ABERDEEN HARBOUR EXPANSION PROJECT
November 2015

Volume 2: Environmental Statement

CHAPTER 3: DESCRIPTION OF THE DEVELOPMENT

3. DESCRIPTION OF THE DEVELOPMENT

3.1 Introduction

This chapter describes the indicative design and phases of the development. The construction of the new harbour will be tendered and awarded under a design and build (D&B) contract and as such this ES does not focus on the fabrication of individual project components. The appointed contractor will be required to design and build the harbour to meet the minimum performance specification (MPS) produced by Aberdeen Harbour Board (AHB). The MPS is defined as the minimum dredge depth, the length of quayside, and the length and height of the breakwaters defined in Table 3.3, and the maximum overtopping rates described in Section 3.5.1.1. The contractor has a degree of flexibility in how they achieve the MPS, and therefore the plant and equipment used are not specified at this stage, as these will be confirmed under the D&B contract, but are outlined and put into context as and where applicable.

The procurement process and appointment of contractors for the D&B contract had not concluded at the time of production of this ES and therefore construction techniques and infrastructure design are based upon the reference design and MPS supplied to the contractors. The final method of construction may deviate from that described in this chapter, but any deviation will be within the parameters of the development's realistic worst case scenario (known as the 'Rochdale Envelope'), which has been further detailed in Chapter 5: Environmental Impact Assessment Process.

By adopting the Rochdale Envelope approach, it is possible to assess the effects of the realistic worst case scenario for the development in this ES. All mitigation recommendations within this ES are based upon these realistic worst case scenarios. If alternative methodologies are proposed that are not included in the Rochdale Envelope, contractors will be required to demonstrate that their design is 'Not Environmentally Worse Than' (NEWT) the residual impacts set out in this ES.

3.2 Project Location and Boundary

The proposed Aberdeen Harbour Expansion Project is located in Nigg Bay, approximately 0.8 km south of the existing harbour within Aberdeen city centre. The proposed harbour lies within a natural bay which looks out into the North Sea and covers an area of approximately 0.87 km^2. The bay is surrounded by rocky cliffs and headlands to the north (Girdle Ness) and south (Greg Ness) which slope down to a cobble beach to the west, and the North Sea to the east.

There are several boundaries which make up the development boundary for the Aberdeen Harbour Expansion Project (Figure 3.1):

- Planning Permission in Principle (PPP) boundary;
- Harbour Revision Order (HRO) boundary;
- Marine Licence (ML) boundary; and
- Development Boundary (see below).

The development boundary is the maximal extant of all the other boundaries together and is the one used for the purposes of this ES. The PPP, HRO and ML boundaries are used in the consenting process for the development, representing the different areas of jurisdiction of the regulatory authorities, as described in more detail in Chapter 4: Planning and Legislation.

