap	Shear	**FAILED**	**FAILED**
CL3-W	Pilecap	Shear	0.012	7,500

By analyzing each element, an overall governing condition is determined. In the case of this structure, shear in the pilecap on the approach was determined to be the overall limiting structural conditions when analyzed using the two model vehicles. The structure fails in CL2-W loading, and two unit vehicles are not permitted access to the structure.

5.1.2 Gangway

The gangway is a typical Transport Canada style steel truss gangway. The associated load limit, as specified by Transport Canada is 1.2kPa. It is recommended that this rating be employed at the facility.

5.1.3 Float

The floats were not load rated, as the amount of information regarding the substructure was insufficient to provide a reliable load rating. It is recommended that a dive inspection be undertaken, conducted and/or supervised by a professional engineer registered in British Columbia, to confirm the float configuration and prepare an associated load rating.

Typical Transport Canada timber floats have been historically rated to a maximum uniform load of 122 kg/m^2 or 1.2 kPa.

5.2 Recommended Load Limit Signage

The following is a detailed diagram of the load limit sign currently posted at the facility. The signage is in conformance with loading analysis results.

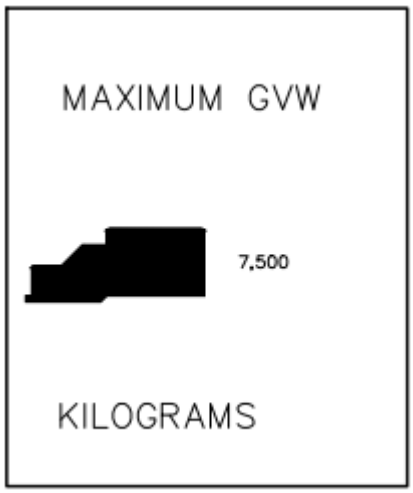


Figure 5.2.1 Load Limit Signage

The load rating was achieved by applying a maximum speed of 10 km/hr to the design vehicles. As such, speed limit signage stating this maximum is also required at the facility.

5.3 Residual Life Estimates

The residual life estimates are based on Section 2.5 of "Procedures for Inspection and Assessment of Fixed Timber Docks, 4th Edition" by R.G. Sexsmith Ltd. These estimates represent the worst case members inspected in any member group. For this reason, the overall condition of the member group is not necessarily reflected by the following residual life estimates

As noted in the above referenced material, the following applies:

- Where treated wood has been examined for presence of decay, and found sound, a life of 8-10 years is appropriate.
- Where evidence of some decay, but very limited extent was found present, a life of 3-6 years is appropriate.
- Where an element has weakened cross-section due to decay, the life can be presumed to be negligible (i.e. 0 years).

See Appendix D to determine which members the residual life estimate applies to.

Approach and Wharfhead

Handrails	- 0 years (based on three elements to be replaced, 1-3 years otherwise)
Guard	- 0 years (based on two elements to be replaced, 3-6 years otherwise)
Decking	- 8-10 years (based on the overall condition of the members)
Stringers	- 8-10 years (based on the overall condition of members)
Pilecaps	- 0 years (based on two elements to be replaced, 3-6 years otherwise)
Piles	- 0 years (based on nine pile repairs/replacements, 3-6 years otherwise)
Cross Bracing	- 3-6 years (based on the overall condition of members)
Batter Piles	- 0 years (based on Pelagic drawings, dive inspection is recommended to confirm)
Fendering	- 0 years (based on the overall condition of the members)

Gangway

Decking	-1-3 years (based on overall condition of the members)

Main Float

Timbers	- 0 years (based on damage to bullrails and flanges, 1-3 years otherwise)
Floatation	- 1-3 years (based on existing condition and differential freeboard)
Mooring Piles	- 3-6 years (based on one remediation recommendation, 8-10 years otherwise)

APPENDIX A
Photographs

3701 Shenton Road
Nanaimo, BC V9T 2H1
Ph: 250-751-8558 Fax: 250-751-8559

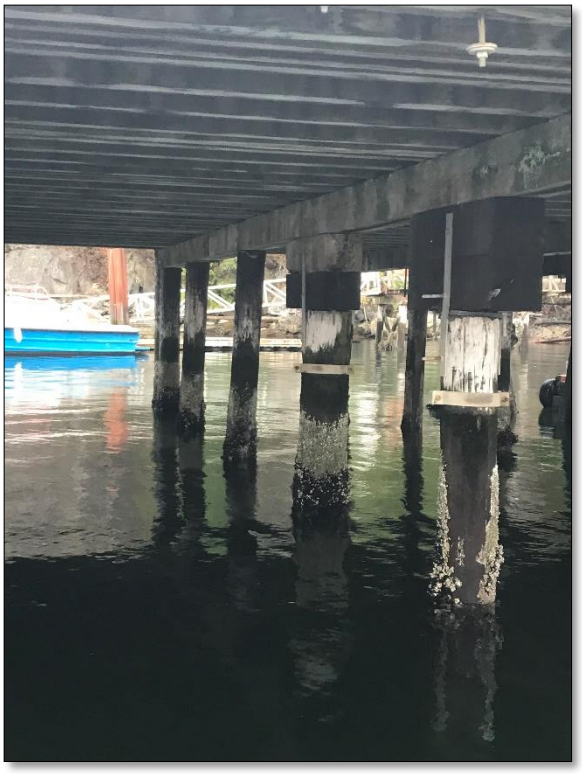
Photograph 1: Keats Landing Port Facility, note: general arrangement looking south

Photograph 2: Approach handrails and guard, note: deterioration due to weathering and biological damage

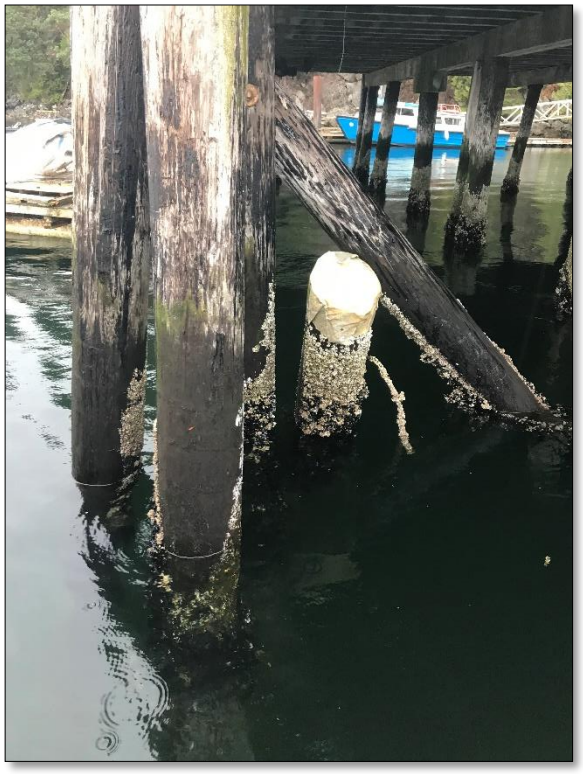
Photograph 3: Concrete abutment, note: water seepage

Photograph 4: Bearing pile 5A, note: spalling of the concrete footing

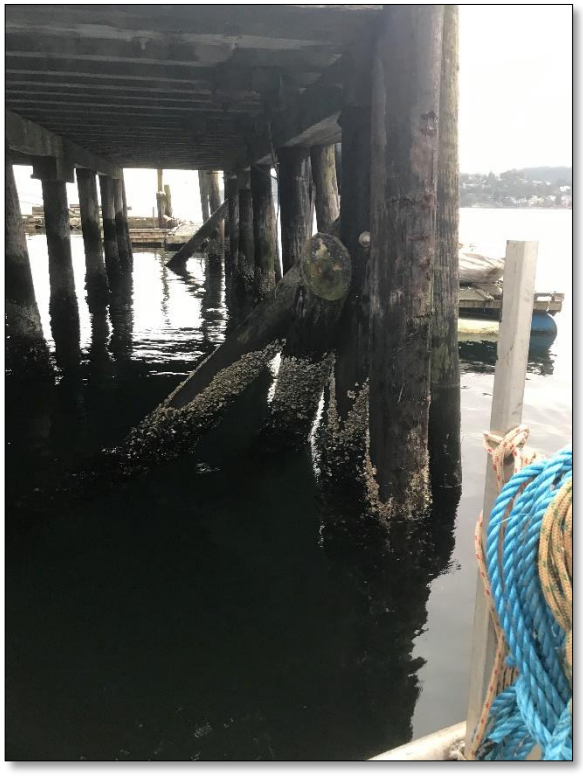
Photograph 5: Guard on wharfhead, note: to be replaced



Photograph 6: Bearing pile repairs, note: strap does not extend to pilecap



Photograph 7: Batter pile 20A east to west, note: no longer connected to bearing pile

