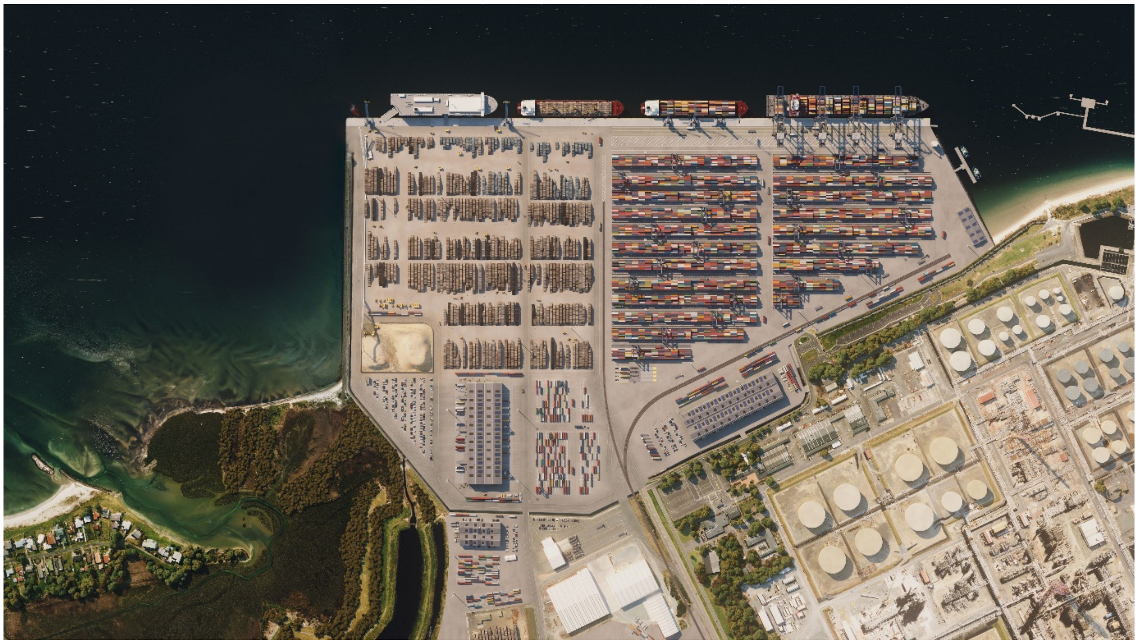
# Appendix 18

## Design Report

# Northport Eastern Extension (Berth 5)

2022-08-01



## Concept Design Report

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*Document Details:*

Date: 01 August 2022
Reference: 6-DV652.00
Status: Final
Revision: C

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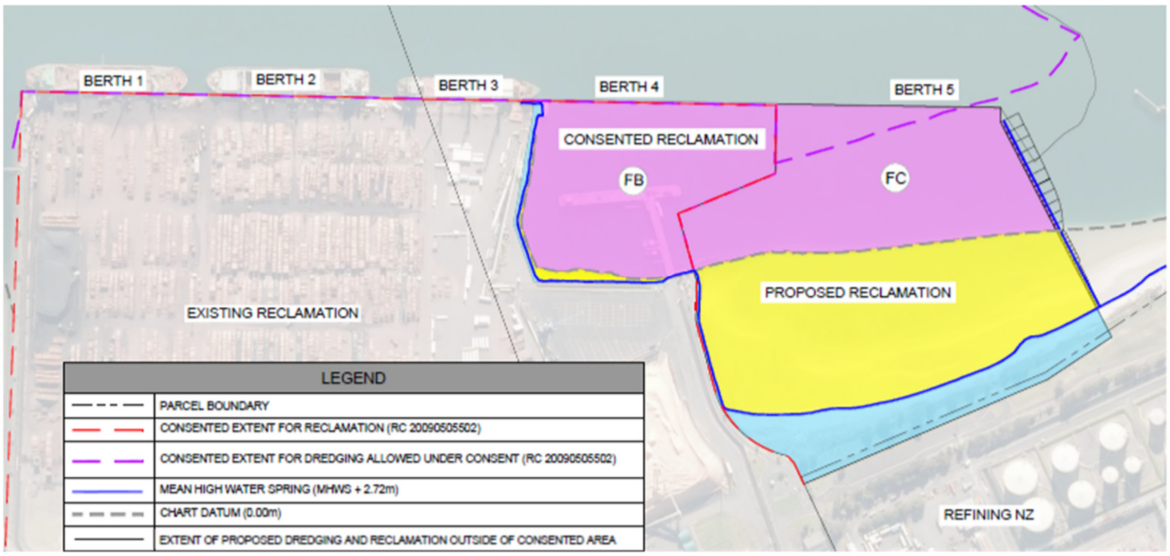
# Contents

# Executive Summary

The objective of this report is to support an application for the consenting of a new berth [Berth 5] to the east of the Northport wharf infrastructure. Berth 5 will be adjacent to the proposed 270m berth extension (Berth 4). Berth 4 has an existing resource consent but has yet to be built.

The proposal provides for a 250m wharf and container berth to the east of the existing 570m of berth 1-3 frontage and 270m for the future Berth 4 as shown in the figure below.




The features of the proposed berth 5 are:

- The container yard is located to the east and immediately adjacent to the existing Northport wharf frontage.
- The wharf design accommodates Super Post Panamax twin-lift or Super Post Panamax tandem-lift ship to shore container cranes (plus hatch platforms).
- Berth 5 frontage is formed as a marginal wharf using concrete filled steel tube piles supporting a suspended concrete deck, the front of the wharf will include fenders.
- The area behind Berth 5 will be reclaimed using excess dredged material from the proposed turning basin and, combined with the already consented reclamation behind Berth 4, will provide approximately 16Ha of paved hardstanding.
- Provide approximately 230m length of rock revetment on the eastern edge of the reclamation to contain the hardstand.
- Bollards will be located along the wharf face along with flush mounted shore bollards located in the backlands.
- All stormwater is retained within the hardstand and will be treated prior to dischargevia the existing Northport stormwater management system.
- The container yard will require services including wastewater, potable water, fire protection, power and general yard lighting.

The proposed structural form has the inherent ability to cope with earthquake induced displacements.

From the geotechnical information available the key parameters are:

- The low end-bearing capacity of the soils to depth
- Vertical loads will be resisted primarily by skin friction.
- Piles will need a significant embedment length to achieve the design load demands

- Open-end piles are proposed
- The reclaimed sand fill will require ground improvement.

Typical ground improvement methods include the following:

1. Deep soil mixing (ground solidified using lime, cement or bitumen introduced into soil mass through rotating in-place mixer)

2. Stone columns (Ground densification by vibration and displacement with gravel to form columns)

3. Vibro-compaction (Ground densification by vibration with a vibroflot hung from a crane)

The proposed structural form of the new Berth 5 wharf is an open piled marginal wharf structure with 914mm diameter piles. The piles are at typical 6m spacing to the main wharf area and arranged in pairs at 6m spacing under the seaward crane rails and at 3m centres under the landward crane rails.

The construction period is approximately 3 ½ years including 9 months for dredging (for reclamation including filter layers), followed by 2 years of pile installation.

# 1 Introduction

Northport has developed a concept design for a container terminal including wharf structures capable of supporting selected ship to shore container cranes and associated infrastructure. The concept design proposal includes a structural form for the wharf and indicative pile sizes and depths. Whilst the actual structural form may change through a detailed design process, the structure presented here is a likely outcome and provides a good basis for related effects assessments by others.

User Requirements for the facility have been provided to WSP by Northport. The user requirements are presented in section 3 of this report.

# 2 Scope of Engineering Report

The scope of this engagement is to complete a high-level concept design suitable for resource consent.

Specifically, the workstream undertaken by WSP for the resource consent application is:

- Concept design of the civils/ marine infrastructure needed for the facilitation and operation of the proposed container terminal
- Concept design construction methodology and indicative works programme.

It should be noted that this phase of the work only covers the development of a proposed concept design for this facility sufficient for related effects assessments by others. It does not constitute a preliminary design.

# 3 User Requirements

Stakeholder User Requirements for the container terminal have been provided to WSP by Northport through a number of engagement meetings and are summarised below.

## 3.1 High-level overview of reclamation

- The dredge material used for the proposed reclamation will be harvested as part of the facility construction. Imported fill (sand and hardfill) may also be used to form the reclamation.
- Dredge material will require densification to render it suitable for support of typical container storage yard operational load demands.

## 3.2 Dredging

The dredging extents and volumes are provided by others.

## 3.3 Berth (and immediate surroundings) requirements

The layout of berths and dimensions along the proposed reclamation is to be as follows:

- The proposed design berth depth along berths 4 and 5 is to -16 m CD. This allows for dredging tolerances and siltation build-up.
- While it is possible that the full berth pocket depth is not required in the initial service, the construction of the new wharf will limit access under the wharf to construct the revetment slope. This means that the full dredge depth is required to at least the toe of the revetment during the initial construction phase to enable the revetment to be completed before the wharf deck is constructed.

### 3.4 STS Cranes, wharf and backlands

- Wharf 4 and 5 will support the STS gantry cranes. The concept design allows for the following:
  - Liebherr Super Post-Panamax twin lift crane
  - Liebherr Super Post-Panamax tandem lift crane
  - Hatch platform positioned on the landside crane legs.
- The fendering and bollards are to be designed for an indicative design vessel of approximate capacity 9000 TEU.
- The heavy-duty pavement is required to support loadings for the operational loads in the container terminal.

### 3.5 Importance Level

Northport have advised that the proposed Berth 5 wharf concept design is to be based on Importance Level 3 (no post-disaster functionality) with a 50-year design life.

# 4 Inputs from other Sources

This concept design has progressed based on information from Northport regarding the berth pocket depth, sediment transport and existing geotechnical information from the port. If changes to vessels or vessel draft occurs or updated information as a result of additional geotechnical and hydrodynamic investigations is provided, some of the concept design may need to be amended.

The concept design described in this report is appropriate for the berth pocket, sediment transport and geotechnical information that has been provided to date.

# 5 Concept Design Methodology

The design methodology adopted was:

1. Collect and assess the Stakeholder User Requirements and proposed layout to develop design loadings.
2. Agree on the adoption of the Importance Levels.
3. Assimilate the existing port wide geotechnical information and site-specific investigation results.
4. Review and where appropriate incorporate previous Northport wharf designs for re-use for the new wharf; this includes an assessment of the seismic liquefaction, and any construction issues specific to this site.
5. Develop a proposed concept design solution to meet the Stakeholder User Requirements, with a focus on buildability and construction methodology.
6. Develop an indicative construction programme including identification of risks and opportunities.
7. Identify where further work may be required in the following stages.