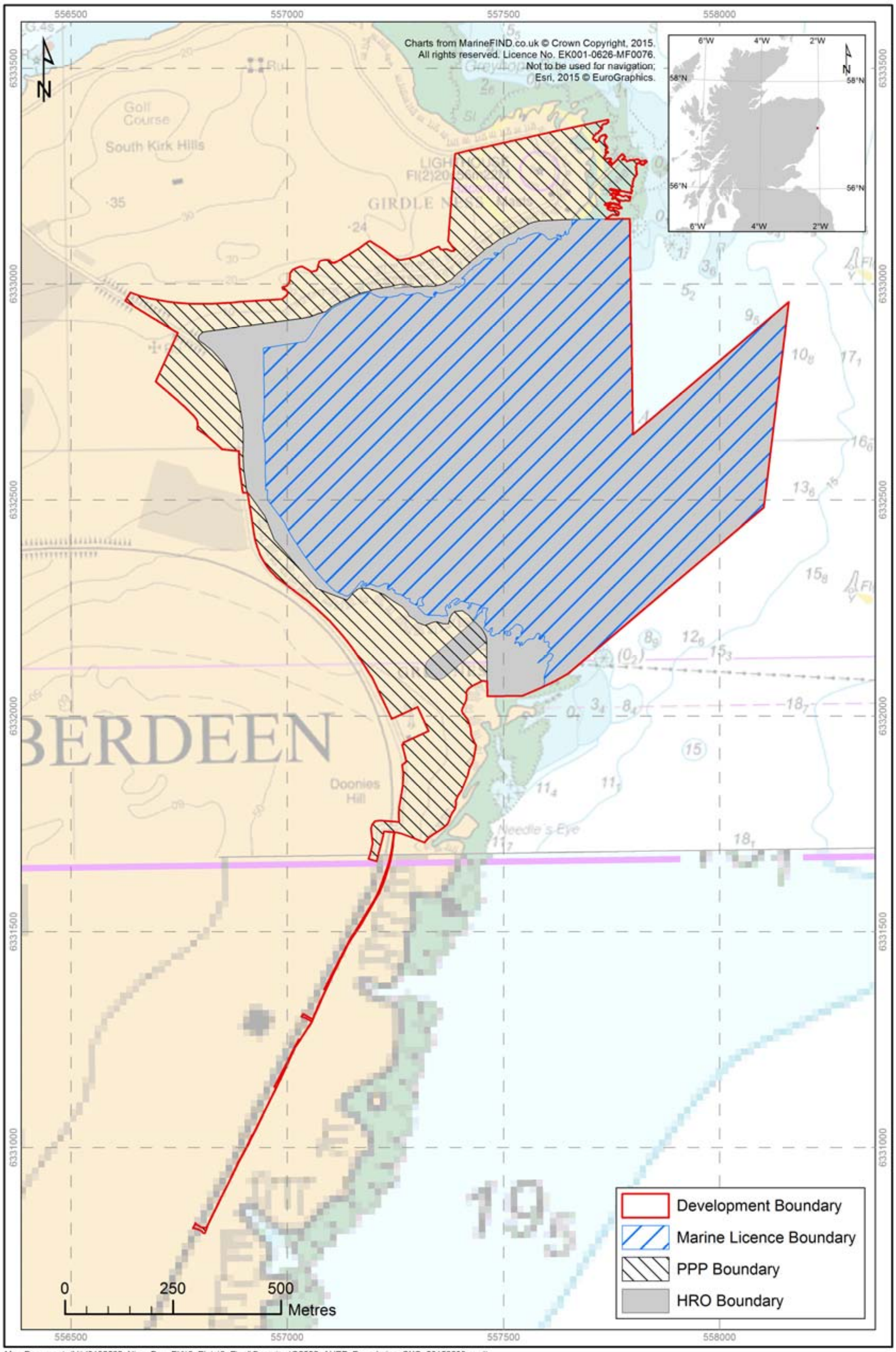

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Figure 3.1: Aberdeen Harbour Expansion Project Development, HRO, PPP, ML and Development boundaries

Figure 3.2 shows areas of temporary land use for construction, and permanent areas for harbour operation. Table 3.1 provides a breakdown of the areas of land and sea associated with the construction and operational phases of the project.

Table 3.1: Land and marine areas

Land Use	Area [km^2]
Marine area (Marine Licence area)	0.79
Total harbour area (HRO area)	0.89
Total permanent land use (Harbour operation)	0.09
Total temporary land use (Construction)	0.19
Total temporary seabed use (Construction)	0.11

3.3 Indicative Project Programme

The proposed new harbour will be constructed under a D&B contract, so the precise details of the construction programme have not yet been confirmed. The dates in this section are based upon consent for the project having been being granted by, and the construction contract being awarded in, late 2016, with detailed design commencing shortly thereafter, and construction works starting in early 2017. It is anticipated that all harbour construction works will be completed by 2020. The dates within Table 3.2 are anticipated windows for activities, and allow for reasonably expected delays such as weather downtime or the suspension of works. The timing of all activities will be in accordance with the Outline Environmental Management Plan (EMP – presented in Chapter 26), and will incorporate the seasonality of all sensitive receptors, such as breeding seasons.

Table 3.2: Indicative construction programme

Construction Activity	Start Date	Duration	Completion Date
Mobilisation/preparatory works/diversions	Q4 2016	6 months	Q1 2017
Temporary access roads	Q4 2016	3 months	Q1 2017
Intake and outlet diversions (as required)	Q4 2016	6 months	Q1 2017
Dredging (including drilling and blasting)	Q1 2017	19 months	Q4 2018
Casting and placing of concrete units	Q1 2017	21 months	Q4 2018
Breakwater construction	Q1 2017	21 months	Q4 2018
Quay piling operations	Q2 2017	23 months	Q2 2019
Quay construction and infilling	Q2 2017	31 months	Q4 2019
Ancillary accommodation and site infrastructure	Q2 2018	Over an 18 month period	Q4 2019
Harbour project complete and harbour fully operational	Q4 2019	Over a 5 month period	Q2 2020
Minor infrastructure works installed during operational phase, such as installation of water tanks etc.	Q2 2020	Up to 12 months	Q2 2021

