Attachment 7

Indicative Construction Methodology

To: Port of Auckland Ltd Date: 20 September 2024

From: Beca Ltd Our Ref: 3237885-1057951712-12379

Prepared by: Peifen Chua Revision: 2

Reviewed by: Andy Harvey

Subject: POAL BN FN Wharves – Indicative Construction Methodology

1 Introduction



Figure 1 Aerial Plan

The Port of Auckland Ltd (POAL) intend to construct two new wharves (see Figure 1):

- 1) An approximately 330m long Bledisloe North Wharf to provide a new berth for cruise and roll-on/ roll-off ships, and
- 2) An approximately 45m long eastern extension to the existing Fergusson FN wharf to enable quay cranes to access full length of container ships.

Beca has been commissioned by POAL to undertake the detailed design of the wharves, as well as provide technical inputs to the resource consent.

The purpose of this memorandum is to provide indicative details on the construction methodology and effects for the proposed wharves works.

2 Bledisloe North Wharf

2.1 Structure Description

The proposed Bledisloe North Wharf is approximately 330m long and 27.5m wide. The wharf comprised of a pile supported concrete deck structure. Piles are steel encased reinforced concrete, socketed into the Waitemata rock that underlies the site. The deck comprised of precast beams, precast deck planks with an in-situ concrete deck topping. Wharf furniture and services include



fenders, bollards, ladders, water hydrants, power pits and cable slots as future provision to provide shore power to ships. Beneath the wharf, an upgraded rock revetment is designed to protect the northern edge of the reclamation. Where possible, the existing rock armouring will be reused and incorporated into the upgraded rock revetment. It is assumed that the existing revetment will need to be stripped, graded, replaced and supplemented with additional rocks. At both ends of the wharf, a new concrete mattress is required to withstand bow thrusters and azipods propulsion from large cruise ships. It is noted that there is sufficient berth water depth, therefore no dredging is required. See Figure 2 for a wharf plan. Refer to Attachments 1 for general arrangement drawings.

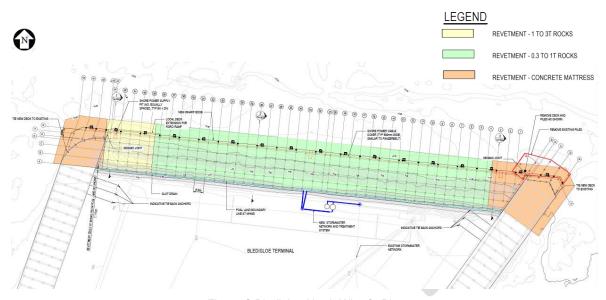


Figure 2 Bledisloe North Wharf - Plan

2.2 Indicative Construction Methodology

The indicative construction methodology, staging and sequencing for the proposed wharf works are as follows (refer to Attachments 3 and 4):

- 1) Remove approximately between 6.5-13m width (one to two pile bents) of existing rocks down to the design slope profile working from landside with a long reach excavator as far down the slope as practicable. Set aside existing rocks to be sorted for re-use as the upgraded rock revetment. Unsuitable small rocks and other materials to be used as filter or grading material or disposed offsite.
- Fill in/ tidy up low areas as required to form the design slope profile. If the existing exposed slope contains smaller rocks and fines, place temporary slope protection to mitigate erosion and loss of material.
- 3) Construct two to three rows (one to two pile bents) of new piles from landside, working progressively seaward with a temporary staging fixed to permanent piles. For the new piles located over the existing rock bund, temporary outer 2m casings are to be installed prior to the permanent inner casings to allow rocks to be removed with a rock clamshell bucket, to allow permanent piles to be driven to design depth.



- 4) Complete one to two pile bents of removal and excavation of the design slope profile including the toe trench working from the temporary staging platform.
- 5) Place one to two pile bents of geotextile, underlayer and rock armour between the piles. Where available, use existing sorted rocks as new underlayer.
- 6) Construct one to two bents of wharf deck by placing precast shell beams, deck planks and cast in-situ topping deck.
- 7) Complete installation of wharf furniture and services (which includes fenders, bollards, ladders and water hydrants).

For both ends of the wharf, a concrete mattress is required in place of the rock revetment. The mattress can be installed prior to or after the wharf deck construction, or under an existing wharf deck. The indicative mattress installation methodology is as follows (see Figure 3 for a typical example from a concrete mattress supplier – Proserve Ltd):

- 1) The formwork panels are pulled out to each bay by divers underwater.
- 2) The mattress is restrained at the retaining wall on the landside and fixed around piles
- 3) The mattress is zipped to neighbouring panels by divers.
- 4) The mattress units are then pump filled with concrete in tremie fashion (placement by gravity feed from a hopper through a vertical pipe extending from above the wharf or from landside to the mattress on the underwater floor).



