

APPENDIX C

2015 HARBOUR WALL INSPECTION

Small Craft Harbours,  
Fisheries and Oceans Canada

## **Port Dalhousie, ON – Harbour Wall Engineering Inspection Report**

**Prepared by:**

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**Project Number:**

60432205

**Date:**

December, 2015

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December 11, 2015

Mr. Mike MacDiarmid, P.Eng, MBA  
Senior Project Engineer  
Small Craft Harbours  
Central and Arctic Region  
Fisheries and Oceans Canada  
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Burlington, ON, L7N 3G7

Dear Mr. MacDiarmid:

**Project No: 60432205**

**Regarding:** Port Dalhousie, ON – Harbour Wall  
Engineering Inspection Report

AECOM is pleased to submit one (1) electronic copy of the Engineering Inspection Report for the Harbour Walls at Port Dalhousie, ON.

The study was conducted in general conformance with the Project Brief for Port Dalhousie, ON – Harbour Wall Engineering Inspection and Options Analysis, and our Project Proposal dated June 2015.

We express our appreciation to SCH staff for providing valuable input and assistance throughout the course of the study. We are available to elaborate on any aspect of the report, and to assist in the implementation of the recommendations, at your request.

Sincerely,  
**AECOM Canada Ltd.**



James Wallace, P.Eng.  
Senior Engineer, Project Manager

JW:nn  
cc:

## Distribution List


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0	1	Small Craft Harbours, Fisheries and Oceans Canada

## Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	JW	November 24, 2015	Draft Engineering Inspection Report for client review
1	JW	December 11, 2015	Engineering Inspection Report


## AECOM Signatures

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## Executive Summary

The condition of the East and the West Piers located on Lake Ontario at the entrance to Port Dalhousie Harbour was assessed in 2014. The assessment of the piers revealed that the timber cribs were in poor condition and that the piers were not safe for public access. Many of the structures within the harbour are of similar age and design.

AECOM has been retained to undertake a condition assessment of the ten structures located within the Harbour Basin at Port Dalhousie. The structures include timber crib wharfs with concrete coping walls and concrete decks, steel sheet pile wharfs with concrete decks, and soldier pile walls.

AECOM found the condition of the structures to range from unsafe to very good. AECOM used a condition rating scale of 1 (unsafe, immediate action required) to 5 (very good, more than 10 years' life remaining). AECOM's assessment of the structures is summarized in the following table:

Structure	Condition Rating	Notes
<b>Dalhousie Yacht Club Wall (#406)</b>	4	Sheet piles and overlay were installed in 1991; residual life expectancy is 25 years.
<b>East Concrete Wall (#408)</b>	1	Existing fueling station piping is an environmental concern. SAFETY CONCERN: The coping needs to be stabilized before the fuel line(s) are damaged.
<b>East Steel Retaining Wall (#409)</b>	4	Construction date is unknown.
<b>Timber Wall (#410)</b>	5	Wall has reached its theoretical useful life but still appears to be performing well.
<b>Southeast Wall (#405)</b>	3	The coping and concrete deck may be moving due to lateral soil pressure
<b>Snug Harbour - West Bank Wall (#202)</b>	4	
<b>Snug Harbour – Harbour Trail Bridge (#202)</b>	2	The existing bridge is in good condition; however, the timber cribs beneath the bridge are failing and may result in debris in the harbour. Failure of the cribs may also result in settlement of the concrete coping that could damage the bridge piles.
<b>Southwest Wall (#403)</b>	3	Rate of deterioration expected to accelerate. SAFETY CONCERN: AECOM advises to prohibit vehicles within 6 m of the face of the wall.
<b>Old Canal Walls (#407)</b>	3	Maintenance required. Minor repairs consisting of removals of vegetation from mortar joints and repointing the joints is required to extend the life expectancy.
<b>Lakeside Park Wharf (#402)</b>	3	Rate of deterioration expected to accelerate. SAFETY CONCERN: AECOM advises to prohibit vehicles within 6 m of the face of the wall.

AECOM identified three walls as a concern to public safety. Until repairs are completed, heavy loads (such as vehicular loads) should be prohibited 6 m from the face of the wall for the following structures:

- The East Concrete Wall (408);
- The Southwest Wall (403); and
- The Lakeside Park Wharf (402).

# Table of Contents

## Statement of Qualifications and Limitations

### Letter of Transmittal

### Distribution List

### Executive Summary

	page
<b>1. Introduction .....</b>	<b>1</b>
<b>2. Background Information.....</b>	<b>2</b>
<b>3. Structures Description .....</b>	<b>2</b>
3.1 Dalhousie Yacht Club Wall (#406).....	4
3.2 East Concrete Wall (#408).....	4
3.3 East Steel Retaining Wall (#409).....	6
3.4 Timber Wall (#410) .....	6
3.5 Southeast Wall (#405) .....	7
3.6 Snug Harbour Basin Structures (#202) .....	7
3.7 Southwest Wall (#403).....	8
3.8 Old Canal Walls (#407).....	8
3.9 Lakeside Park Wharf (#402).....	8
<b>4. Previous Inspection Reports.....</b>	<b>9</b>
<b>5. Condition Assessment .....</b>	<b>10</b>
5.1 Inspection of Structures .....	10
5.2 Condition Rating .....	11
5.3 Useful Residual Life.....	11
5.4 Condition of Structures .....	11
5.4.1 Dalhousie Yacht Club Wall (#406).....	12
5.4.2 East Concrete Wall (#408) .....	12
5.4.3 East Steel Retaining Wall (#409).....	13
5.4.4 Timber Wall (#410) .....	13
5.4.5 Southeast Wall (#405) .....	14
5.4.6 Snug Harbour Basin Structures (#202) .....	14
5.4.7 Southwest Wall (#403).....	15
5.4.8 Old Canal Walls (#407) .....	15
5.4.9 Lakeside Park Wharf (#402).....	16
5.5 Summary of Condition Assessment .....	16
<b>6. Safety Concerns and Recommendations.....</b>	<b>17</b>

## List of Figures

Figure 1: General Layout.....	1
Figure 2: Harbour Wall Chainage .....	3
Figure 3: Typical Section at the Dalhousie Yacht Club Wall (406).....	4
Figure 4: Typical Section at the East Concrete Wall (#408) .....	5
Figure 5: Layout of Infrastructure behind East Concrete Wall (#408) .....	5

Figure 6: Typical Section at the East Steel Retaining Wall (#409)..... 6

Figure 7: Typical Section at the Timber Wall (#410) ..... 6

Figure 8: Typical Section at the Southeast Wall (405) ..... 7

Figure 9: Typical Section at the West Bank of Snug Harbour Basin (202) ..... 8

Figure 10: Typical Current Condition of the East Concrete Wall..... 13

List of Tables

Table 1: Rating Scale for Structural Evaluation ..... 11

Table 2: Structure Ratings ..... 17

Appendices

Appendix A Condition Survey Drawings

Appendix B Photo-Log

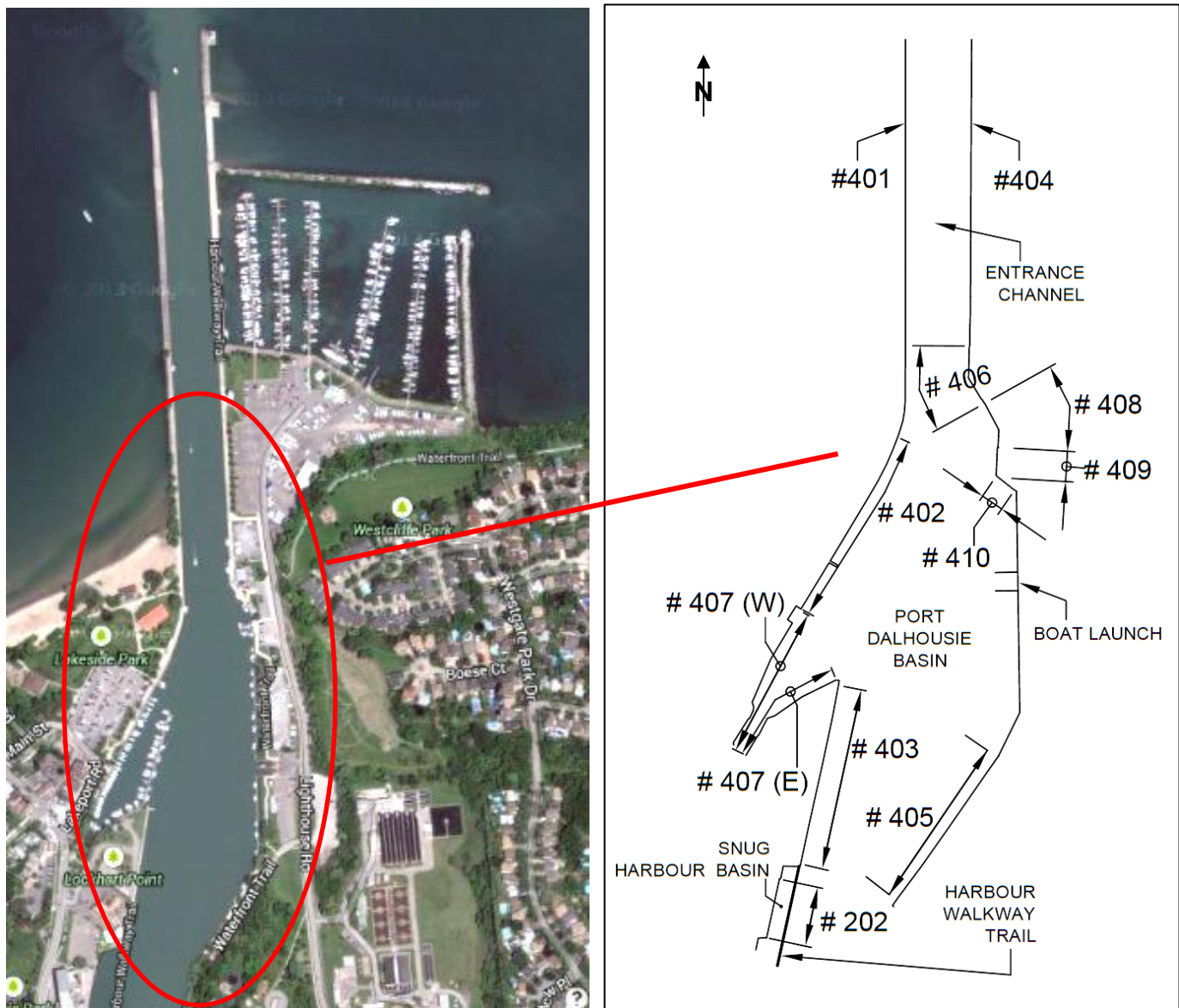
Appendix C ACI Dive Report and Sonar Report



# 1. Introduction

Port Dalhousie is a small community located on the southwest shore of Lake Ontario, west of the Welland Canal and the Niagara River. It is part of the City of St. Catharines. Primarily a recreational area, there is a harbour at the center of the community that is busy with small boats and pleasure craft in the summer. The harbour is formed by a combination of walls and shoreline. The entrance to the harbour is sheltered by two long piers. The Dalhousie Yacht Club operates a marina, a fueling station, and a sailing school within the harbour (a second, larger marina exists outside of the harbour). The general layout of the site is illustrated in Figure 1.

The condition of the East and West Piers was assessed in 2014. The assessment of the East and West piers (Structure #404 and #401) revealed that the sections of the piers were in poor condition and constituted a safety risk to the public. Other structures within the harbour are of similar age and design. The poor condition of the piers has



**Figure 1: General Layout**

created concern over the condition of the other structures in the harbour basin. Accordingly, Small Craft Harbours (SCH), within Fisheries and Oceans Canada, has retained AECOM to undertake a condition assessment of the following structures:

- The Dalhousie Yacht Club Wall (#406) – 57 m long steel sheet pile wall;
- The East Concrete Wall (#408) – 44 m long timber crib substructure and concrete surface;
- The East Steel Retaining Wall (#409) – 26 m long steel sheet pile wall;
- The Timber Wall (#410) – 23 m long soldier pile wall with steel H-piles and timber infill;
- The Southeast Wall (#405) – 169.7 m long timber crib substructure and concrete surface;
- Snug Harbour Basin Structures (#202) – various structures on timber cribs located within DFO/SCH property;
- The Southwest Wall (#403) – 176.1 m long timber crib substructure and concrete surface;
- The Old Canal Walls (#407) – 182.7 m long timber crib substructure and limestone upper walls; and
- The Lakeside Park Wharf (#402) – 200.8 m long timber crib substructure and concrete surface.

To complete the condition assessment, AECOM undertook a detailed visual inspection of the structures, both above water and underwater, commissioned sonar imaging of all structures, completed a detailed topographic survey and depth soundings of the structures and adjacent areas, and performed a delamination survey of the concrete deck surfaces. The underwater inspection was undertaken by a dive team from ASI Group, working under the direction of AECOM's engineer.

AECOM then assigned a condition rating to each component and estimated the residual life.

Detailed above-water and underwater inspections of the structures were last conducted in 1991 by Acres International Limited/ASI Group. The report for the 1991 inspection was reviewed and compared to the results of the current inspection.

## 2. Background Information

The following background material and information was available for this study:

1. Pier and Entrance Improvements, Drawings C-1 to C-7, by Public Works Canada, 1983
2. Port Dalhousie Marine Structure Inspection, Acres International Limited, 1991
3. Emergency Wharf Repairs, Drawings MT500 to MT5001, by Public Works Canada, 1991
4. Port Dalhousie, ON – East and West Piers Condition and Structural Evaluation Report, 2015
5. Port Dalhousie, ON – East and West Piers Recommended Repairs and Options Analysis Report, 2015

## 3. Structures Description

The harbour wall chainages and the limits of the study are illustrated in Figure 2. A brief description of each structure inspected is included in the following subsections, including: the Dalhousie Yacht Club Wall (#406); the East Concrete Wall (#408); the East Steel Retaining Wall (#409); the Timber Wall (#410); the Southeast Wall (#405); Snug Harbour Basin Structures including the pedestrian bridge (#202); the Southwest Wall (#403); the Old Canal Walls (#407); and the Lakeside Park Wharf (#402).

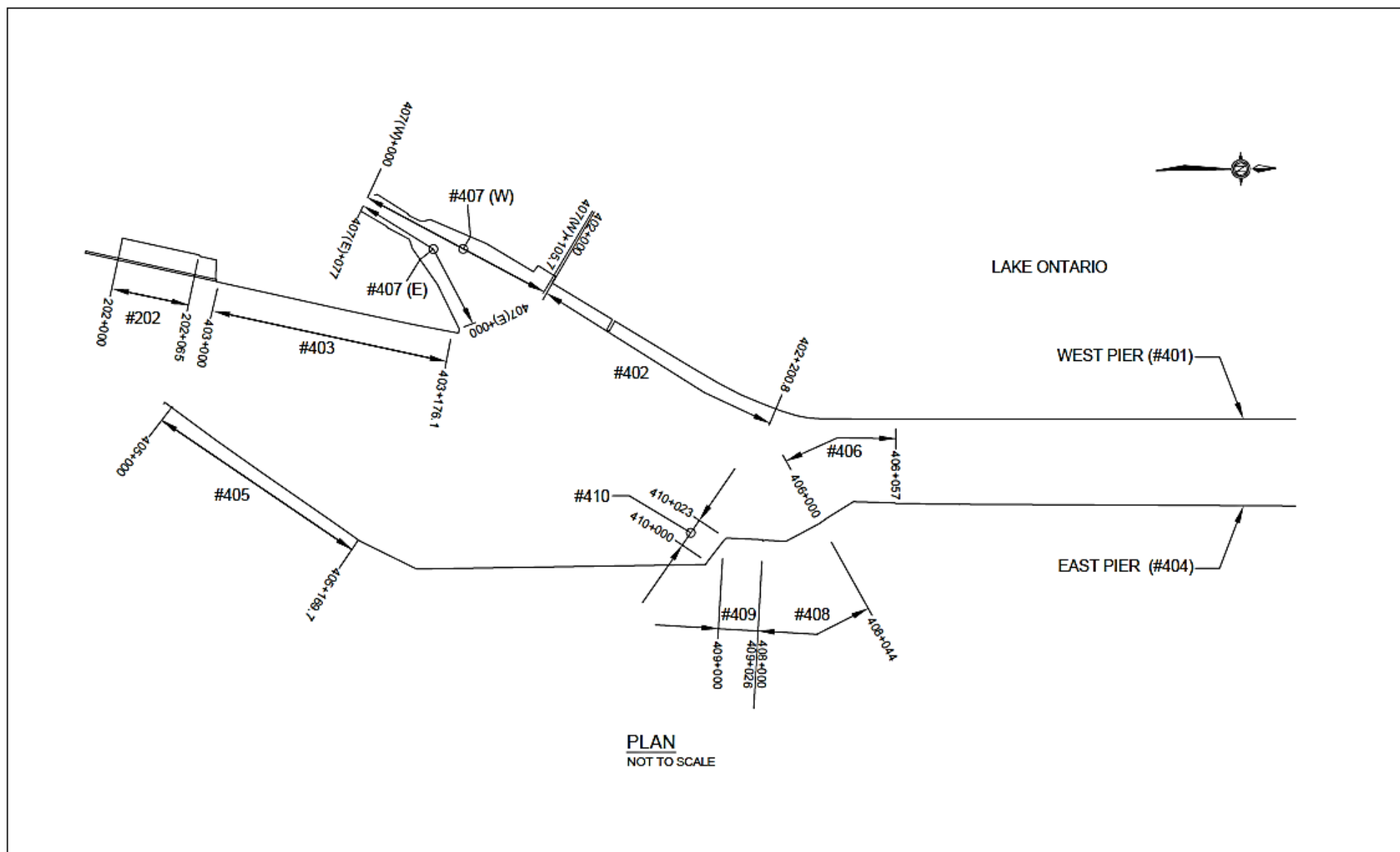


Figure 2: Harbour Wall Chainage

### 3.1 Dalhousie Yacht Club Wall (#406)

The Dalhousie Yacht Club Wall (#406) is a 57 m long steel sheet pile wall. The wall is the southward continuation of the East Pier (404). The wall was originally constructed in the late 1840's, with the concrete portions added later. The wall was encapsulated in steel sheet piles with a new concrete deck overlay in 1991. Illustrated in Figure 3 is a typical section of the Dalhousie Yacht Club Wall.