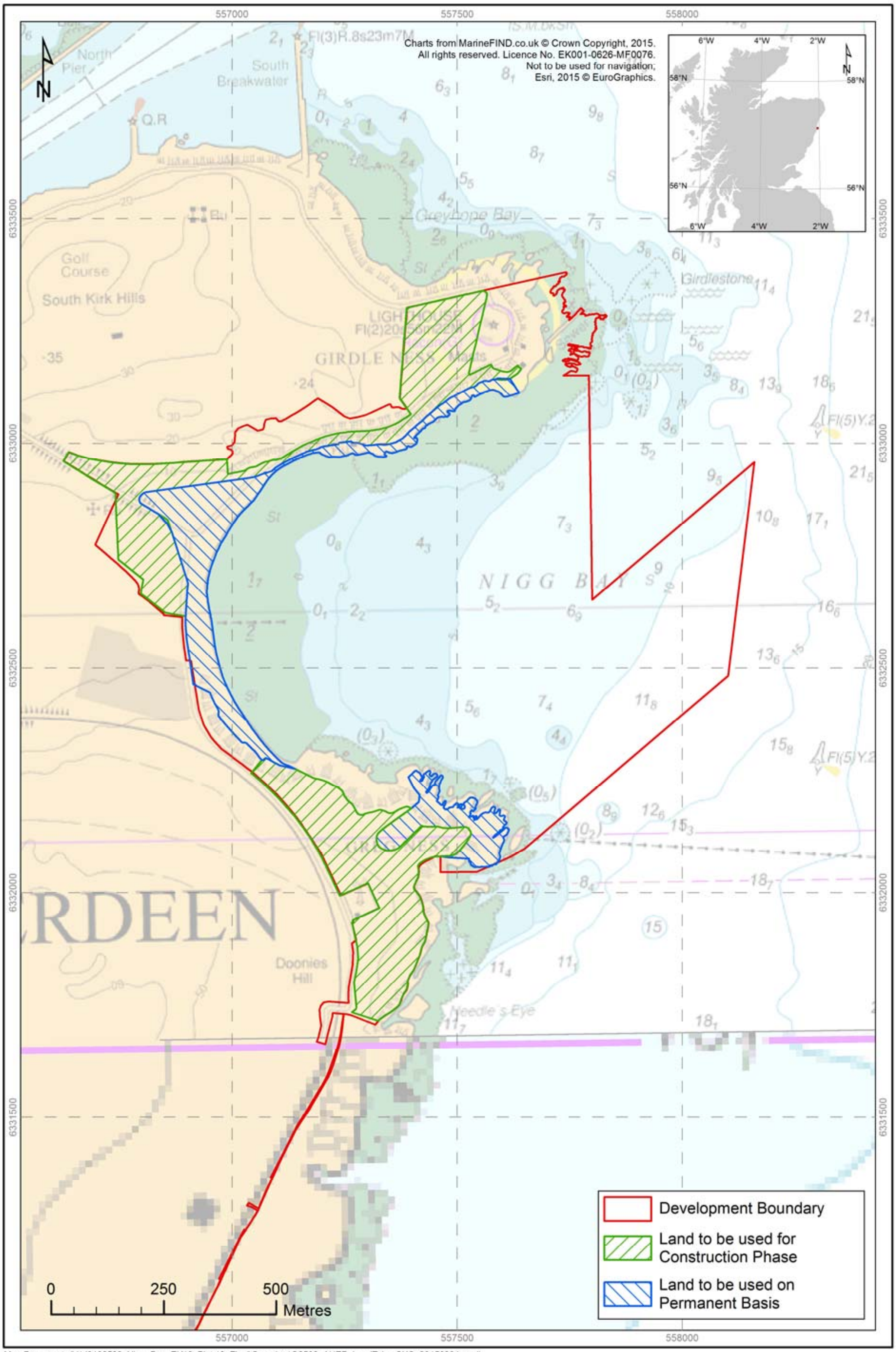

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Figure 3.2: Areas of temporary and permanent land use

The following is an indicative construction methodology. The appointed D&B contractor will be required to consider and develop their own specific methodology, but it is likely to be similar to that set out below:

i. Site establishment and temporary works which are likely to include batching plants and casting yards. This may be a phased element, with the potential for provision growing to meet the project requirements and diminishing again as work packages complete

ii. Erection of perimeter fencing will be commenced early within the programme to provide security protection;

iii. Temporary local diversions to Greyhope Road and the coastal path and protection/diversion of outfalls and intakes within the bay will be commenced early in the programme;

iv. Road and path diversions will commence at various stages of the programme. Initial temporary diversions will be undertaken as soon as practicable;

v. Dredging will take place to form a bed for the construction of the breakwaters, ahead of the main capital dredging works;

vi. Breakwater formation – mass fill core with rock armour protection. Subject to availability of suitable materials, it is anticipated that that both the north and south breakwaters will be constructed simultaneously;

vii. As soon as practicable the dredging to deepen the bay will commence. The nature and timing of dredging operations will be affected by weather conditions, as well as the volume of dredged material that can be practically and economically re-used within the land reclamation;

viii. Works to form the solid quays and land reclamation on the north of the bay will commence as soon as the breakwaters provide a safe working environment. Solid quay construction will require filling/piling and capping progressively along its length. Service trenches will be constructed within the slabs;

ix. Security gatehouse and welfare blocks along with site wide lighting will be installed prior to the facility becoming operational;

x. Works to construct the suspended decks will commence as soon as practicable following the completion of revetment formation.

xi. Temporary site establishments will be reduced progressively as the works progress and requirements reduce. This will include re-instatement prior to the contractor demobilising (leaving the site at the end of the construction phase).

Approximately 1500 m of new quayside (south-east, east, north and west) is to be constructed. Where rock is above the required dredge level, dredging must be completed before quay construction can commence (Arch Henderson, 2015).

The access road to the southern breakwater and the diversion of Greyhope Road will be required early on in the harbour works.

Other harbour infrastructure works include car parking facilities to be built in the north-west corner of the site boundary, as well as, water and fuel tanks, and gatehouse and welfare facilities (as shown on

Figure 3.3). Although not part of the initial development works, fuel tanks and bulk storage tanks will be constructed after quays are completed.

Detailed design and construction methods will be produced after the appointment of the D&B contractor; however, the operational life span of the project structures are to be designed to a minimum of 60 years for the quaysides and 100 years for the breakwaters, therefore decommissioning is not considered within this ES, and would be subject to a separate EIA.

3.4 Harbour Construction Works

The description of the construction works has been developed in close partnership with AHB and their engineering consultants Arch Henderson and HR Wallingford, and through information provided in relevant technical engineering reports including:

- Aberdeen Harbour Nigg Bay Development: Reference Design – Breakwater (HR Wallingford, 2015a); and
- Best Practicable Environmental Option (BPEO) (Arch Henderson, 2015).