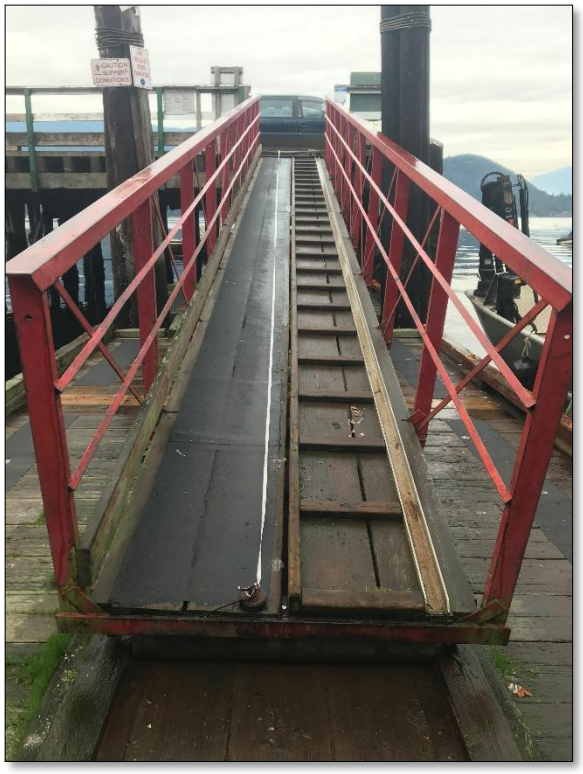


Photograph 8: Batter pile 20F, note: no aluminum flashing at cut end

Photograph 9: Vehicles remaining parked on the structure for extended periods of time

Photograph 10: Service shed, note: mechanical damage to siding

Photograph 11: Derrick crane, note: general arrangement



Photograph 12: Gangway, note: minor coating losses and surface corrosion of the steel

Photograph 13: Float, note: low point at gangway roller

Photograph 14: Mooring pile well, note: not restraining mooring piles

Photograph 15: Life ring

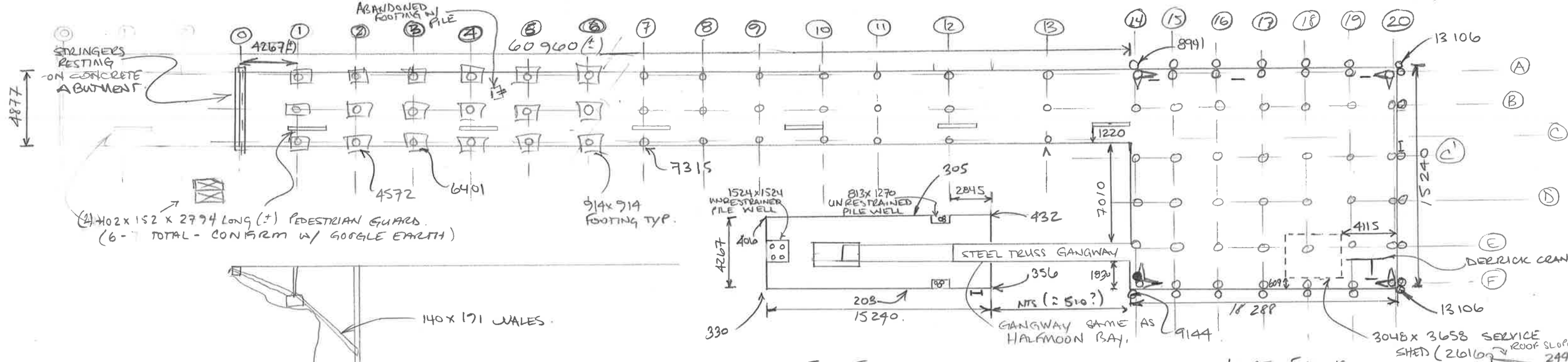
Photograph 16: Electrical service box, note: no lock at bottom connection

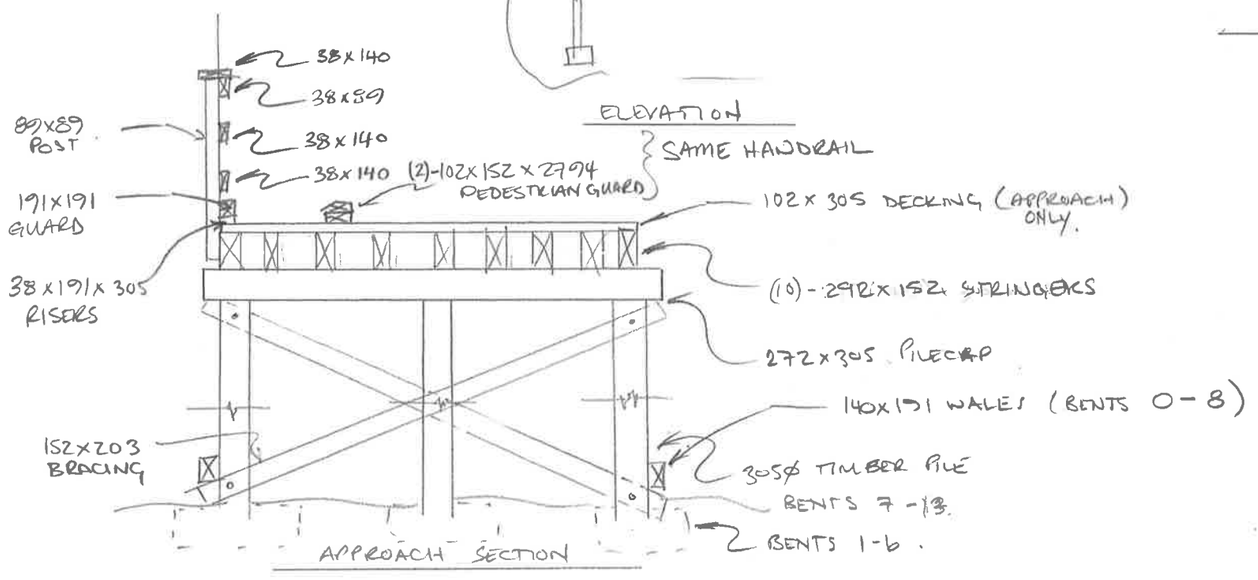
Photograph 17: Miscellaneous bracing connected to abandoned piling, note: potential navigation hazard

Photograph 18: Miscellaneous scow with debris secured to wharf, note: insufficient fendering for this application

APPENDIX B
Field Notes

3701 Shenton Road
Nanaimo, BC V9T 2H1
Ph: 250-751-8558 Fax: 250-751-8559





ELEVATION

FLOAT FRAMING

RUBBOARD 75 x 305
DECKING 38 x 305
BULLRAILS 89 x 140
RISERS 89 x 140 x 305 LNG.

W/HARF FRAMING

TIMBERGUARD 191 x 241
RISERS 102 x 203 x 305 LNG
DECKING 75 x 305.

LEGEND

- H LADDER
- — KLEAT
- LIFE RING
- ^ LIGHT POST

LANDING PAD SECTION

DETAILS TO SHOW:

- DECK NAILING
- GUARD/RISER CONNECTION
- POST " "
- DRIFT PIN " "
- CROSS BRACE " "

4551-002.
KEATS LANDING
2018.11.13
(14:45)

APPENDIX C
Reference Drawings

3701 Shenton Road
Nanaimo, BC V9T 2H1
Ph: 250-751-8558 Fax: 250-751-8559

ARCHITECTURAL D 24" x 36"

GENERAL:

1. READ STRUCTURAL DRAWINGS IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS AND DOCUMENTS. REPORT ANY CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK.
2. VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO CONSTRUCTION.
3. NOTIFY THE ENGINEER 48 HOURS IN ADVANCE FOR INSPECTION OF STRUCTURAL CONNECTIONS BEFORE COVERING UP.
4. CONTRACTOR'S RESPONSIBILITY: THESE DRAWINGS SHOW COMPLETED STRUCTURAL COMPONENTS OF THE DOCKS. THE REQUIRED TEMPORARY BRACING AND SHORING TO PERFORM THE WORK SAFELY IS THE RESPONSIBILITY OF THE CONTRACTOR.
5. ENVIRONMENTAL WORK PROCEDURES, TIMING AND SPECIAL PRECAUTIONS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS AND LIMITATIONS OF THE FEDERAL DEPARTMENT OF FISHERIES AND OCEANS, AND THE PROVINCIAL MINISTRY OF WATER, LAND AND AIR PROTECTION.
6. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS OTHERWISE NOTED.
7. HORIZONTAL DATUM U.T.M. NAD 83.
8. VERTICAL DATUM (ELEVATIONS AND CONTOURS) TO CHART DATUM (C.D.).
9. TIDE ELEVATIONS AT THE SITE ARE BASED ON VALUES PUBLISHED BY THE CANADIAN HYDROGRAPHIC SERVICE (CHS) FOR BEDWELL HARBOUR, PENDER ISLAND AND ARE AS FOLLOWS:

HIGHER HIGH WATER, LARGE TIDE (H.H.W.L.T.)	5.1 METRES
HIGHER HIGH WATER, MEAN TIDE (H.H.W.M.T.)	4.6 METRES
MEAN WATER LEVEL (M.W.L.)	3.2 METRES
LOWER LOW WATER, MEAN TIDE (L.L.W.M.T.)	1.3 METRES
LOWER LOW WATER, LARGE TIDE (L.L.W.L.T.)	0.1 METRES

10. SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION.

DEMOLITION:

1. ALL UNSALVAGEABLE MATERIAL FROM SITE TO BE DISPOSED OF IN ACCORDANCE WITH ALL LOCAL, PROVINCIAL AND FEDERAL REGULATIONS AT THE CONTRACTOR'S EXPENSE.
2. USED TIMBER PILES REMOVED FROM SITE ARE TO BE DISPOSED OF IN ACCORDANCE WITH ALL LOCAL, PROVINCIAL AND FEDERAL REGULATIONS AT THE CONTRACTOR'S EXPENSE.