# 6 Seismic Considerations

The seismic design for the proposed Berth 5 is focused on the ability of the wharf structures to sustain the design levels of shaking with an acceptable level of damage.

Investigations suggest that at the design levels of seismic shaking, some liquefaction of the upper layers of the seabed and reclamation fill that is deposited through a water column may be experienced, and that some densification and improvement of these layers will be required as part of this project. It is expected that this would likely require only modest ground improvement, for example stone columns.

# 7 Preliminary Geotechnical Analysis

The existing investigations for Berths 1, 2, and 3 indicate that sands would be the predominate material encountered at berths 4 and 5 with isolated silty sand and clayey sand layers.

The general observations from the available borelogs and the Tonkin + Taylor dynamic load test data from Berth 3 suggests the subsurface is variable with no clearly defined bearing stratum. Therefore, the pile capacity will be derived mostly from side resistance through the sands rather than end bearing.

Based on the crane loads, an approximate 3m pile spacing has been considered for the landward and seaward piles supporting the crane rails. The seaward piles are the most critical, with the landward piles having higher overburden, however it is recommended that all piles should be driven to the same depth and consequently for this concept design the piles are shown driven to the same depth.

The selected pile solution is 914 mm diameter steel tubes to be driven open ended so as to minimise driving noise and vibration. The following table shows target driving depths and capacities based on the assumption that 25 percent of piles will be subject to dynamic load testing after installation.

Summary of pile sizing and depths for the two crane types:

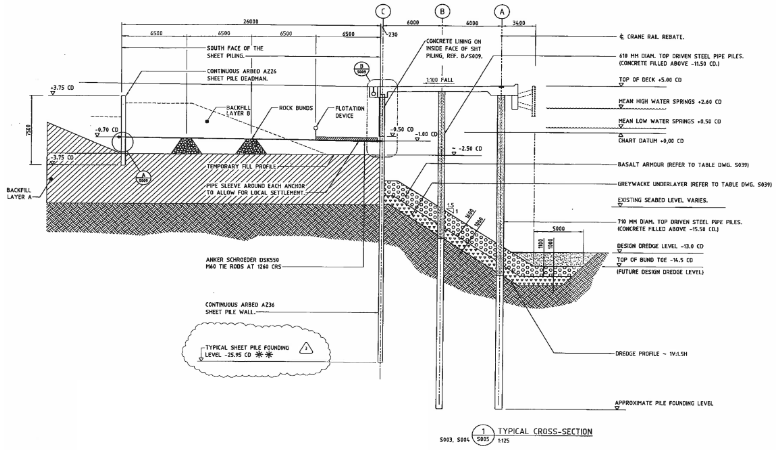
| Crane | Pile Axial demand | Pile selected | Drive depth |
|---|---|---|---|
| Super Post Panamax tandem-lift | 4350 kN | 914OD open-ended | -50m CD |
| Super Post Panamax twin-lift | 3600 kN | 914OD open-ended | -44m CD |

# 8 Design Options and Proposed Concept Design Solution

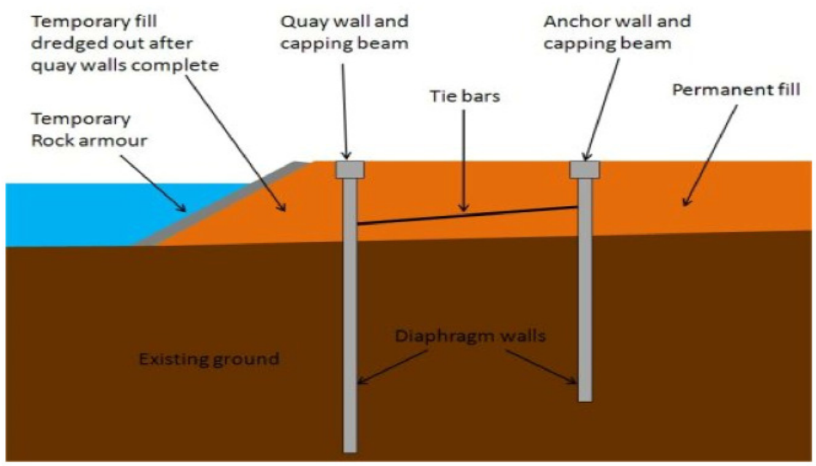
## 8.1 Options Considered

While several possible options exist for the structural form of the wharves, only one option was developed for the concept design on the basis that the chosen marginal wharf option has the best overall outcome when assessed against the selection criteria considered in Section 8.2. The options that were considered are shown below:

- “hybrid” wharves similar to Berths 1 and 2



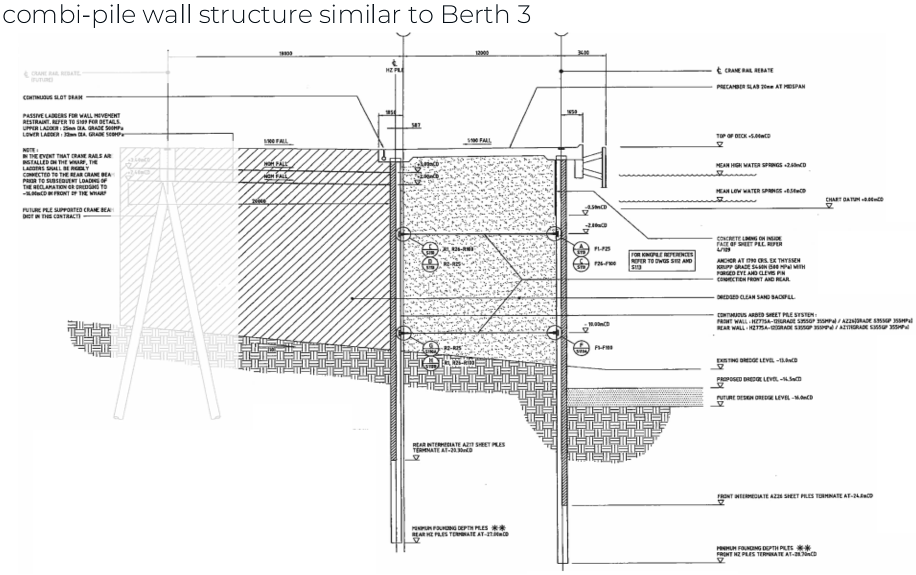

- Diaphragm wall with tieback anchors



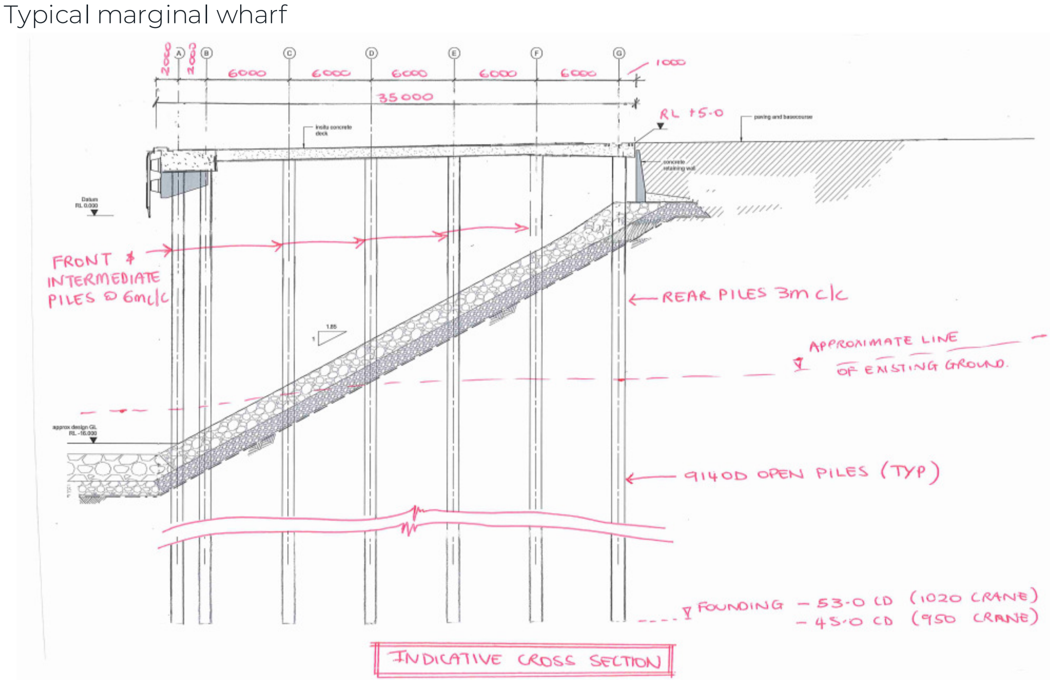

- Interlocking circular caissons gravel or sand filled

- Single combi-pile wall with tieback anchors


- Twin combi-pile wall structure similar to Berth 3



- Typical marginal wharf



## 8.2 Selection Criteria

Several criteria were considered when arriving at a proposed concept design solution. These included:

- Large axial load demands arising from crane loading.
- Structural form to offer displacement capacity, resilience and post seismic event functionality
- An acceptable programme and a limited period of exposure to construction noise with a focus on driving resistance and pile type.
- The ability to select the construction form and methodology to manage environmental, social and cultural considerations while also targeting construction cost optimisation.
- Workable construction sequencing including use of floating platforms and divers
- The benefits of repurposing the dredged fill from the vessel turning area into the reclamation
- The availability of rock/gravel from nearby quarries and optimising use of construction materials
- Consideration of contractor capability including labour and plant required
- The extent of ground improvement required
- Optimising materials required

Based on the above criteria an open piled marginal wharf with rock revetment was the chosen option for the following reasons:

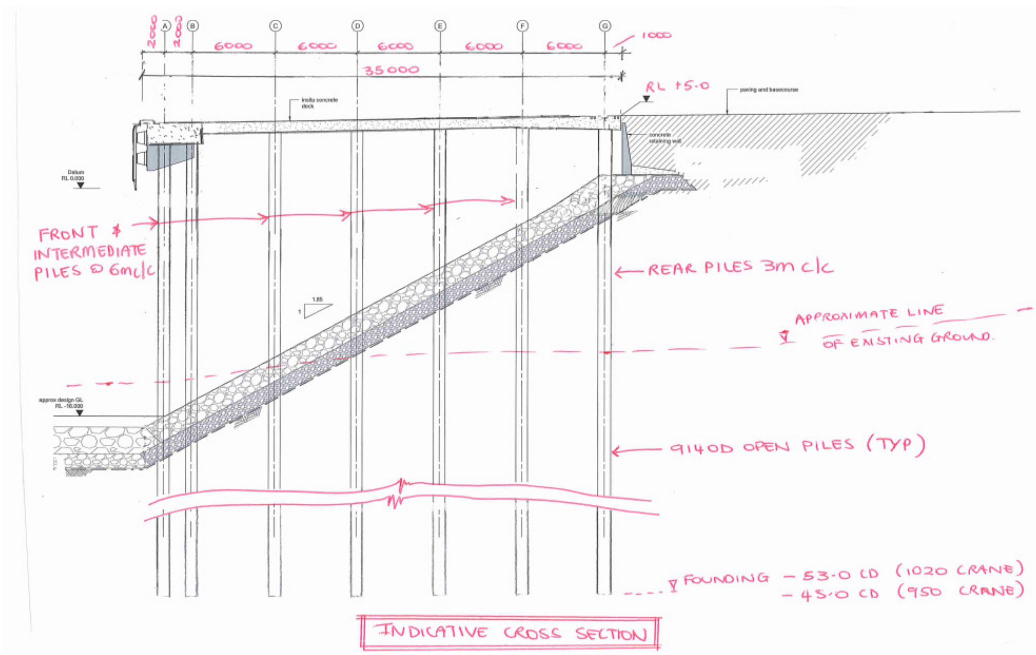
1. The hybrid wharf would result in two legs of the container crane being supported on the piled portion of the wharf and two legs being supported on the backfilled backlands. This not only has a day-to-day operational risk if the landward crane rail settles relative to the seaward crane rail, but the piled portion will respond differently during seismic events than the backfilled portion resulting in differential movement damage to the wharf and increase in rail gauge as tie rods to the landward rail stretch under load. Higher levels of damage and longer operational outage times would be required compared to the marginal piled wharf option. The hybrid wharf option has therefore been discounted.
2. The diaphragm wall with tie backs has less deformation capacity in seismic events compared to a piled marginal wharf and would therefore require more extensive, and expensive, ground improvement to achieve the required level of seismic performance. Rail gauge will be more readily compromised. Repair of the diaphragm wall option will be more challenging than the marginal piled wharf option with a higher risk that the diaphragm wall option would need to be demolished and rebuilt following a major seismic event. The diaphragm wall with tie backs option has therefore been discounted.
3. The interlocking circular caissons with gravel or sand infill are expensive. With the added pricing volatility that exists for steel in the global market at present the potential for cost increases is significant. Therefore, this option has been discounted.
4. The single combi-pile wall with tie back option has been discounted due to the significant and expensive ground improvement that would be required to the reclamation to enable this option to achieve the seismic performance requirements. Rail gauge will be more readily compromised.
5. The twin combi-pile wall structure has similar issues as the hybrid option discussed above. The landward and seaward crane legs would be supported on structural systems that would respond differently in a seismic event. Rail gauge would be more readily compromised. The outage times following a seismic event are expected to be considerably longer with more expensive repairs compared to a marginal piled wharf solution. Therefore, this option has been discounted.

6. The marginal piled wharf option would provide the best outcome when assessed against the selection criteria compared to the other options considered, refer to Section 8.3 for further discussion.

## 8.3 Proposed Concept Design

For the purposes of the consent process, an open piled marginal wharf with rock revetment together with a rock revetment to the east has been selected for concept design for Berth 5. The final design will be confirmed in future design phases .

To support the large axial loads on the wharf and achieve the required seismic performance the piles will need to be concrete filled circular steel piles. Screw piles do not have the required axial or lateral load capacity that will be required for this wharf.




Berth 5 – An open piled marginal wharf with rock revetment cross section

The benefits of the proposed concept design solution are:

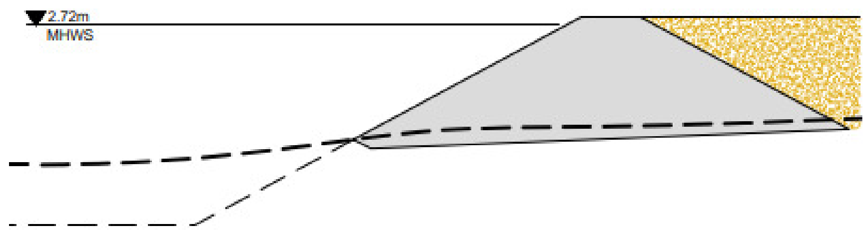
- Provides the structural and geotechnical capacity to support the crane demands
- Has displacement capacity to offer post seismic event functionality
- The geometry can be adjusted to respond to minor changes in User Requirements without necessitating a complete change in construction form.
- A bulkhead structure can be constructed on the corner to tie into the intersecting rock revetment.
- Durability requirements can be readily addressed using proven technologies
- Provides for a large load capacity concrete deck without significant settlement concerns.
- Has very simple construction procedure
- Ground improvement is expected to be straight forward. There is flexibility in the selection of a ground improvement technique.

Indicative drawings of the proposed concept design for Berth 5 are included in Appendix B.

# 9 Proposed Construction Methodology

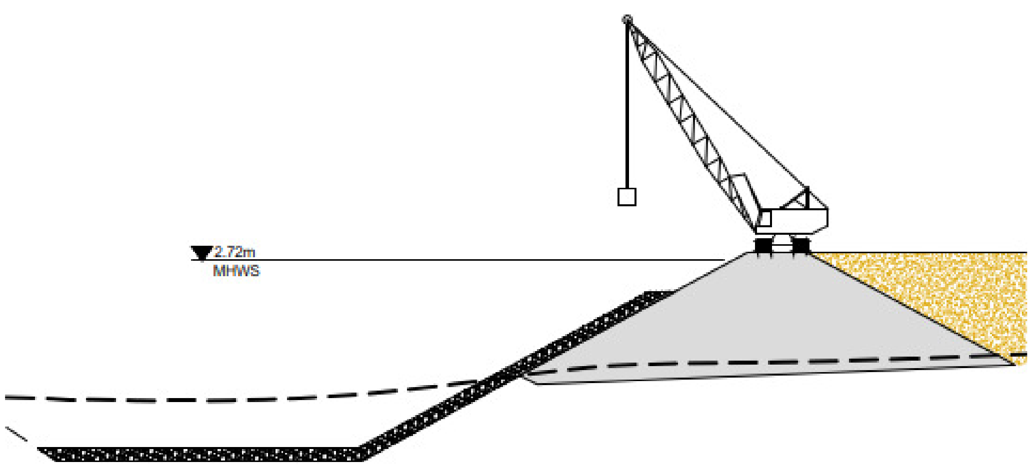
A summary of an effective construction methodology is presented. Although dredging is beyond the scope of this report, the dredging component has been included in the methodology below:

1. Construct the reclamation assuming that fill will come from other dredging works:
    a. Create temporary containment & dewatering bunds/ponds on land at water's edge
    b. Pump dredgings directly from dredger via floating delivery pipes into ponds
    c. Allow wet sand to dewater within the ponds
    d. Install floating silt curtains around the reclamation zone
    e. Doze dewatered sands from ponds into harbour within the silt curtained area
    f. Progressively build new containment ponds on top of reclaimed area and fill with dredgings
    g. Repeat steps a – f until reclamation is complete
    h. Undertake ground improvement of reclamation



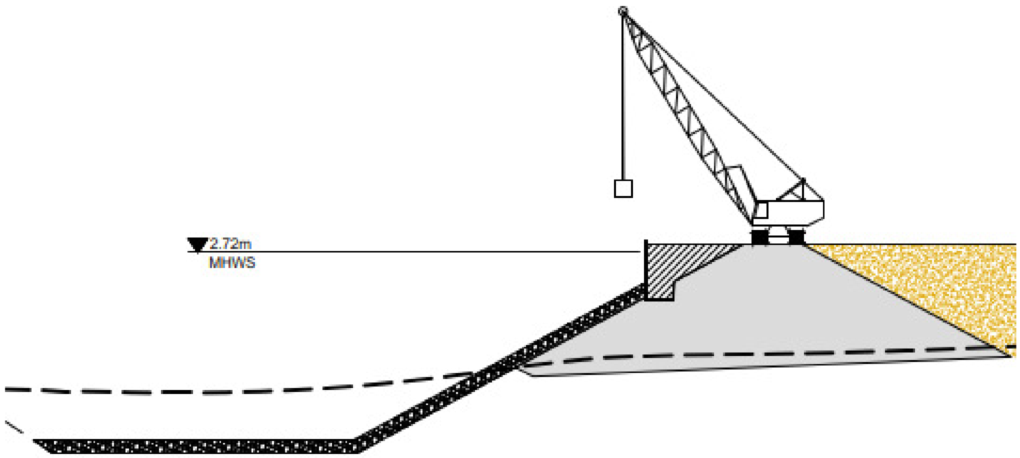

*Commencement – bund and reclamation with ground improvement in place*

2. Shape edge of reclamation and trim back to design slope
3. Line with rock filter layers – do not place rip rap if possible (consider scour from tidal currents) until after piling is completed