Figure 3.3 shows the proposed harbour layout, infrastructure and dredged areas.

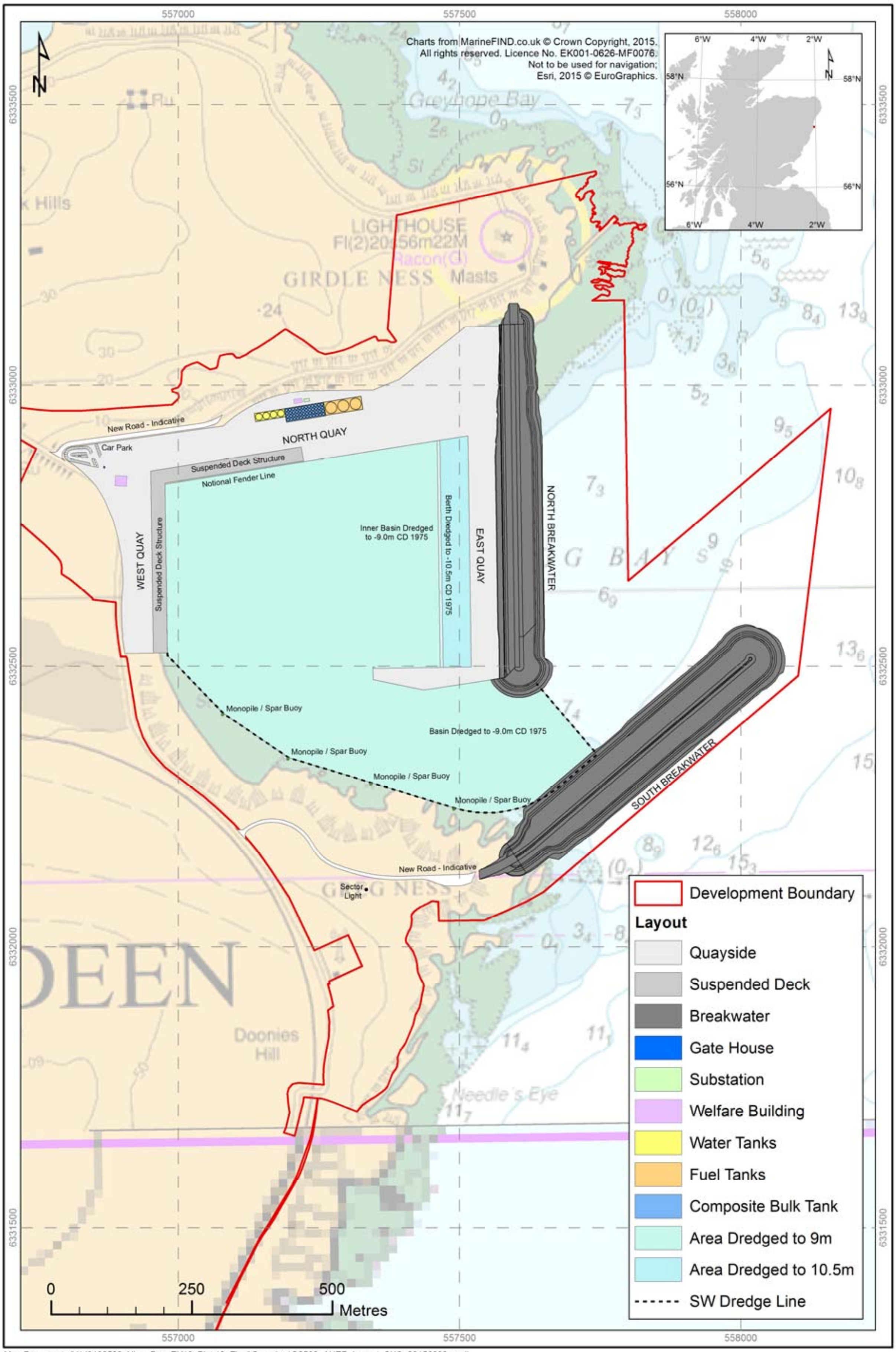

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Figure 3.3: Harbour layout, infrastructure and dredged areas

The typical dimensions of the harbour works are presented in Table 3.3 and Figure 3.3. See Section 3.8 for a breakdown of the details of the harbour infrastructure.

Table 3.3: Indicative dimensions of harbour works and layout as shown in Figure 3.3

Harbour Works		Dimensions
Breakwaters	North	Seabed Length: ~700 m Crest Length: 645 m Average Width: ~69 m Breakwater Roundhead (Bulb) Width: 86 m Maximum Height: 12 m above CD
	South	Seabed Length: ~670 m Crest Length: 580 m Average Width: ~117 m Breakwater Roundhead (Bulb) Width: 123 m Maximum Height: 12 m above CD
Dredging	Inner basin	-9 m CD
	East quay berth	-10.5 m CD
	Approach channel	-10.5 m CD
Navigation channel		Between the north and south breakwater the shortest distance will be approximately 165 m Between the south-east pier and the rocky shore of Greg Ness will be approximately 177 m at the closest point
Quayside	South end of East Quay	175 m from corner of the south-east pier to where it connects to the east quay, and 20 m north to south at its narrowest and 40 m at its widest.
	East quay	412 m from the corner of the south-east pier and the corner of the north quay 60 m between the northern breakwater and the harbour facing quay wall
	North quay	546 m from the corner of the east quay to the corner of the west quay, including the 249 m suspended deck structure
	West quay	300 m from corner of the north quay to the southern end of the west quay, including the 300 m suspended deck structure

3.4.1 Project Activities

Assessment of potential impacts and effects upon receptors are based on consideration of activities summarised below. The proposed timing of activities is based on the programme in Table 3.2; however, these should be considered as working windows, as these activities are unlikely to be undertaken continuously throughout these programme phases.