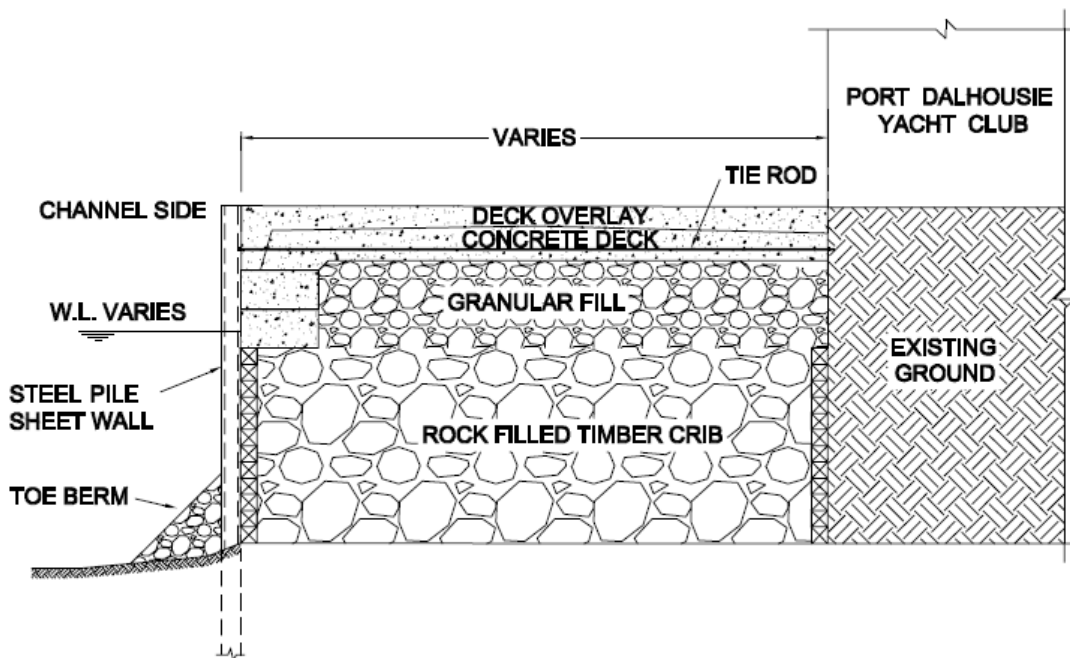


Figure 3: Typical Section at the Dalhousie Yacht Club Wall (#406)

### 3.2 East Concrete Wall (#408)

The East Concrete Wall (#408) is 44 m in length and consists of timber cribs filled with rock and topped with concrete coping blocks and a cast-in-place concrete deck. The timber cribs are believed to date back to the late 1840's. The concrete coping blocks and original concrete deck were added circa 1900. Although the remains of a timber pile fendering system were observed below the water level, nothing remains of the fendering system above water.

The Dalhousie Yacht Club operates a fueling station for watercraft at this location. The station consists of a small building located 2.5 m from the face of the wall and an exterior fuel pump. Underground fuel tanks, or fuel lines to underground fuel tanks, are presumed to exist somewhere behind this wall.

There is also a gravel parking area located behind the wall. The parking area is at an angle to the wall. At its closest, the gravel parking area is 8 m from the face of the wall.

Illustrated in Figure 4 is a typical section of the East Concrete Wall. The layout of the building and the parking area is given in Figure 5.

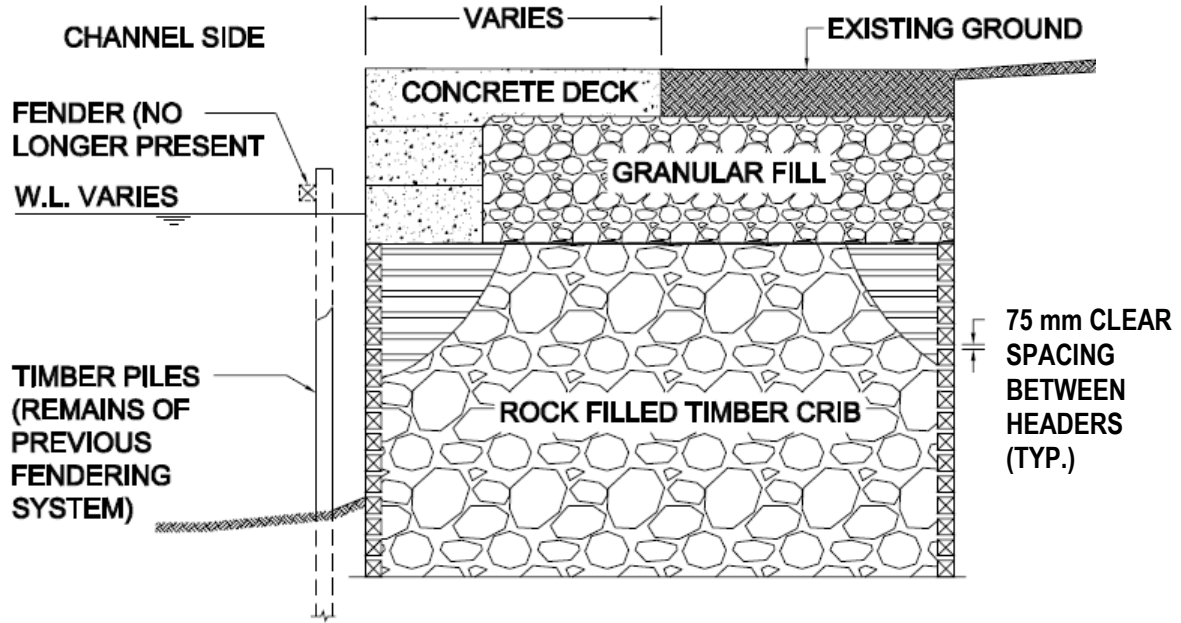


Figure 4: Typical Section at the East Concrete Wall (#408)

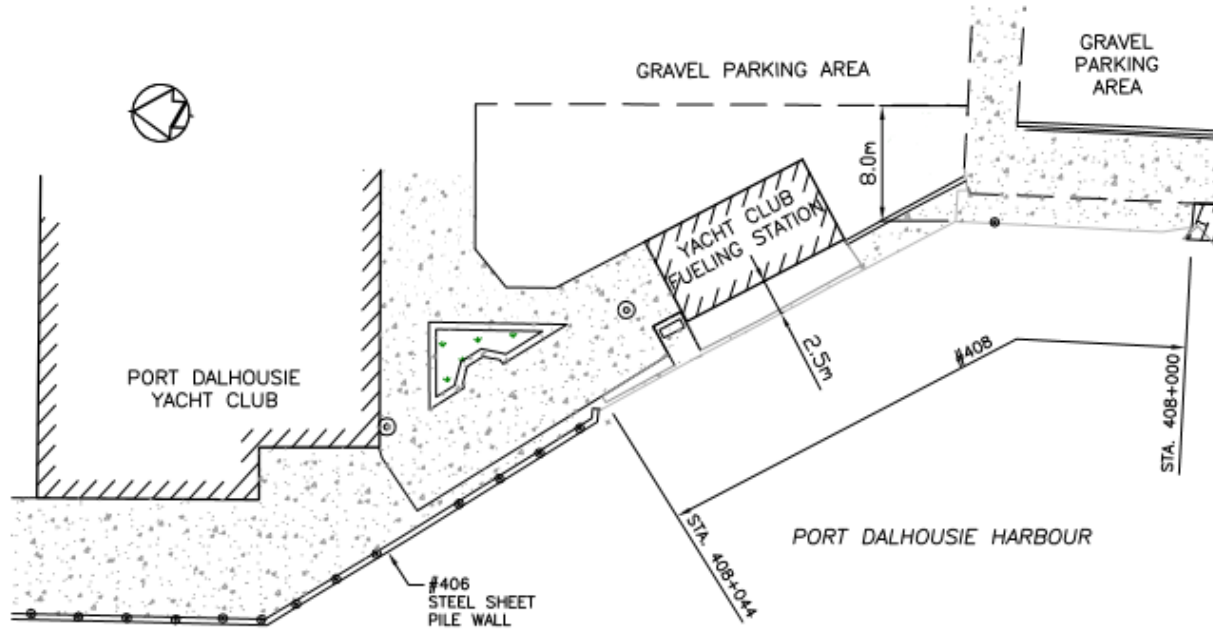


Figure 5: Layout of Infrastructure Behind East Concrete Wall (#408)

### 3.3 East Steel Retaining Wall (#409)

The East Steel Retaining Wall (#409) steel sheet pile (SSP) wall and is 26 m in length. A timber cap covers the top of the sheet piles. It is unknown if an older timber crib structure exists behind the SSP wall. Illustrated in Figure 6 is a typical section of the East Steel Retaining Wall.

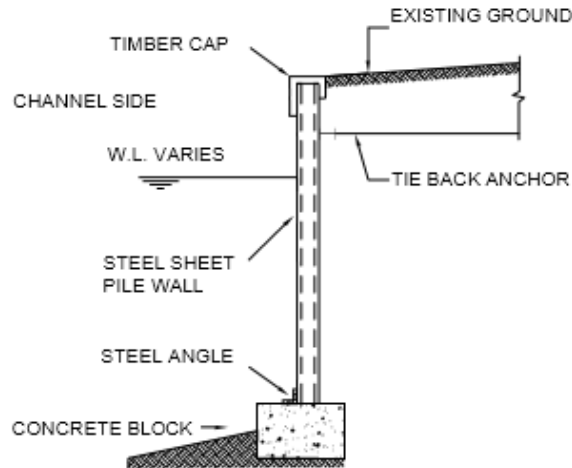


Figure 6: Typical Section at the East Steel Retaining Wall (#409)

### 3.4 Timber Wall (#410)

The Timber Wall (#410) is a cantilevered soldier pile wall with steel H-piles and timber lagging. The timber laggings are 235 x 235 mm in size. It is 23 m long. The timber wall retains earth on the north side of a creek inlet. The timber laggings between the steel H-piles were replaced in 1991. The life expectancy for the timber lagging in a marine environment is 25 years. Illustrated in Figure 7 is a typical detail of the Timber Wall.

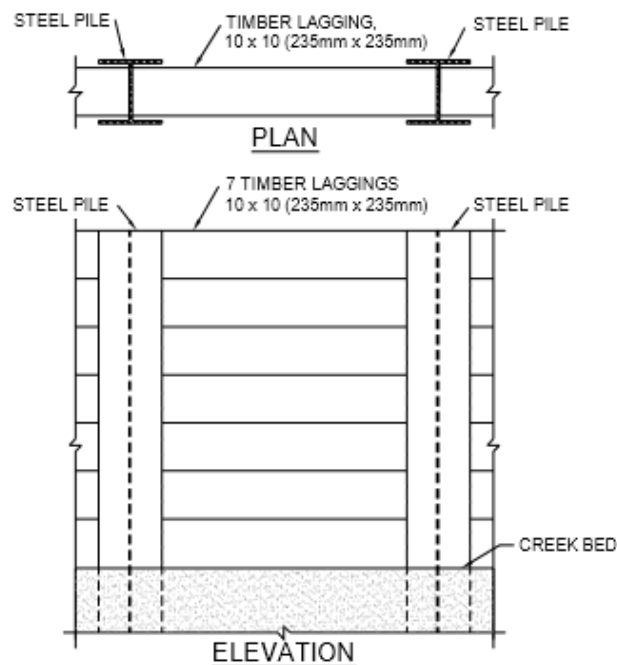


Figure 7: Typical Detail at the Timber Wall (#410)

### 3.5 Southeast Wall (#405)

The Southeast Wall (#405) is 169.7 m in length and made up of timber cribs filled with rock and topped with concrete coping blocks and a cast-in-place concrete deck. The wall was constructed around 1867, although the concrete coping may have been installed later. Riprap was placed at the southern end of the wall to protect the crib from undermining from upstream discharges (the Ontario Hydro sluiceway and Heywood Generating Station are located immediately upstream). Vehicular traffic does not have access to the concrete deck. The typical section of the Southeast Wall is illustrated in Figure 8.

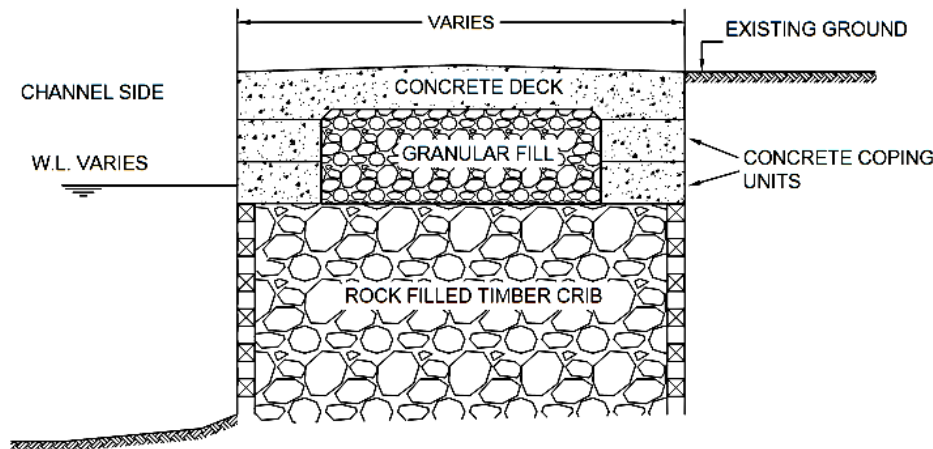


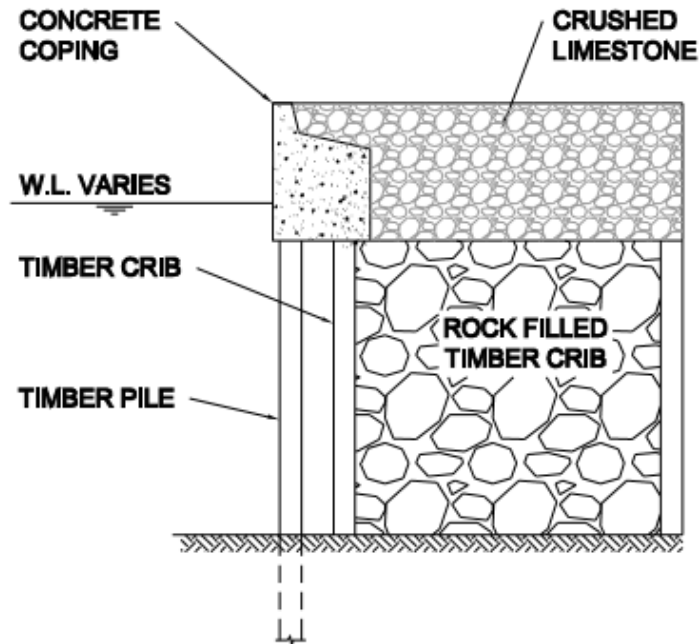
Figure 8: Typical Section at the Southeast Wall (405)

### 3.6 Snug Harbour Basin Structures (#202)

The Snug Harbour Basin (#202) was constructed in the 1880's. It consists of two structures: the West Bank Wall and the Harbour Trail Pedestrian Bridge Crossing. The basin was once used to moor vessels, although it does not appear to be in use today.

The West Bank of Snug Harbour Basin consists of a timber crib structure with a cast in place coping and a crushed gravel deck surface. The Lincoln Textiles Factory appears to bear on these cribs or on a foundation system behind the cribs (west of the wall). Unlike the rest of the structures in the harbour, the West Bank crib facing timbers are oriented vertically and the concrete coping intentionally overhangs the cribs. A series of timber piles have been driven around the cribs to support the edge of the concrete coping. The typical section of the West Bank of Snug Harbour Basin is illustrated in Figure 9.

The Harbour Trail Bridge is a multi-span steel pedestrian bridge constructed over two existing timber crib structures. The timber crib structures and the concrete coping are the remnants of an earlier bridge structure known as the Bypass Bridges. The Harbour Trail Bridge and the two existing timber crib structures divide the Snug Harbour from the main Port Dalhousie Harbour. Each bridge pier consists of four (4) steel tube piles that are driven through the existing crib structures and into the underlying strata. The Harbour Trail Bridge appears to be independent of the crib structure and the piles do not appear to rely on the existing timber crib structure for strength or stability. The north and south crib structures are of different construction, with space in between to allow a small vessel to enter the Snug Harbour. The south structure is timber cribs, fitted tightly together, with concrete coping at the surface. The coping blocks are limestone at the southern extremity where the structure meets the shoreline. The north structure consists of 2.35 x 2.35 m square timber cribs that are spaced on 4.7 m centers. The concrete coping extends over the 2.35 m space between the timber cribs.



**Figure 9: Typical Section at the West Bank of Snug Harbour Basin (202)**

### 3.7 Southwest Wall (#403)

The Southwest Wall (#403) is 176.1 m in length and consists of timber cribs filled with rock and topped with concrete coping blocks and a cast-in-place concrete deck. The wall was likely constructed in the 1880's. A 120 m section of the concrete deck/cap was replaced in 2000. The typical section of the Southwest Wall is similar to the section shown in Figure 8 for the Southeast Wall.

The wall supports a public parking lot (offset 2 m from the face of the wall) and a pedestrian walkway (along the edge of the wall).

### 3.8 Old Canal Walls (#407)

The East and West sections of the Old Canal Walls (#407 E and #407 W) are 77 m and 105.7 m in length, respectively. The walls consist of timber cribs supporting the rubble and mortar retaining wall. The bases of walls were built in 1842 and the upper parts may have been added later. Deteriorated mortar joints in the front face of the West Old Canal Wall were patch repaired in 1991. The Old Canal Walls are constructed similar to the illustration given in Figure 8, but with large cut stones fit together with mortar instead of precast concrete to form the coping.

### 3.9 Lakeside Park Wharf (#402)

The Lakeside Park Wharf (#402) is 200.8 m in length and is the southward continuation of the West Pier (#401). The Wharf consists of timber cribs filled with rock and topped with concrete coping blocks and a cast-in-place concrete deck. The timber cribs were originally built in the late 1840's. The concrete coping blocks and original concrete deck were added circa 1900. The typical section of the Lakeside Park Wharf is similar to the section shown in Figure 8 for the Southeast Wall.

The wall supports a public parking lot (offset 3 m from the face of the wall) and a pedestrian walkway (along the edge of the wall).



## 4. Previous Inspection Reports

The last condition assessment was completed in 1991 by Acres International Ltd. The assessment scope included the entire Port Dalhousie Basin and was not limited to the harbour walls. As such, structures such as the picnic shelter in the park, the marina, the breakwater, and the abandoned bridge are also discussed in the report. As the current assignment is limited to the condition assessment of the harbour walls, only sections of the previous report that pertain to the harbour walls will be discussed.

### **Dalhousie Yacht Club Wall (#406)**

The timber cribs below the concrete wall had moved towards the Basin. In the 1991 rehabilitation, steel sheet pile walls were erected along the west face of the Dalhousie Yacht Club Wall where the timber cribs had moved. Details of this repair are provided in the 1991 Public Works Canada drawings contained in Appendix A.

### **East Concrete Wall (#408)**

The concrete deck, the concrete coping blocks, and the timber cribs were generally in good condition.

### **East Steel Retaining Wall (#409)**

The steel retaining wall was relatively plumb and in good condition with no undermining.