TIMBER:

1. ALL TIMBER SHALL BE PRESSURE TREATED NLGA NO. 1 COAST DOUGLAS FIR OR BETTER. LUMBER TO BE GRADED TO NLGA STANDARD GRADING RULES FOR CANADIAN LUMBER, 2003.
2. TIMBER PILES TO BE SUPPLIED SIZE 36
3. ALL TIMBERS SHALL BE CUT TO THE REQUIRED LENGTH PRIOR TO TREATMENT. FIELD CUT TIMBERS WILL BE REJECTED AND REPLACED AT THE CONTRACTOR'S EXPENSE, EXCLUDING CROSS BRACE DRILLING AT THE TOP CONNECTIONS.
4. TREATMENT TO BE IN ACCORDANCE WITH CSA O80:

4.1. CATEGORY 3.2 EXPOSED TO WEATHER, NOT IN GROUND CONTACT. INCLUDING BULLRAILS AND RISERS.

4.1.1. ACZA, 4.0kg/m³
4.1.2. CCA, 4.0kg/m³

4.2. CATEGORY UC 4.1 CONTACT WITH SPLASH ZONE. INCLUDING WHARF JOISTS. STRINGERS, FISH PLATES, PLYWOOD NOT COVERED UNDER UC5A, PILECAPS & BLOCKING.

4.2.1. ACZA, 6.4kg/m³
4.2.2. CCA, 6.4kg/m³
4.2.3. CREOSOTE:
4.2.3.1. 160kg/m³ IF THICKNESS LESS THAN 115MM
4.2.3.2. 120kg/m³ IF THICKNESS GREATER THAN OR EQUAL TO 115MM

4.3. USE CATEGORY UC5A, MARINE. INCLUDING WOOD PILES, PLYWOOD, CROSS BRACES, WALES.
4.3.1. ACZA, 30kg/m³ OR
4.3.2. CCA, 24kg/m³ OR
4.3.3. CREOSOTE 290kg/m³
4.3.3.1. PENETRATION IN ACCORDANCE WITH O80

4.4. AFTER CUTOFF, TREAT PILE TOPS WITH TWO COATS OF HOT CREOSOTE OIL AND ONE COAT OF APPROVED MASTIC AT LEAST 6mm THICK.

4.5. ALL FENDER PILES TO BE COVERED A SHEET OF 24 GUAGE ANNEALED CORROSION RESISTANT ALUMINUM, CUT 300mm LARGER THAN THE PILE TOP.

4.6. ALL DRILLED BOLT HOLES COMPLETED AFTER TREATMENT MUST BE FIELD TREATED WITH TWO COATS OF HOT CREOSOTE AND BOLTS/PLUGS MUST BE DIPPED IN CREOSOTE PRIOR TO INSTALLATION.

4.7. PLUG ALL UNUSED BOLT HOLES WITH TIGHT FITTING CREOSOTE TREATED BOLTS, AND NEOPRENE GASKET AND WASHER EACH END.

4.8. TIMBER HANDLING
4.8.1. ALL TREATED TIMBER AS TO NOT PUNCTURE THE TREATED LAYER. ANY MEMBERS IDENTIFIED AS BEING DAMAGED THROUGH THE TREATED LAYER EITHER PRIOR TO OR DURING INSTALLATION WILL BE REJECTED AT THE EXPENSE OF THE CONTRACTOR.

4.9. ALL SHIMS MUST BE CREOSOTE TREATED PLYWOOD AND MUST BE SECURED IN PLACE BY AT LEAST TWO (2) NAILS AT OPPOSITE CORNERS OF THE SHIM OR APPROVED EQUIVALENT

5. PROPOSED ALTERNATIVES TO THE SUPPLIED DESIGN TO BE APPROVED BY ENGINEER.

6. PILE DRIVING
6.1. PILES ARE TO BE DRIVEN TIP DOWN UNTIL A DRIVING ENERGY OF 25–30 kJ IS ACHIEVED OR TO REFUSAL (5 BLOWS / 25mm).
6.2. DRIVE TO THE FOLLOWING TOLERANCES
6.2.1. LOCATION OF PILES: 25mm ±
6.2.2. VERTICAL TOLERANCE: 2% OR 1:50

7. PILE REPLACEMENT

7.1. EXISTING PILES TO BE REPLACED SHALL BE FULLY EXTRACTED
7.2. REPLACEMENT PILES TO ACHIEVE A MINIMUM PENETRATION EQUAL TO THAT OF THE REMOVED PILE AND TO SATISFY THE PILE DRIVING CRITERIA NOTED ABOVE.

METAL FABRICATIONS:

1. UNLESS NOTED OTHERWISE BY THE ENGINEER IN WRITING THE STEEL AND/OR ALUMINUM FABRICATOR SHALL SUPPLY THE ENGINEER WITH SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION. SHOP DRAWINGS SHALL INDICATE ALL DETAILS, MATERIAL SPECIFICATIONS AND DESIGN LOADS.
2. A COPY OF THE FABRICATOR'S CANADIAN WELDING BUREAU CERTIFICATES SHALL BE INCLUDED WITH THE SHOP DRAWING SUBMISSION.
3. ALL WELDING SHALL BE IN ACCORDANCE WITH CSA W59–03 (R2008) AND SHALL BE PERFORMED BY FABRICATORS "FULLY APPROVED" BY THE CANADIAN WELDING BUREAU UNDER CSA W55.3–08. FABRICATING SHOP TO HAVE A MINIMUM DIVISION 2.1 CERTIFICATION BY THE CANADIAN WELDING BUREAU TO THE REQUIREMENTS OF CSA W47.1 (STEEL). THE FABRICATOR SHALL SUBMIT PROOF OF CERTIFICATION PRIOR TO START OF WORK.
4. DESIGN FABRICATIONS TO CSA–S16–09, LIMIT STATES DESIGN OF STEEL STRUCTURES.
5. EXCEPT PARTS OF MEMBERS TO BE EMBEDDED IN CONCRETE, GALVANIZED OR UNLESS NOTED OTHERWISE ON THE DRAWINGS, ALL STEEL WORK SHALL BE SHOP PRIMED. PRIMING SHALL BE IN ACCORDANCE WITH CISC/CPMA–1–73A "QUICK DRYING PRIMER" WHEN NO TOP COAT IS REQUIRED AND IN ACCORDANCE WITH CISC/CPMA–2–75 WHEN A TOP COAT IS SPECIFIED. IF A TOP COAT IS SPECIFIED THE PRIMER SHALL BE SELECTED ENSURING COMPATIBILITY WITH THE SPECIFIED SYSTEM. ITEMS SPECIFIED TO BE GALVANIZED SHALL BE HOT DIPPED GALVANIZED TO ASTM A–123–08, MINIMUM ZINC COATING OF 600G/SQ.M. FIELD TOUCH–UP ALL ABRASIONS, SCRATCHES, WELDS OR BOLTS
6. ISOLATE ALUMINUM FROM DISSIMILAR METALS EXCEPT STAINLESS STEEL, ZINC OR WHITE BRONZE WITH BITUMINOUS PAINT. ALL FASTENERS TO BE COMPATIBLE WITH THE MATERIALS THROUGH WHICH THEY PASS.
7. DELIVER, STORE, HANDLE AND PROTECT MATERIALS FROM DAMAGE. INSTALL PLUMB AND TRUE IN EXACT LOCATIONS, SECURELY FASTENED TO THE BUILDING STRUCTURE AS DETAILED.
8. THE CONTRACTOR SHALL PROVIDE TEMPORARY BRACING DURING CONSTRUCTION. THE BRACING SHALL BE DESIGNED, INSTALLED AND MAINTAINED BY THE CONTRACTOR. THE BRACING SHALL BE REMOVED ONLY AFTER THE INSTALLATION IS COMPLETE.
9. ALL WELDS TO CONTINUOUS SEAL WELDS.
10. ALL STEELWORK SHALL BE COATED PRIOR TO DELIVERY TO THE SITE WHERE POSSIBLE. ONLY FIELD TOUCH–UP SHOULD BE REQUIRED. IF IT IS NECESSARY TO FIELD PAINT, CONTAINMENT MEASURES SATISFACTORY TO THE ENGINEER SHALL BE IN PLACE BEFORE PREPARATION AND PAINTING COMMENCE

ENVIRONMENTAL CONSTRUCTION REQUIREMENTS:

1. ENVIRONMENTAL WORK PROCEDURES, TIMING AND SPECIAL PRECAUTIONS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF FISHERIES AND OCEANS CANADA AND THE PROVINCIAL MINISTRY OF ENVIRONMENT.
2. CONTRACTOR TO FOLLOW THE REQUIREMENTS OF THE "BEST MANAGEMENT PRACTICES FOR CONSTRUCTING DOCKS AND FLOAT IN THE SOUTH COAST AREA (SUNSHINE COAST – VANCOUVER ISLAND), FISHERIES AND OCEANS CANADA", AND "BEST MANAGEMENT PRACTICES FOR PILE DRIVING AND RELATED OPERATIONS – BC MARINE PILE DRIVING CONTRACTOR'S ASSOCIATION, NOVEMBER 2003", FOR ALL WORK ON THIS PROJECT.
3. SECTION 9 NOTIFICATION AND DFO APPROVAL REQUIRED.
4. CONDITIONS OF MELP AND DFO APPROVALS TO BE FOLLOWED.
5. CONTRACTOR MUST EMPLOY METHODS TO MITIGATE HARM TO FISH AND USE DEBRIS CONTROL DEVICES WHEN DRILLING OR WORKING OVER WATER.
6. ALL DEBRIS, SAWDUST AND SHAVINGS FALLING INTO THE WATER CAUSED BY THE WORK SHALL BE CONTAINED AND PROMPTLY CLEANED UP AND PROPERLY DISPOSED OF.
7. CONTRACTOR MUST HAVE EMERGENCY SPILL EQUIPMENT AVAILABLE WHENEVER WORKING ON OR NEAR THE WATER.
8. WHEN GRINDING OR CORING CURED CONCRETE, THE DUST AND FINES ENTERING THE WATER MUST NOT EXCEED THE ALLOWABLE LIMIT FOR SUSPENDED SOLIDS. WHEN GRINDING GREEN OR INCOMPLETELY CURED CONCRETE AND THE DUST OR FINES ARE ENTERING THE WATER, pH MONITORING SHALL BE CONDUCTED TO ENSURE ALLOWABLE RANGES ARE MAINTAINED. IN THE EVENT THAT THE LEVELS ARE OUTSIDE THE ACCEPTABLE RANGES, PREVENTATIVE MEASURES SHALL BE INTRODUCED. THIS MAY INCLUDE INTRODUCING SILT CURTAINS TO CONTAIN THE SOLIDS AND PREVENT FISH FROM ENTERING A CONTAMINATED AREA OR CONSTRUCTING CATCH BASINS TO COVER THE RUN OFF AND NEUTRALIZING IT PRIOR TO DISPOSAL.
9. SPILLS: WHEN PATCHING CONCRETE, ALL SPILLS MUST BE CONTAINED AND PREVENTED FROM ENTERING THE WATER.
10. WHENEVER THERE IS THE POSSIBILITY OF CONTAMINANTS ENTERING THE WATER, THE CONTRACTOR WILL MONITOR pH LEVELS TO ENSURE ACCEPTABLE LEVELS.
11.

ABBREVIATIONS

CL.	–	CLEAR
C	–	CENTRELINE
CP.	–	COMPLETE PENETRATION
C/W	–	COMPLETE WITH
DWG.	–	DRAWING
EL.	–	ELEVATION
I.D.	–	INSIDE DIAMETER
LLH	–	LONG LEG HORIZONTAL
LLV	–	LONG LEG VERTICAL
MAX.	–	MAXIMUM
MIN.	–	MINIMUM
N.T.S.	–	NOT TO SCALE
OPP.	–	OPPOSITE
PL	–	PLATE
R	–	RADIUS
SIM.	–	SIMILAR
S.S.	–	STAINLESS STEEL
T.O.	–	TOP OF
TYP.	–	TYPICAL
U/S	–	UNDERSIDE
U.N.O.	–	UNLESS NOTED OTHERWISE
WP	–	WORK POINT

KEY PLAN
1:500

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

ISSUES

No.	DATE YYYY.MM.DD	ISSUED FOR
A	2018.12.17	CLIENT REVIEW
B	2019.02.15	REPORT

SUB CONSULTANT

DRAFTED LHO
DRAFTING REVIEW
DESIGNED SPS
DESIGN REVIEW

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250–751–8558 Fax: 250–751–8559
Email: mail@heroldengineering.com

ENGINEERS SEAL

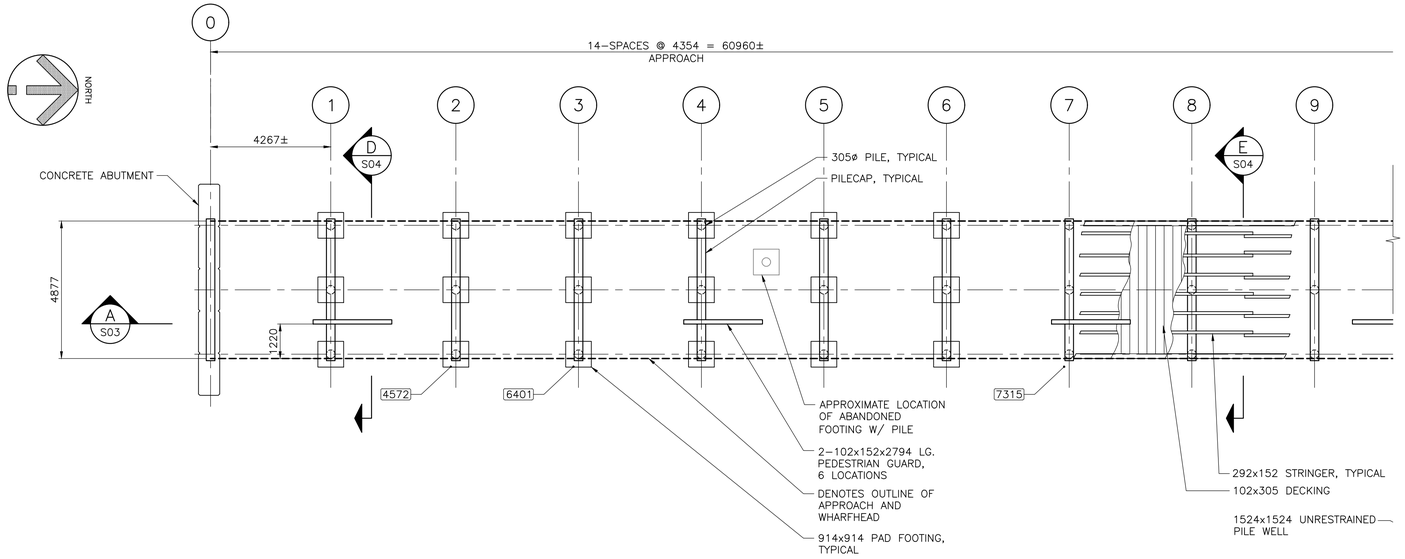
KEATS LANDING:
SITE PLAN

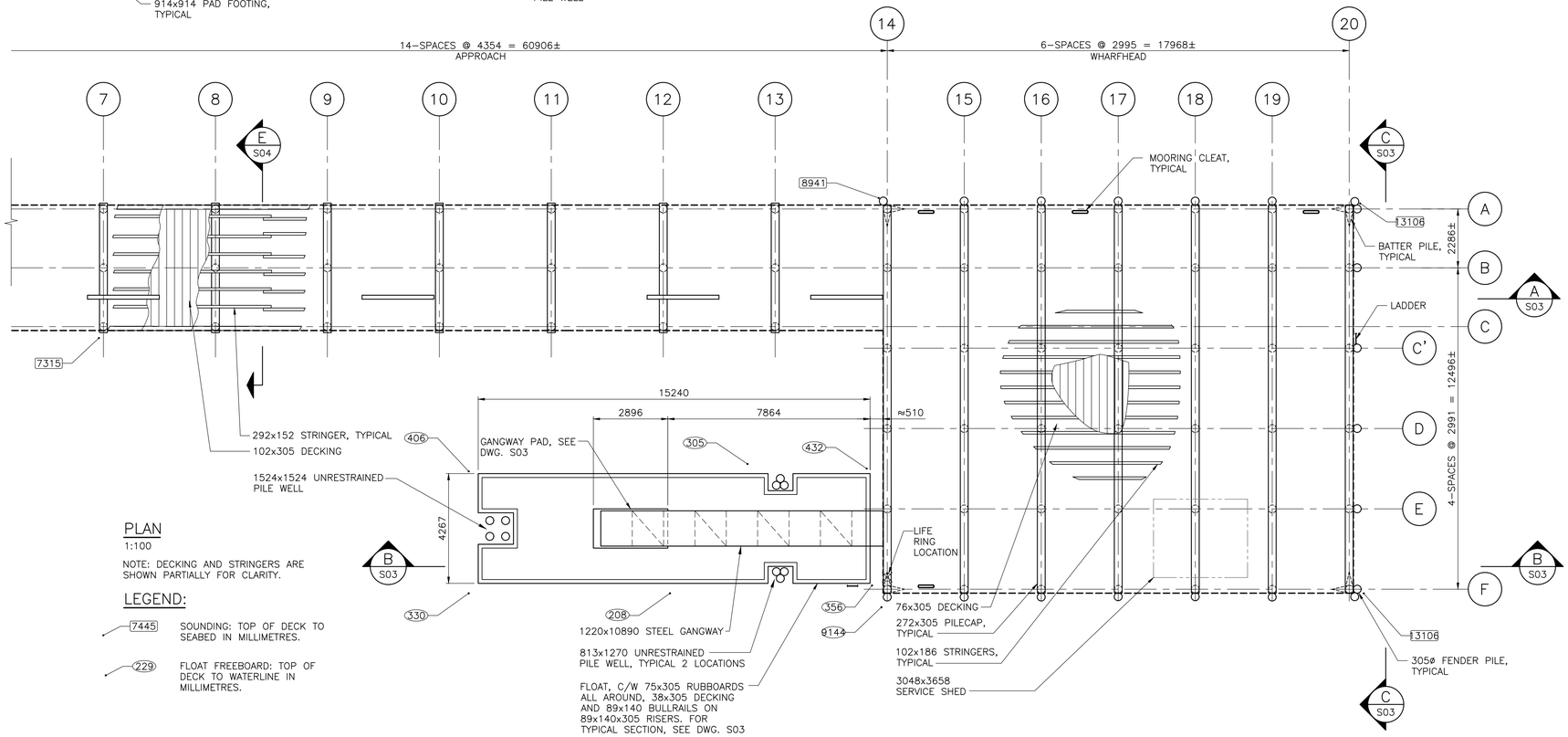
SCRD PORT FACILITIES
- LOAD LIMIT SAFETY
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No. 4551–002	CLIENT DWG. No. N/A
SCALE AS SHOWN	PERMIT No. N/A
HEL DRAWING No. S01	REVISION B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION

File: X:\Projects\4551-002 SCRD Port Facilities – Load Limit Safety Assessment\4545 Drawings\Admin\4551-002-Keats Landing.dwg Plot Time: Feb. 13, 19 3:58 PM User: Greg Wate





PLAN
1:100

NOTE: DECKING AND STRINGERS ARE SHOWN PARTIALLY FOR CLARITY.

LEGEND:

7445 — SOUNDING: TOP OF DECK TO SEABED IN MILLIMETRES.

229 — FLOAT FREEBOARD: TOP OF DECK TO WATERLINE IN MILLIMETRES.

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

NOTES:

1. FOR GENERAL NOTES, SEE DWG. S01.
2. ALL ITEMS ARE TIMBER, UNLESS NOTED OTHERWISE.
3. ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE VERIFIED PRIOR TO REMEDIATION/CONSTRUCTION ACTIVITIES.

ISSUES

No.	DATE YYYY.MM.DD	ISSUED FOR
A	2018.12.17	CLIENT REVIEW
B	2019.02.15	REPORT

SUB CONSULTANT

DRAFTED LHO

DRAFTING REVIEW

DESIGNED SPS

DESIGN REVIEW

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250–751–8558 Fax: 250–751–8559
Email: mail@heroldengineering.com

ENGINEERS SEAL

KEATS LANDING: GENERAL ARRANGEMENT - SHEET 1

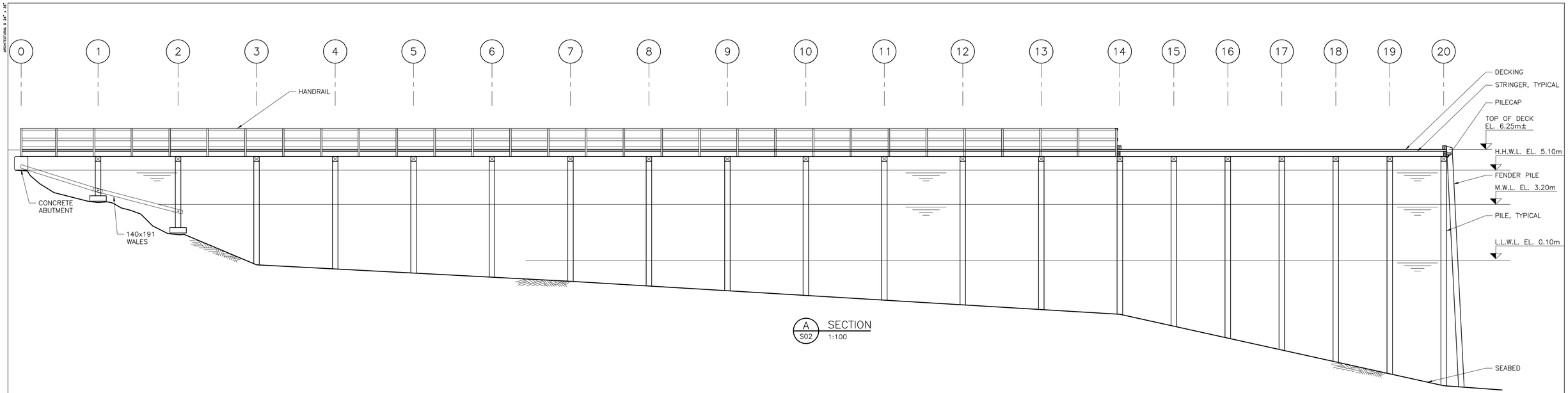
SCRD PORT FACILITIES - LOAD LIMIT SAFETY

1975 FIELD ROAD SECHELT BC V0N 3A1

SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No.	CLIENT DWG. No.
4551–002	N/A
SCALE	PERMIT No.
AS SHOWN	N/A
HEL DRAWING No.	REVISION
S02	B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION



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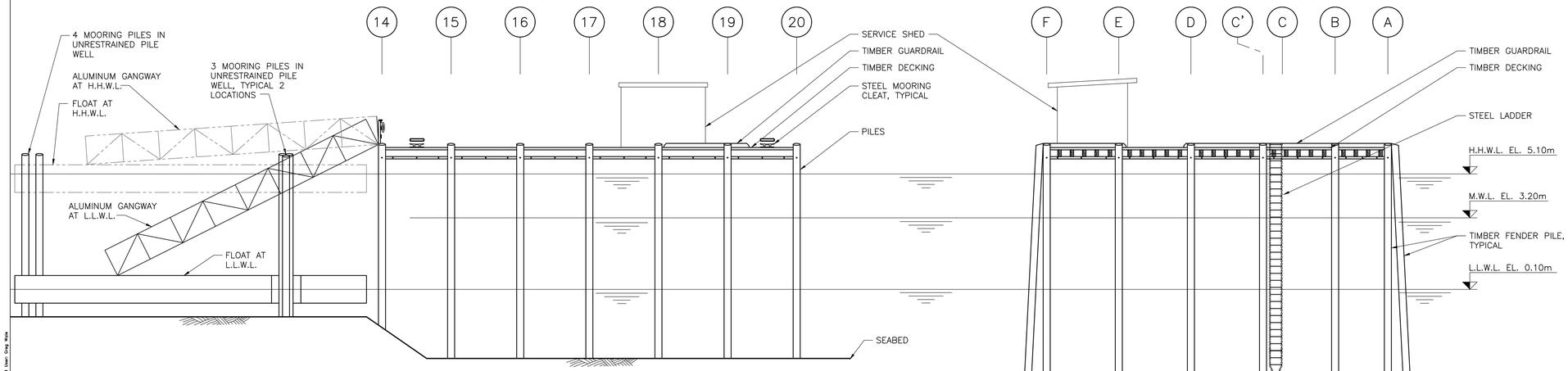
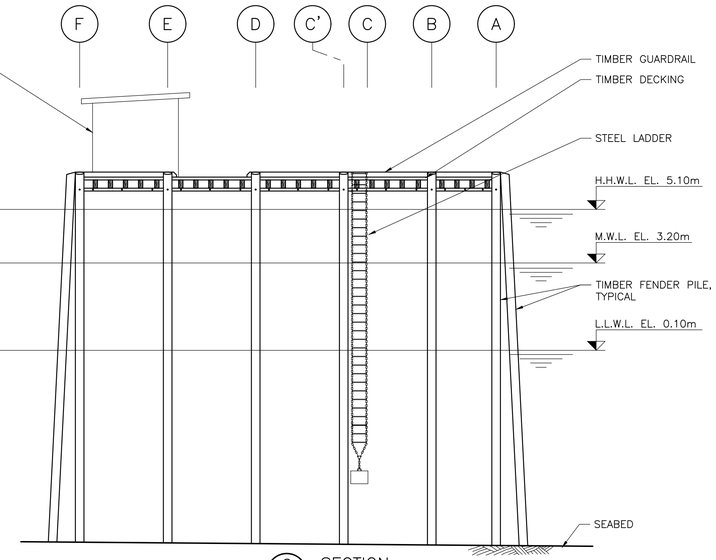


B S02 SECTION
1:100



C S02 SECTION
1:100

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

NOTES:

1. FOR GENERAL NOTES, SEE DWG. S01.
2. ALL ITEMS ARE TIMBER, UNLESS NOTED OTHERWISE.
3. ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE VERIFIED PRIOR TO REMEDIATION/CONSTRUCTION ACTIVITIES.