Summary of construction activities:

- Temporary site establishment;
- Vehicle movement;
- Vessel movement;
- Piling;
- Drilling and blasting;
- Dredging and disposal;
- Placement of breakwater armour units;

- Excavation and earthworks;
- Formation of solid quay walls;
- Construction of revetment;
- Concrete works;
- Installation of quayside furniture;
- Diversions;
- Roads construction;
- Hard landscaping;
- Minor building works; and
- Reinstatement works (of temporary work areas).

Summary of operational activities:

- Vessel movement;
- Vessel bunkering;
- Limited vessel maintenance;
- Maintenance dredging;
- Loading and unloading cargo; and
- Vehicle movement.

3.4.2 Outfall Relocation

The outfall for the United Fish Industries (UFI) factory discharges into Nigg Bay. It is proposed to retain the outfall in its current location with additional protection works, although it will discharge at a deeper level than at present (see ES Chapter 7: Water and Sediment Quality for further details). The Marine Scotland Science (MSS) aquarium intake will be relocated in agreement with MSS, most likely to foot of north breakwater.

3.4.3 Reinstatement

The temporary working areas envisaged during construction are shown on Figure 3.2. These will be reinstated once construction is complete (see Chapter 11: Terrestrial Ecology for further details).

3.5 Breakwaters

The completed harbour will be sheltered from weather and wave action through the construction of rubble mound breakwaters at the north and south of Nigg Bay. Each breakwater will be approximately 600 m long along the crest (Table 3.3), with a maximum crest level of 12 m above CD. The joint probability of a 1:200 year return period wave and water level conditions including 100 years sea level rise, has been used for the design criterion of the breakwaters (HR Wallingford, 2015b).

It is anticipated that both breakwaters will be constructed simultaneously (after a preliminary dredge of the area which will form the bed of the breakwaters) and that construction will begin on these ahead of the quay wall and main dredging works being started. It is anticipated that the breakwater construction will take approximately 21 months to complete, although this may be subject to minor variations depending on the contractor's methodology.

3.5.1 Breakwater Design

The reference design of the breakwaters has been developed in accordance with the Construction Design and Management (CDM) regulations. All the levels, above and below Mean Low Water Spring (MLWS) are relative to Admiralty Chart Datum (CD). The northern and southern breakwaters consist of concrete and rock armour rubble mounds. Figure 3.4 and Figure 3.5 show cross-sections through the mid-points of the northern and southern breakwaters respectively. There are principle layers common to each breakwater in the reference design:

- Core: The core represents the principle fill material and shape of the breakwater. A coarser grade core layer (comparable to the underlayer in size) is proposed on the seaward face in order to minimise wave damage during construction, and the inner layer consists of a finer grade material.
- Toe: A supporting toe is required to protect the bottom of the armour layer. A typical toe is comprised of one row of armour units placed on a bedding layer and buttressed with a double layer of rocks placed in front of the units for reinforcement. In some locations the toe is laid on the existing bed and is trenched in other locations to provide additional stability and/or minimise navigational impact.
- Underlayer: An underlayer will be installed under the primary armour layer to transmit loadings adequately, maintain permeability of the breakwater and retain the core material underneath. The grading of the underlayer ranges from 1-3 tonnes to 3-6 tonnes.
- Primary Armour: A concrete armour unit has been selected due to the hydraulic conditions at the site. Sizes of the units in the reference design range from 8 m^3 to 16 m^3. The outer and inner face of the southern breakwater both utilise concrete armour units for the primary armour material whereas for the rear face of the northern breakwater (tying into the East Quay) a rock armour material has been adopted which extends into a trench designed to capture and drain waves overtopping the breakwater crest.