Figure 3 Concrete Mattress Installation (from Proserve)

The above construction methodology is indicative only based on the concept design of the proposed works. Construction details may change as the design progresses and develops. The contractor shall develop a detailed construction methodology as part of the Contract works and may have alternative work methods, staging and sequencing.



2.3 Construction Effects and Controls

Based on the above indicative construction methodology, the construction effects identified for each activity and proposed controls are described in the following subsections.

2.3.1 Removal of Existing Rock Revetment

The construction effects associated with the removal of existing revetment is the risk of erosion and wash out of fine sediments potentially containing contaminated materials.

The indicative methodology described in Section 2.2 minimises the risk of exposure by only working 6.5-13m (1-2 pile bents) at any one time. Further erosion protection controls such as a temporary concrete mat or rock bags (that is quick to install/ uninstall) shall be implemented if upon stripping of the existing rock surface exposes any smaller rocks or fines.

Refer also to the Contaminated Soil Management Plan (CSMP) for more details on soil disturbances controls. The Contractor shall provide a detailed methodology including implementation of sediment and erosion controls as part of the Contract requirements to mitigate against any effects.

Existing rocks removed that are deemed unsuitable to be used for the proposed works shall be disposed offsite to an approved facility.

2.3.2 Removal of Toe Trench Material/ Minor Slope Filling

The excavation of toe trench and any minor filling on the slope will cause seabed disturbances underwater. Excavated dredged materials will need to be placed or removed and collected in a controlled manner by a long reach excavator working from landside or on the temporary staging platform. Excavated toe trench material will be disposed offsite to an approved facility.

2.3.3 Piling

Piling works require driving of temporary outer casings to remove and clear any rocks within the bund in order to drive the permanent steel casings down to bedrock. Noise may be generated from the driving of pile casings. The contractor shall implement controls such as the use of a vibratory hammer as opposed to a drop hammer to minimise noise.

A drilling rig will remove materials contained within the piles, to be collected in a controlled manner and disposed offsite to an approved facility. Steel reinforcement cage is installed and concrete tremie is poured to complete the piles. The concrete tremie is confined within the pile casings, therefore have minimal effects on the environment. As the top of piles is to be broken down to sound concrete, the concrete debris is to be collected and captured to prevent it from entering into the harbour.

2.3.4 Rock Revetment

The rock revetment works, comprised of a geotextile, underlayer and rock armour layer are done in a controlled manner, using a rock clamshell bucket placing each rock into position. The controlled placement of each rock means the works is confined to the slope surface and toe trench, and therefore have minimal effects on the environment.



2.3.5 Concrete Mattress

The proposed concrete mattress at both ends of the wharf can be installed under an existing wharf. The fluid concrete is pumped into the formwork filler sleeves and filled in a tremie-filling fashion. The fluid concrete during pumping is fully contained within the tremie pipe, filler sleeves and the formwork, and protected against wash out during curing by the formwork, therefore have minimal effects on the environment.

2.3.6 Deck

The wharf deck is constructed above water level over temporary working platforms. Precast beams are installed over piles with precast deck planks spanning between beams. Temporary side formwork is placed to enable in-situ concrete portion of the deck to be completed. The deck works is fully contained within the formwork and precast concrete elements, therefore have minimal effects on the environment.

3 Fergusson FN Eastern Wharf Extension

3.1 Structure Description

The proposed Fergusson FN Eastern Wharf Extension is approximately 45m long and 33.5m wide. The wharf comprised of a pile supported concrete deck structure. Piles are steel encased reinforced concrete, socketed into the Waitemata rock that underlies the site. The deck comprised of a flat slab in-situ reinforced concrete. Wharf furniture and services include crane rails, crane cable slot, fenders, bollards, ladders and water hydrants. Beneath the wharf, the rock revetment is extended from the end of the existing FN wharf and wraps around to the eastern end of the reclamation bund. The current berth water depth is at -13.5m CD, therefore no dredging is required. See Figure 2 for a wharf plan. Refer to Attachment 2 for general arrangement drawings.



Figure 4 Fergusson FN Eastern Wharf Extension - Plan



3.2 Indicative Construction Methodology

The indicative construction methodology for the proposed wharf extension works are as follows:

- 1) Construct two to three rows (one to two pile bents spaced at 6.5m centres) of new piles from landside, working progressively seaward with a temporary staging.
- 2) Trim the approximately 1m of mudcrete bund overbuild down to the design slope profile for one to two pile bents (6.5-13m).
 - (Note:- Mudcrete is a cement stabilised soil material, commonly used to repurpose dredged seabed material into a structural material)
- Place one to two pile bents of geotextile, underlayer and rock armour between the piles.
 Where available, use existing sorted rocks from Bledisloe North as new underlayer.
- 4) Construct the reinforced in-situ wharf deck with formwork supported off the permanent piles.
- 5) Complete installation of wharf furniture and services (which includes crane rails, bollards, fenders, access ladders and water hydrants).