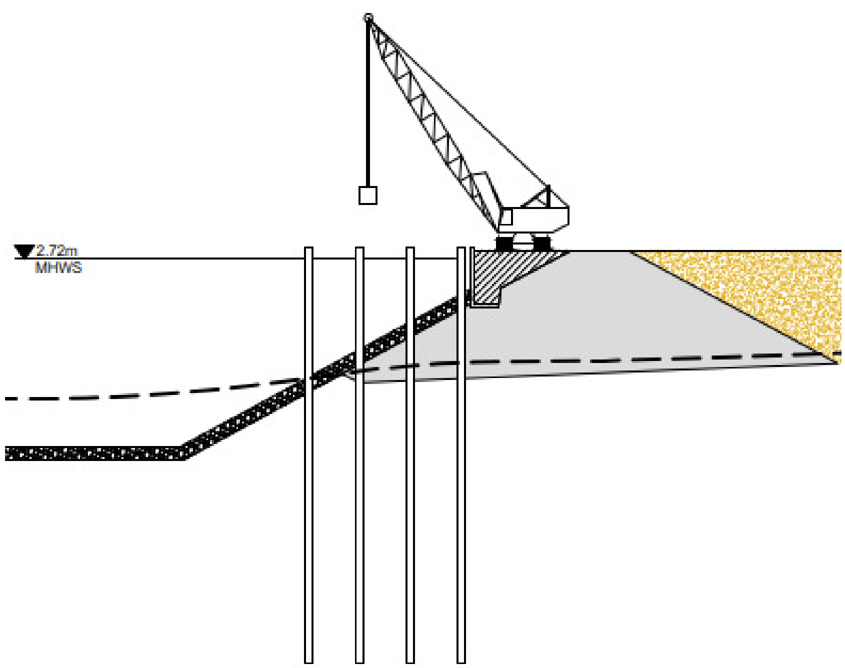

*Shape reclamation & line with rock filter layers*

4. Construct concrete retaining wall including any temporary works required to support the construction crane
5. Backfill behind retaining wall with stockpiled dredgings
6. Construct a crane working platform behind the retaining wall



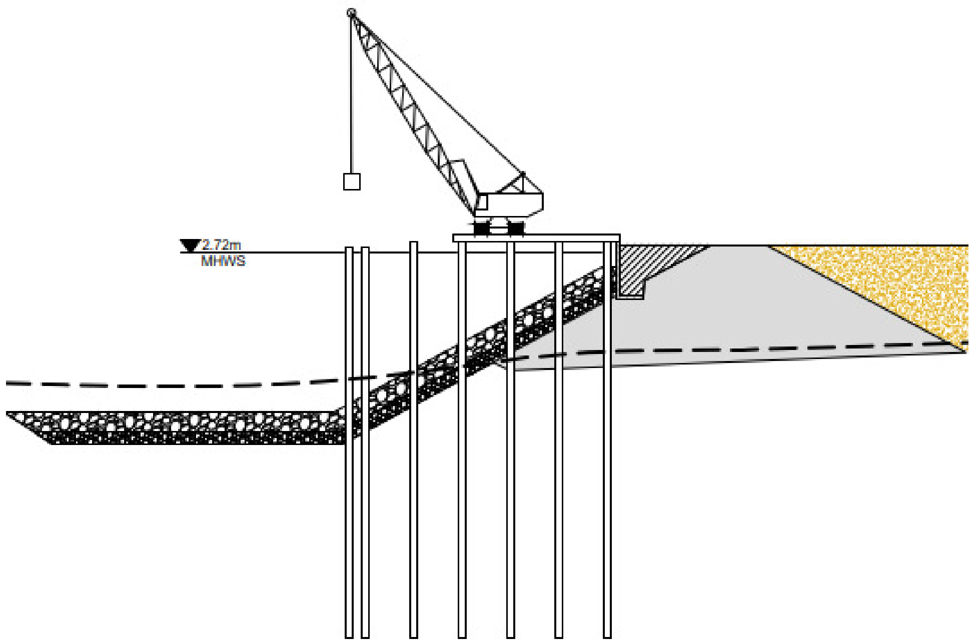

*Retaining wall and crane working platform behind retaining wall*

7. Fabricate a 14-pile gate (2 bays) and install on temporary piles
8. Pre-weld diameter 914mmOD piles into 36m (16 tons) and 24m (11 tons) lengths in welding yard on site.
9. If the rip rap is already placed, weld a 1m long "stinger" with a backing plate onto the leading end of the piles leaving at least 50% of the casing mouth open. If there is no rip rap, it should be possible to drive the piles through the filter layers with no stinger.
10. Pitch 36m long piles with the 750-ton crawler crane (or 280-ton service crane – capacity 16 ton at 40m) into gate
11. Commence pile driving with vibrohammer until penetration is slowed, then change to hydraulic impact hammer
12. Place S280 hydrohammer (30 ton) on piles with 750-ton crane.
13. Drive piles to top of gate
14. Pitch 24m length and splice weld extension to create 60m pile length
15. Drive piles to final depth and set.



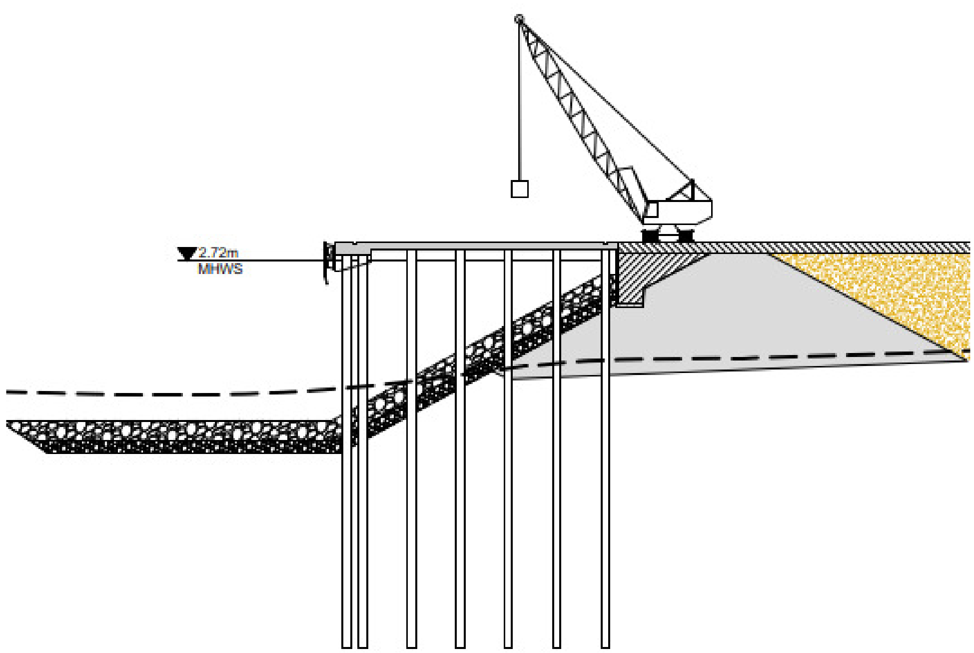

*Drive piles*

16. Extract and advance piling gate to next bays
17. Empty material from inside the pile shafts to design depth with fly-drill suspended from either of the cranes
18. Place reinforcing and concrete pile shafts as required
19. Repeat steps 10-18 until all piles are completed




*Complete piling including empty piles and place reinforcement and concrete in pile shaft*

20. Place rip rap with long reach digger (or crane and grab) between piles
21. Construct wharf deck in situ in 2 bay pours as piling progresses ahead
22. Install wharf furnishings (fenders, bollards etc) and services
23. Complete backland works




*Place rip rap, construct wharf deck, complete backland works and deck furniture*

Notes.

1. This is one method of construction – considered to be the shortest construction programme.
2. It would also be possible to construct the wharf off temporary staging using smaller cranes – this would be a longer construction programme than described above.
3. It is also possible to work off water-based equipment – this would be slower than either option above and is more subject to weather induced downtime etc.

# 10 Construction Plant

The following plant are provided by Noel Band of Construction Logic based on how a New Zealand marine contractor may undertake the work to construct the whole project. It is possible that a contractor may devise a different construction methodology and use different plant, however the methodology and plant suggested below is based on the construction plant and construction methodology used to construct the new wharf structures at Lyttelton and Napier in the last 5 to 10 years. It is therefore considered that whilst the plant and methodology may be modified by the contractors it is expected that the chosen plant and methodology will largely be similar to what is provided below and therefore the effects likely to be similar.

Vibro hammer technology has developed significantly in recent years. The 14 – 20 tonne vibro hammer included in the plant below is now available in New Zealand and significantly reduces the time required for impact hammering as the piles can be advanced significantly deeper into the sediments with the larger Vibro-hammer.

Reclamation from dredging harbour basin

- Cutter suction dredger (or backhoe dredger)
- Floating delivery pipes
- Service craft
- Diggers
- Dozer
- Trailer suction plant

Piling

- 750-ton crawler crane (capacity 30 ton @ 52m)
- 150/280-ton service crane x 2# (1 at workface + 1 in welding yard)
- IHC S280 hydraulic hammer (or similar) (hammer weight is 30 ton)
- 14 - 20-ton Vibrohammer
- 5-ton Vibrohammer (gate piles install + extract)
- Flydrill
- Various smaller service plant items e.g. digger + dumpers (pile spoil removal), concrete pump, welding machines, tractor/trailer, rescue/workboat/s etc

Wharf construction

- Large (e.g. 125 ton) long reach digger (placing rip rap) or crane grab
- 280-ton crane

Backlands (including services + paving)

- Diggers
- Graders
- Rollers
- Asphalt pavers

Temporary works items

- Piling gate
- Deck formwork sets

# 11 Cycle Times & Indicative Construction Programme

The following assumptions have been made to consider the likely cycle times and to develop the indicative construction programme in Appendix A:

- Reclamation material will be gained from harbour dredgings
- Dredging works progress @ 5000$m^3$/day
- Dredge volume is approximately 1.7 million $m^3$
- No consolidation period needed for reclamation
- Northport will award 2 separate contracts for dredging/reclamation works and wharf construction

Cycle times for one piling rig (note that the contractor may elect to use 2 rigs)

Pile duration – average 10 -12 hours/pile (using a 14-pile gate)
Vibro + Hammering duration/pile - 4 hours/pile