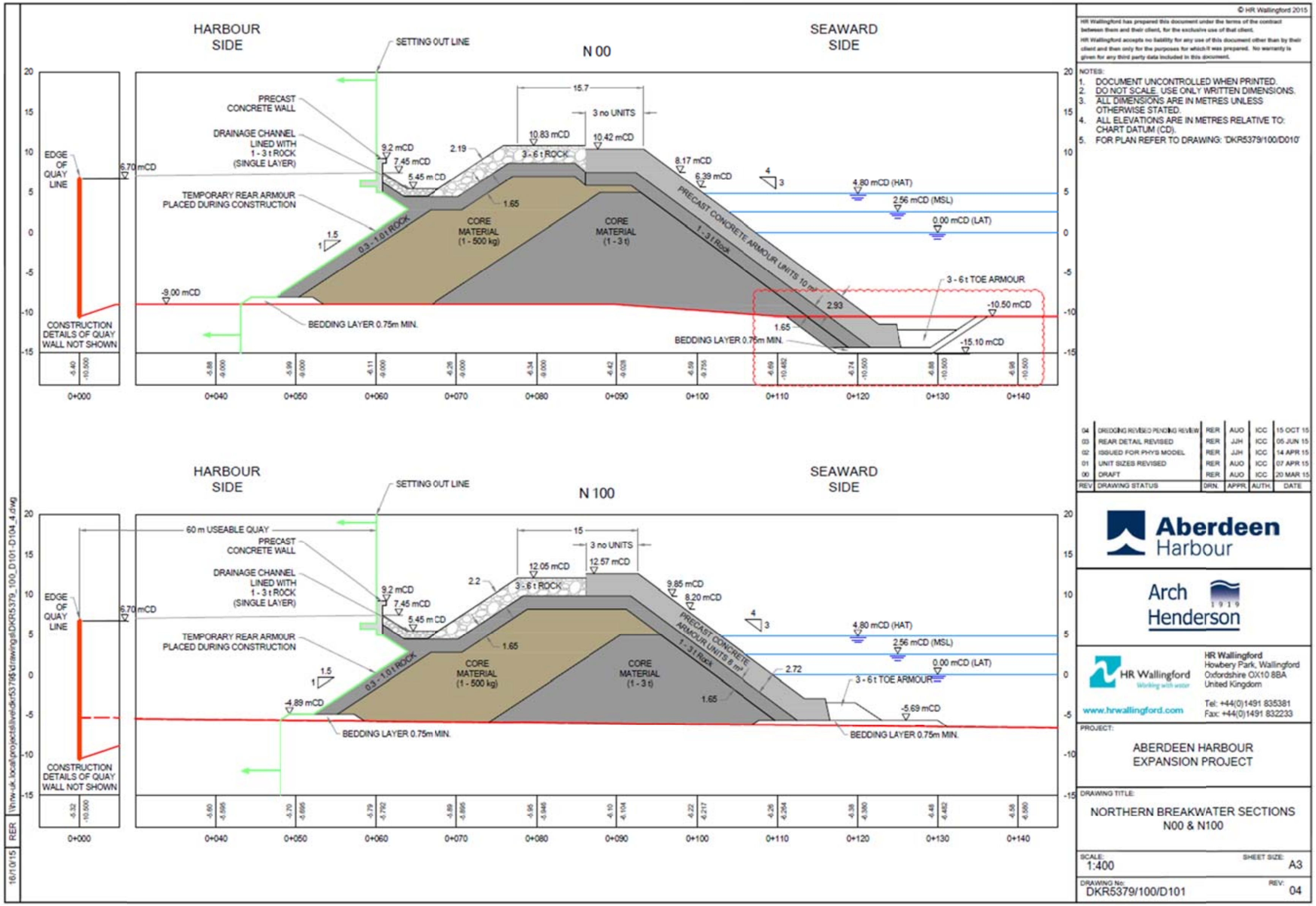

Figure 3.4: Cross-section through mid-point of northern breakwater

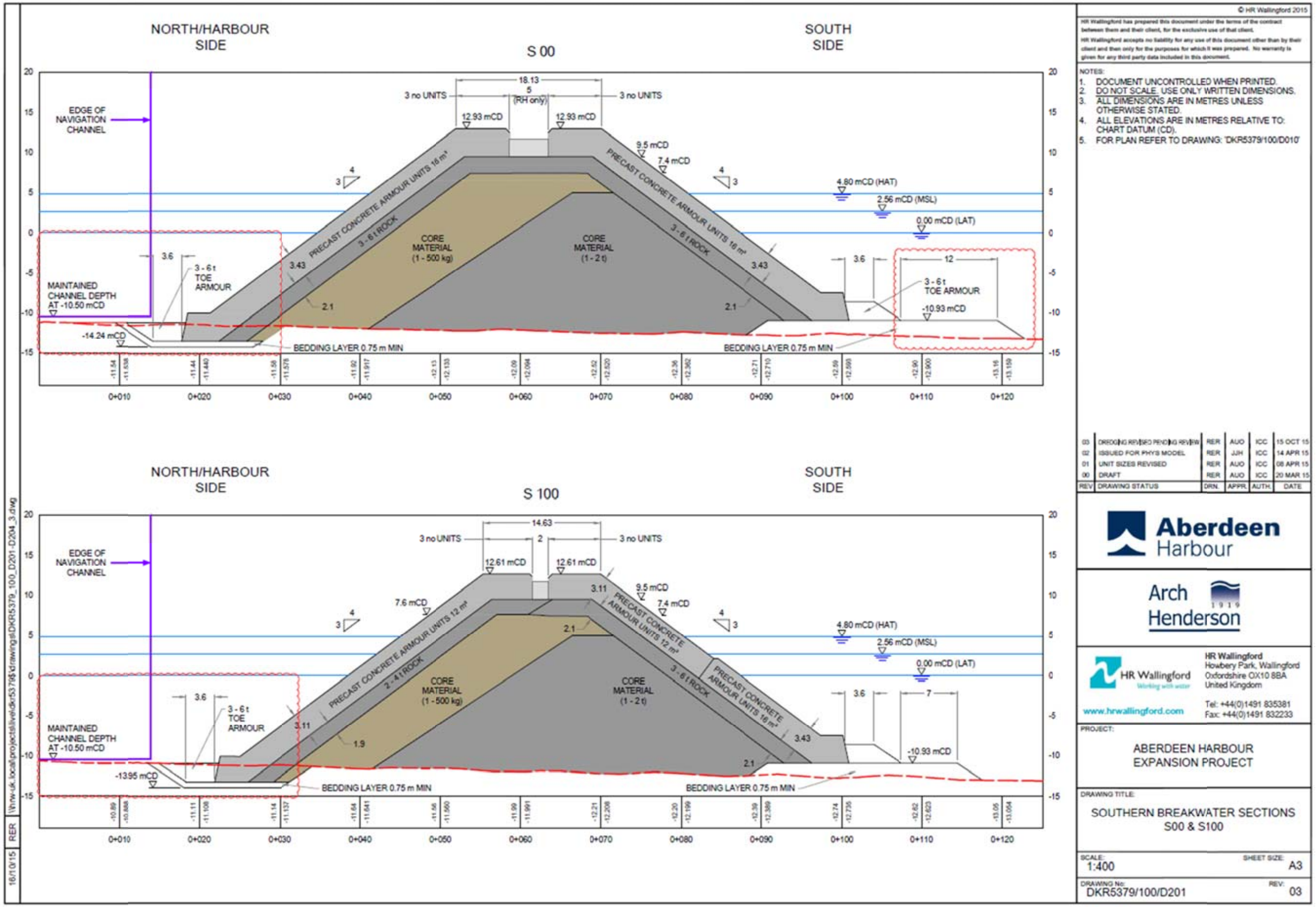

Figure 3.5: Cross-section through mid-point of southern breakwater

3.5.1.1 Climate Change

The breakwater design considered the Defra (2006) climate change allowances for Scotland (HR Wallingford, 2015b). The recommendations to account for sea level rise are to add 2.5 mm/year to 2025, then 7.0 mm/year to 2055, then 10.0 mm/year to 2085, then 13.0 mm/year thereafter to the design thresholds (HR Wallingford, 2015b). SEPA (2014) guidance (referenced in HR Wallingford, 2015b) states that a minimum of 600 mm sea level rise should be incorporated into the design.

The joint probability water level associated with the 1:200 year wave condition is 5.27 m above CD, which includes the sea level rise allowance until 2110 of +0.87 m. The joint probability water level associated with the 1:1 year has been estimated as 5.17 m above CD, which also includes the sea level rise allowance until 2110 (HR Wallingford, 2015b).

3.5.2 Illustrative Breakwater Construction Methodology

It is anticipated that the breakwaters will be constructed from the land by unloading material from trucks and by placing underlayer and armour using excavators and/or cranes. The crest of the core has been designed to have a minimum width of 16 m.

Temporary site access shall be required for both north and south breakwaters during construction and for future maintenance. Terrestrial site access via road for the northern breakwater will be created from Greyhope Road, adjacent to the Scottish Water valve house building. Terrestrial access via road to the southern breakwater will be achieved by crossing the field at Greg Ness (HR Wallingford, 2015d), as shown on Figure 3.3.

It is anticipated that the construction of the breakwaters will commence before the quay wall construction and dredging works, although some dredging and breakwater construction will be done concurrently. Quayside construction will commence before the breakwaters are fully completed. The breakwater roots will have limited storage areas therefore some storage areas will need to be created and or material placed directly into the works. The toe of some breakwater sections will require dredging. Given the exposed location of the site and severe wave conditions, it is envisaged that primary armour on the seaward side will be installed once sections of the core and underlayer are placed, to prevent it from washing away. Figure 3.6 illustrates the proposed breakwater construction sequence (HR Wallingford, 2015d).