### **Timber Wall (#410)**

The timber laggings of the retaining wall were rotted and sink holes were developing behind wall. In the 1991 rehabilitation, the timber laggings between the steel H-piles were replaced. Details of this repair are provided in the 1991 Public Works Canada drawings contained in Appendix A.

### **Southeast Wall (#405)**

The Southeast Wall (#405) was in good condition. Only the concrete coping at Southern end of the wall, which falls on Ontario Hydro Property, showed signs of slight movement.

### **Snug Harbour Basin Structures (#202)**

The By-Pass Bridges were sound although each pier had apparently settled at the southeast corner. All bridge slabs still were seated upon the haunches of the piers.

The coping wall in the West Bank of Snug Harbour Basin (#202) had only transverse cracking at intervals that could coincide with the junction of cribs. The timber cribs beneath the wall were not inspected.

### **Southwest Wall (#403)**

The Southwest Wall (#403) was in good condition though the concrete coping had lost some concrete blocks.

### **Old Canal Wall (#407)**

The surface wall of the West Old Canal Wall (#407 W) had deteriorated considerably. The deterioration of the face of the wall could be traced to the run-off from street to the west of the wall. In 1991 rehabilitation, the wall of the West Old Canal Wall was rebuilt from a platform hung over the edge of the wall down to the water level. Details of this repair are provided in the 1991 Public Works Canada drawings contained in Appendix A.

The East Old Canal Wall (#407 E) was in good condition.

## Lakeside Park Wharf (#402)

The Lakeside Park Wharf (#402) was in satisfactory condition at the coping level. Minor areas of undermining and deteriorated timbers were noted in the timber cribs.

## 1991 Emergency Wharf Repair Contract

The results of the 1991 condition assessment were the basis of the 1991 emergency repair contract implemented by Public Works Canada. Based on review of the 1991 drawings it appears that most of the recommendations of the 1991 inspection report were completed within 2 years.

# 5. Condition Assessment

## 5.1 Inspection of Structures

The structures were visually inspected over three days (July 20<sup>th</sup>, July 23<sup>th</sup>, and 27<sup>th</sup> 2015) by James Wallace, P.Eng. (AECOM) and Navid Nikravan, E.I.T. (AECOM; July 23<sup>th</sup> 2015 only). Justin Munro of AECOM completed the topographic survey of the structures. James Wallace supervised and directed the underwater inspection completed by ASI Group.

The **visual above-water inspection** consisted of a methodical review of all accessible parts of the structures. The deck surface was examined and any observed cracks, spalls, scaling, and other surface defects were documented. The entire deck surface was sounded using chains to identify delaminations. The concrete coping on the channel side of the structures, where visible above the waterline, was visually examined. Refer to Appendix B and C for detailed observations and photographs.

A **topographic survey** was completed using Total Station equipment. The surveyors recorded measurements at 12.5 m intervals along each wall. At each interval, the elevation of the top of structure was recorded, as well as the position of the wall face and the width of the concrete deck.

An **underwater inspection** of the structures was conducted by a dive team from ASI Group, working under the direction of James Wallace of AECOM.

The underwater inspection focused on the condition of the timber cribs. The dive team used two-way radios and underwater cameras to communicate with Mr. Wallace during the inspection. This allowed Mr. Wallace to direct the diver's attention to areas of concern during the inspection. The diver was able to swim along the timber crib facing and observe holes and broken members, as well as using tactile methods (his hands) to identify loose or rotted timbers and gaps between timbers. The diver carried a metre stick to measure the size of voids and prod into holes and gaps to determine the location of the rock fill behind the crib face.

The results of underwater inspection are documented in the diver's notes and the inspection drawings contained in Appendix B. Due to the limited visibility in the water (and the difficulty in accurately locating the diver from the surface), all dimensions and measurements recorded during the underwater inspection are approximate. Measurements of the timber cribs indicated on the drawings should be considered accurate to +/- 10% whereas locations indicated on the drawings should be considered accurate to within 2 metres.

## 5.2 Condition Rating

The various components of the structures have been rated in accordance with Small Craft Harbours Condition Rating Scale. The structural condition rating of the structures has been divided based on the various structure components. To simplify the evaluation, AECOM has adopted the SCH rating scale (given in Table 1) to describe the condition of the various components of the structures.

The condition rating for each wall or structure is given in Table 2.

**Table 1: Condition Rating Scale**

Rating Scale	Description
<b>1 (unsafe)</b>	Project action must be carried out within the next year
<b>2 (poor)</b>	Project action would have to begin within the next 2 year period
<b>3 (fair)</b>	Project action would have to begin within the next 3 year period
<b>4 (good)</b>	Inspection and minor maintenance within 5 years
<b>5 (very good)</b>	Inspection and minor maintenance within 10 years

## 5.3 Useful Residual Life

A method is given in Section A5 of the PWGSC Guidelines Inspection and Maintenance of Marine Facilities manual to determine the Useful Residual Life of many common marine structures. The method is based on the theoretical useful life of many common marine structures and a weighting coefficient related to the environmental site conditions.

This method is not applicable to many of the structures in the Port Dalhousie Harbour because the majority of the existing structures are old and have already exceeded the theoretical useful life given in Section A5. For these structures and using this method, the Useful Residual Life would be zero.

Given that many of the existing structures are functioning as intended and are performing satisfactorily, the actual residual life is greater than zero.

Where the calculation of the Useful Residual Life gives a meaningful result, that result will be given. For other structures, it will be stated that the structure has exceeded the theoretical useful life. It will also be stated whether or not the structure is performing well.

## 5.4 Condition of Structures

Drawings documenting the results of the above and below water inspections are included in Appendix A. Photographs of the above water concrete coping wall face are included in Appendix B.

#### 5.4.1 Dalhousie Yacht Club Wall (#406)

The deck over the Dalhousie Yacht Club Wall appears to be in good condition. Medium cracks were observed at Station 406+013, Station 406+014, and Station 406+027 (See Photos 4-6 in Appendix B). One (1) small delaminated area was detected on the deck slab at Station 406+000 (See Photo 3 in Appendix B).

The steel sheet piling appears to be relatively plumb and in good condition above the waterline. The interlocks on the steel sheet piles are tight with no apparent splits. The waler bolts and tie rods were in place and appeared to be secure. The steel sheet piling is covered by Zebra Mussels below the waterline. No undermining was observed.

Based on our inspection, we have given the concrete deck a Condition Rating of 4 and the steel sheet piles a Condition Rating of 5. Useful Residual Life is calculated to be 23 years.

#### 5.4.2 East Concrete Wall (#408)

The deck over the East Concrete Wall appears to be in fair condition. Medium transverse cracks were noted at Station 408+002, Station 408+004, and Station 408+036 (See Photos 8-10 in Appendix B).

The exposed surfaces of the concrete coping blocks appear to be in poor condition with several medium concrete spalls and wide cracks. During the underwater inspection, the front face of the concrete coping was observed to be offset from the front face of the timber cribs by approximately 450 mm. The coping appears to be sliding towards the Basin. Lateral earth pressure, over time, appears to have pushed the concrete coping wall and the concrete deck towards the Basin (see Figure 11 for an illustrative example). The manager for the Dalhousie Yacht Club claims that the grassy area behind the deck slab has settled over the last 3 years; however, no measurements exist to quantify the settlement.

The movement of the concrete coping blocks is of particular concern because there is an existing fuel line buried behind this wall and a fueling station mounted on the concrete deck. The fuel storage tanks are located in the grassy area behind the office building operated by the Dalhousie Yacht Club. Excessive soil movement could rupture the fuel line and pose an environmental hazard. There is also the risk that the movement of the concrete coping blocks will destabilize the coping units and cause both the coping units and the deck to fail.

In many locations, the top timber headers are missing from the crib. With the exception of the top timbers on the front face of the wall, the headers are relatively plumb and the connections appear to be sound. No sign of rot or deterioration was observed in the timber headers; however, many of the timber anchor heads near the bottom of the cribs were found to be rotten. Because the anchor heads are rotten, they may no longer be capable of restraining the timber headers. Movement of the timber headers would account for the settlement of the grassy area behind the deck slab. No signs of undermining of the timber cribs were observed.

The remains of a previous timber fendering system were observed by the divers. The remains of the timber piles appear too short to interfere with vessel mooring or navigation.

Based on our inspection, we have given the concrete deck and concrete coping units a Condition Rating of 1 and the timber cribs a Condition Rating of 2. The crib facing appears to be in good condition, but this is misleading as the timber anchors that secure the facing are rotten. The East Concrete Wall is performing poorly. There is a risk that the coping will fail or that excessive soil movements will rupture the buried fuel lines. Immediate action is warranted.

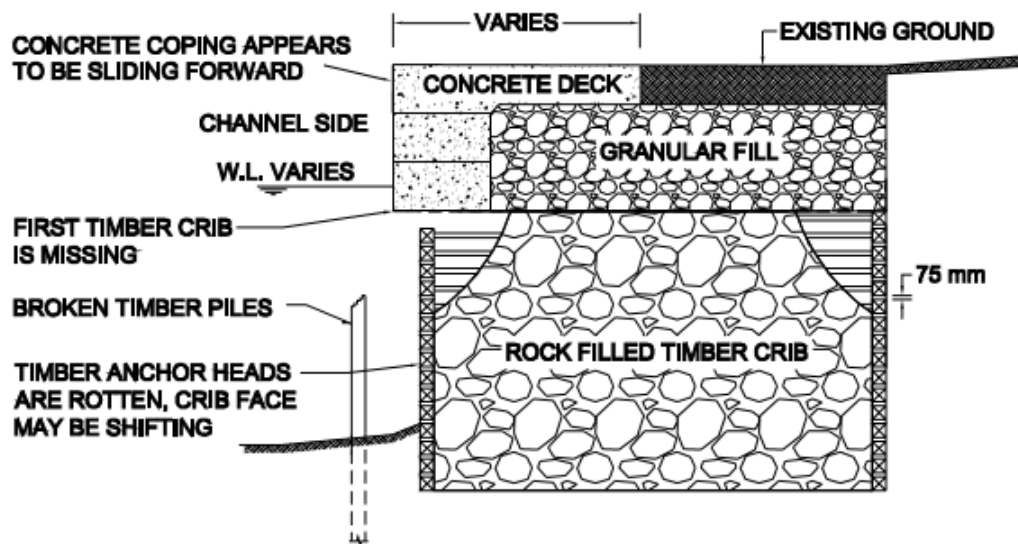


Figure 10: Typical Current Condition of the East Concrete Wall

#### 5.4.3 East Steel Retaining Wall (#409)

The steel sheet piling appears to be relatively plumb and in good condition above and below the waterline. The interlocks on the steel sheet piles are tight with no apparent splits. The waler bolts and tie rods are in place and appeared to be secure. Where the sheet piles were driven into the lake bed, no undermining was observed.

The timber cap shows signs of wear and will need to be replaced within five years. The cap appears to be a non-structural element of the wall that exists for purely aesthetic reasons. Some loose bolts were observed. These bolts appear to be related to fendering system that is no longer present.

Based on our inspection, we have given the steel sheet piling wall a Condition Rating of 4. The age of the wall is unknown and Useful Residual Life cannot be determined. The East Steel Retaining Wall appears to be performing well.

#### 5.4.4 Timber Wall (#410)

The timber laggings are sound with sharp and well-defined corners. The steel H-piles were in good condition. No significant section loss, corrosion, or other defects were observed in the piles (See Photos 12 and 13 in Appendix B).

The lagging is only extends approximately 900 mm from the top of the wall. There is a gap between the lake bed and the underside of the lagging that is filled with rock and appears to be stable.

It is believed that the timber laggings were installed in 1991. If true, then the timbers are in very good condition for their age. The theoretical life expectancy for heavy timbers in a marine environment is 25 years. The wall has reached its theoretical life expectancy and is performing well. Nothing was observed to suggest that maintenance or replacement would be required in the near future.

Based on our inspection, we have given the timber wall a Condition Rating of 5.

#### 5.4.5 Southeast Wall (#405)

The original concrete deck surface between Station 405+000 to 405+010 (southern end of the wall) is in poor condition with many large cracks, severe concrete spalls, and exposed reinforcing bars (See Photos 15-17 in Appendix B). Medium cracks were observed on the deck at Station 405+002, Station 405+003, and Station 405+005. Large spalls were observed at Station 405+002 and Station 405+005.

The concrete deck surface between Station 405+010 to Station 405+169.1 previously received a concrete overlay and is in good condition (See Photo 18 in Appendix B). Only three (3) medium cracks were detected on the deck at Station 405+035, Station 405+057, and Station 405+077 (See Photo 19 in Appendix B).

The exposed surfaces of the concrete coping blocks appear to be in fair-to-good condition with several light to medium concrete spalls, medium cracks, and small gaps between concrete coping blocks and timber cribs.

The coping is overhanging the timber cribs by up to 200 mm between Station 405+020 and 405+085. The coping is flush with the cribs everywhere else. It is unknown if the overhang is an original as-construction condition or if lateral soil forces have pushed the coping and concrete deck forward. The heavy equipment that would have been used to construct the overlay may also have caused the coping to shift.

The timber cribs were found to be in good condition. No signs of undermining of the timber cribs were observed. A gap of up to 200 mm was observed between the top of the timber cribs and the underside of the concrete coping units between Station 405+100 and 405+140. This may be a sign of settlement of the timber cribs in this area.

Overall, the wall appears to be performing satisfactorily. Based on our inspection, we have given the Southeast Wall a Condition Rating of 3.

#### 5.4.6 Snug Harbour Basin Structures (#202)

The deck surface of the West Bank Wall consists of compacted crushed limestone contained by a concrete coping curb. No sinkholes or uneven settlement was observed. An approximately 2 m tall chain link fence is mounted to the concrete curb and it stands vertical with no indication of movement. It should be noted that the deck surface appears to be a parking lot for use by the employees of Lincoln Textiles. The surface appears to be regularly maintained.

The concrete coping of the West Bank Wall appears to be in fair condition with many small to medium concrete spalls, large cracks, and scouring up to 50 mm deep and honeycombing at the south corner.

The underwater investigation of the West Bank Wall found timber cribs to be in fair condition with sound timber facing members. The rock fill was tight to the back of the facing timbers with no signs of settlement. No signs of rot or deterioration of the connections were observed.

Overall, the wall appears to be performing relatively well. Based on our inspection, we have given the West Bank Wall a Condition Rating of 4.

The concrete coping blocks of the structures under Harbour Trail Pedestrian Bridge Crossing appear to vary from poor to good condition with minor spalls and settlement observed.

The divers reported that the timber cribs of the pier under the pedestrian bridge were in fair to poor condition. In many places, the top header timbers were observed to be bulging outward into Basin or were completely missing. It was unclear if the deterioration is due to failing timber end connections or due to damage from impacts with vessels.

The timber cribs of the north structure appeared to be in a more advanced state of deterioration. While the south structure is in fair condition, the north structures appear to be performing poorly. Based on our inspection, we have given the structures a Condition Rating of 2.

Note that the Harbour Trail Bridge appears to be structurally independent of the crib structures. While failure of the timber cribs could potentially damage the piles supporting the Harbour Trail Bridge, the greater risk is that failure of the timber cribs will result in unwanted debris in the harbour basin.

#### **5.4.7 Southwest Wall (#403)**

The concrete deck surface appears to be in fair condition (See Photos 24 in Appendix B). Medium cracks were observed on the deck at Station 403+072, Station 403+075, Station 403+105, Station 403+108, Station 403+112, Station 403+117, Station 403+119, Station 403+125, Station 403+127, Station 403+130, Station 403+132, Station 403+137, Station 403+139, and Station 403+142 (See Photos 25 and 26 in Appendix C). These cracks are relatively straight and extend the full width of the wall.

The inspection indicates that the concrete coping blocks are in fair condition with many large spalls and exposed steel reinforcing bars.

The timber crib is in fair-to-poor condition from Station 403+000 to Station 403+090. The ends of some of the timber facing members have decayed and are no longer securely fastened to the timber cross-ties. In some places, the top timber facing member is missing and some of the rock fill under the coping blocks has fallen away. In some other places, the top timber is now loose and may break free of the timber crib in the near future.

The timber crib is in fair-to-good condition from Station 403+090 to Station 403+176.1.

While the wall currently appears to be performing satisfactorily, the rate of deterioration of the timber cribs is likely to accelerate. As the connection of an individual timber header within the facing wall fails, additional stresses are applied to the remaining headers. The facing walls of the cribs could begin to deteriorate quickly. Based on our inspection, we have given the Southeast Wall a Condition Rating of 3.

#### **5.4.8 Old Canal Walls (#407)**

The concrete deck surface of the West Old Canal Wall (#407 W) appears to be in good condition. The top surface of the East Old Canal Wall was not accessible for inspection.

The Old Canal Walls do not have precast concrete coping units on top of the timber cribs. Instead, the coping units are vertically stacked limestone within the limits of the original lock and sloping limestone units within the original lock entrance. The limestone units appear to be in good condition with no significant deterioration of the units observed. Some of the joints between units in the lower part of the wall appear to be larger than the typical gap and may be a sign of settlement of the underlying timber cribs. However, it may also be the result of plants taking root in the joints. (See Photos 27 and 28 in Appendix B). Many of the mortar joints have disintegrated in the sloped limestone coping locations (See Photo 29 in Appendix B).

The timber cribs of the East and West Old Canal Wall (#407 E) are buried below the current harbour bed level and only the very top timber could be observed. Where the top timber was buried in sediment, once dug up it was observed to be in good condition with no signs of decay or deterioration. Where the top timber was above the lake bottom, it was frequently observed to be rotten.

Overall, the Old Canal Walls appear to be performing satisfactorily. Based on our inspection, we have given the structures a Condition Rating of 3.

#### **5.4.9 Lakeside Park Wharf (#402)**

The east side of the concrete deck (from face of the coping wall to the fence) from Station 402+000 to Station 402+080 is in poor condition (See Photos 32-40 in Appendix B). Large concrete spalls and exposed reinforcing bars were observed at Station 402+015, Station 402+020, Station 402+030, Station 402+043, Station 402+065, Station 402+070, and Station 402+075. Medium cracks were observed at Station 402+030, Station 402+043, and Station 402+055.

The concrete deck from Station 402+080 to Station 402+200.8 is in good condition (See Photo 41 in Appendix B). Medium cracks were observed in the deck at 402+123, Station 402+140, Station 402+145, and Station 402+157 (See Photos 42-45 in Appendix B).

The inspection of the wall found that the concrete coping has deteriorated considerably between Station 402+000 to Station 402+080. Many large spalls, large voids, and eroded surfaces were identified in the coping blocks between Station 402+000 to Station 402+080.

The concrete coping blocks from Station 402+080 to Station 402+200.8 are in fair to good condition.

The timber cribs from Station 402+000 to Station 402+110 are in poor condition. The underwater inspection found that the front face of the timber cribs is offset from the front face of the concrete coping by up to 250 mm in some places. In this area, the top of the timber crib facing appears to have been pushed forward, ahead of the concrete coping. The ends of the top timbers in this area were found to be rotten and no longer well connected to the rest of the crib.