The above construction methodology is indicative only based on the preliminary design of the proposed works. Construction details may change as the design progresses and develops. The contractor shall develop a detailed construction methodology as part of the Contract works and may have alternative work methods, staging and sequencing.

3.3 Construction Effects and Controls

Based on the above indicative construction methodology, the construction effects identified for each activity and proposed controls are described in the following subsections.

3.3.1 Piling

For piling works, noise may be generated from the driving of the permanent steel pile casings. The contractor shall implement controls such as the use of a vibratory hammer as opposed to a drop hammer to minimise noise generation from the works.

A drilling rig will remove materials contained within the piles, to be collected in a controlled manner and disposed offsite to an approved dump facility. Steel reinforcement cage is installed and concrete tremie is poured to complete the piles. The concrete tremie is confined within the pile casings, therefore have minimal effects on the environment. As the top of piles is to be broken down to sound concrete, the concrete debris is to be collected and captured to prevent from entering into the harbour.

3.3.2 Mudcrete Trimming & Rock Revetment

The rock revetment works, comprised of trimming of the mudcrete bund, placement of a geotextile, underlayer and rock armour layer are done in a controlled manner, using an excavation bucket and a rock clamshell bucket for placing each rock into position. The controlled placement of each rock means that the works is confined to the slope surface and toe trench, and therefore have minimal effects on the environment.



3.3.3 Deck

The wharf deck is constructed above the water level over temporary working platforms. Temporary formwork is placed on the underside and sides of the deck, supported by the permanent piles. Steel reinforcement is installed, and in-situ concrete poured to complete the deck. The deck works is fully contained within the temporary formwork, therefore have minimal effects on the environment.

Attachments

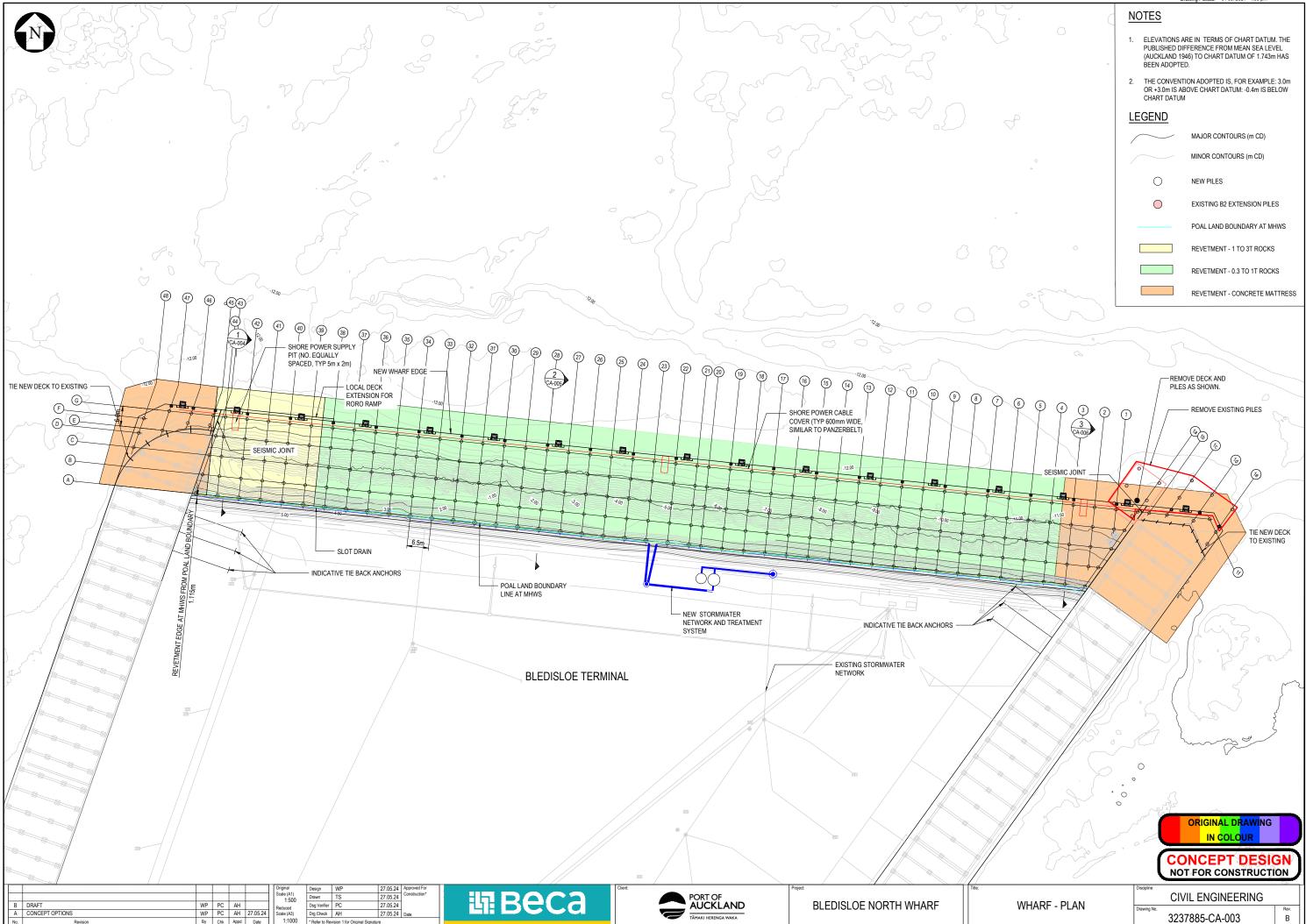
Attachment 1 - Bledisloe North General Arrangement Drawings

