

Professional Diving Services

Part of the Professional Divers Group

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Princes Pier Pile Forest Survey



January 2024

Attention:
Jonathan Liang
Senior Project Manager, Capital Projects
Precinct Delivery / Strategy and Precincts
Department of Transport and Planning

This is to certify that under the direction of Jonathan Liang, Professional Diving Services completed a failure risk-based swim through survey of all 3,462 timber piles in the pile 'Forest' at Princes Pier. Works were completed in January of 2024. A summary of the works is presented in the following report.

Professional Divers forwards this report without favour or prejudice. This report presents a true and accurate representation of the findings. There were no reports of accident or injury during the works and all WorkSafe Victoria AS/NZS 2299.1:2015 and Professional Diving Services operational and safety requirements have been complied with.

Chris op't Hoog
Project Manager / Engineer
Professional Diving Services

1 Introduction

This is to certify that under the direction of Jonathan Liang, Professional Diving Services (PDS) completed a swim through survey of all 3,462 timber piles in the pile 'Forest' at Princes Pier. A failure risk-based swim through survey was conducted. An overview of the structure is provided in Figures 1 to 3.

The intent of the survey was to identify failing piles that may pose a hazard/risk to the waterway.

The inspections were carried out by Professional Diving Services' staff conducted from Vessel based operations. All PDS vessels used were in TSV survey.

Recent History

- 2010/11 – Pile repair (large project)
- 2011/17 – Maintenance period
- 2018 – Pile WSCAM survey (priority 1 piles, 148 piles)
- 2019 – (March) Pile strengthening/encasements (4 piles)
- 2019 – (April to May) Pile repair maintenance:
 - (A) bent 6 to 27, all rows), and
 - (B) bent 48 to 70, rows AA to CC.
- 2019 – (May to June) Pile WSCAM survey (priority 2 piles, 308 piles)
- 2019 – (May to June) Pile Forest swim-through
- 2022 – Pile Forest pile hazard removal (90 piles)
- 2022/23 – Pile survey, protection and rehabilitation project (large project)
- 2024 – (Jan) Pile Forest swim-through – this report