The timber cribs from Station 402+110 to Station 402+200.8 are in fair to poor condition. The top timber was frequently observed to be offset by up to 200 mm with no fill found behind the timber.

While the wall currently appears to be performing satisfactorily, the rate of deterioration of the timber cribs is likely to accelerate. As the connection of an individual timber header within the facing wall fails, additional stresses are applied to the remaining headers. The facing walls of the cribs could begin to deteriorate quickly. Based on our inspection, we have given the Lakeside Park Wharf a Condition Rating of 3.

### **5.5 Summary of Condition Assessment**

The structures within the harbour basin are generally in fair condition and are performing satisfactorily. However, some of the structures are in poor condition and warrant immediate attention.

The condition rating assigned and other comments for each wall or structure are summarized in Table 2.



**Table 2: Structure Condition Ratings**

Structure	Condition Rating	Notes
<b>Dalhousie Yacht Club Wall (#406)</b>	4	Sheet piles and overlay were installed in 1991; residual life expectancy is 25 years.
<b>East Concrete Wall (#408)</b>	1	Existing fueling station piping is an environmental concern. SAFETY CONCERN: The coping needs to be stabilized before the fuel line(s) are damaged.
<b>East Steel Retaining Wall (#409)</b>	4	Construction date is unknown.
<b>Timber Wall (#410)</b>	5	Wall has reached its theoretical useful life but still appears to be performing well.
<b>Southeast Wall (#405)</b>	3	The coping and concrete deck may be moving due to lateral soil pressure
<b>Snug Harbour - West Bank Wall (#202)</b>	4	
<b>Snug Harbour – Harbour Trail Bridge (#202)</b>	2	The existing bridge is in good condition; however, the timber cribs beneath the bridge are failing and may result in debris in the harbour. Failure of the cribs may also result in settlement of the concrete coping that could damage the bridge piles.
<b>Southwest Wall (#403)</b>	3	Rate of deterioration expected to accelerate. SAFETY CONCERN: AECOM advises to prohibit vehicles within 6 m of the face of the wall.
<b>Old Canal Walls (#407)</b>	3	Maintenance required. Minor repairs consisting of removals of vegetation from mortar joints and repointing the joints is required to extend the life expectancy.
<b>Lakeside Park Wharf (#402)</b>	3	Rate of deterioration expected to accelerate. SAFETY CONCERN: AECOM advises to prohibit vehicles within 6 m of the face of the wall.

## 6. Safety Concerns and Recommendations

Generally, the existing structures in the Port Dalhousie Harbour Basin appear to be performing satisfactorily and pose little risk to public safety.

Many of the structures are constructed of timber cribs with concrete coping walls and concrete decks. The timber cribs, by virtue of being submerged in cold water, generally have experienced relatively little decay or deterioration. The harbour has sheltered the structures from large waves and the constant flow of water has protected the structures from damage due to ice formations in the winter.

However, there has been some deterioration of the structures. In some cases, a monitoring programme should be implemented to ensure that public safety is not jeopardized by future deterioration. In other cases, immediate repairs are warranted.

Repair options are outside the scope of this report and will be addressed in the forthcoming Options Analysis report.

However, AECOM has concerns regarding public safety with following three structures.

### **East Concrete Wall (#408)**

Significant movement of the concrete coping and deck elements of this wall were observed by the dive team. Comments from the yacht club manager regarding shifting soil elevations behind this wall in recent years suggest that the movement is recent and likely still active. The presence of a fueling station and an underground fuel line pose an additional environmental risk as well as a public safety risk.

Further study (including geotechnical investigation and ground penetrating radar) may be required to determine an appropriate means of stabilizing the movement of the coping wall without interfering with the existing fuel lines. AECOM recommends taking action to stabilize this wall within the next 12 months.

Until the concrete coping and the deck are stabilized, AECOM recommends that heavy surcharge loads, such as vehicular loads, be prohibited within 6 m of the face of the wall.

### **Southwest Wall (#403)**

The wall is deteriorating similar to what was observed on the East and West Piers. The deterioration is not as advanced, which is to be expected given that the wall is in a more sheltered location.

The ends of the timbers in the cribs are rotten and starting to pull away from their connections. This is similar to the condition of the main piers as observed in 2014. In time, the entire crib face will fall away and the rock fill contained within the crib will spill out. When this happens, the crib will no longer be able to support the concrete coping blocks. Eventually, after a sufficient number of cribs have failed, the entire concrete deck will fall into the harbour.

There is no immediate risk at this wall; however, the rate of deterioration is expected to accelerate. The timber cribs should be inspected on a regular basis to monitor the rate of deterioration. AECOM recommends annual inspections at first, although inspections every second year may be acceptable once the rate of deterioration is established.

Additionally, AECOM recommends prohibiting large surcharge loads, including vehicular loads, within 6 m of the face of the wall. In particular, it is worth noting that AECOM observed the local fire department using the parking lot above this wall to park fire trucks when testing the water pumps. Given the surcharge load that a fire truck would impose on the retained earth, AECOM recommends that the fire truck operators be advised to keep the truck 6 m back from the face of the wall.

### **Lakeside Park Wharf (#402)**

The wall is deteriorating similar to what was observed on the East and West Piers. The deterioration is not as advanced, which is to be expected given that the wall is in a more sheltered location. It is more advanced than the deterioration observed at the Southwest Wall (#403).

The ends of the timbers in the cribs are rotten and starting to pull away from their connections. This is similar to the condition of the main piers as observed in 2014. In time, the entire crib face will fall away and the rock fill contained within the crib will spill out. When this happens, the crib will no longer be able to support the concrete coping blocks. Eventually, after a sufficient number of cribs have failed, the entire concrete deck will fall into the harbour.

There is no immediate risk at this wall; however, the rate of deterioration is expected to accelerate. The timber cribs should be inspected on a regular basis to monitor the rate of deterioration. AECOM recommends annual inspections at first.

Additionally, AECOM recommends prohibiting large surcharge loads, including vehicular loads, within 6 m of the face of the wall. This includes city maintenance vehicles, such as gardening trucks used for watering flower beds.

AECOM also recommends that this wall be included in any proposed rehabilitation plans for the existing piers.

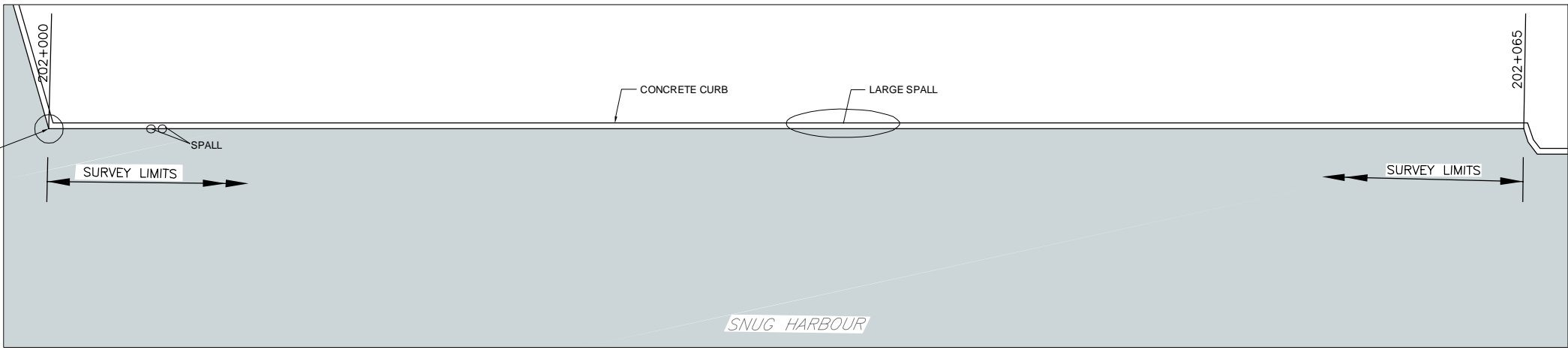
# Appendix A

## Port Dalhousie, ON – Harbour Wall Engineering Inspection Report

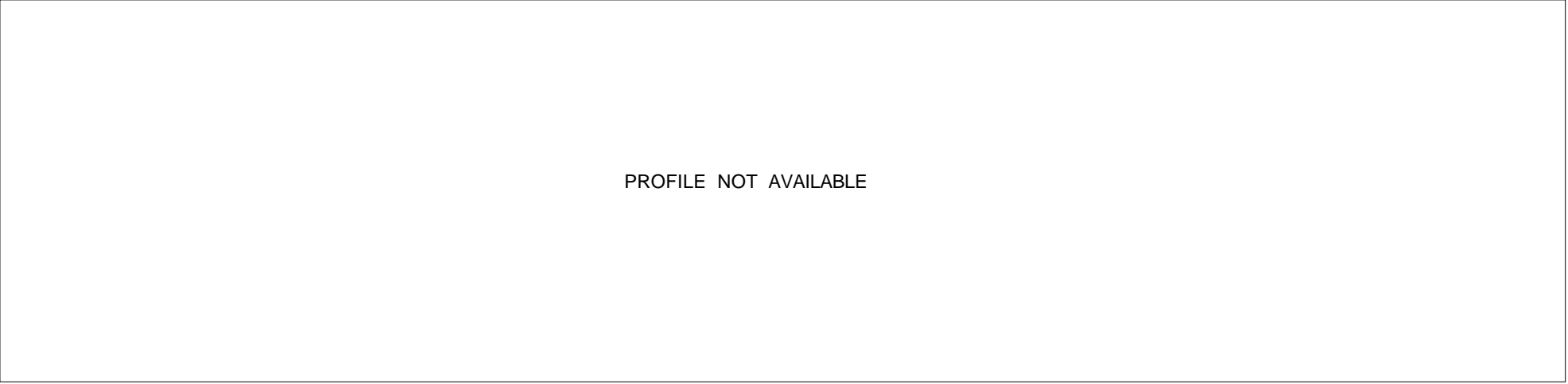
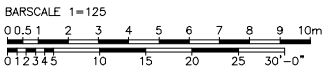
- Condition Survey Drawings



LARGE SPALL AT TOP OF COPING  
0.6 m WIDE x 0.6 m TALL  
0.45 m DEPTH



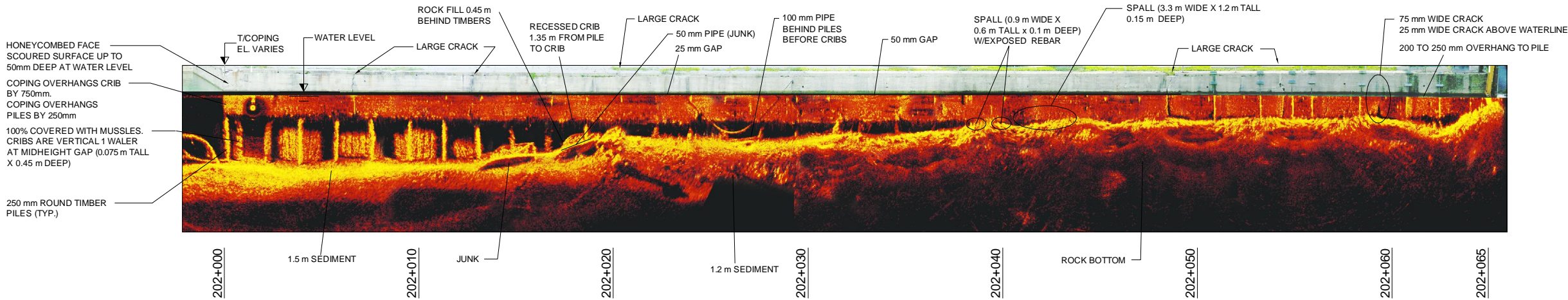
PLAN - SNUG HARBOUR BASIN STA. 202+000 TO 202+065



PROFILE NOT AVAILABLE

ELEVATION - SNUG HARBOUR BASIN STA. 202+000 TO 202+065

SCALE: HORIZ. 1:125  
VERTICAL 1:1250



ELEVATION - SNUG HARBOUR BASIN STA. 202+000 TO 202+065

SCALE: HORIZ. 1:125



PROJECT

PORT DALHOUSIE  
HARBOUR WALL  
INSPECTIONS

DALHOUSIE, ONTARIO

CLIENT

Public Works and  
Governments  
Services Canada

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CONSULTANT

AECOM  
300 Water Street  
Whitby, Ontario, Canada L1N 9J2  
905-668-9363 tel 905.668.0221 fax  
www.aecom.com

LEGEND

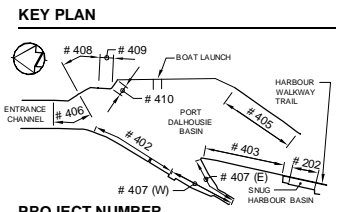
⊙	BOLLARD
●	HYDROPOLE
⊠	JUNCTION BOX
⊞	EMERGENCY LADDER
⊙	LIFE RING STATION
○	POST
⊞	POWER PEDESTAL
⊞	LIGHT STANDARD
⊞	BELL PEDESTAL
— X —	CHAINLINK FENCE
— ○ —	WROUGHT IRON FENCE
— □ —	WOOD FENCE
X	SPOT ELEVATION
—	HARBOUR WALL PROFILE

NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5661F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

1/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION



PROJECT NUMBER

60432205

SHEET TITLE

SNUG HARBOUR BASIN - # 202  
PLAN AND ELEVATIONS  
STA. 202+000 TO 202+065

SHEET NUMBER

202 - 1 OF 1



LIMESTONE BLOCK ← → CONCRETE COPING

CRIBS ARE IN GOOD CONDITION

CRIB MOVED FORWARD 50 mm

TOP 2 TIMBERS HAVE SHIFTED INTO SNUG HARBOUR

TIMBERS ARE ROTTEN BUT STILL HOLDING

25 mm OVERHANG

CRIB AND CONCRETE ARE FLUSH

TOP 2 TIMBERS HAVE SHIFTED 600 mm. NEXT 2 ARE BENT

SOLID TIMBER

PLAN - PEDESTRIAN BRIDGE

PROFILE NOT AVAILABLE

ELEVATION - PEDESTRIAN BRIDGE

SCALE:   HORIZ   1:125  
          VERTICAL 1:1250

2.1 m LIMESTONE BLOCK  
2.1 m TIMBER CRIB  
12 TIMBERS WERE COUNTED  
TIMBERS ARE TIGHT TOGETHER  
AND IN GOOD CONDITION  
NO GAP BETWEEN LIMESTONE  
AND TIMBERS

150 mm GAP BETWEEN  
CONCRETE AND TIMBERS

TIMBER CRIBS

TOP 2 TIMBERS PARALLEL TO BRIDGE  
ARE MISSING

TOP 2 TIMBERS HAVE SHIFTED BY 600 mm.  
NEXT 2 TIMBERS ARE BENT.  
REST OF THE CRIB IS IN GOOD CONDITION

TOP 2 TIMBERS ARE MISSING.  
THE REST OF THE CRIB  
IS IN GOOD CONDITION

25mm GAP BETWEEN  
TIMBERS (TYP.)

ELEVATION - PEDESTRIAN BRIDGE

SCALE:   HORIZ   1:125

LEGEND

⊙	HP	BOLLARD	SPALLS
●	HP	HYDROPOLE	
□	JB	JUNCTION BOX	MAP CRACKING
□	EL	EMERGENCY LADDER	
□	LRS	LIFE RING STATION	HONEYCOMBE AREAS
○	POST		
□	PP	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
□	LS	LIGHT STANDARD	
⊗	BELL PED	BELL PEDESTAL	MEDIUM CRACKS IN CONCRETE
— X —		CHAINLINK FENCE	
— ○ —		WROUGHT IRON FENCE	
— □ —		WOOD FENCE	
—		SPOT ELEVATION	
—		HARBOUR WALL PROFILE	

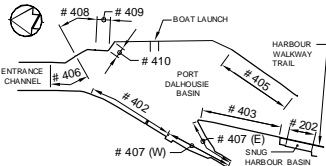
NOTE:  
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LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

60432205

SHEET TITLE

PEDESTRIAN BRIDGE  
PLAN AND ELEVATIONS  
STA. PB+000 TO PB+065

SHEET NUMBER

PB - 1 OF 1



PORT DALHOUSIE  
HARBOUR WALL  
INSPECTIONS

DALHOUSIE, ONTARIO

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Governments  
Services CanadaWILLOWDALE, ONTARIO  
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300 Water Street  
Whitby, Ontario, Canada L1N 9J2  
905-668-9363 tel 905.668.0221 fax  
www.aecom.com

## LEGEND

⊙	BOLLARD	SPALLS
HP	HYDROPOLE	MAP CRACKING
JB	JUNCTION BOX	HONEYCOMB AREAS
EL	EMERGENCY LADDER	
LRS	LIFE RING STATION	
POST	POST	
PP	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
LS	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
BELL	BELL PEDESTAL	
X	CHAINLINK FENCE	
W	WROUGHT IRON FENCE	
W	WOOD FENCE	
	SPOT ELEVATION	
	HARBOR WALL PROFILE	

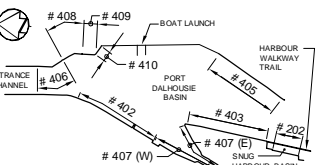
NOTE:  
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LIGHTHOUSE. ELEVATION = 75.822mASL