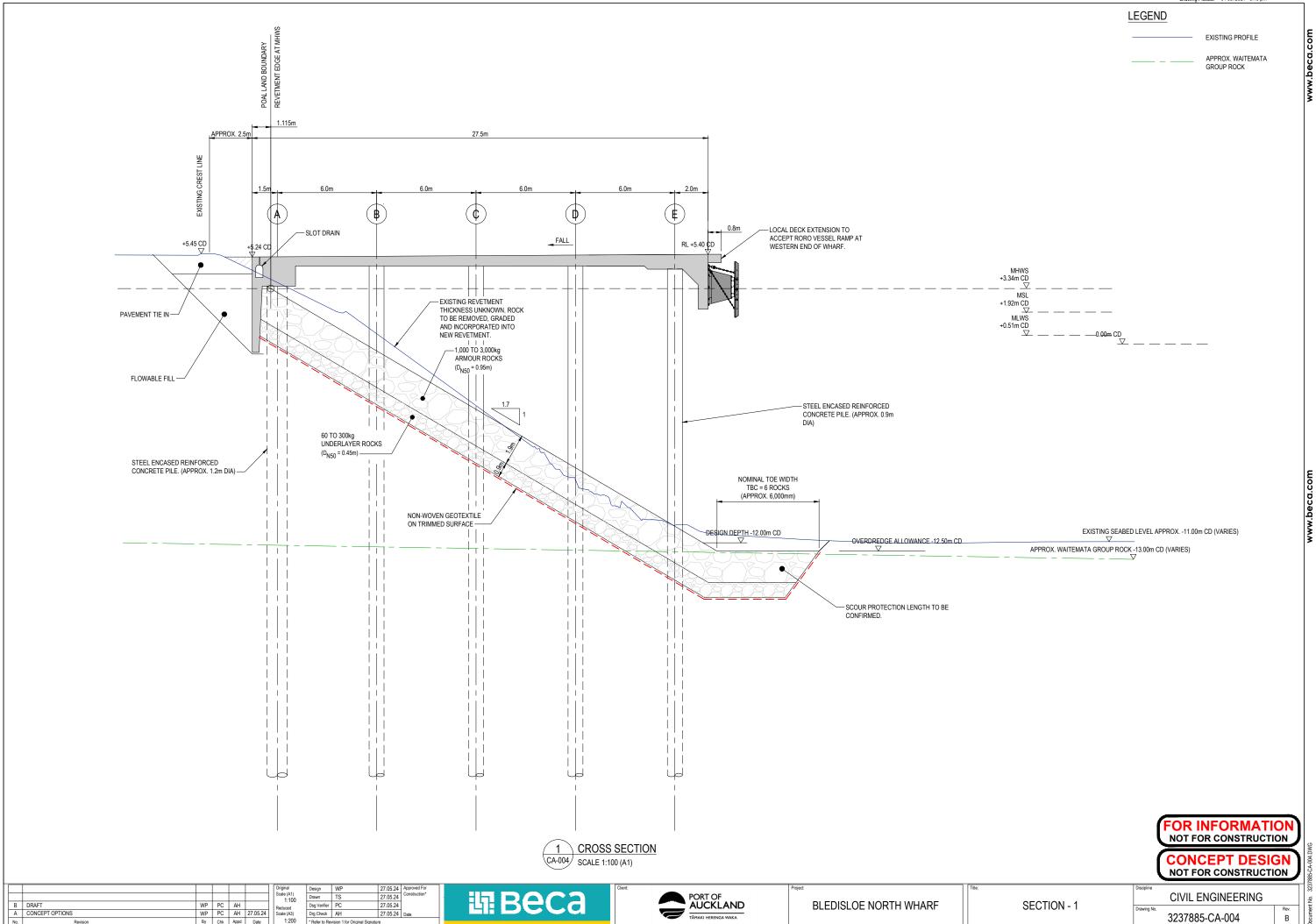
Attachment 2 – Fergusson FN Eastern Extension General Arrangement Drawings