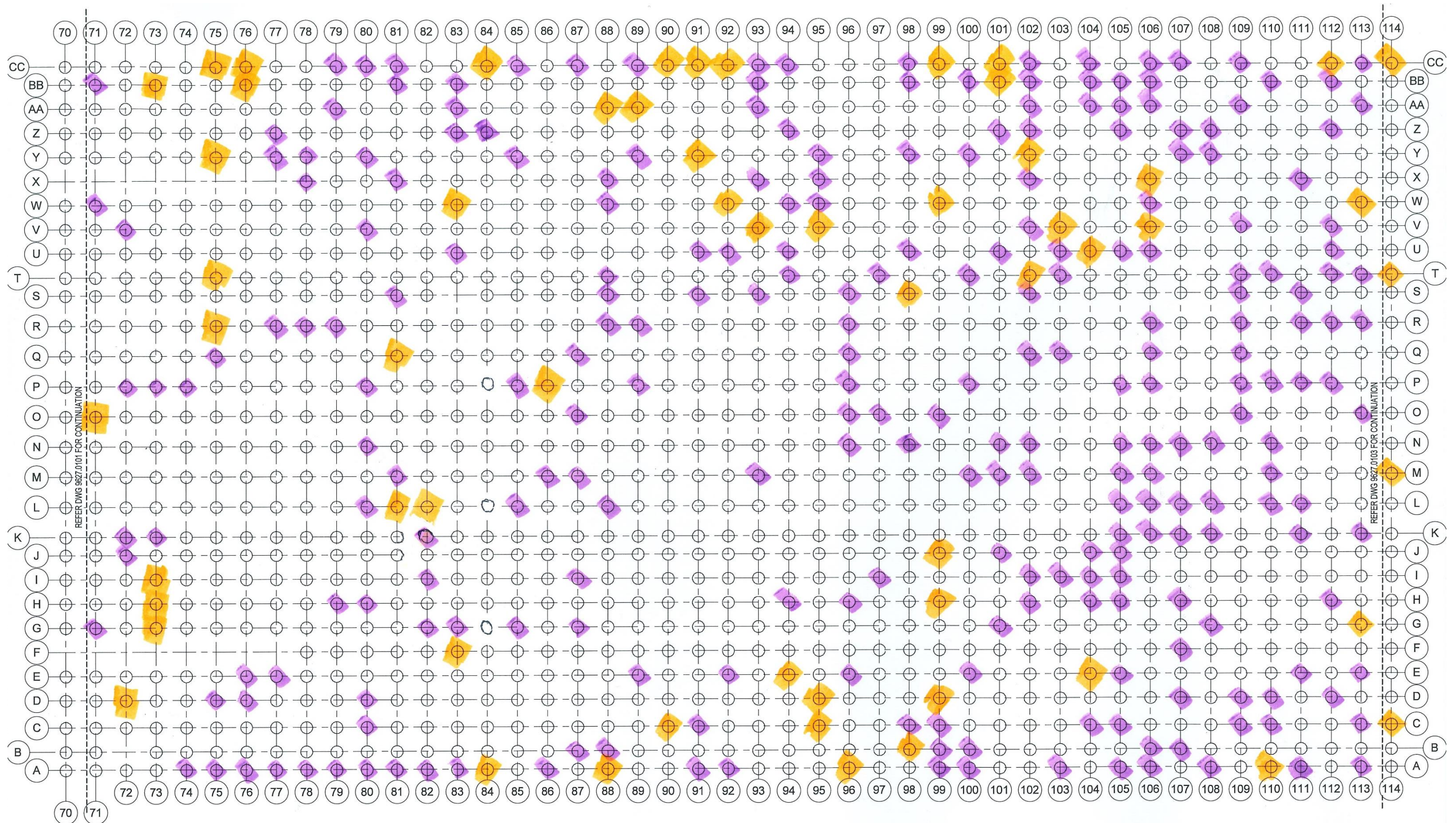


Figure 1. Pile 'Forest' plan with swim through ratings highlighted. (Key: Purple are broken/missing; Orange are failing).