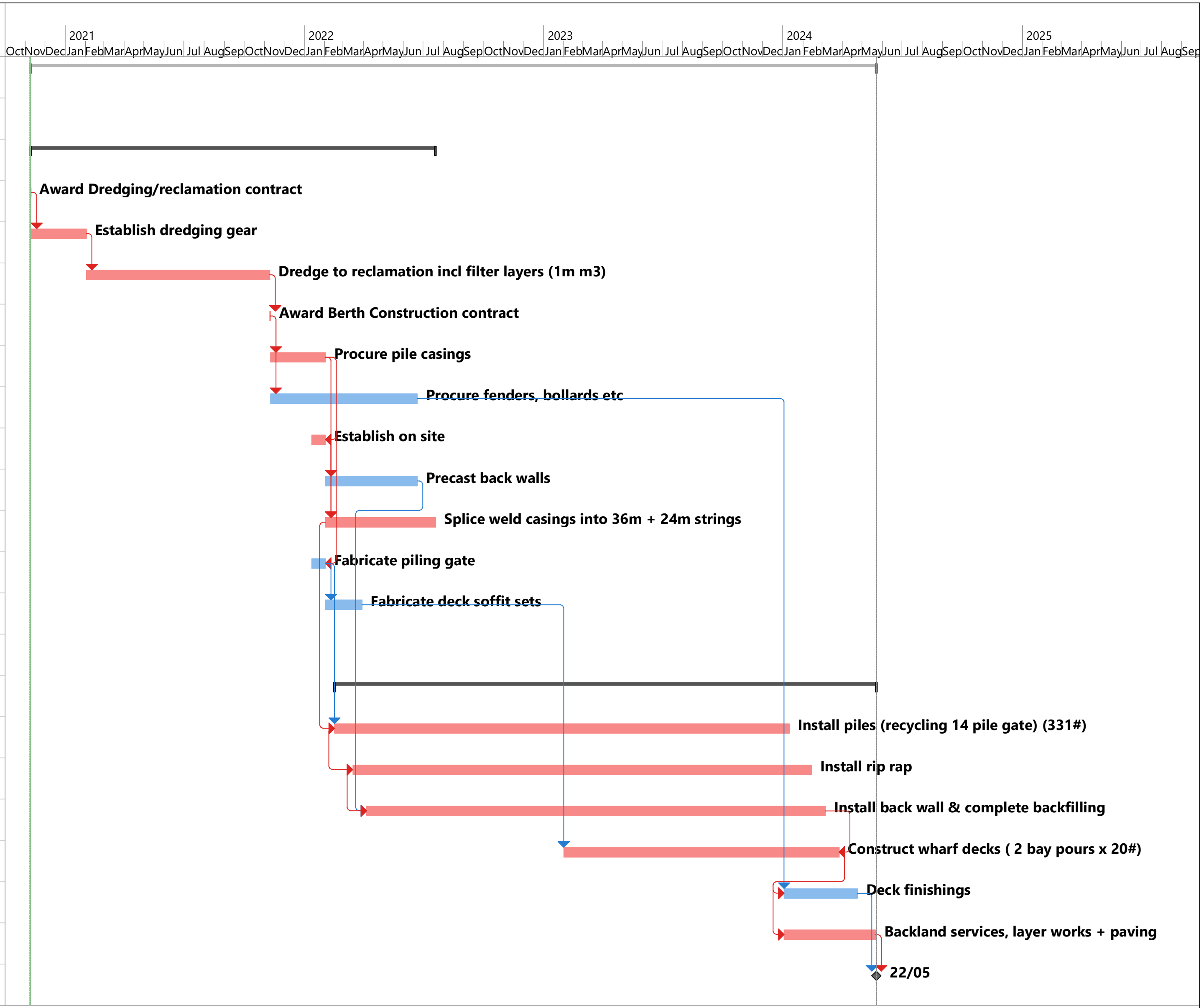
Programme
The Construction activity programme is approximately 3 ½ years in duration:

- Dredging/reclamation contract – approximately 12 months, which includes 3 months of establishment by the contractor prior to the dredging works commencing.
- Berth construction works – approximately 28 months (with 1 piling spread). Of this approximately 24 months would have some piling activity.
- If a second piling spread is deployed, construction time could be roughly halved, (noting that single rip rap placing, and deck construction spreads are likely to be able to keep pace with 2 piling spreads)
- Steel procurement will need to precede the main wharf construction activity as the casings will be required as soon as the reclamation is formed.
- A second piling set-up could feasibly halve the duration of the piling operation.

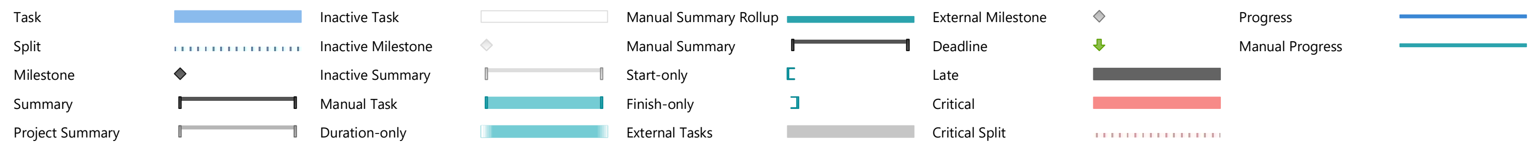
# Appendix A

## Indicative Construction Programme

| ID | Task Name | Duration |
|---|---|---|
| 0 | **Northport Berth 5 Program Rev 0 - 071120** | **923 days** |
| 1 | | |
| 2 | **Preliminaries** | **442 days** |
| 3 | Award Dredging/reclamation contract | 1 day |
| 4 | Establish dredging gear | 3 mons |
| 5 | Dredge to reclamation incl filter layers (1m m3) | 200 days |
| 6 | Award Berth Construction contract | 1 day |
| 7 | Procure pile casings | 3 mons |
| 8 | Procure fenders, bollards etc | 8 mons |
| 9 | Establish on site | 3 wks |
| 10 | Precast back walls | 5 mons |
| 11 | Splice weld casings into 36m + 24m strings | 120 days |
| 12 | Fabricate piling gate | 15 days |
| 13 | Fabricate deck soffit sets | 8 wks |
| 14 | | |
| 15 | **Berth Construction** | **591 days** |
| 16 | Install piles (recycling 14 pile gate) (331#) | 496 days |
| 17 | Install rip rap | 500 days |
| 18 | Install back wall & complete backfilling | 500 days |
| 19 | Construct wharf decks ( 2 bay pours x 20#) | 300 days |
| 20 | Deck finishings | 4 mons |
| 21 | Backland services, layer works + paving | 5 mons |
| 22 | Commission wharf | 1 day |

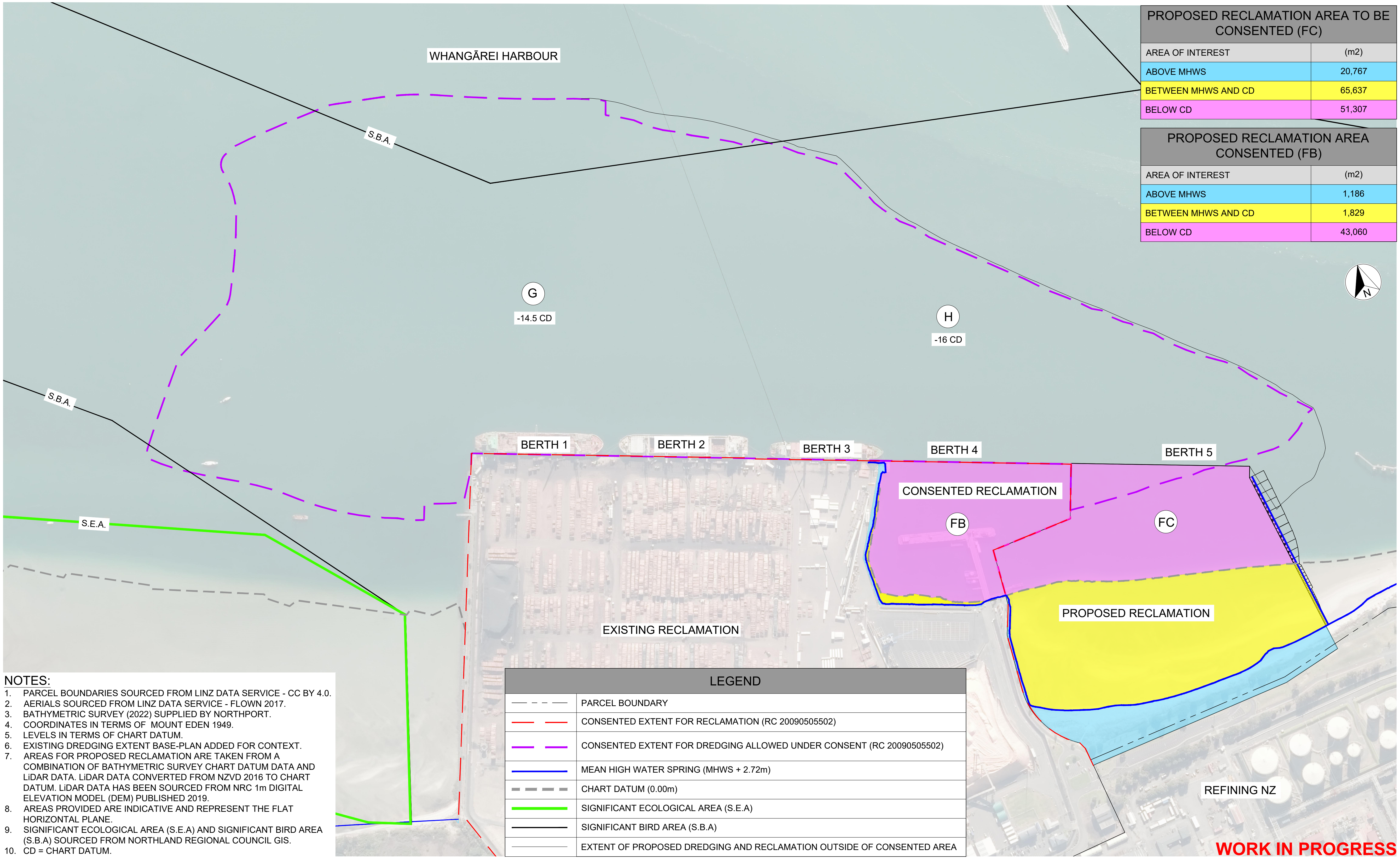



Project: Northport Berth 5 Prog
Date: Mon 9/11/20



# Appendix B

## Concept Drawings




| PROPOSED RECLAMATION AREA TO BE CONSENTED (FC) | |
|---|---|
| AREA OF INTEREST | (m2) |
| ABOVE MHWS | 20,767 |
| BETWEEN MHWS AND CD | 65,637 |
| BELOW CD | 51,307 |

| PROPOSED RECLAMATION AREA CONSENTED (FB) | |
|---|---|
| AREA OF INTEREST | (m2) |
| ABOVE MHWS | 1,186 |
| BETWEEN MHWS AND CD | 1,829 |
| BELOW CD | 43,060 |

NOTES:
1. PARCEL BOUNDARIES SOURCED FROM LINZ DATA SERVICE - CC BY 4.0.
2. AERIALS SOURCED FROM LINZ DATA SERVICE - FLOWN 2017.
3. BATHYMETRIC SURVEY (2022) SUPPLIED BY NORTHPORT.
4. COORDINATES IN TERMS OF MOUNT EDEN 1949.
5. LEVELS IN TERMS OF CHART DATUM.
6. EXISTING DREDGING EXTENT BASE-PLAN ADDED FOR CONTEXT.
7. AREAS FOR PROPOSED RECLAMATION ARE TAKEN FROM A COMBINATION OF BATHYMETRIC SURVEY CHART DATUM DATA AND LiDAR DATA. LiDAR DATA CONVERTED FROM NZVD 2016 TO CHART DATUM. LiDAR DATA HAS BEEN SOURCED FROM NRC 1m DIGITAL ELEVATION MODEL (DEM) PUBLISHED 2019.
8. AREAS PROVIDED ARE INDICATIVE AND REPRESENT THE FLAT HORIZONTAL PLANE.
9. SIGNIFICANT ECOLOGICAL AREA (S.E.A) AND SIGNIFICANT BIRD AREA (S.B.A) SOURCED FROM NORTHLAND REGIONAL COUNCIL GIS.
10. CD = CHART DATUM.