Attachment 3 – Indicative Construction Sequence (Bledisloe North)

Attachment 4 – Indicative Construction Staging Plan (Bledisloe North)







NOTES:

- ELEVATIONS ARE IN TERMS OF CHART DATUM. THE PUBLISHED DIFFERENCE FROM MEAN SEA LEVEL (AUCKLAND 1946) TO CHART DATUM OF 1.743m HAS BEEN ADOPTED. THE CONVENTION ADOPTED IS, FOR EXAMPLE: 3.0m OR +3.0m IS ABOVE CHART DATUM, -0.4m IS BELOW
- CO-ORDINATE VALUES ARE IN TERMS OF NZTM2000 (NEW ZEALAND TRANSVERSE MERCATOR).
- 3. CONTRACTOR TO REFER TO SITE DATA FOR MOST RECENT ${\bf HYDOGRAPHIC\ SURVEY}.$
- 4. CONTRACT WORKS INCLUDE:
 WHARF STRUCTURE AND ASSOCIATED WHARF FURNITURE, SERVICES AND STORMWATER COLLECTION SYSTEM
 - REMOVAL OF EXISTING MOORING DOLPHIN ACCESS GANGWAY AND DEMOLITION OF SUPPORTING PILE
 - EXTENT OF ROCK REVETMENT SHOWN
- 5. WORKS NOT PART OF THIS CONTRACT:
 RECLAMATION CONSTRUCTION
 - RECLAMATION SERVICES AND STORMWATER
 - WORKS PAVEMENT WORKS
 - DREDGING

LEGEND



PROPOSED FERGUSSON FN WHARF EASTERN EXTENSION



PROPOSED ROCK REVETMENT



RECLAMATION (REFER NOTE 5)



EXISTING STRUCTURES EXISTING RECLAMATION





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01.08.24



FERGUSSON FN WHARF EASTERN EXTENSION

GENERAL SITE LAYOUT PLAN 3237885-GE-2001

SITE LAYOUT PLAN
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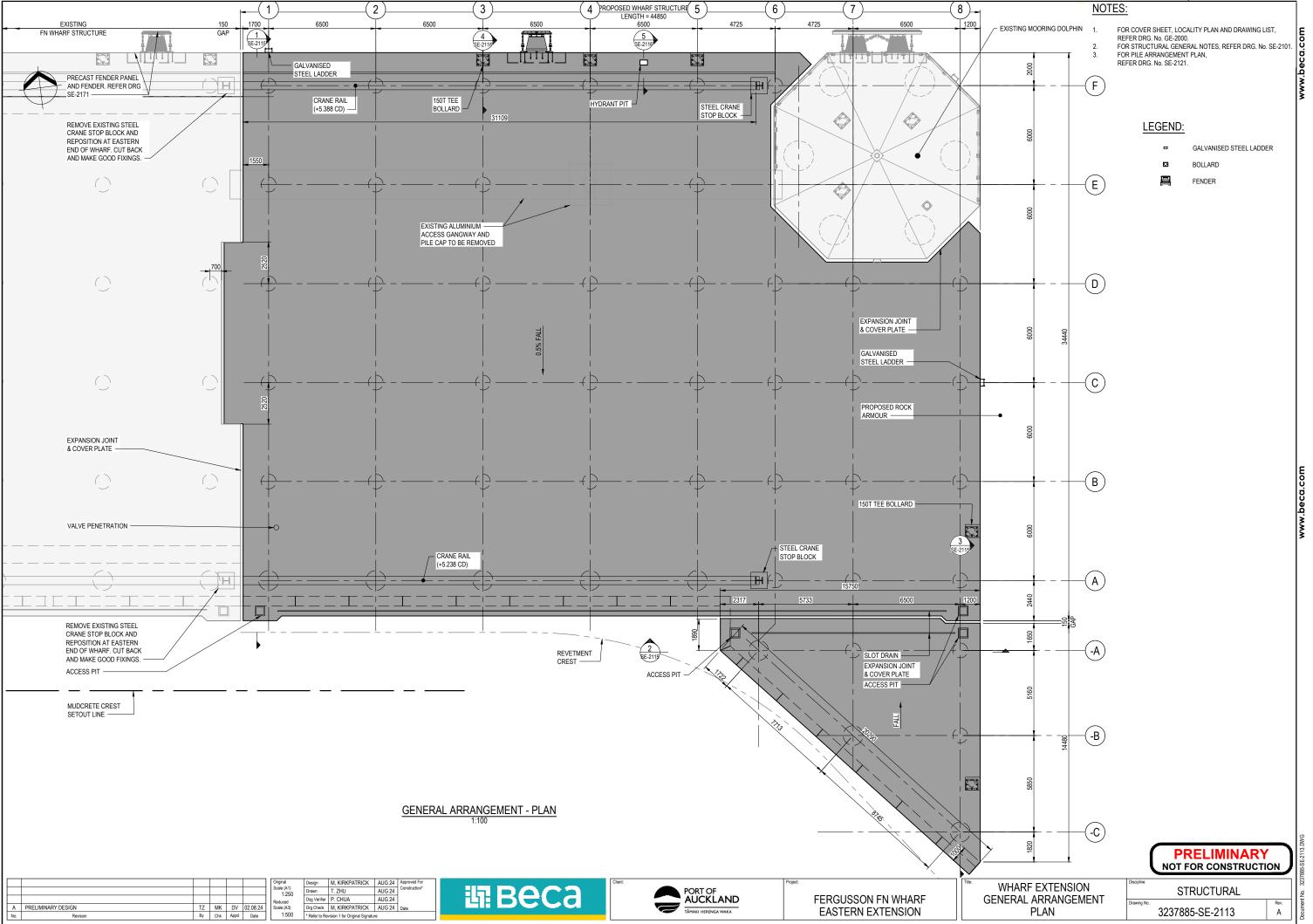
ORIGINAL DRAWING