## REGISTRATION

## ISSUE/REVISION

1	JUL 13/15	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

## KEY PLAN



## PROJECT NUMBER

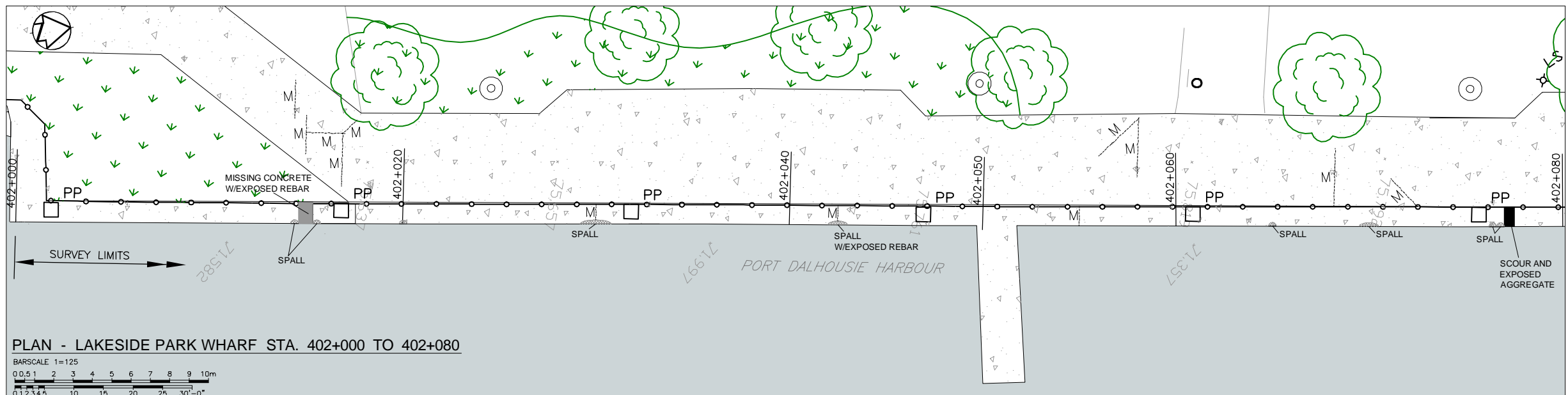
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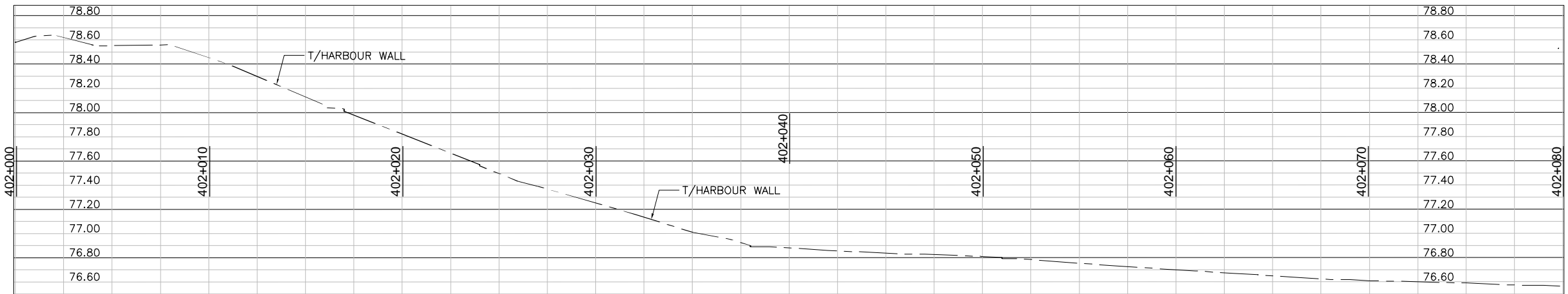
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PLAN AND ELEVATIONS  
STA. 402+000 TO 402+080

## SHEET NUMBER

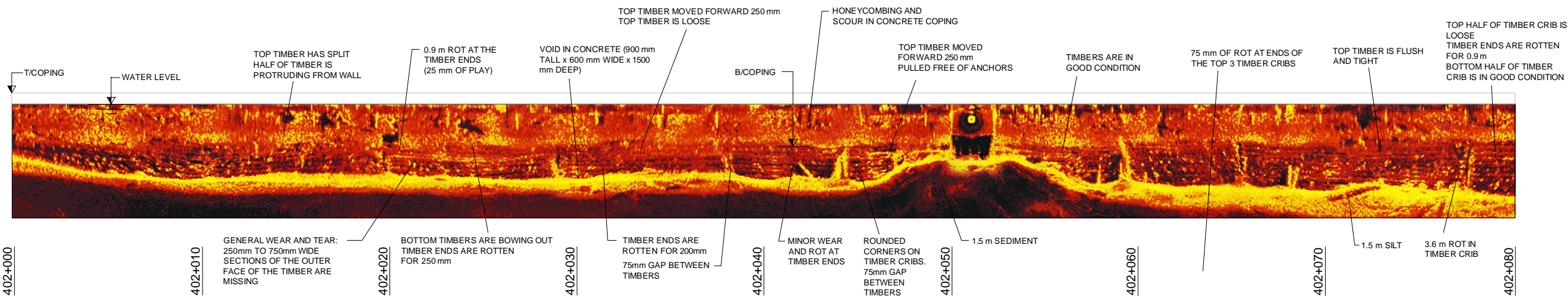
402 - 1 OF 3

MATCH LINE STA. 402+080  
FOR CONTINUATION SEE DWG 402 - 2 OF 3

PLAN - LAKESIDE PARK WHARF STA. 402+000 TO 402+080

BARS SCALE 1=125  
0 0.5 1 2 3 4 5 6 7 8 9 10m  
0 1 2 3 4 5 6 7 8 9 10 15 20 25 30'-0"

ELEVATION - LAKESIDE PARK WHARF STA. 402+000 TO 402+080

SCALE: HORIZ 1:125  
VERTICAL 1:500

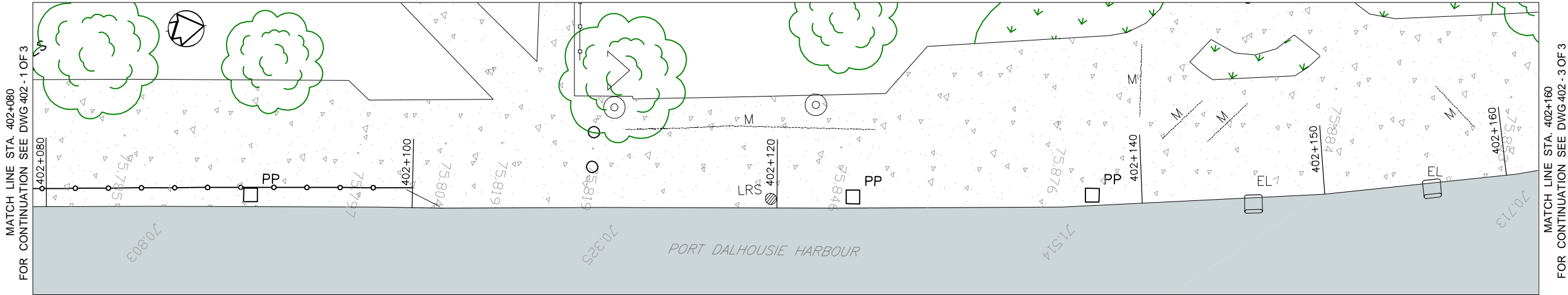
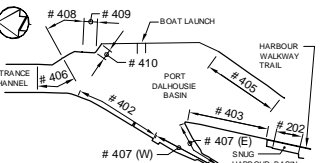
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SCALE: HORIZ 1:125

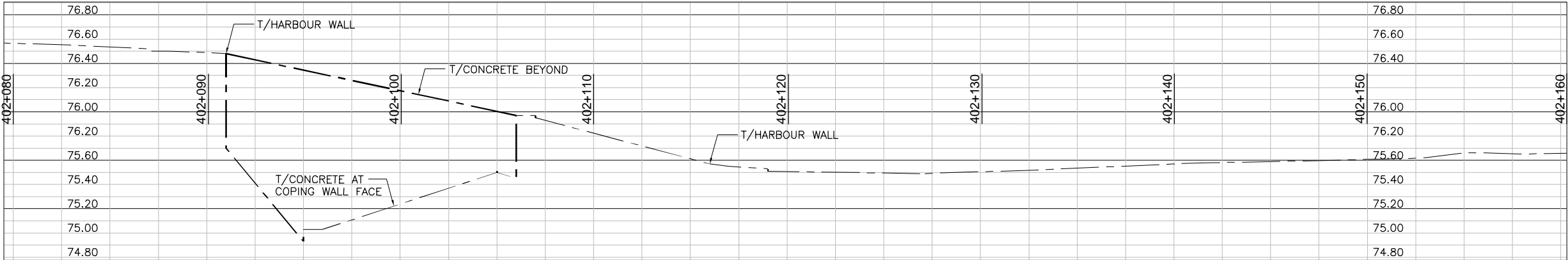
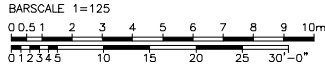
⊙	BOLLARD	SPALLS
HP	HYDROPOLE	MAP CRACKING
JB	JUNCTION BOX	HONEYCOMBET AREAS
EL	EMERGENCY LADDER	
LRS	LIFE RING STATION	
PP	POST	
LS	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
LS	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
BELL	BELL PEDESTAL	
X	CHAINLINK FENCE	
W	WROUGHT IRON FENCE	
W	WOOD FENCE	
SP	SPOT ELEVATION	
HP	HARBOR WALL PROFILE	

NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954/5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

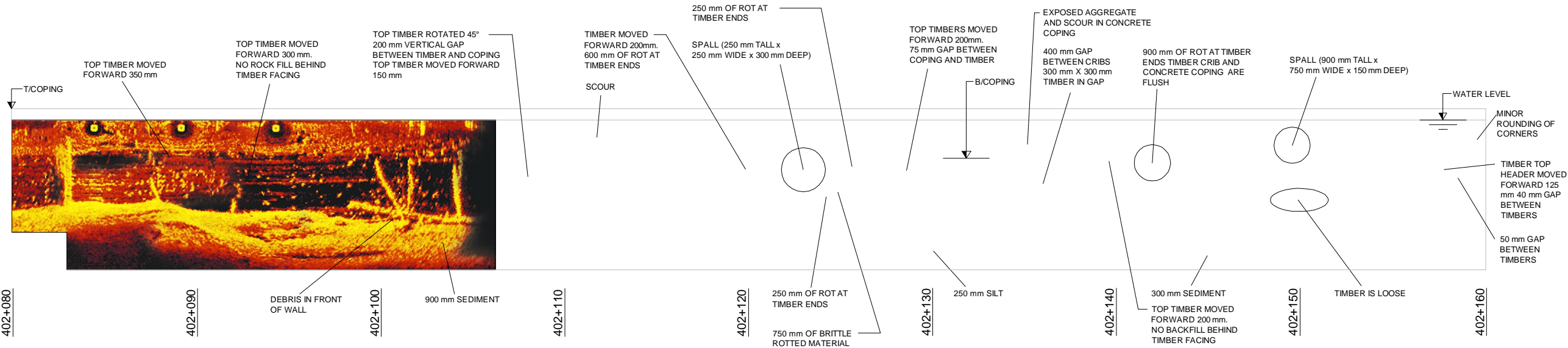


PLAN - LAKESIDE PARK WHARF STA. 402+080 TO 402+160



ELEVATION - LAKESIDE PARK WHARF STA. 402+080 TO 402+160

SCALE: HORIZ 1:125  
VERTICAL 1:500



ELEVATION - LAKESIDE PARK WHARF STA. 402+080 TO 402+160

SCALE: HORIZ 1:125

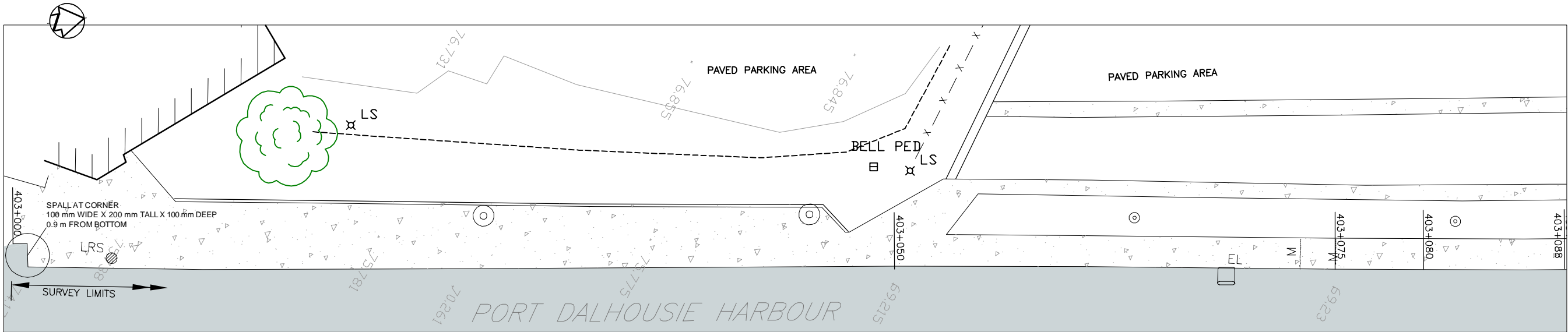
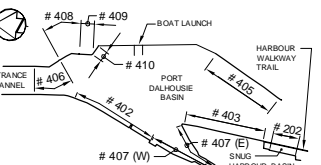




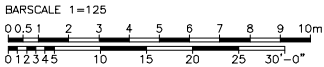
⊙	HP	BOLLARD	SPALLS
●	JB	HYDROPOLE	MAP CRACKING
□	EL	JUNCTION BOX	HONEYCOMB AREAS
□	LRS	EMERGENCY LADDER	
⊙	PP	LIFE RING STATION	
○	LS	POST	
□	PP	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
⊙	LS	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
⊙	BELL PED	BELL PEDESTAL	
—	—	CHAINLINK FENCE	
—	—	WROUGHT IRON FENCE	
—	—	WOOD FENCE	
—	—	SPOT ELEVATION	
—	—	HARBOUR WALL PROFILE	

NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 001954U5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

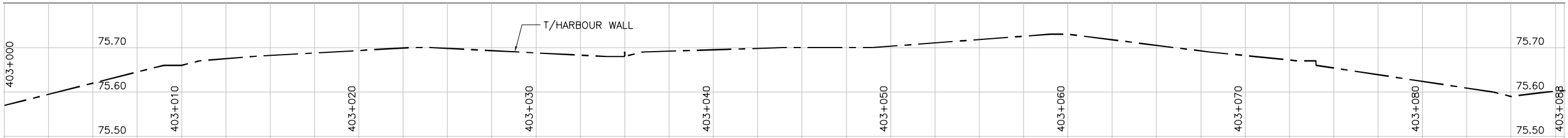
1/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION



PLAN - SOUTH-WEST WALL STA. 403+000 TO 403+080

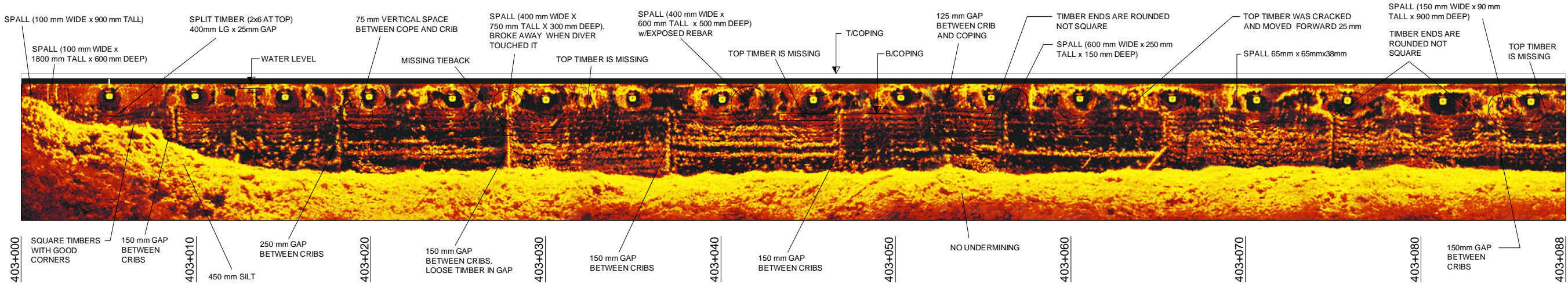


MATCH LINE STA. 403+088  
FOR CONTINUATION SEE DWG 403 - 2 of 2



ELEVATION - SOUTH-WEST WALL STA. 403+000 TO 403+080

SCALE: HORIZ 1:125  
VERTICAL 1:1250



ELEVATION - SOUTH-WEST WALL STA. 403+000 TO 403+080

SCALE: HORIZ 1:125

LEGEND

⊙	HP	BOLLARD	SPALLS
●	HP	HYDROPOLE	MAP
⊠	JB	JUNCTION BOX	CRACKING
□	EL	EMERGENCY LADDER	HONEYCOMB
LRS	○	LIFE RING STATION	AREAS
○	PP	POST	HAIRLINE
□	PP	POWER PEDESTAL	CRACKS IN
⊠	LS	LIGHT STANDARD	CONCRETE
BELL	B	BELL PEDESTAL	MEDIUM
— x —		CHAINLINK FENCE	CRACKS IN
— ○ —		WROUGHT IRON FENCE	CONCRETE
— □ —		WOOD FENCE	
—		SPOT ELEVATION	
—		HARBOUR WALL PROFILE	

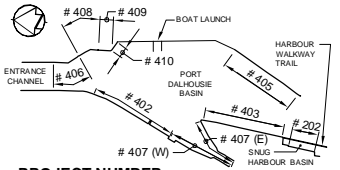
NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 001954U5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

1	JUL 13/15	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

KEY PLAN



PROJECT NUMBER

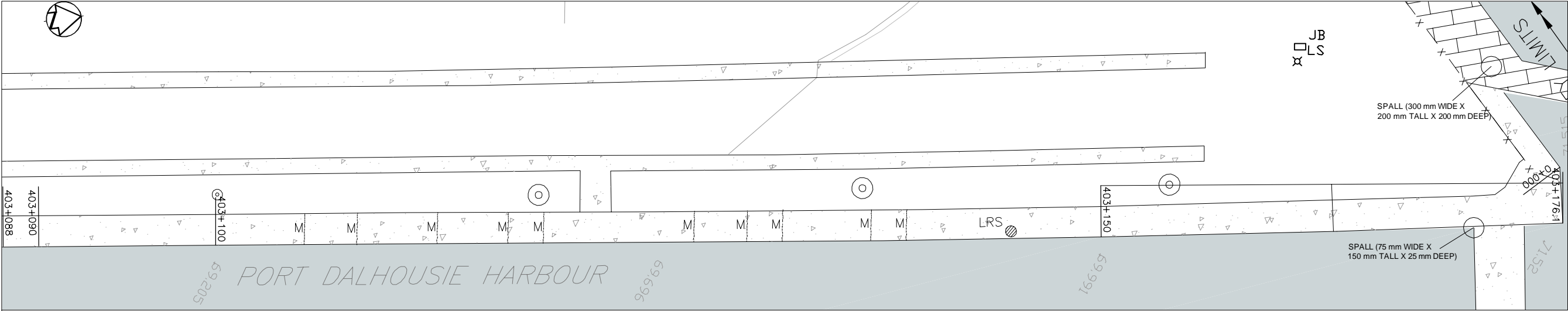
60432205

SHEET TITLE

SOUTH - WEST WALL # 403  
PLAN AND ELEVATIONS  
STA. 403+088 TO 403-176.1

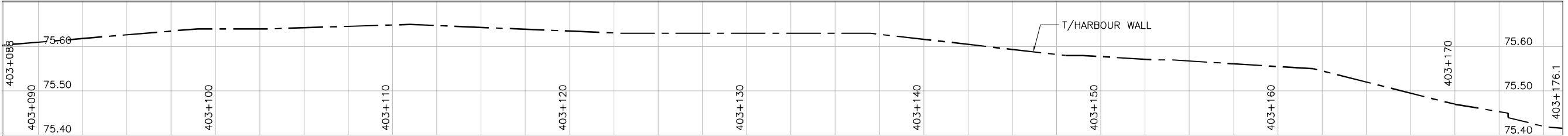
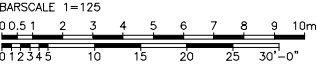
SHEET NUMBER