1:2500 @ A1 1:5000 @ A3 0 40 80 120 160 200 240 m

| LEGEND | |
|---|---|
| (thin grey dashed line) | PARCEL BOUNDARY |
| (red dashed line) | CONSENTED EXTENT FOR RECLAMATION (RC 20090505502) |
| (purple dashed line) | CONSENTED EXTENT FOR DREDGING ALLOWED UNDER CONSENT (RC 20090505502) |
| (blue line) | MEAN HIGH WATER SPRING (MHWS + 2.72m) |
| (thick grey dashed line) | CHART DATUM (0.00m) |
| (green line) | SIGNIFICANT ECOLOGICAL AREA (S.E.A) |
| (black line) | SIGNIFICANT BIRD AREA (S.B.A) |
| (thin grey line) | EXTENT OF PROPOSED DREDGING AND RECLAMATION OUTSIDE OF CONSENTED AREA |

**WORK IN PROGRESS**

PRINTED 1/07/2022 11:49:41 AM

| REVISION | AMENDMENT | APPROVED | DATE |
|---|---|---|---|
| A | ISSUED FOR INFORMATION | P.J.H. | 2021-08-10 |
| B | ISSUED FOR COMMENT | - | - |
| C | ISSUED FOR RESOURCE CONSENT | DTJ | 2021-11-15 |
| D | ISSUED FOR RESOURCE CONSENT | - | - |

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CIVIL

SCALES: 1:2500 AT A1, 1:5000 AT A3
ORIGINAL SIZE: A1
DRAWN: V. GILES
DESIGNED: D. CLAASSEN
APPROVED: -
DRAWING VERIFIED: -
DESIGN VERIFIED: -
APPROVED DATE: -

CONCEPT - RESOURCE CONSENT

PROJECT
NORTHPORT
RALPH TRIMMER DRIVE, MARSDEN POINT
NORTHPORT - PROPOSED RECLAMATION & DREDGING

TITLE
PROPOSED RECLAMATION AND BERTH 4 (FB) AREAS

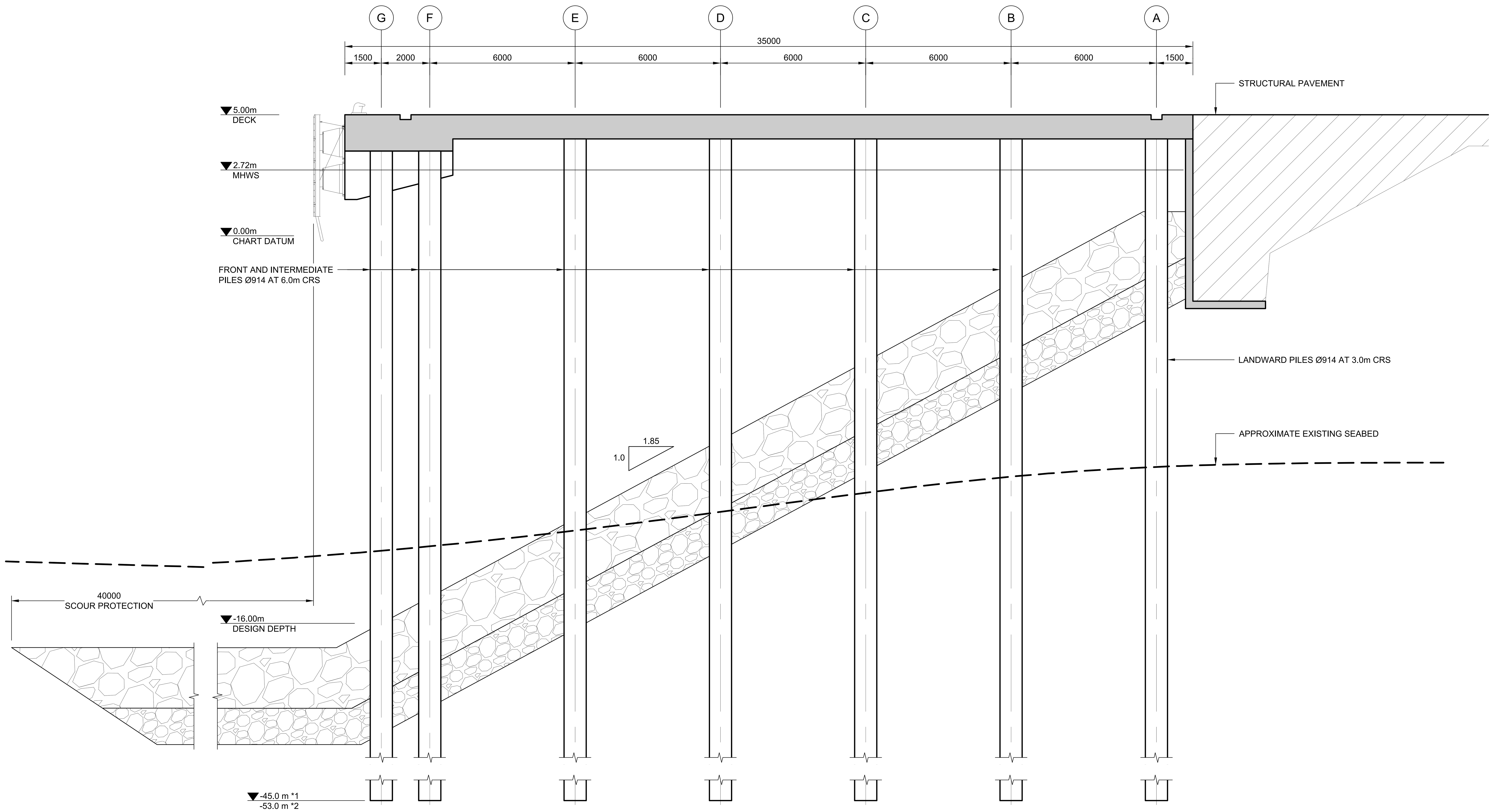
WSP PROJECT NO. (SUB-PROJECT): 1-19278.01(03)
SHEET NO.: C01
REVISION: D

Survey
Drawing
Design
Checked
Date

Original sheet size A1 (841x594) Plot Date 2022-07-01 at 11:49:41 AM u:\projectsnz\11\1-19278.00 northport ship maintenance facility\Home\200 technical\210 drawings\(C)Civil\+AutoCAD\1-19278.01 Ecologist Consent Drawings-C01.dwg C01(E)

## NOTES:

1. ALL LEVELS SHOWN TO MARSDEN POINT CHART DATUM
2. CONCEPT DESIGN TO ACCOMODATE DESIGN LOADS ASSOCIATED WITH SHIP TO SHORE CRANE OF FOLLOWING CONCEPT SPECIFICATION:
   - *1 SUPER POST PANAMAX TWIN LIFT
   - *2 SUPER POST PANAMAX TANDEM LIFT




1:100@ A1 / 1:200@ A3 — 0 1 2 3 4 5 6 7 8 9 10 m

| REVISION | AMENDMENT | APPROVED | DATE |
|---|---|---|---|
| A | ISSUED FOR CLIENT COMMENT | JMS | 2020-11-24 |
| B | ISSUED FOR CONSENT | JMS | 2020-12-14 |

Northport

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New Zealand

CIVIL - PORTS AND MARINE

SCALES: 1:100 (1:200 AT A3) — ORIGINAL SIZE: A1

| DRAWN | DESIGNED | APPROVED |
|---|---|---|
| C LOWREY | R MACNAB | G CHALMERS |
| DRAWING VERIFIED | DESIGN VERIFIED | APPROVED DATE |
| | J STANWAY | 2020-11-24 |

CONCEPT DESIGN

PROJECT: NORTHPORT MARSDEN POINT PROPOSED EXPANSION

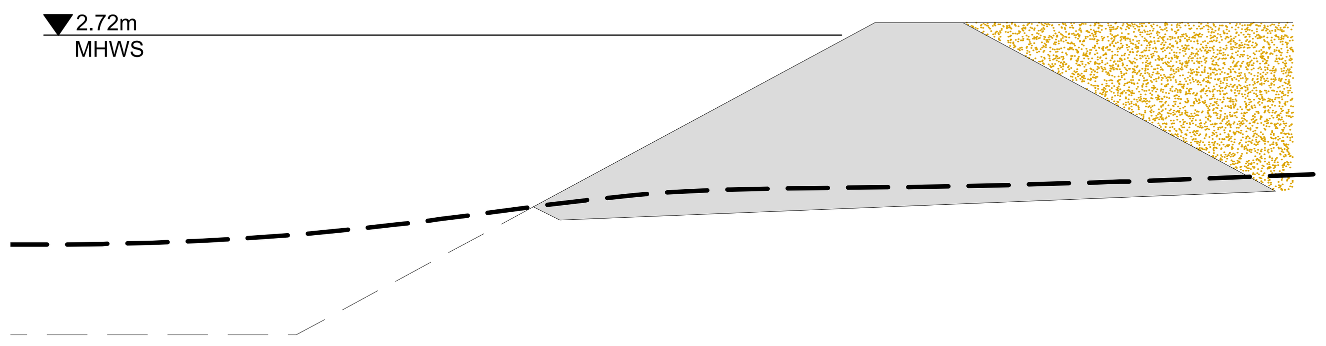
TITLE: BERTH 5 INDICATIVE CROSS SECTION

WSP PROJECT NO. (SUB-PROJECT): 6-DV652.00 — SHEET NO.: C-1301 — REVISION: B

Original sheet size A1 (841x594) Plot Date 2020-12-14 at 4:08:59 PM U:\ProjectsNZ\6d\6-DV652.00 Northport consent assistance\Home\DRAWINGS\(C) Civil\+AutoCAD\6-DV652.00_C-1301.dwg C-1301