IN COLOUR

PRELIMINARY

NOT FOR CONSTRUCTION

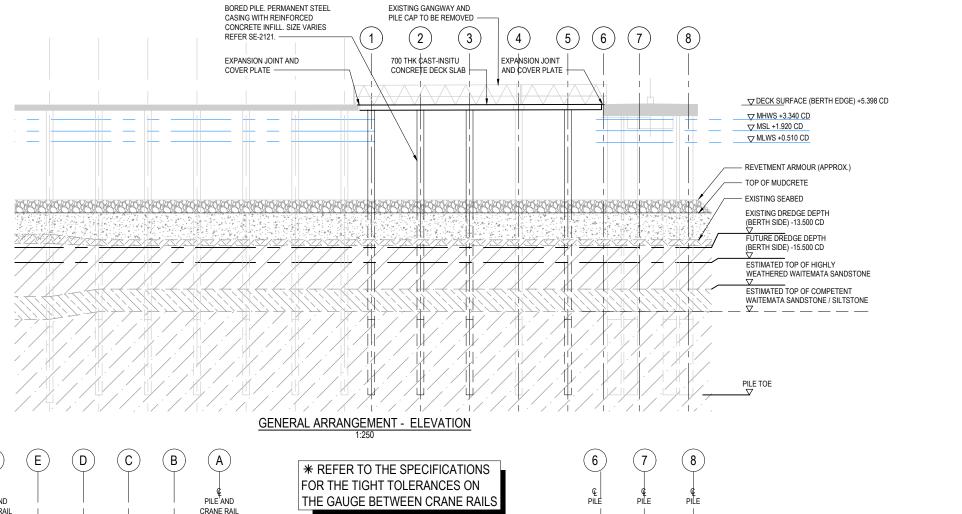


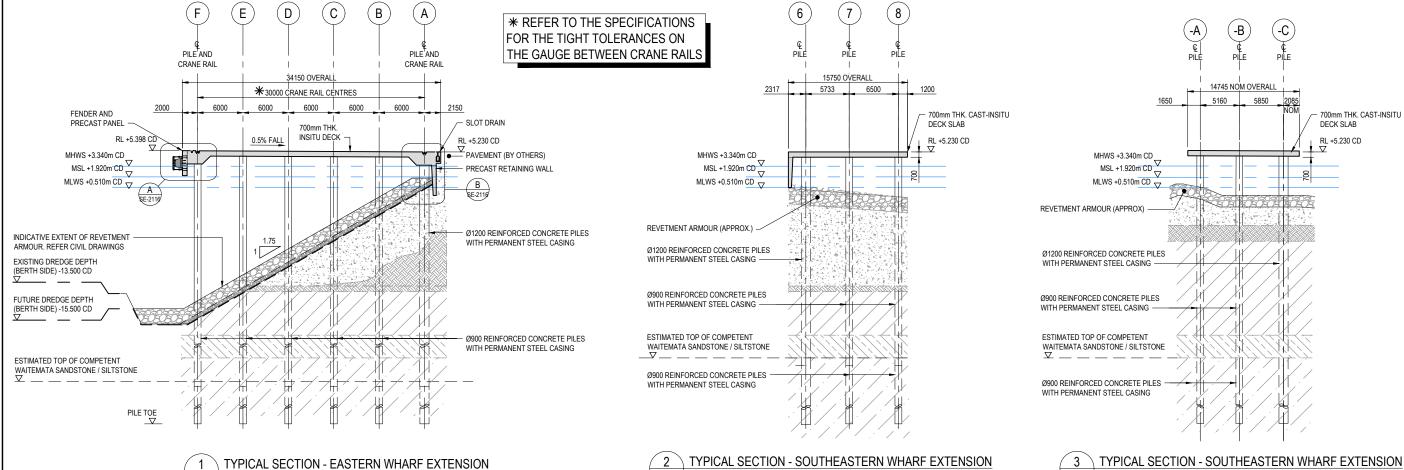


NOTES: FOR COVER SHEET, LOCALITY PLAN AND DRAWING LIST, REFER DRG. No. GE-2000.

FOR STRUCTURAL GENERAL NOTES, REFER DRG. No. SE-2101.

FOR GENERAL ARRANGEMENT PLAN AND ELEVATION, REFER DRG. SE-2113.





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FERGUSSON FN WHARF EASTERN EXTENSION

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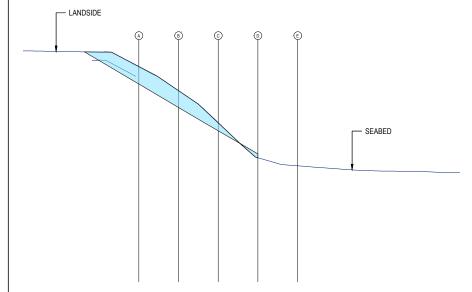
GENERAL ARRANGEMENT TYPICAL SECTIONS

NOT FOR CONSTRUCTION STRUCTURAL