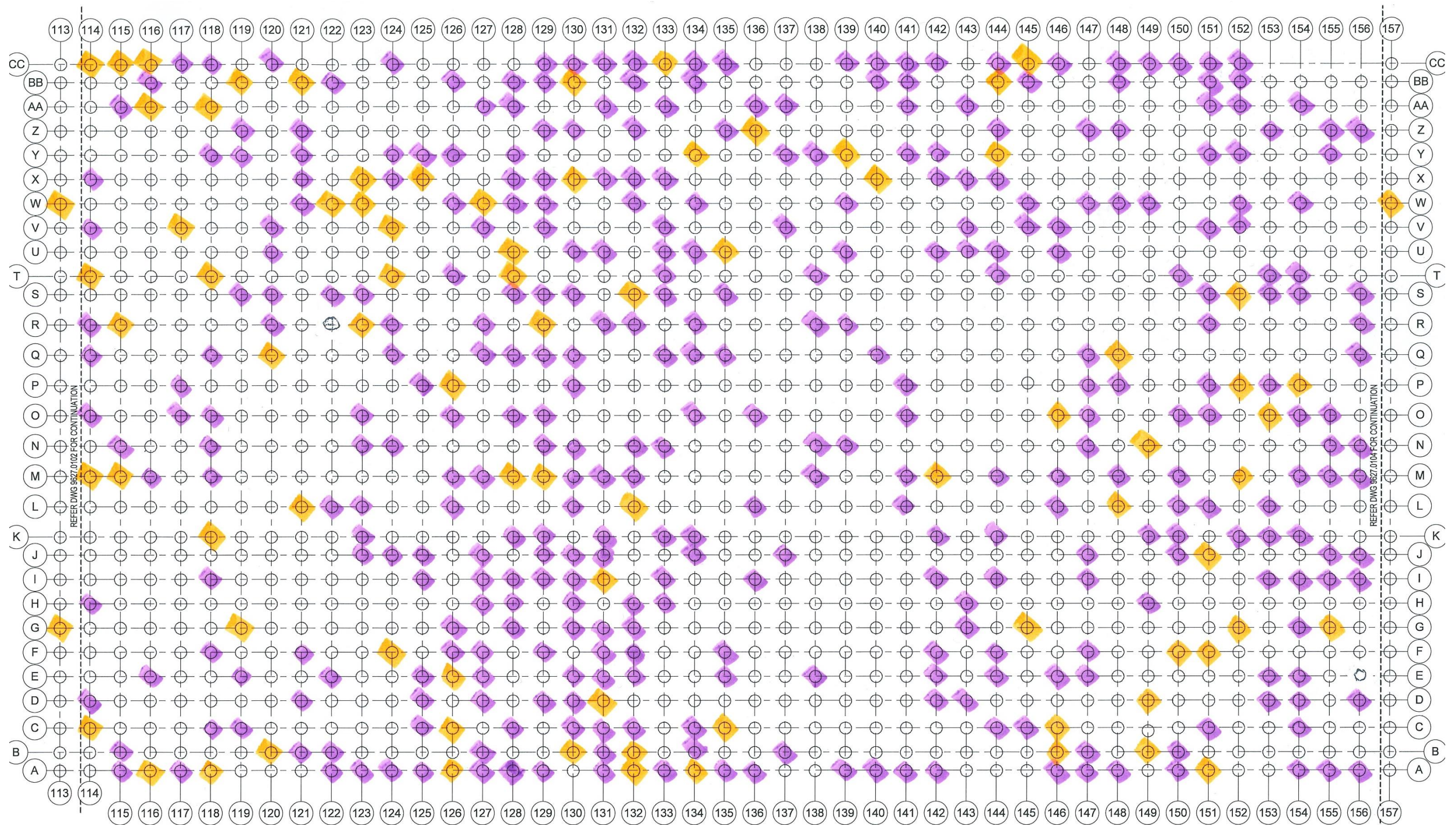


Figure 2. Pile ‘Forest’ plan with swim through ratings highlighted. (Key: Purple are broken/missing; Orange are failing).

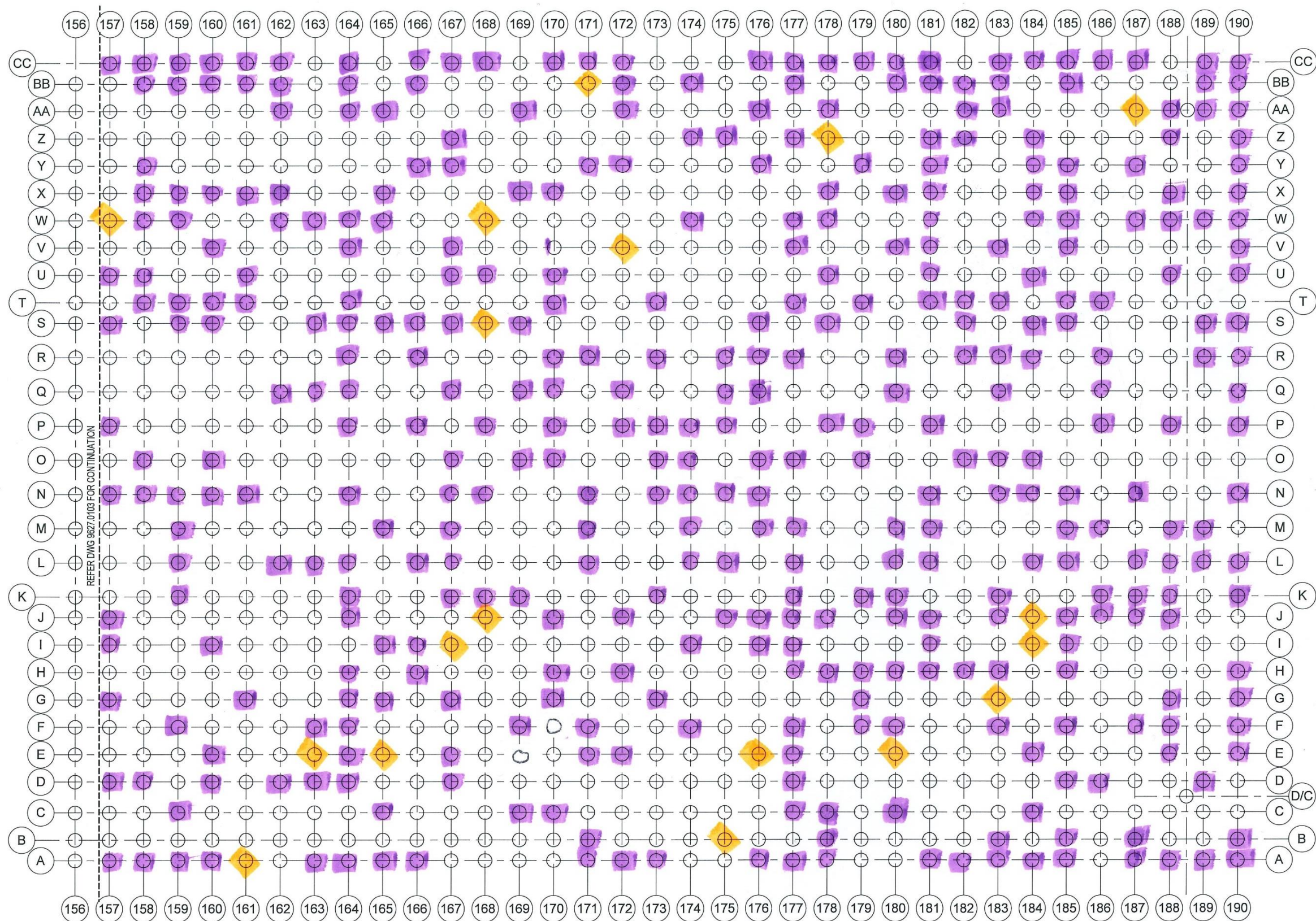


Figure 3. Pile 'Forest' plan with swim through ratings highlighted. (Key: Purple are broken/missing; Orange are failing).