ISSUES

No.	DATE YYYY.MM.DD	ISSUED FOR
A	2018.12.17	CLIENT REVIEW
B	2019.02.15	REPORT

SUB CONSULTANT

DRAFTED LHO
DRAFTING REVIEW
DESIGNED SPS
DESIGN REVIEW

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250-751-8558 Fax: 250-751-8559
Email: mail@heroldengineering.com

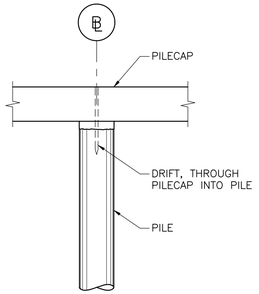
ENGINEERS SEAL

KETAS LANDING:
GENERAL
ARRANGEMENT -
SHEET 2

SCRD PORT FACILITIES
- LOAD LIMIT SAFETY
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No.	CLIENT DWG. No.
4551-002	N/A
SCALE: AS SHOWN	PERMIT No.: N/A
HEL DRAWING No.: S03	REVISION: B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION



PILE TO PILECAP CONNECTION
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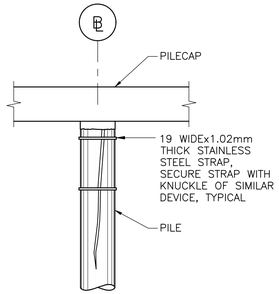

PILE STRAPPING DETAIL
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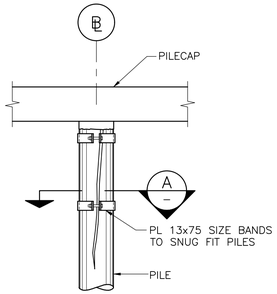

PILE BANDING DETAIL
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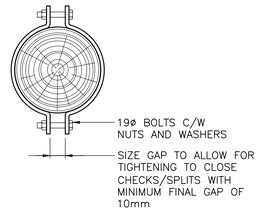

A – SECTION
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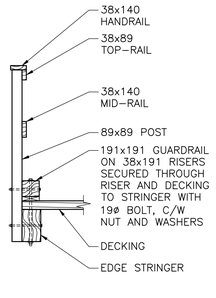
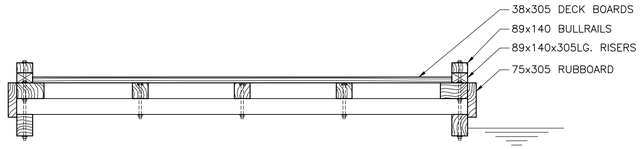
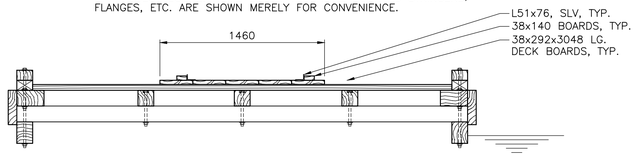


HANDRAIL AND GUARDRAIL DETAIL
1:25

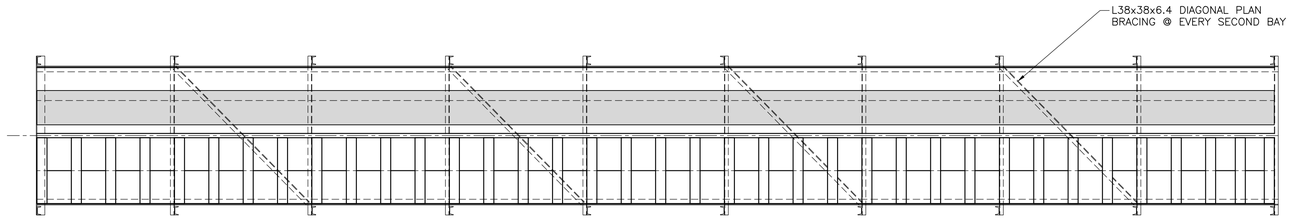


TYPICAL SECTION THROUGH FLOAT
1:25

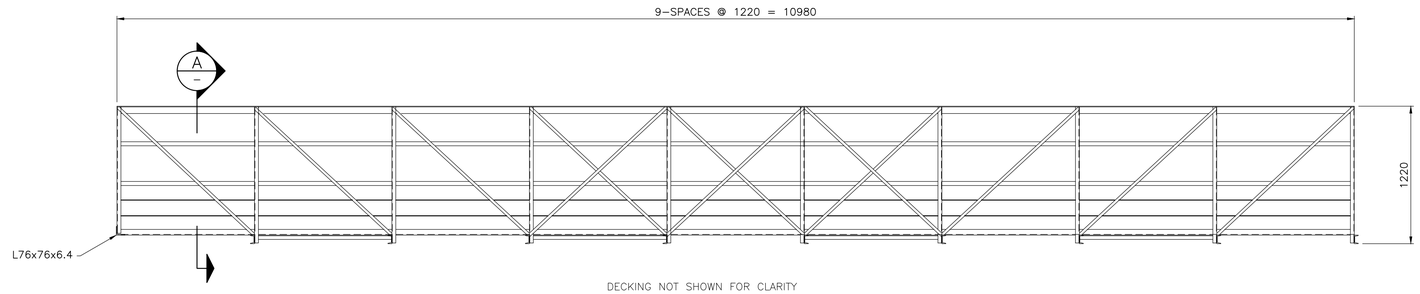
FLOAT DETAILS BELOW WATERLINE AND DECK NOT CONFIRMED. OUTSIDE OF PROJECT SCOPE. ITEMS BELOW WATERLINE SUCH AS STRINGERS, FLANGES, ETC. ARE SHOWN MERELY FOR CONVENIENCE.



SECTION THROUGH GANGWAY LANDING PAD
1:25

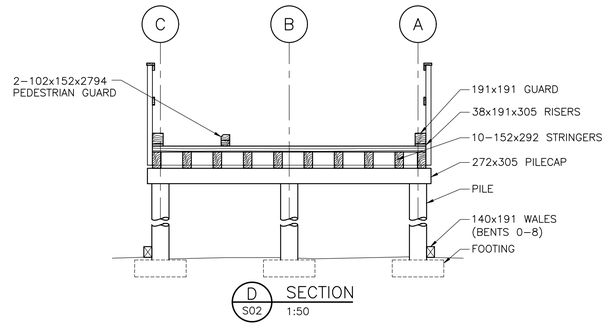


PLAN – STEEL GANGWAY
1:25

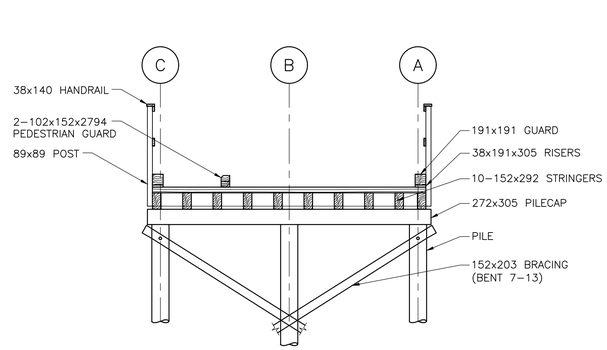


DECKING NOT SHOWN FOR CLARITY

ELEVATION – STEEL GANGWAY
1:25



D S02 SECTION
1:50



E S02 SECTION
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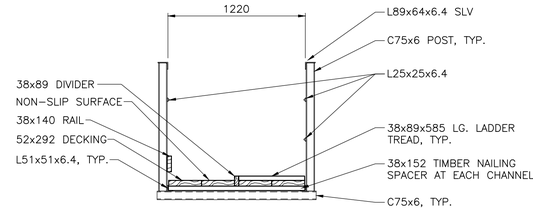

A – SECTION
1:25

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

NOTES:

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ISSUES									
No.	DATE YYYY.MM.DD	ISSUED FOR	No.	DATE YYYY.MM.DD	ISSUED FOR	No.	DATE YYYY.MM.DD	ISSUED FOR
A	2018.12.17	CLIENT REVIEW						
B	2019.02.15	REPORT						

SUB CONSULTANT

DRAFTED LHO
DRAFTING REVIEW
DESIGNED SPS
DESIGN REVIEW

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250–751–8558 Fax: 250–751–8559
Email: mail@heroldengineering.com

ENGINEERS SEAL

KEATS LANDING: DETAILS

SCRD PORT FACILITIES
- LOAD LIMIT SAFETY
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No.	CLIENT DWG. No.
4551–002	N/A
SCALE: AS SHOWN	PERMIT No.: N/A
HEL DRAWING No.: S04	REVISION: B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION

APPENDIX D
Herold Engineering Damage Table

HEROLD ENGINEERING
3701 Shenton Road
Nanaimo, BC V9T 2H1
Ph: 250-751-8558 Fax: 250-751-8559