403 - 2 OF 2



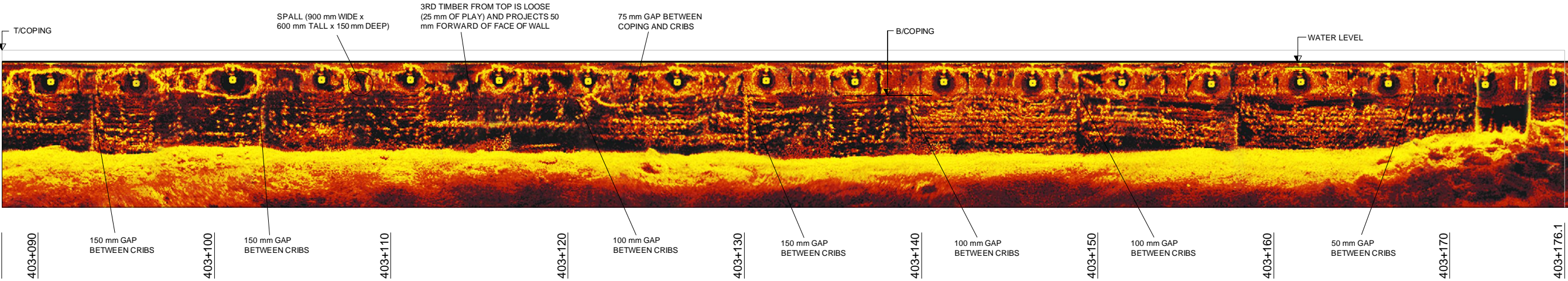
MATCH LINE STA. 403+088  
FOR CONTINUATION SEE DWG 403 - 1 OF 2

PLAN - SOUTH-WEST WALL STA. 403-088 TO 403-176.1



ELEVATION - SOUTH-WEST WALL STA. 403-000 TO 403-080

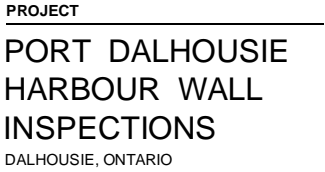
SCALE: HORIZ 1:125  
VERTICAL 1:1250



ELEVATION - SOUTH-WEST WALL STA. 403-000 TO 403-080

SCALE: HORIZ 1:125





**CLIENT**

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**Public Works and  
Governments  
Services Canada**




WILLOWDALE, ONTARIO  
905.xxx.xxx tel 905.xxx.xxx fax

**CONSULTANT**

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AECOM  
300 Water Street  
Whitby, Ontario, Canada L1N 9J2  
905-668-9363 tel 905.668.0221 fax  
[www.aecom.com](http://www.aecom.com)

LEGEND

⊙	BOLLARD		SPALLS
●	HYDROPOLE		
JB	JUNCTION BOX		MAP CRACKING
EL	EMERGENCY LADDER		
LRS	LIFE RING STATION		HONEYCOMB AREAS
⊙	POST		
PP	POWER PEDESTAL	--H--	HAIRLINE CRACKS IN CONCRETE
LS	LIGHT STANDARD	--M--	MEDIUM CRACKS IN CONCRETE
BELL	BELL PEDESTAL		
x	CHAINLINK FENCE		
—○—	WROUGHT IRON FENCE		
—	WOOD FENCE		
△	SPOT ELEVATION		

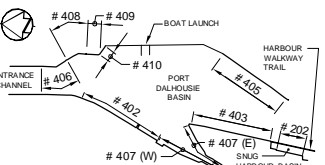
**NOTE:**  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

## REGISTRATION

**ISSUE/REVISION**

1	JUL 13/15	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

## KEY PLAN



## PROJECT NUMBER

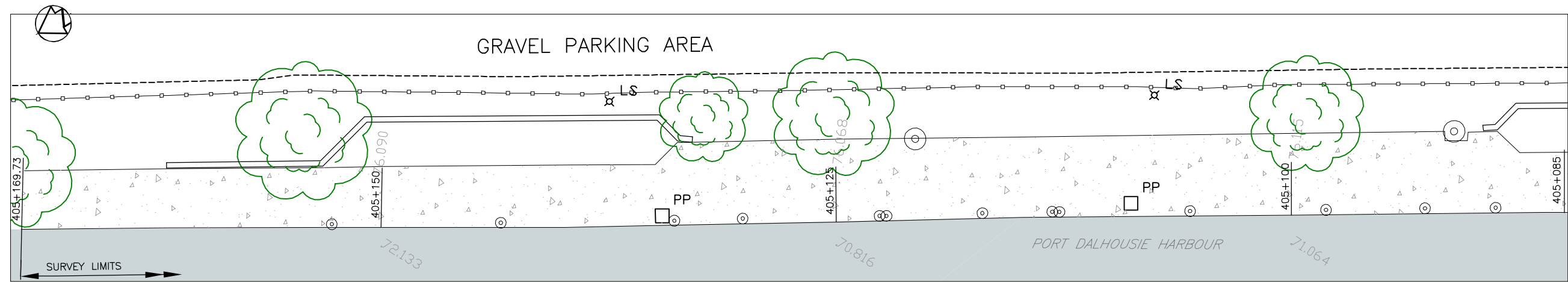
60432205

**SHEET TITLE**

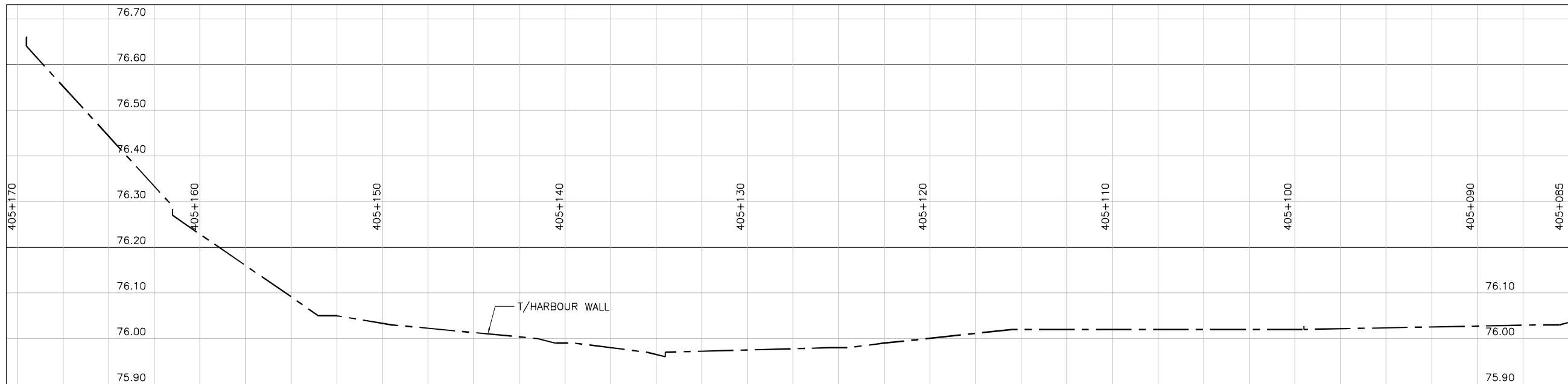
SOUTH - EAST WALL # 405  
PLAN AND ELEVATIONS  
STA. 405+169.73 TO 405-085

**SHEET NUMBER**

405 - 1 OF 2

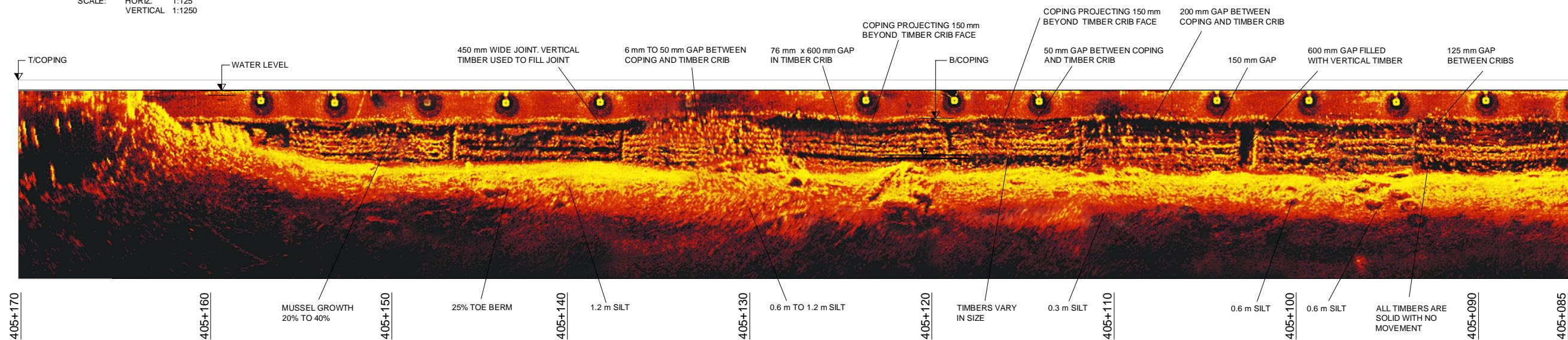


PLAN - SOUTH-EAST WALL STA. 405-085 TO 405-169



ELEVATION - SOUTH-EAST WALL STA. 405-085 TO 405-169

SCALE:      HORIZ.      1:125  
                 VERTICAL      1:1250



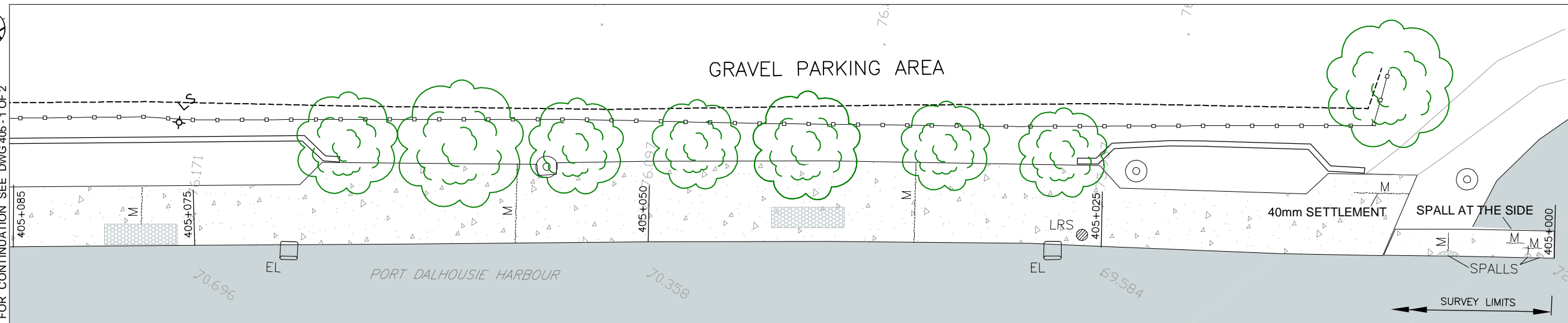
ELEVATION - SOUTH-EAST WALL STA. 405-085 TO 405-169

SCALE:      HORIZ.      1:125

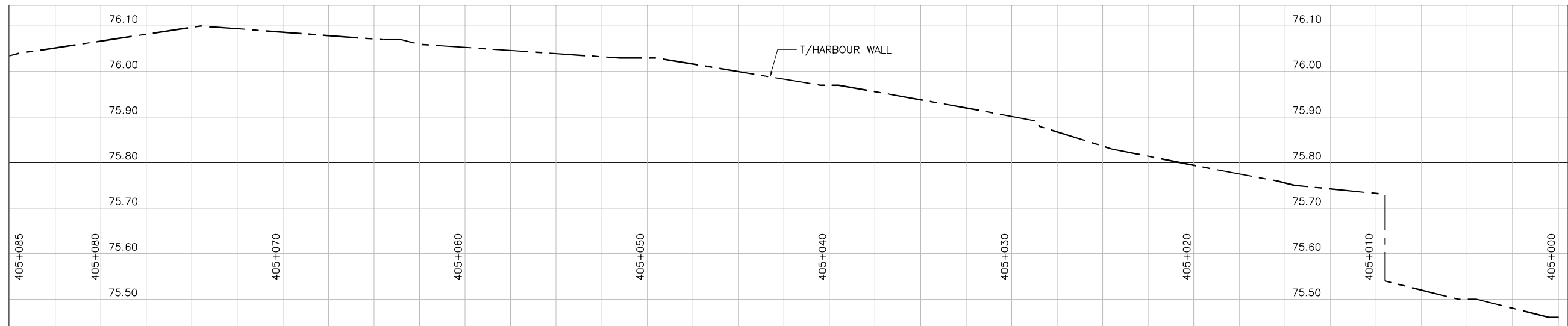
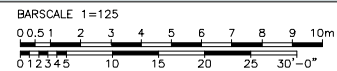




MATCH LINE STA. 405+085  
FOR CONTINUATION SEE DWG 405-1 OF 2

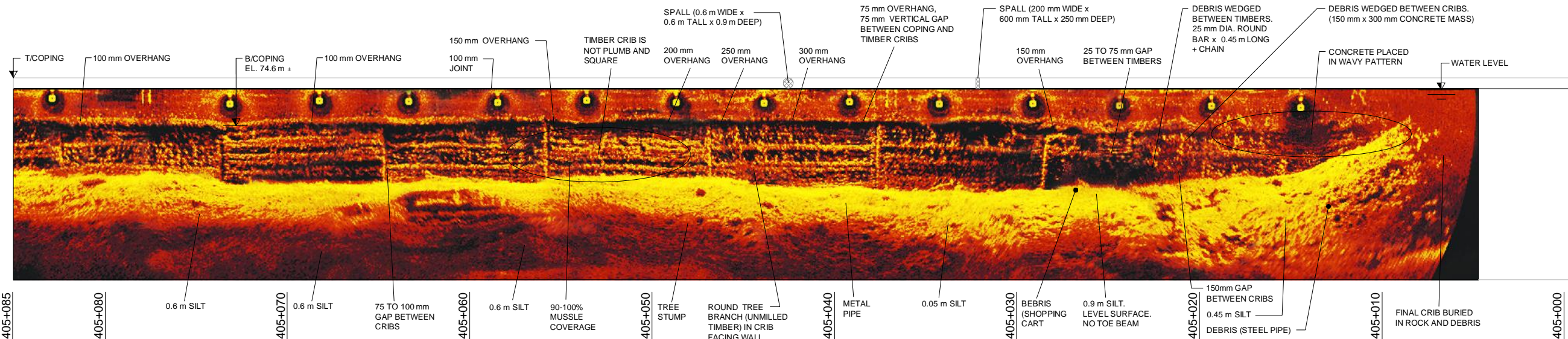


PLAN - SOUTH-EAST WALL STA. 405+000 TO 405+085



ELEVATION - SOUTH-EAST WALL STA. 405+000 TO 403+085

SCALE: HORIZ 1:125  
VERTICAL 1:1250



ELEVATION - SOUTH-EAST WALL STA. 403+000 TO 403+085

SCALE: HORIZ 1:125

PROJECT

PORT DALHOUSIE  
HARBOUR WALL  
INSPECTIONS

DALHOUSIE, ONTARIO

CLIENT

Public Works and  
Governments  
Services Canada

WILLOWDALE, ONTARIO  
905.xxx.xxx tel 905.xxx.xxx fax

CONSULTANT

AECOM  
300 Water Street  
Whitby, Ontario, Canada L1N 9J2  
905-668-9363 tel 905.668.0221 fax  
www.aecom.com

LEGEND

HP	BOLLARD	SPALLS
JB	HYDROPOLE	MAP CRACKING
EL	JUNCTION BOX	HONEYCOMB AREAS
LRS	EMERGENCY LADDER	
PP	LIFE RING STATION	
LS	POST	
BELL	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
PED	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
	BELL PEDESTAL	
	CHAINLINK FENCE	
	WROUGHT IRON FENCE	
	WOOD FENCE	
	SPOT ELEVATION	
	HARBOUR WALL PROFILE	

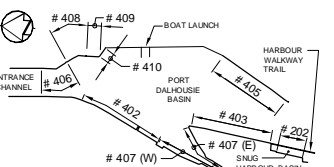
NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954/5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.82mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

60432205

SHEET TITLE

SOUTH - EAST WALL # 405  
PLAN AND ELEVATIONS  
STA. 405+085 TO 405+000

SHEET NUMBER

405 - 2 OF 2

LEGEND

	BOLLARD		SPALLS
	HYDROPOLE		MAP CRACKING
	JUNCTION BOX		HONEYCOMB AREAS
	EMERGENCY LADDER		
	LIFE RING STATION		
	POST		
	POWER PEDESTAL		HAIRLINE CRACKS IN CONCRETE
	LIGHT STANDARD		MEDIUM CRACKS IN CONCRETE
	BELL PEDESTAL		
	CHAINLINK FENCE		
	WROUGHT IRON FENCE		
	WOOD FENCE		
	SPOT ELEVATION		
	HARBOUR WALL PROFILE		

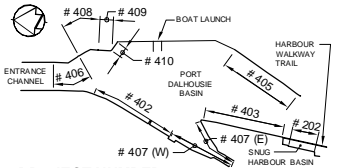
NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954/5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