2 Methods

2.1 Approach

A failure risk-based survey was conducted. Swim through inspection was undertaken to identify failed or failing piles (those with a high likelihood of breaking). Piles were identified as either:

1. OK – Intact (no heavy defects evident)
2. Failing – Clearly poor to very poor condition (large hollowing/necking, breaks, significant pile swaying, etc.)
3. Broken – Failed/broken or missing

Divers visually inspected piles by swimming at RL 0 m CD (just below low water level).

1. This allowed the top portion of the piles to be assessed for risk of failure.
 - a. Note: >60% of failures identified on timber piles as assessed by PDS in the greater area (Beacon Cove to Station Pier) were in this zone.
2. Divers also conducted spot inspections of seabed to assess if missing pile sections were present and in need of recovery.

No cleaning was undertaken and only limited pile labelling was completed.

2.2 Limitations

1. Visual survey of timber piles is limited by:
 - a. Length of pile inspected (e.g. areas of piles below RL -1.5 m were typically not inspected)
 - b. Underwater visibility at the time of survey
 - c. Level of cleaning of the pile surface prior to inspection
 - d. In-water perspective
2. Assessment of pile condition is based on the criteria outlined in our report. This did not include a review by a structural engineer or a structural analysis. The nature of this survey was as a high-level risk assessment.

3 Major Findings

In total, 154 (4.45%) of all piles were identified to have large defects that may cause the top portion of the piles to fall into the water. These piles were recorded to be in ‘failing’ condition and are recommended for removal. Overall, since the survey conducted in 2019, in the 5 years that has since past, that would approximately total 31 piles (0.9%) per year that required removal.

A large number of piles (1013 piles or 29.25%) had pile sections visibly protruding from seabed (some up to the tidal zone) and were recorded as broken or missing. These piles are expected to pose a low likelihood in the short term, of drifting into the waterway in the short term.

Debris on seabed was observed and consisted of old pile sections and miscellaneous timber. All debris observed was buried or partially buried posing very low risk of migrating into the waterway. No debris recommended for recovery was observed.

It is possible that mobile debris is present but was not visible. Future monitoring surveys or pile removal work are recommended to also include provision to conduct additional seabed spot checks (and where required removal of debris).

A summary of pile condition ratings Table 1. Detailed results are provided in the spreadsheet in Appendix B.

Table 1. Condition Ratings

Rating	No. of Piles	%
OK	2295	66.3
Failing	154	4.45
Broken	1013*	29.25
Total	3462	

*of which 90 removed in 2022.



Figure 4. Failing pile – hollowing (104-E)



Figure 5. Failing pile – necking (148-L)

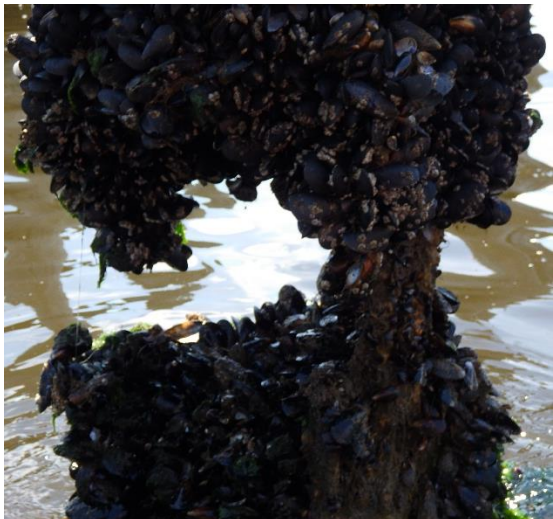


Figure 6. Failing pile – hollowing (165-E)



Figure 7. Failing pile – hollowing (168-W)

4 Recommendations

The following is recommended:

1. Removal of failing piles
 - Programmed work (within the next 2 years)
 - i. 154 piles identified
 - Programmed work (yearly from 2025)
 - i. 31 piles (estimated)
2. Programmed risk-based pile survey (every 1-2 years)
 - 3,462 piles total

Appendices

A. Results spreadsheet