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
Approach **all locations measured from abutment (Bent 0) datum (0m)*						
Approach	Overall	-	-	Significant debris including large tree stumps and driftwood. The debris is lodged within the substructure.	Remove large debris from within substructure as part of ongoing maintenance to mitigate impact damage to the structure.	2019
Handrail	Overall	Mechanical	Fair-Good	Minor-moderate checking and splitting. Minor amounts of coating loss. Ongoing replacement of the timbers with untreated lumber is evident at the shoreward end.	Ongoing monitoring. Untreated lumber is not recommended for the marine environment and will deteriorate at an increased rate when compared to treated timber. Treated timber is recommended when completing repairs/replacement.	
Handrail	Gridline C @ 0m	Mechanical	Poor-Fair	Significant check at the cut end of the handrail.	Replace 38x140mm timber handrail.	2019
Handrail	Gridline C @ 0m	Mechanical	Poor	Significant check at the cut end of the top rail.	Replace 38x89x915mm long timber top rail.	2019
Handrail	Gridline A @56.7m	Mechanical	Poor	Significant check along the length of the post. Approximately 25-30% CSL at the top connection.	Replace 89x89x1524mm long timber post.	2019
Guard	Overall	Mechanical /Biological	Fair-Good	Moderate amounts of splitting and checking due to mechanical damage and weathering. Select exposed bolt holes indicate minor	Ongoing monitoring. Coring of the timbers to ascertain the condition of the internal cross section is recommended at the next scheduled inspection.	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				biological damage when probed.		
Guard	Gridline A @ 0m	Biological	Fair	Moderate biological growth and deterioration of the cross section at the cut end.	Ongoing monitoring. Clear vegetation in the area to mitigate the rate of biological damage and exposure to moisture.	2019
Pedestrian Guard	Overall	Mechanical	Fair-Good	Moderate coating loss, and minor amounts of mechanical damage due to abrasion/impact.	Ongoing monitoring.	
Risers	Overall	Mechanical /Biological	Fair-Good	Minor splitting of the timber due to mechanical damage and weathering. Minor amounts of biological damage due to moisture where the risers contact the deck.	Ongoing monitoring.	
Decking	Overall	Mechanical	Good	Minor splitting due to mechanical damage (usage) and weathering.	Ongoing monitoring.	
Decking	Gridline C along the length	Mechanical	Fair-Poor	Asphalt roofing strips have been installed along the pedestrian walkway. Several strips have failed at the cracks between the timber decking.	Ongoing monitoring. Consider for replacement within the next 1-3 years.	2019 - 2022
Stringers	Overall	-	Good	The stringers appear to be in good condition.	Ongoing monitoring.	
Stringers	Shoreward end of approach	Biological	Good	Moderate amounts of biological growth on the surface of the stringers.	Ongoing monitoring. Coring of the elements is recommended at the next scheduled	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
					inspection to ascertain the condition of the internal cross section.	
Pilecap	Overall	-	Good	Moderate amounts of biological growth on the surface of the pilecaps.	Ongoing monitoring. Coring of the elements is recommended at the next scheduled inspection to ascertain the condition of the internal cross section.	
Pilecap	Bent 5	Repair	Very Poor	There are two pilecaps at this location. No strapping has been installed to connect the bearing pile and cap arrangement. Possible location of drift pin.	Provide steel angle strapping to secure arrangement at each bearing pile on either side of pilecaps.	2019
Pilecap	Bent 6	Repair	Very Poor	There are two pilecaps at this location. No strapping has been installed to connect the bearing pile and cap arrangement.	Provide steel angle strapping to secure arrangement at each bearing pile on either side of pilecaps.	2019
Bearing Pile	Overall	Mechanical /Biological	Good-Fair	Moderate amounts of splitting and checking due to mechanical damage. Several concrete footings have significant spalling and require repair.	Ongoing monitoring of the bearing piles and repair to the footings noted. A dive inspection is recommended at the next scheduled inspection to ascertain the condition of the submerged portion of the piles and footings.	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
Bearing Pile	1A	Repair	Good	Concrete pile in this location.	Ongoing monitoring.	
Bearing Pile	3C	Mechanical	Poor	Footing does not have complete bearing and has lost a significant amount of the cross section due to cracking and spalling. Evidence of corrosion to the internal reinforcing steel is present.	Cast additional concrete to re-found the footing.	2019
Bearing Pile	4B	Mechanical	Poor	Footing does not have complete bearing and has lost a significant amount of the cross section due to cracking and spalling. Evidence of corrosion to the internal reinforcing steel is present.	Cast additional concrete to re-found the footing.	2019
Bearing Pile	5A	Mechanical	Poor	Footing does not have complete bearing and has lost a significant amount of the cross section due to cracking and spalling. Evidence of corrosion to the internal reinforcing steel is present.	Cast additional concrete to re-found the footing.	2019
Bearing Pile	5B	Mechanical	Poor	Footing does not have complete bearing and has lost a significant amount of the cross section due to cracking and spalling. Evidence of corrosion to the internal reinforcing steel is present.	Cast additional concrete to re-found the footing.	2019
Cross Brace	Overall	Mechanical	Good	Minor amounts of CSL due to abrasion	Ongoing monitoring. A dive inspection is	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				and impact with debris.	recommended to ascertain the condition of the submerged portion of the brace elements.	
Cross Brace	Bent 13	Missing	Very Poor	Missing cross brace.	Install 152x203 timber cross brace.	2019
Wale	Overall	Mechanical /Biological	Good	Minor amounts of CSL due to abrasion and impact with debris.	Ongoing monitoring. A dive inspection is recommended to ascertain the condition of the submerged portion of the brace elements.	
Miscellaneous	Bent 13-Bent 14	-	-	Large timber elements have been secured to the stringers below the deck.	Ongoing monitoring. This contributes additional weight to the structure, and does not appear to be functional.	
Wharfhead						
Handrail	Overall	Mechanical /Biological	Fair	Moderate checking and splitting, minor amounts of coating loss and biological growth. Ongoing replacement of the timbers with untreated lumber is evident at the shoreward end of the wharfhead.	Ongoing monitoring. Untreated lumber is not suitable for the marine environment and will deteriorate at an increased rate. Treated timber is recommended when completing repairs/replacement.	
Guard	Overall	Mechanical /Biological	Poor	The guard has significant splitting and checking with failure of the coating (paint). There is significant biological growth and	Power-wash the existing guard to remove biological growth. Replace 191x241 timber guard around the wharf perimeter within the next year.	2019

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				moderate amounts of biological damage.		
Guard	20C'-20D	Mechanical /Biological	Poor	Significant checking and splitting due to abrasion. Guard appears to be loose and is not flush with deck edge.	Replace 191x241x1830mm long section of guard.	2019
Guard	20D-20E	Missing	Very Poor	There is no guard at this location.	Install 191x241 guard	2019
Risers	Overall	Mechanical /Biological	Very Poor	Several elements are loose. The risers have significant cross sectional loss due to checking, and have moderate amounts of biological growth and damage.	Power-wash risers and complete repairs (below). Replace all 89x89x305mm long risers at the same time as the guard is replaced.	2019
Decking	Overall	Mechanical /Biological	Fair-Good	Minor checking and splitting due to abrasion and mechanical damage. There is moderate amounts of biological growth along the surface of the deck.	Ongoing monitoring. Power-wash the deck to remove biological growth.	2019
Decking	Under service shed	-	Good	The wharf is double decked under the shed. There is minor biological growth along the seaward edge.	Ongoing monitoring.	
Stringers	Overall	-	Good	The stringers appear to be in good condition.	Ongoing monitoring. Coring of the elements is recommended at the next scheduled inspection to ascertain the condition of the internal cross section.	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
Pilecap	Overall	Biological	Good	Moderate amounts of biological growth on the surface of the pilecaps.	Ongoing monitoring. Coring of the elements is recommended at the next scheduled inspection to ascertain the condition of the internal cross section.	
Bearing Pile	Overall	Mechanical /Biological	Fair	There is moderate amounts of splitting at the pile tops. The piles have lost some of their creosote layer due to weathering.	Ongoing monitoring. Dive inspection and coring of the elements is recommended at the next scheduled inspection to ascertain the condition of the submerged portion of the pile and competence of the internal cross section.	
Bearing Pile	14C'	Repair	Good	Single corbel between bearing pile and pilecap.	Ongoing monitoring.	
Bearing Pile	14E	Repair	Good	Single corbel between bearing pile and pilecap. Thru-bolts secure the pilecap to the corbel.	Ongoing monitoring.	
Bearing Pile	14E	-	Poor	Abandoned cross brace hanging from the top of the pile.	This arrangement has no structural function. Ongoing monitoring is recommended, with removal should this become a navigation/safety hazard.	
Bearing Pile	15D	Repair	Poor	Single corbel between bearing pile and pilecap. No	Install metal strap and/or steel angle to	2019

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				metal strapping has been installed.	stabilize the arrangement.	
Bearing Pile	15E-15F	-	-	Single cross brace spanning from 15F to an abandoned pile at 15E.	This arrangement has no structural function. Ongoing monitoring is recommended, with removal should this become a navigation/safety hazard.	
Bearing Pile	16B	Repair	Good	Double corbel between pile and pilecap, metal strapping has been installed. Pile has steel collar repair installed within the top 1m of the pile.	Ongoing monitoring.	
Bearing Pile	16C'	Repair	Good	Double corbel between pile and pilecap, metal strapping has been installed. Pile has steel collar repair installed within the top 1m of the pile.	Ongoing monitoring.	
Bearing Pile	17D	Repair	Poor	Single corbel between bearing pile and pilecap. No metal strapping has been installed.	Install metal strap and/or steel angle to stabilize the arrangement.	2019
Bearing Pile	18C'	Repair	Poor	Single corbel between bearing pile and pilecap. No metal strapping has been installed.	Install metal strap and/or steel angle to stabilize the arrangement.	2019
Bearing Pile	19D	Repair	Poor	Single corbel between bearing pile and pilecap. No metal strapping has been installed.	Install metal strap and/or steel angle to stabilize the arrangement.	2019