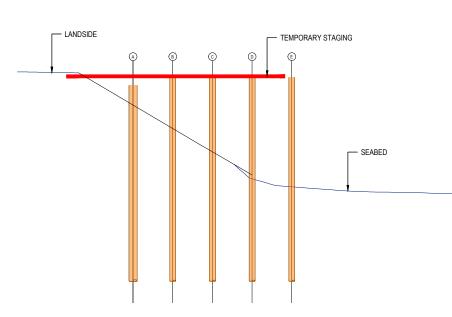
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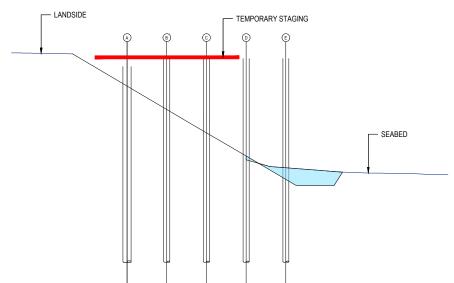
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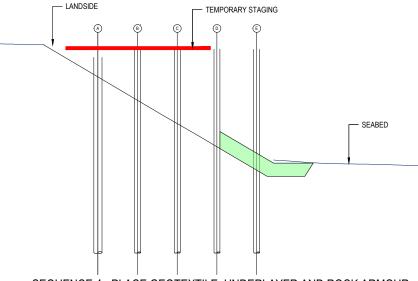
SEQUENCE 1 - REMOVE EXISTING ROCK REVETMENT AND EXCAVATE TO DESIGN SLOPE FROM GL A TO GL D WORKING FROM LANDSIDE. FILL SLOPE IN AREAS AS REQUIRED TO FORM DESIGN SLOPE.



SEQUENCE 2 - CONSTRUCT PILES GL A TO GL E PROGRESSIVELY WITH TEMPORARY STAGING.

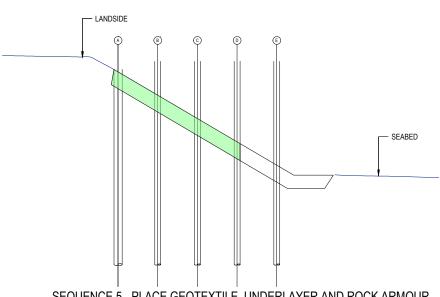


SEQUENCE 3 - EXCAVATE TOE TRENCH FROM TEMPORARY STAGING.