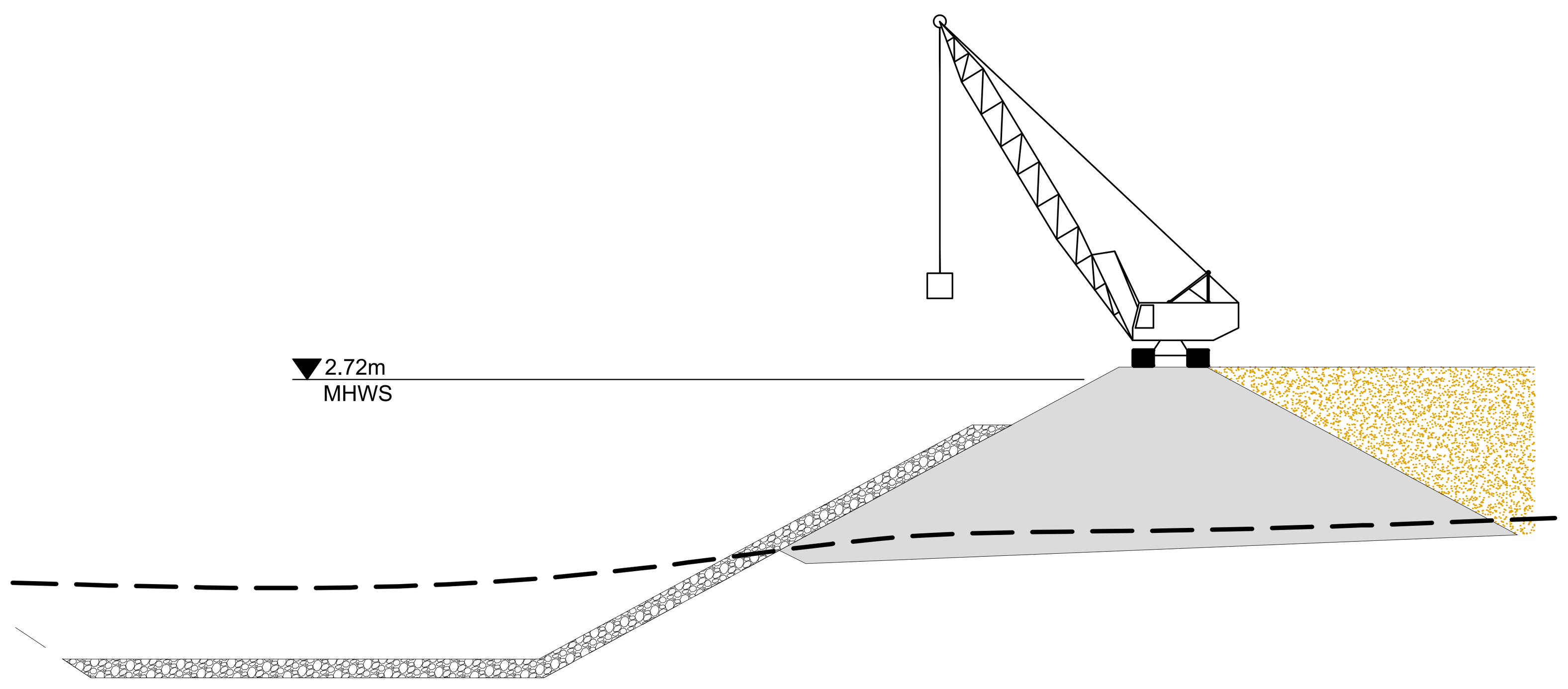
## NOTES:

1. ALL LEVELS SHOWN TO MARSDEN POINT CHART DATUM



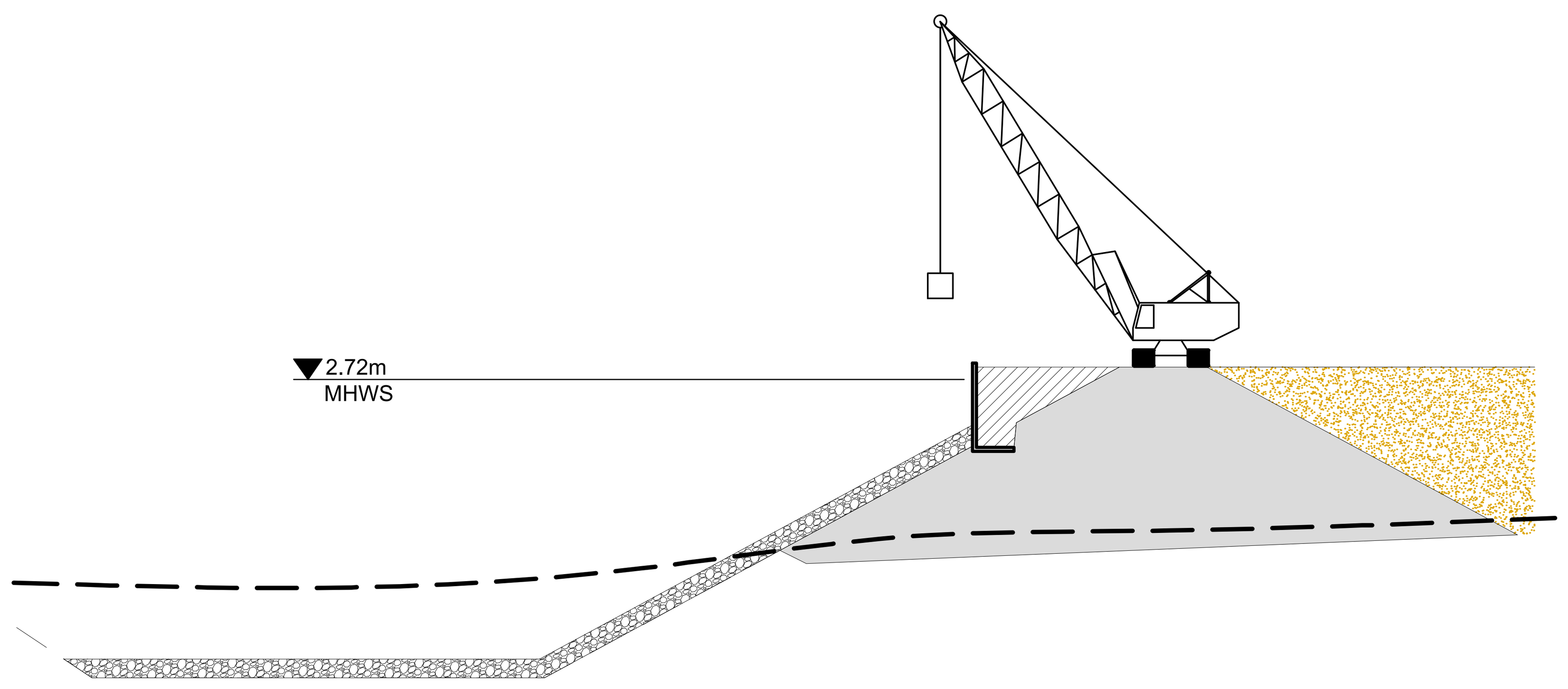

### COMMENCEMENT

- BUND AND RECLAMATION CONSTRUCTED WITH GROUND IMPROVEMENT IN PLACE



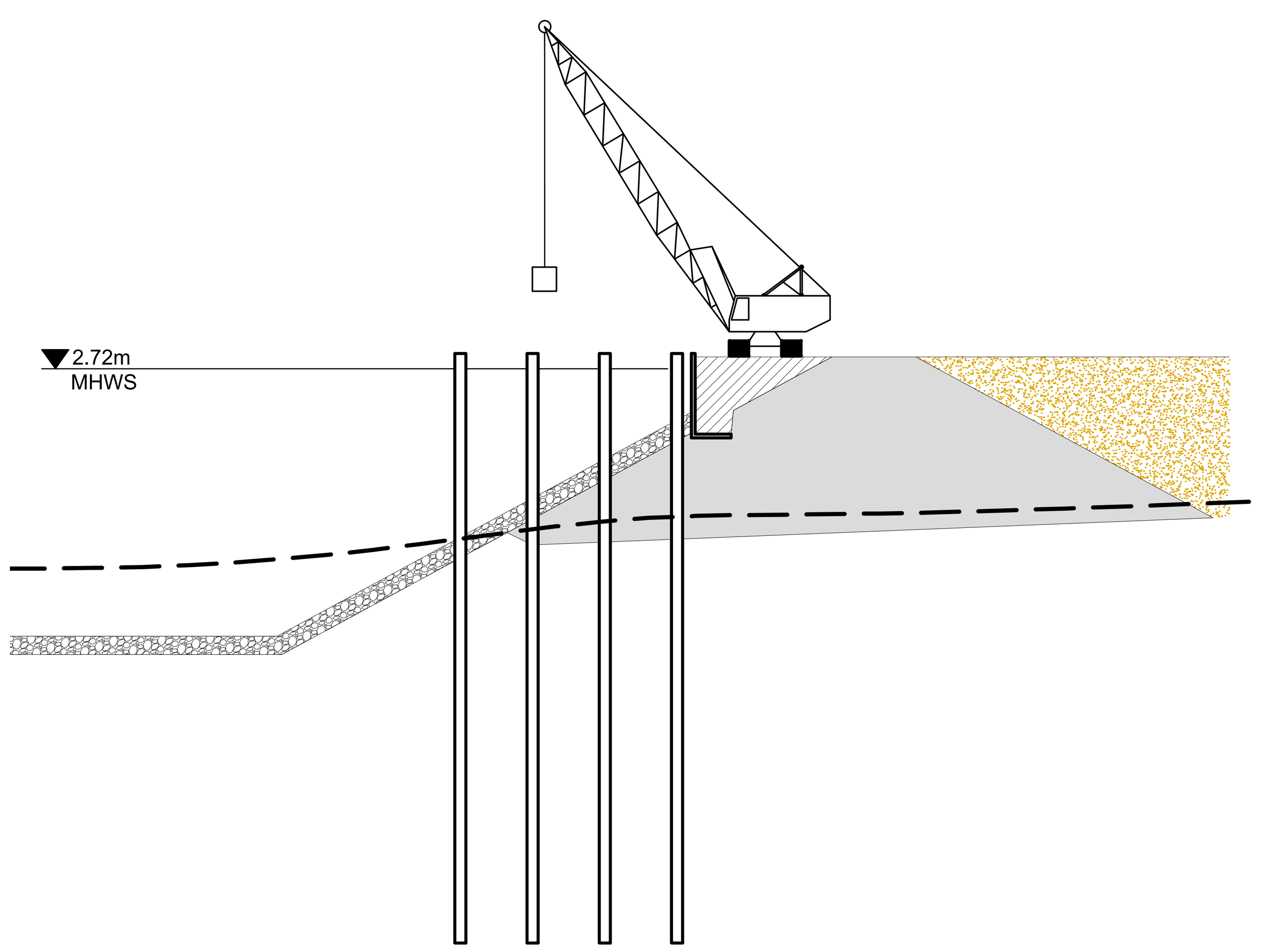

### STEP A

- SHAPE EDGE OF RECLAMATION
- LINE RECLAMATION FACE WITH ROCK FILTER LAYER



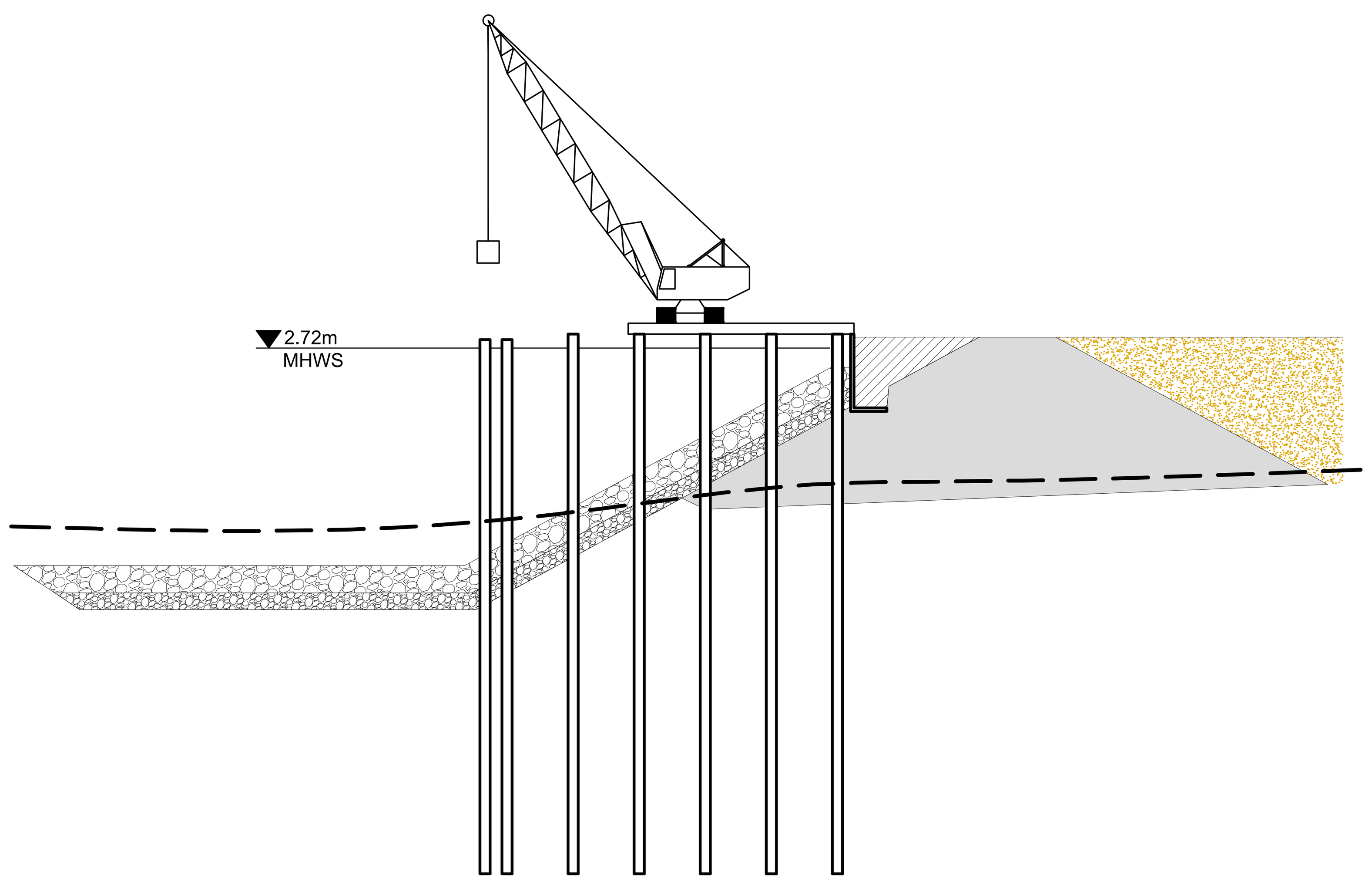

### STEP B

- CONSTRUCT RETAINING WALL AND BACKFILL



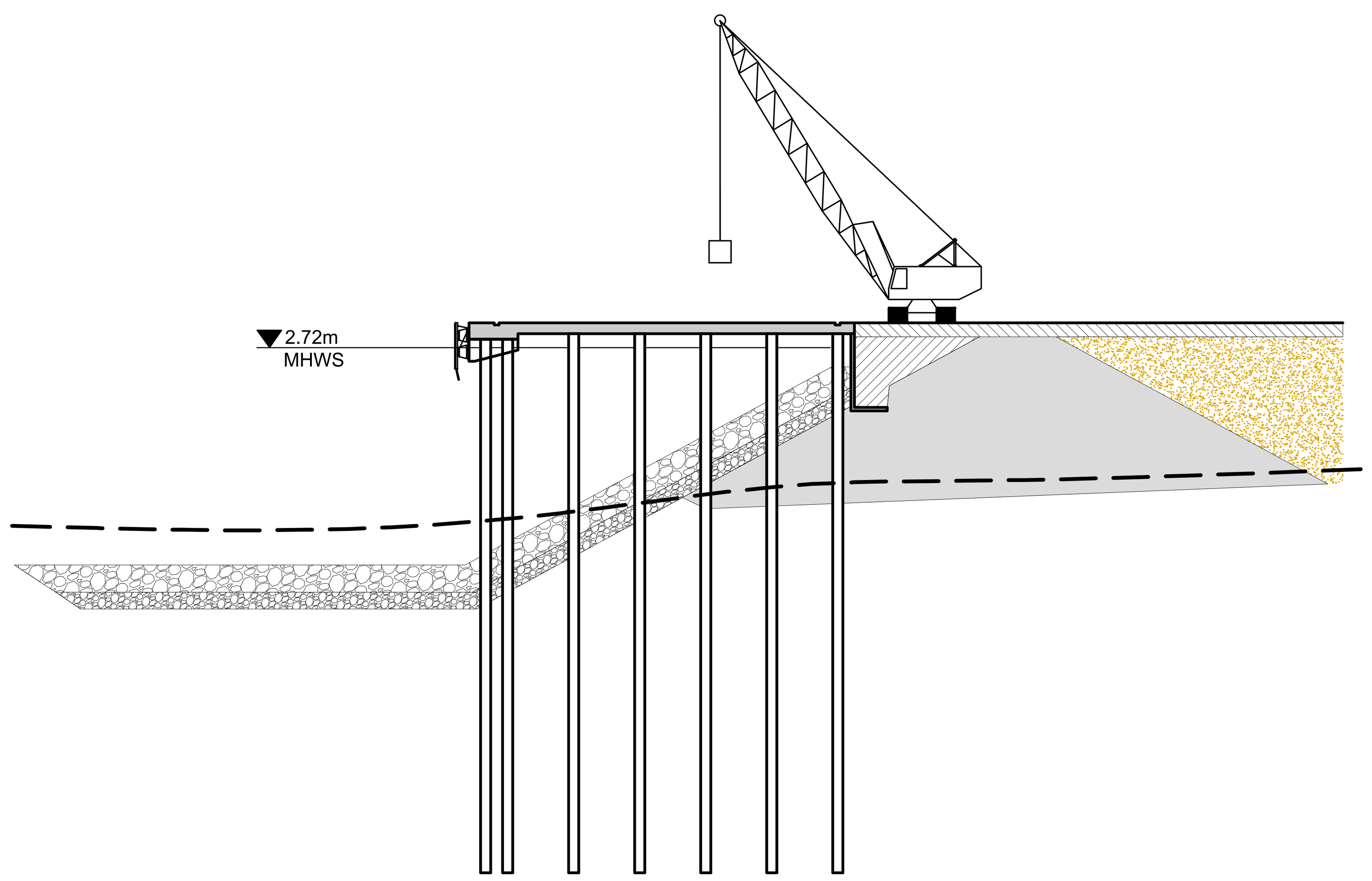

### STEP C

- INSTALL LANDWARD PILES FROM SHORE




### STEP D

- INSTALL SEAWARD PILES FROM TEMPORARY STAGING
- INSTALL ROCK ARMOUR PROTECTION




### STEP E

- CONSTRUCT WHARF DECK
- CONSTRUCT PAVEMENT

1:500@ A1
1:1000@ A3
0 5 10 15 20 25 30 35 40 45 50 m

| REVISION | AMENDMENT | APPROVED | DATE |
|---|---|---|---|
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| B | ISSUED FOR CONSENT | JMS | 2020-12-14 |

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CIVIL - PORTS AND MARINE

SCALES: 1:500 (1:1000 AT A3)
ORIGINAL SIZE: A1

| DRAWN | DESIGNED | APPROVED |
|---|---|---|
| C LOWREY | R MACNAB | G CHALMERS |
| DRAWING VERIFIED | DESIGN VERIFIED | APPROVED DATE |
| | J STANWAY | 2020-11-24 |

CONCEPT DESIGN

PROJECT
NORTHPORT
MARSDEN POINT
PROPOSED EXPANSION

TITLE
BERTH 5
SEQUENCING CROSS SECTIONS

WSP PROJECT NO. (SUB-PROJECT): 6-DV652.00
SHEET NO.: C-1311
REVISION: B

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