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
Bearing Pile	20C'	Repair	Poor	Single corbel between bearing pile and pilecap. No metal strapping has been installed.	Install metal strap and/or steel angle to stabilize the arrangement.	2019
Batter Pile	Overall	Mechanical /Biological	Good	The batter piles were significantly submerged at the time of the inspection, but appear to be in good condition.	Ongoing monitoring. Dive inspection and coring of the elements is recommended at the next scheduled inspection to ascertain the condition of the submerged portion of the pile and competence of the internal cross section.	
Batter Pile	20A running east west	-	Very Poor	Batter pile is not attached to the bearing pile and is no longer in serviceable condition.	Re-secure batter pile to bearing pile, or removal subject to analysis	2019
Batter Pile	20F running east to west	Missing	Fair	Batter pile does not have aluminum flashing at exposed cut end.	Install aluminum flashing at cut end.	2019
Fender Chocks	Overall	Mechanical /Biological	Fair-Poor	Significant checking and splitting due to mechanical damage, biological damage, and weathering.	Ongoing monitoring. Consider for replacement or removal within the next 1-3 years.	2019 - 2022
Fender Pile	Overall	Mechanical /Biological	Very Poor	The tops of several piles have severe mechanical damage due to impact and the aluminum flashing has been damaged. There is moderate amounts of damage due to abrasion.	Ongoing monitoring. Dive inspection is recommended at the next scheduled inspection to ascertain the condition of the submerged portion of the pile.	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
Fender Pile	20D	Mechanical /Biological	Very Poor	Aluminum flashing has failed and the top of the pile is significantly damaged due to biological decay and mechanical damage.	Replace aluminum flashing.	2019
Fender Pile	20E	Mechanical /Biological	Very Poor	Aluminum flashing has failed and the top of the pile is significantly damaged due to biological decay and mechanical damage throughout.	Replace aluminum flashing.	2019
Fender Pile	20F	Mechanical /Biological	Very Poor	Aluminum flashing has failed and the top of the pile is significantly damaged due to biological decay and mechanical damage.	Replace aluminum flashing.	2019
Service Shed	Metal siding	Mechanical	Fair	The metal siding has moderate mechanical damage along the seaward face. There are localized areas of coating loss.	Ongoing monitoring.	
Derrick Crane	Northwest corner of wharfhead	-	Good	Derrick crane and anchor bolts are in good condition.	Ongoing monitoring.	
Gangway						
Steel Truss	Overall	Biological/ Corrosive	Good	Minor amounts of biological growth concentrated to the verticals and underside of the truss. Minor coating failures and surface corrosion were also noted.	Power-wash gangway to remove biological growth. Ongoing monitoring of the coating loss and corrosion, with field touch ups recommended during the next	2019

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
					facility upgrade. Possible replacement with aluminum gangway.	
Steel Truss	Seaward end	-	-	The gangway is supported on a steel roller. These rollers have significant mass, which will locally reduce the freeboard of the float. There is evidence of water ingress to the substructure of the float at this location (vegetative growth through decking/landing pad).	Ongoing monitoring. The float is nearing the end of its service life, and will require replacement/ significant remediation to remain serviceable long term. Replacing the steel gangway with an aluminum gangway would reduce the weight on the float and may rectify some of the freeboard differential.	
Decking	Overall	-	Good	The deck boards are in good condition.	Ongoing monitoring.	
Landing Pad	Overall	Mechanical /Biological	Fair-Poor	Significant amounts of biological growth around the perimeter of the landing pad. Moderate amounts of damage to the cut ends due to water ingress and biological damage.	Ongoing monitoring.	
Float						
Superstructure	Overall	Biological	Fair-Poor	Significant biological and fungal growth.	Power-wash float superstructure.	2019
Float	Overall	Mechanical /Biological	Poor-Fair	The float is listing significantly, and has a significant differential freeboard around the float perimeter.	The float is nearing the end of its service life, and replacement of the entire structure is	2019 - 2020

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				Limited observations of the substructure indicate that the floatation is insufficient. Several timber elements (visible from above water) have severe deterioration. There is evidence of vegetative growth between the deck boards and landing pad which has a lower freeboard due to freeboard due to the point load from the gangway. The bullrails, risers, pile well guards, and decking all have moderate to severe splitting and checking due to abrasion and mechanical damage.	recommended within the 1-2 years.	
Bullrails	Overall	Mechanical /Biological	Fair	Moderate CSL, splitting, and checking due to abrasion and weathering. Evidence of biological damage.	Ongoing monitoring. Consider for replacement within the next 3 years.	2019 - 2022
Risers	Overall	Mechanical /Biological	Fair	Moderate deterioration due to weathering, water ingress, and abrasion. Evidence of vegetative growth at the base of select risers on the west edge of the float.	Ongoing monitoring. Consider for replacement within the next 3 years, or with float replacement program.	2019 - 2022
Pile Well Guards	Overall	Mechanical /Biological	Fair-Good	Minor-moderate amounts of	Ongoing monitoring.	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				biological growth. Significant coating loss and moderate splitting due to mechanical damage and weathering.		
Pile Well	All three mooring locations	Missing	Fair	The pile wells do not fully restrain the mooring dolphins.	Ongoing monitoring.	
Decking	Overall	Mechanical /Biological	Fair-Poor	Moderate amounts of splitting and deterioration due to mechanical damage and abrasion. There is evidence of biological growth and decay due to water ingress near the gangway where the freeboard is significantly low.	Ongoing monitoring. Consider for replacement within the next 1-3 years, with float replacement.	2019 - 2022
Decking	2nd deck board south of the north mooring pile dolphins	Mechanical /Biological	Poor	Significant split in the deck board which has begun to decay. The split is propagating the length of the deck board, and has approximately 25-30% CSL.	Replace 38x305x3963mm long timber deck board, or replace float (as described above).	2019
Decking	East edge of float adjacent to gangway landing pad.	Mechanical	Very Poor	Splitting at the connection points with moderate CSL.	Replace two (2) - 38x305x1220mm long timber deck boards or replace float (as described above).	2019
Rubboards	Overall	Mechanical /Biological	Fair-Good	Moderate amounts of biological growth.	Ongoing monitoring.	

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
Mooring Piles	Overall	-	-	The mooring piles have been protected using UHMW strips along the pile well guards, as well as along the length of the pile in the intertidal zone. Minor amounts of biological growth and mechanical damage due to abrasion.	Ongoing monitoring. A dive inspection is recommended to ascertain the condition of the submerged pile. It is also recommended that the location of the UHMW strips be inspected in subsequent condition assessments.	
Mooring Piles	North mooring dolphins	Missing	Fair-Poor	There are no cross beams stiffening the mooring arrangement, as is typical for facilities of this nature.	Given that the pile wells do not fully restrain the float and there is no cross beam constraining the piles from lateral movement, it is recommended that a cross beam be installed to confine the arrangement. Or replace float (as described above) c/w mooring wells.	2019
Floatation	Overall	Mechanical /Biological	Poor	The float is listing significantly. Limited observations of the substructure indicate that the floatation is damaged and/or insufficient. Several timber elements (visible from above water) have significantly deteriorated due to water ingress. There is evidence of vegetative growth between the deck boards and landing	The float is nearing the end of its service life, and replacement of the entire structure is recommended within the 1-2 years.	2019 - 2020

Item	Location	Damage	Condition	Comments	Recommendation	Remediation Year
				pad at the low point in the float.		
Health & Safety						
Handrail	Overall	Safety	-	Handrails do not conform to current OH&S standards. They are climbable, and have openings larger than 102mm at a high which exceeds 610mm.	It is recommended that timber pickets be installed with a maximum clear spacing of 102mm to the inside face of the handrails. Alternatively, chain link fencing may also be used.	
Electrical Box	Shoreward end of approach @ Gridline C	Safety	-	There is a lock on the top connection, but not at the bottom. The electric box is accessible when the door is pulled from the bottom.	Provide a lock mid-panel or lock both connection points to prevent public access.	2019
Gangway	Overall	Safety	-	The gangway exceeds a slope of 2% during low tides. This 2% slope is the maximum slope allowed per OH&S wheelchair access.	Should the SCRD require wheelchair access, reconfiguration of the facility is recommended.	
Safety Ladder	20B-20C'	Safety	-	Top grab rail is secured to deteriorated guard and is not secure.	Replace 191x254 guard and re-secure grab rail.	2019
Safety Ladder	20B-20C'	Safety	-	No signage present.	Provide ladder signage of both the seaward and shoreward faces of the guard at ladder location.	2019
Fire Suppression	Overall	Safety	-	There is no fire suppression (extinguisher, water services, etc.) at the facility.	It is recommended that fire suppression measures be considered at the facility.	