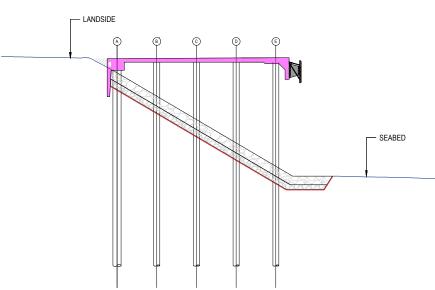
SEQUENCE 4 - PLACE GEOTEXTILE, UNDERLAYER AND ROCK ARMOUR TOE TRENCH FROM TEMPORARY STAGING.

NOTE: NOT APPLICABLE FOR CONCRETE MATTRESS AT ENDS OF WHARF.



SEQUENCE 5 - PLACE GEOTEXTILE, UNDERLAYER AND ROCK ARMOUR ON GLA TO GL D FROM LANDSIDE.

NOTE: NOT APPLICABLE FOR CONCRETE MATTRESS AT ENDS OF WHARF.



SEQUENCE 6 - CONSTRUCT DECK AND COMPLETE WHARF FURNITURE.

SEQUENCE 7 (AT ENDS OF WHARF ONLY) - CONCRETE MATTRESS: PLACE GEOTEXTILE BAGS AND FILL WITH CONCRETE FROM THE TOP OF WHARF. BOLSTER BAGS TO SEAL AROUND PILES.

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1							Scale (A1) NTS	Drawn			Construction*
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1	No.	Revision	By	Chk	Appd	Date	NTS	* Refer to Revision 1 for Original Signature			

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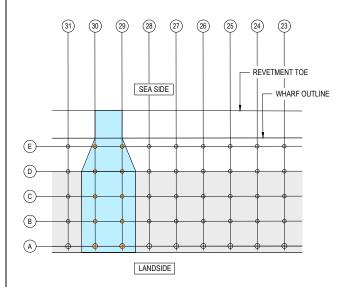


BLEDISLOE NORTH WHARF

INDICATIVE CONSTRUCTION SEQUENCE

CIVIL 3237885-SKETCH 1

WHARF DECK

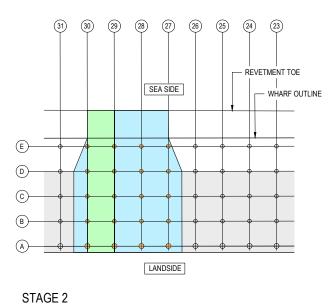


STAGE 1 GL 29 TO 30:

> SEQUENCE 1 - SLOPE EXCAVATION (EXTENDS HALF BAY EACH SIDE)

SEQUENCE 2 - PILES

SEQUENCE 3 - TOE TRENCH EXCAVATION



GL 29 TO GL 30:

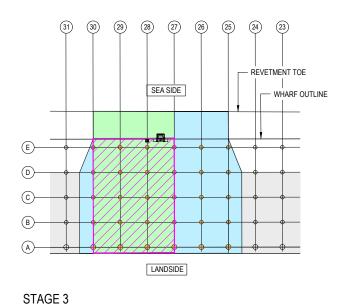
SEQUENCE 4 - TOE TRENCH ARMOUR SEQUENCE 5 - SLOPE ARMOUR

GL 27 TO GL 29:

SEQUENCE 1 - SLOPE EXCAVATION (EXTENDS HALF BAY)

SEQUENCE 2 - PILES

SEQUENCE 3 - TOE TRENCH EXCAVATION



GL 27 TO GL 30:

SEQUENCE 4 - TOE TRENCH ARMOUR

SEQUENCE 5 - SLOPE ARMOUR

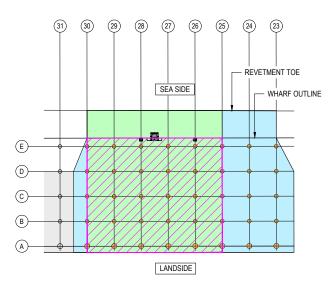
SEQUENCE 6 - WHARF DECK AND FURNITURE

GL 25 TO GL 27:

SEQUENCE 1 - SLOPE EXCAVATION (EXTENDS HALF BAY)

SEQUENCE 2 - PILES

SEQUENCE 3 - TOE TRENCH EXCAVATION



STAGE 4

GL 25 TO GL 27:

SEQUENCE 4 - TOE TRENCH ARMOUR

SEQUENCE 5 - SLOPE ARMOUR

SEQUENCE 6 - WHARF DECK AND FURNITURE

GL 23 TO GL 25:

SEQUENCE 1 - SLOPE EXCAVATION

SEQUENCE 2 - PILES

SEQUENCE 3 - TOE TRENCH EXCAVATION

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BLEDISLOE NORTH WHARF

INDICATIVE CONSTRUCTION STAGING PLAN

3237885-SKETCH 1