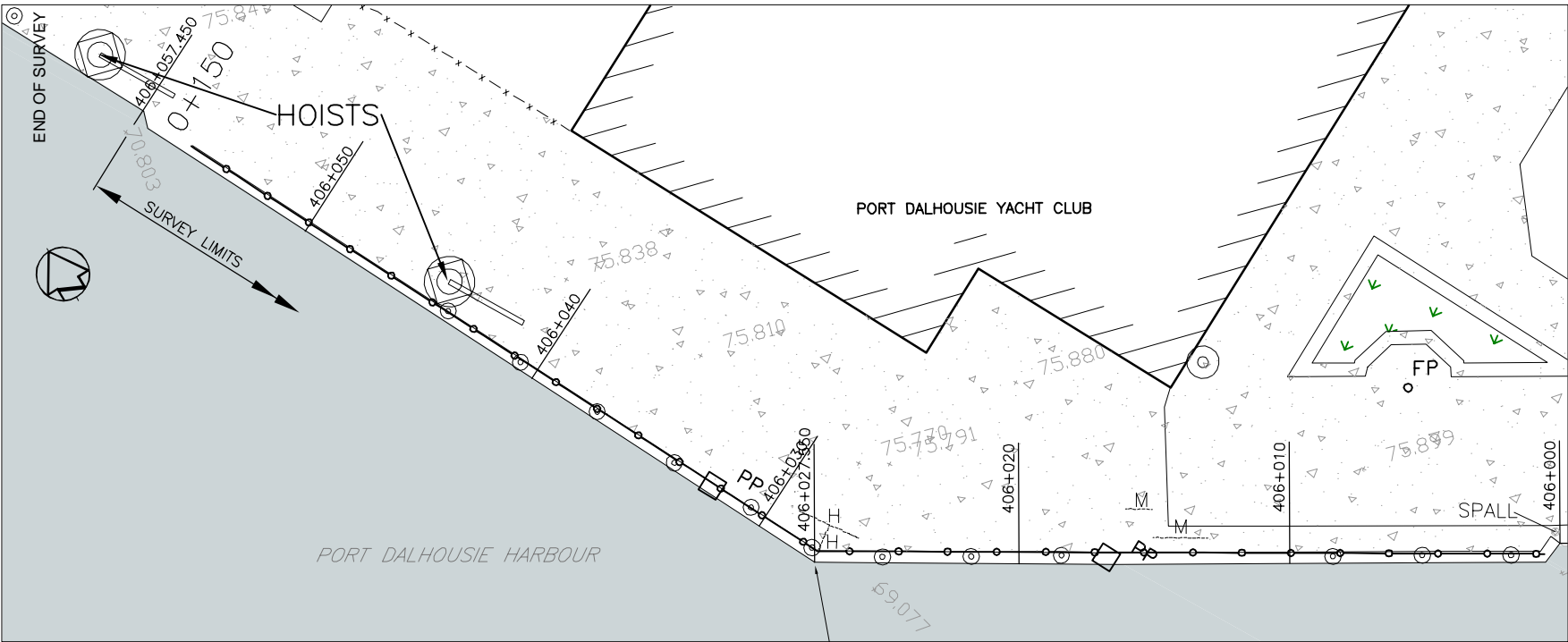
60432205

SHEET TITLE

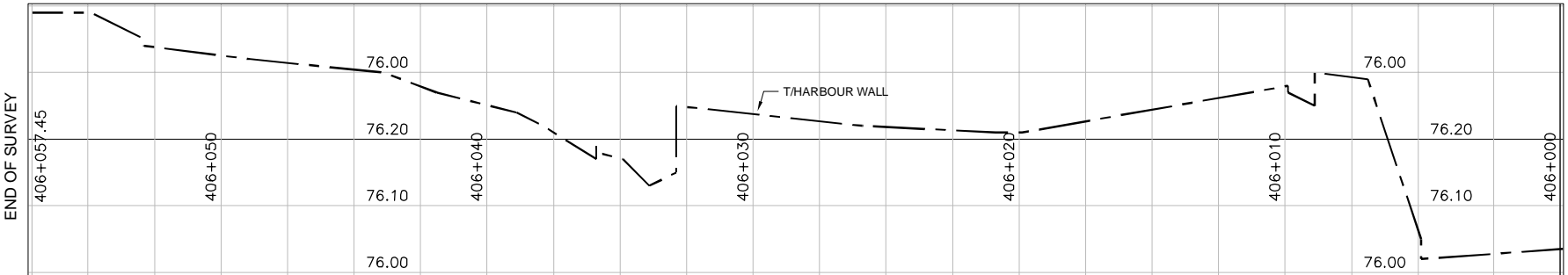
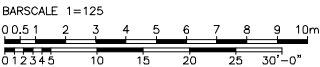
D.Y.C. WALL # 406  
PLAN AND ELEVATIONS  
STA. 406+000 TO 406+057.450

SHEET NUMBER

406 - 1 OF 1

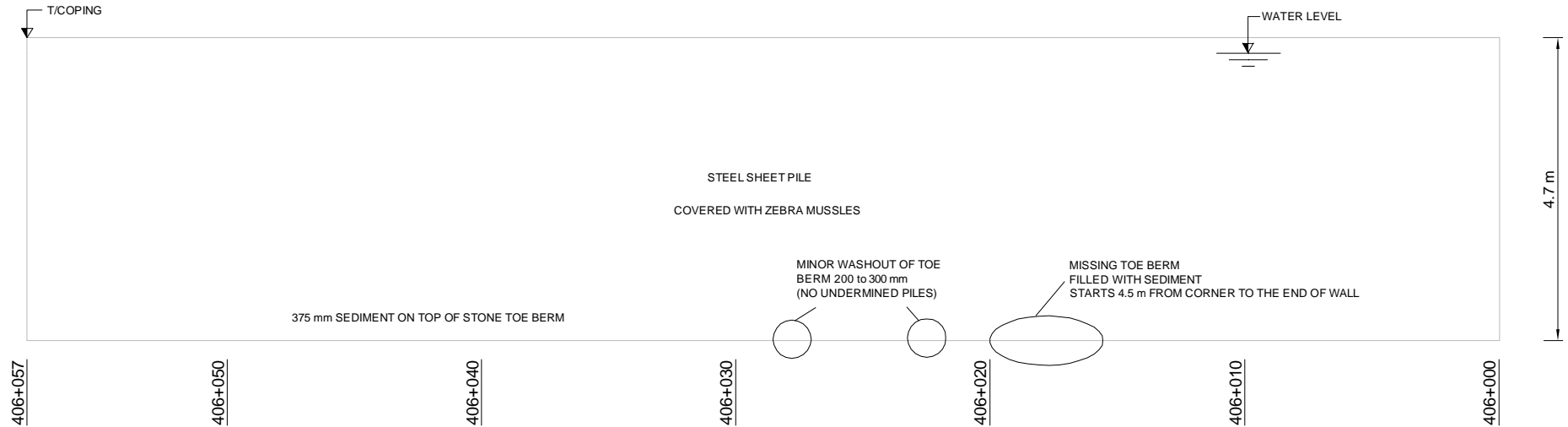


PLAN - DALHOUSIE YACHT CLUB WALL STA. 406+000 TO 406+057



ELEVATION - DALHOUSIE YACHT CLUB G WALL STA. 406+000 TO 406+057

SCALE: HORIZ 1:125  
VERTICAL 1:1250



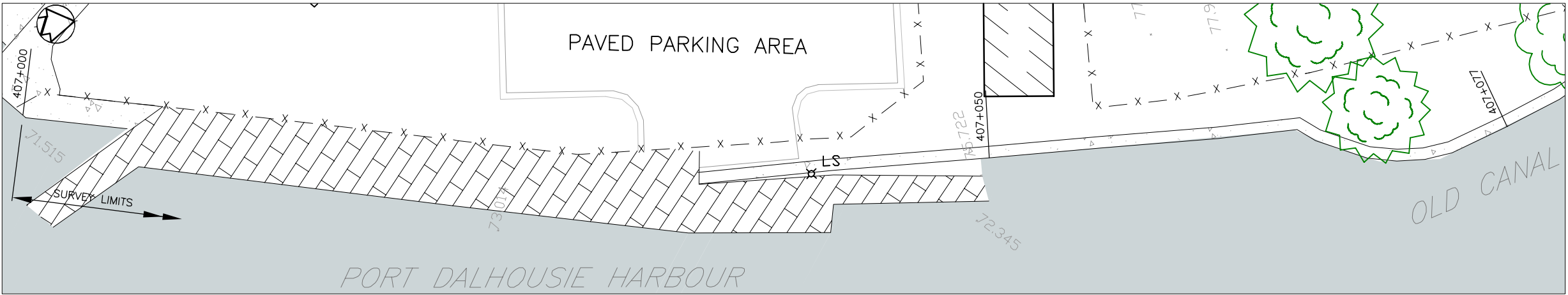
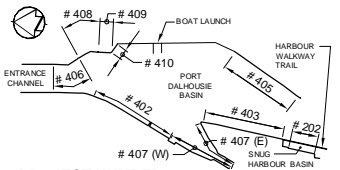
ELEVATION - DALHOUSIE YACHT CLUB G WALL STA. 406+000 TO 406+057

SCALE: HORIZ 1:125

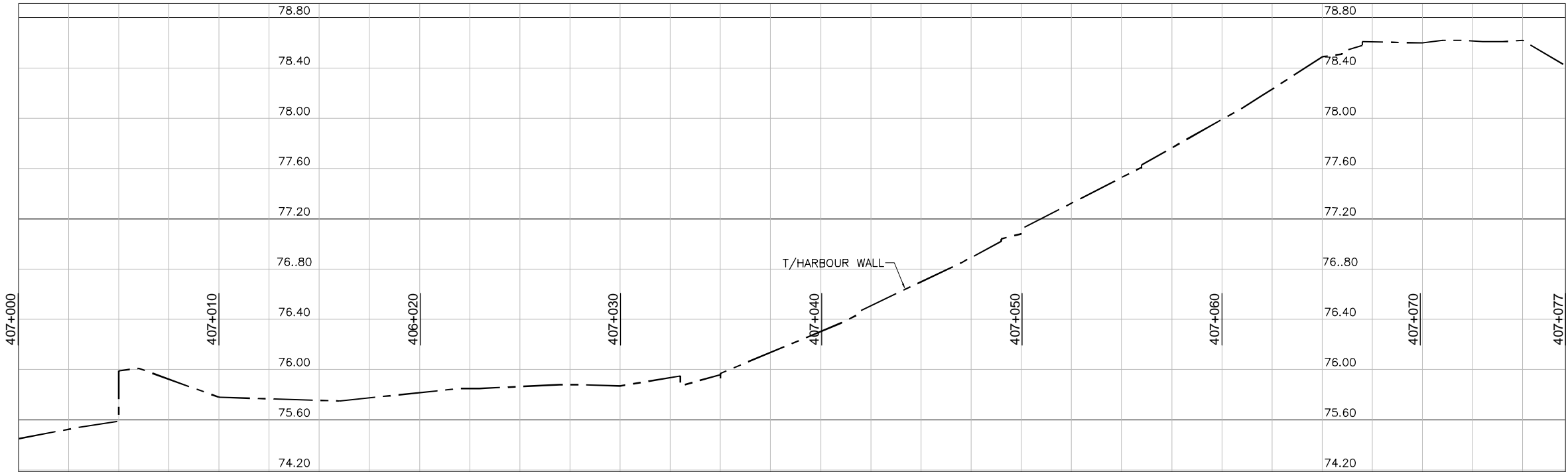
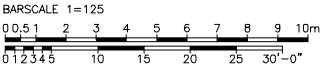
⊙	HP	BOLLARD	SPALLS
●	JB	HYDROPOLE	MAP
□	EL	JUNCTION BOX	CRACKING
□	EL	EMERGENCY LADDER	HONEYCOMBET
○	LRS	LIFE RING STATION	AREAS
○	PP	POST	
□	PP	POWER PEDESTAL	HAIRLINE
×	LS	LIGHT STANDARD	CRACKS IN
⊙	BELL PED	BELL PEDESTAL	CONCRETE
— X —		CHAINLINK FENCE	MEDIUM
— ○ —		WROUGHT IRON FENCE	CRACKS IN
— □ —		WOOD FENCE	CONCRETE
—		SPOT ELEVATION	
—		HARBOUR WALL PROFILE	

NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 001954U5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

1	JUL 13/15	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

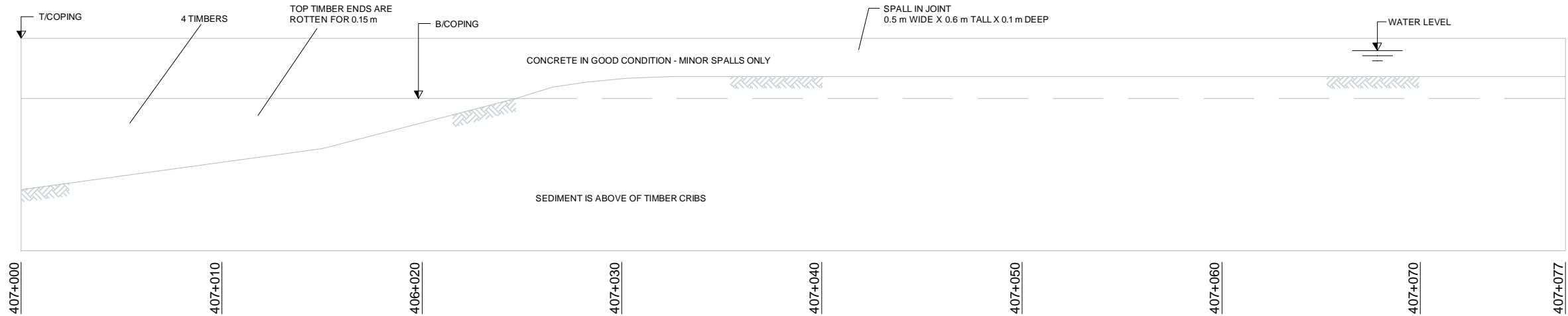


PLAN - OLD CANAL WALL (EAST SIDE) STA. 407+000 TO 407+077



ELEVATION - OLD CANAL WALL (EAST SIDE) STA. 407+000 TO 407+077

SCALE: HORIZ. 1:125  
VERTICAL 1:1250



ELEVATION - OLD CANAL WALL (EAST SIDE) STA. 407+000 TO 407+077

SCALE: HORIZ. 1:125



LEGEND

HP	BOLLARD	SPALLS
HP	HYDROPOLE	MAP CRACKING
JB	JUNCTION BOX	HONEYCOMB AREAS
EL	EMERGENCY LADDER	
LRS	LIFE RING STATION	
PP	POST	
PP	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
LS	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
BELL PED	BELL PEDESTAL	
X	CHAINLINK FENCE	
W	WROUGHT IRON FENCE	
W	WOOD FENCE	
SP	SPOT ELEVATION	
HP	HARBOUR WALL PROFILE	

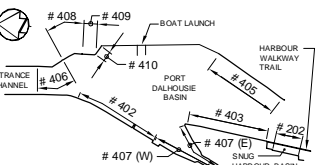
NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954/5561F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

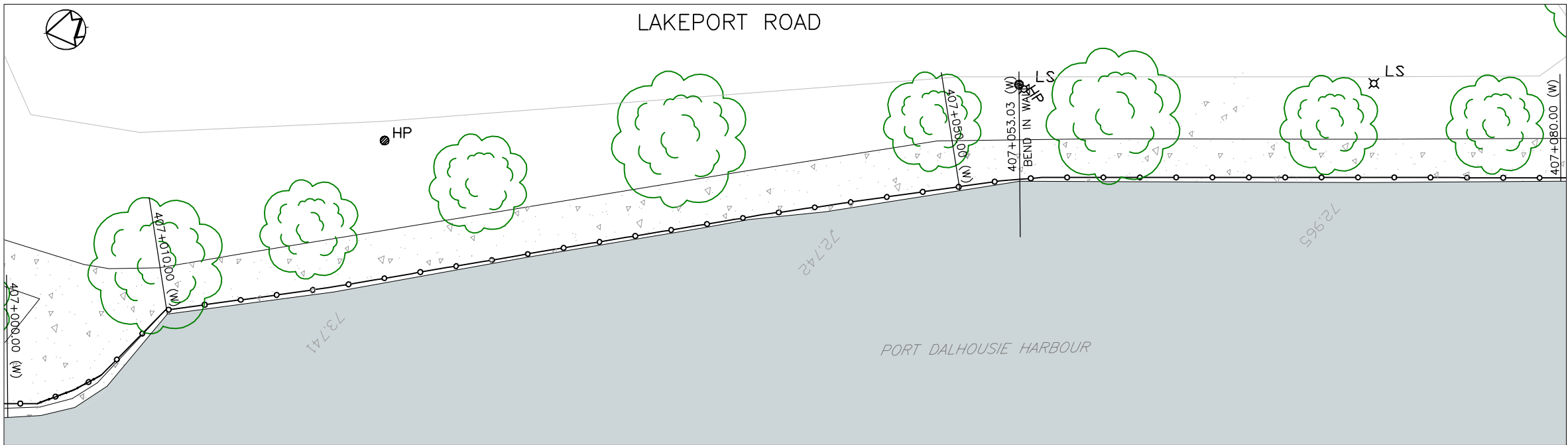
60432205

SHEET TITLE

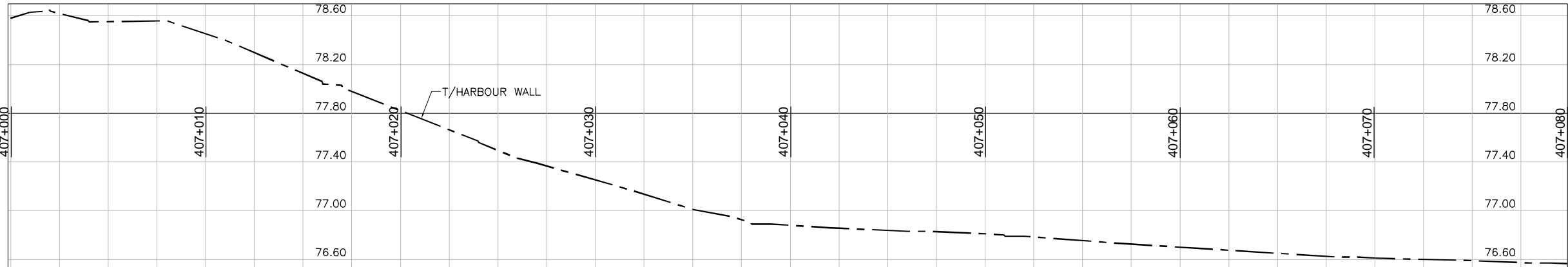
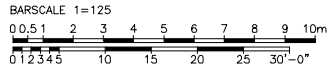
OLD CANAL WALLS # 407  
PLAN AND ELEVATIONS  
STA. 407+000 TO 407+080

SHEET NUMBER

407 - 1 OF 2 (WEST)

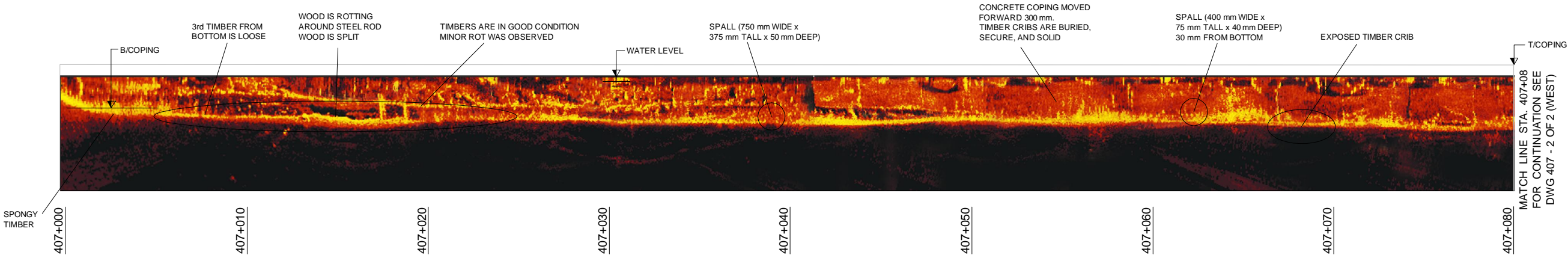


PLAN - OLD CANAL WALL (WEST SIDE) STA. 407+000 TO 407+080



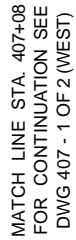
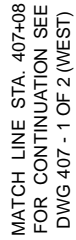
ELEVATION - OLD CANAL WALL (WEST SIDE) STA. 407+000 TO 407+080

SCALE: HORIZ 1:125  
VERTICAL 1:1250



ELEVATION - OLD CANAL WALL (WEST SIDE) STA. 407+000 TO 407+080

SCALE: HORIZ 1:125



MATCH LINE STA. 407+08  
FOR CONTINUATION SEE  
DWG 407 - 1 OF 2 (WEST)



Printed on % Post-Consumer



LEGEND

⊙	BOLLARD	SPALLS
●	HYDROPOLE	MAP CRACKING
⊠	JUNCTION BOX	HONEYCOMBED AREAS
EL	EMERGENCY LADDER	
LRS	LIFE RING STATION	
○	POST	
PP	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
LS	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
BELL PED	BELL PEDESTAL	
— X —	CHAINLINK FENCE	
— ○ —	WROUGHT IRON FENCE	
— □ —	WOOD FENCE	
—	SPOT ELEVATION	
—	HARBOUR WALL PROFILE	

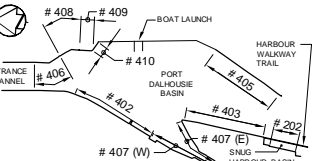
NOTE:  
ELEVATIONS BASED UPON COVD MONUMENT 0011954U5661F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

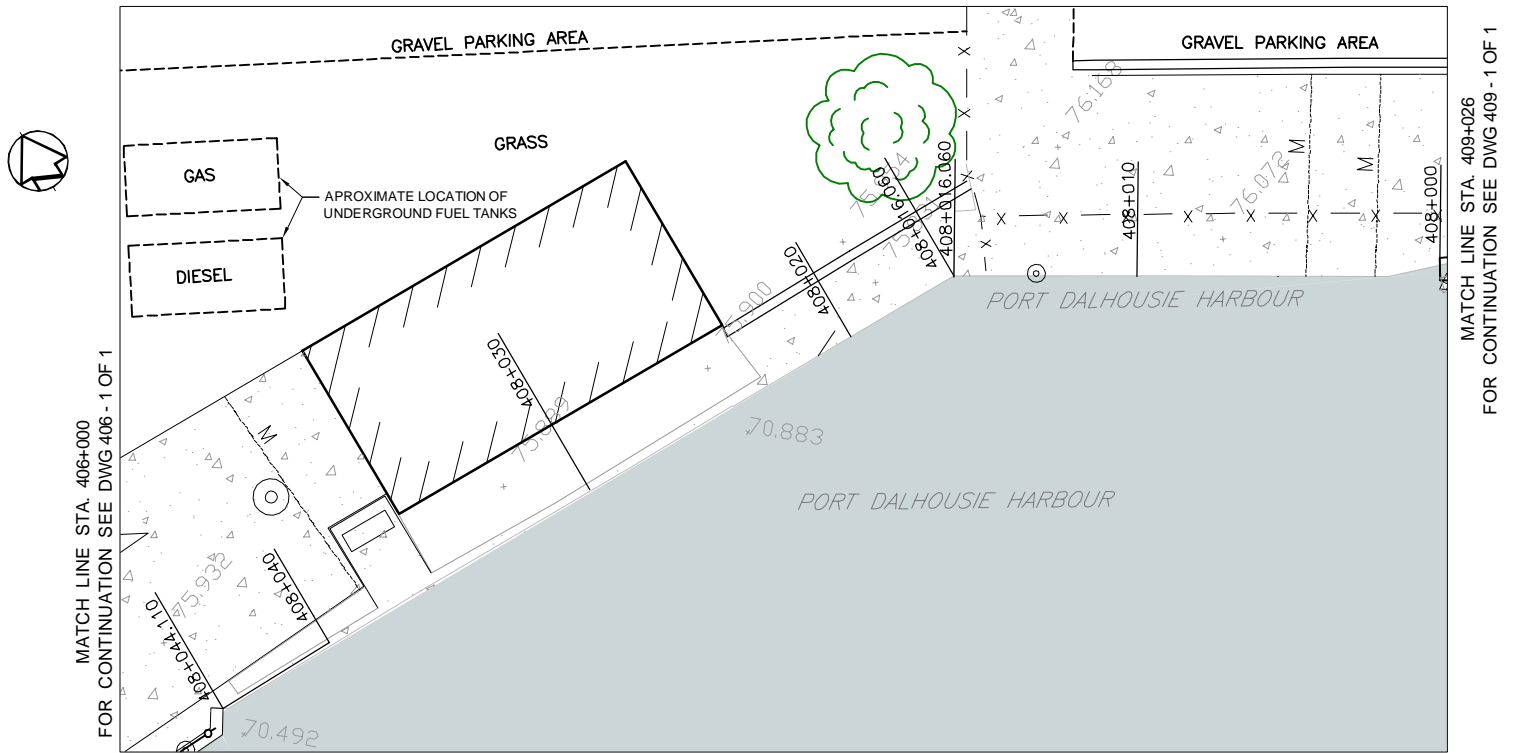
60432205

SHEET TITLE

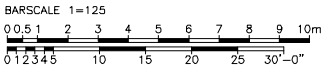
EAST CONCRETE WALL # 408  
PLAN AND ELEVATIONS  
STA. 408+000 TO 408+044.110

SHEET NUMBER

408 - 1 OF 1

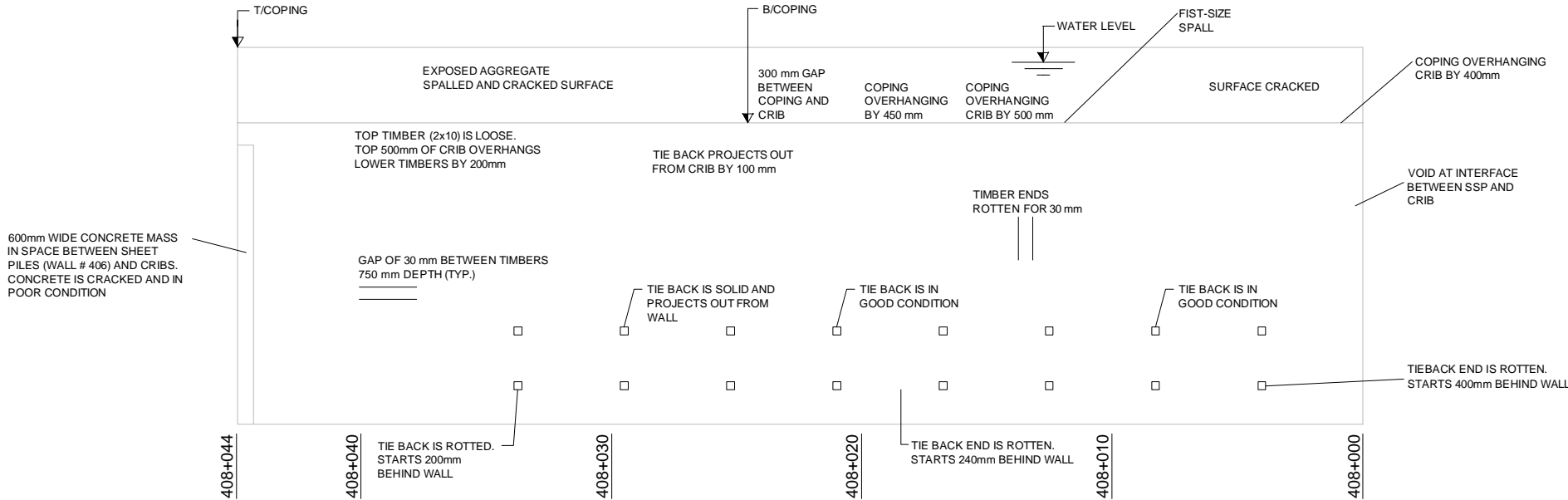


PLAN - EAST STEEL RETAINING STA. 408+000 TO 408+044.110



ELEVATION - EAST STEEL RETAINING WALL STA. 408+000 TO 408+044.110

SCALE: HORIZ 1:125  
VERTICAL 1:1250



ELEVATION - EAST STEEL RETAINING WALL STA. 408+000 TO 408+044.110

SCALE: HORIZ 1:125

LEGEND

⊙	BOLLARD	SPALLS
●	HYDROPOLE	
JB	JUNCTION BOX	MAP CRACKING
EL	EMERGENCY LADDER	
LRS	LIFE RING STATION	HONEYCOMBED AREAS
○	POST	
PP	POWER PEDESTAL	HAIRLINE CRACKS IN CONCRETE
LS	LIGHT STANDARD	MEDIUM CRACKS IN CONCRETE
BELL	BELL PEDESTAL	
X	CHAINLINK FENCE	
○	WROUGHT IRON FENCE	
□	WOOD FENCE	
—	SPOT ELEVATION	
—	HARBOUR WALL PROFILE	

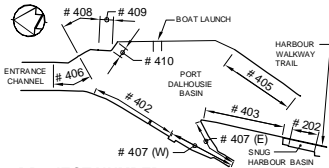
NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5681F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.822mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

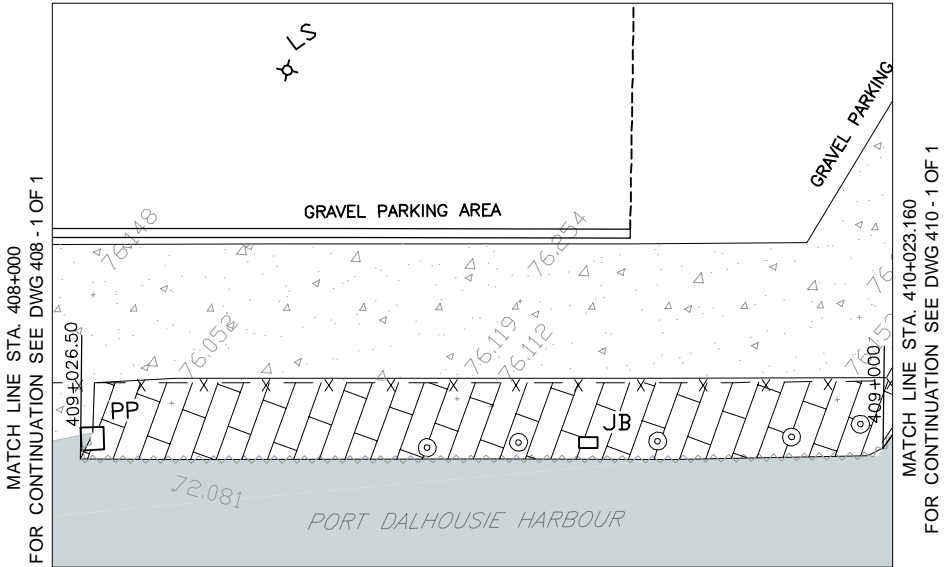
60432205

SHEET TITLE

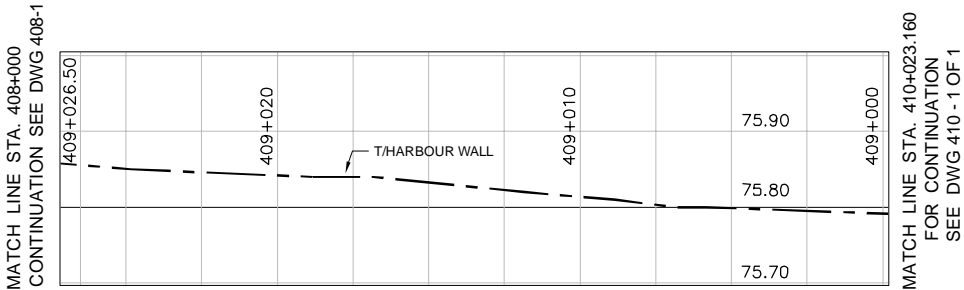
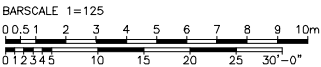
EAST STEEL RET. WALL # 409  
PLAN AND ELEVATIONS  
STA. 409+000 TO 409+026.500

SHEET NUMBER

409 - 1 OF 1

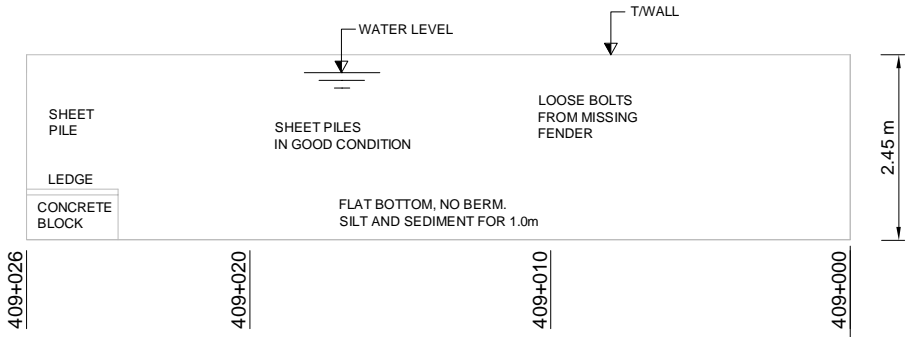


PLAN - EAST STEEL RETAINING STA. 409-000 TO 409.026.500



ELEVATION - EAST STEEL RETAINING WALL STA. 409-000 TO 409.026.500

SCALE: HORIZ 1:125  
VERTICAL 1:1250



ELEVATION - EAST STEEL RETAINING WALL STA. 409-000 TO 409.026.500

SCALE: HORIZ 1:125

LEGEND

	BOLLARD		SPALLS
	HYDROPOLE		MAP CRACKING
	JUNCTION BOX		HONEYCOMBET AREAS
	EMERGENCY LADDER		
	LIFE RING STATION		
	POST		
	POWER PEDESTAL		HAIRLINE CRACKS IN CONCRETE
	LIGHT STANDARD		MEDIUM CRACKS IN CONCRETE
	BELL PEDESTAL		
	CHAINLINK FENCE		
	WROUGHT IRON FENCE		
	WOOD FENCE		
	SPOT ELEVATION		
	HARBOR WALL PROFILE		

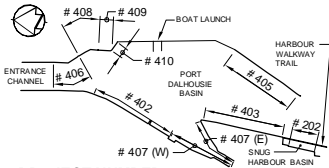
NOTE:  
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5661F  
LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER  
LIGHTHOUSE. ELEVATION = 75.922mASL

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	JUL 13/15	ISSUED FOR INFORMATION

KEY PLAN



PROJECT NUMBER

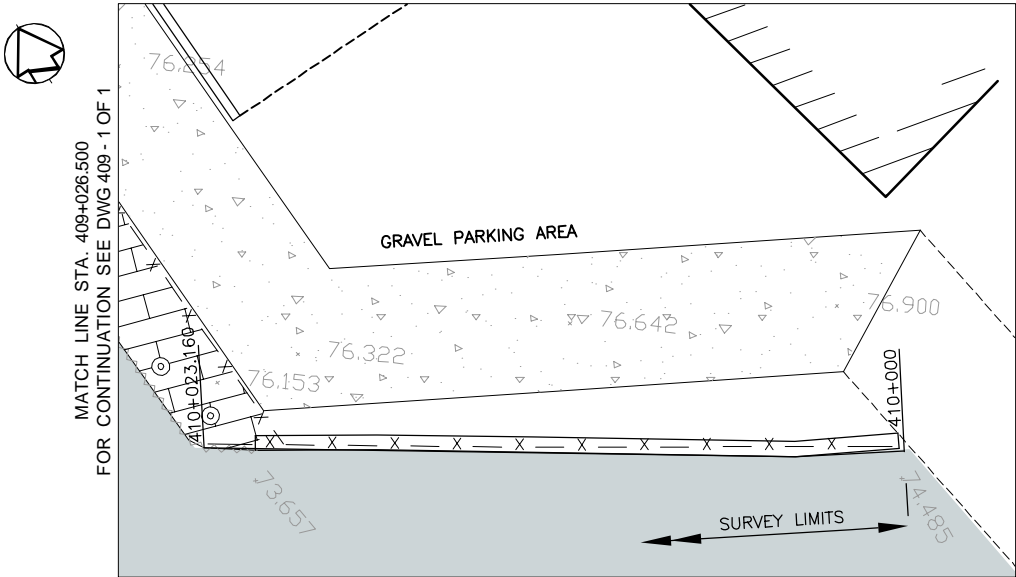
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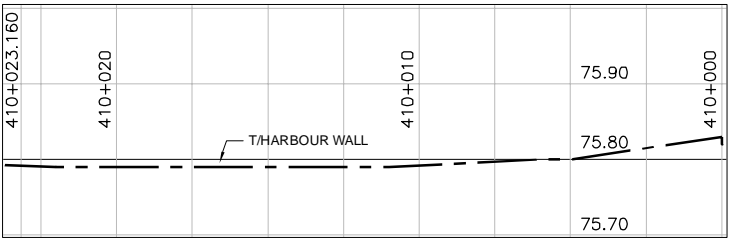
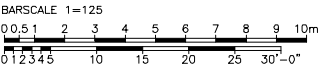
TIMBER WALL # 410  
PLAN AND ELEVATIONS  
STA. 410+000 TO 410-023.160

SHEET NUMBER

410 - 1 OF 1

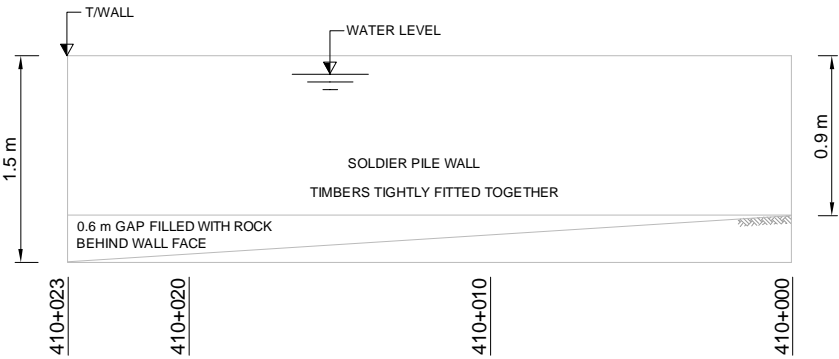


PLAN - TIMBER WALL STA. 410-000 TO 410-023.160



ELEVATION - TIMBER WALL STA. 410-000 TO 410-023.160

SCALE:   HORIZ.   1:125  
          VERTICAL 1:1250



ELEVATION - TIMBER WALL WALL STA. 410-000 TO 410-023.160

SCALE:   HORIZ.   1:125

# Appendix B

## Port Dalhousie, ON – Harbour Wall Engineering Inspection Report

- Photo-Log

Appendix Photographs  
Removed