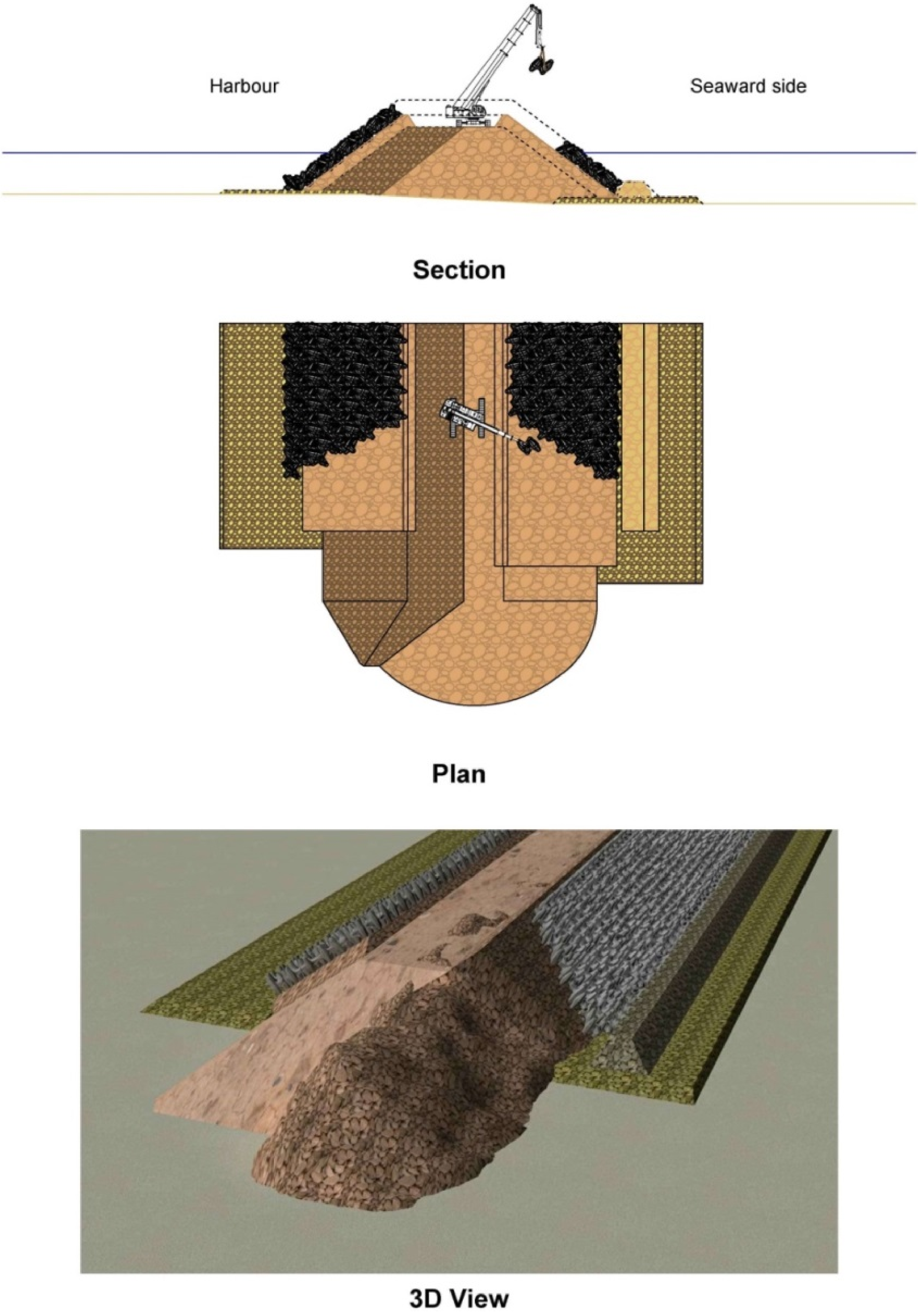

Figure 3.6: Illustrative breakwater construction sequence

Wherever viable, excavated and dredged material will be re-used as infill on site where practicable, particularly excavated or dredged rock. However, in order to meet the MPS, D&B contractors may choose to obtain rock and infill from other land-based sources. Potential sources include local quarries and those further afield in west Scotland and Norway. It is likely that large rock will be brought to site by sea; however, for the purposes of assessing the realistic worst case scenario, this ES has assumed that all construction materials will be delivered by road. This is assessed in ES Chapter 18: Traffic and Transport and ES Appendix 18-A: Transport Assessment.

Prior to their use in the breakwater construction, the concrete armour units will be fabricated and cured either offsite (and brought to the site by road) or within designated temporary working areas (shown on Figure 3.2) (HR Wallingford, 2015d). For the purposes of assessing the realistic worst case scenario, this ES has assumed that the armour units will be made onsite within designated temporary working areas.

The construction of the breakwaters will involve both land and marine based operations. It is likely that the preferred option is the use of land based equipment for the delivery of the majority of material due to unfavourable wave conditions (HR Wallingford, 2015d). However, the core material could be placed, using tipper trucks and split barges (a barge which can hold material between the bulkheads which is where the barge splits along the bottom and deposits its cargo) and/or side stone dumpers (these vessels deposit the rock from the side of the vessel) simultaneously from land and from the sea. Filter layers can then be placed in similar ways, followed by armour units. These units can be placed by excavator and/or cable cranes, either from a barge, or from the breakwater. They could be supplied from the breakwater using a flatbed truck or by water on flat-top barges. It is possible that the area of seabed to the east of the north breakwater may be used as a lay down area.

Initially a backhoe dredger is likely to be used to dredge a footprint for the breakwater. Land based material may be placed directly onto the breakwater or stockpiled on site. Hauling, spreading, levelling and compaction of the core causeway berm would be undertaken by a loading shovel, 20 tonne to 40 tonne articulated dump trucks (ADTs) or road wagons, a heavy duty bulldozer with angle blade, towed roller and 45 tonne 360° long reach excavator with GPS monitor to control trimming (HR Wallingford, 2015d).

The concrete armour units will likely be placed using land based equipment albeit some of the units at the base of the breakwater may need to be installed with marine plant (HR Wallingford, 2015d). It is possible that jack-up barges may be used for this, and therefore the area of seabed east of the north breakwater may be disturbed.

For the breakwater rock armour the 1 tonne to 3 tonne rock would be loaded by 360° excavator into ADTs and transported along the breakwater core to the point of deposition. Rock would be placed using a 360° long reach excavator, placing between tides onto the trimmed face of the core. (Where possible operations will continue on a 24 hour basis, however some elements of the work may be tidally restricted.) It is envisaged that both faces of the breakwater would be worked simultaneously to keep pace with the seaward extension of the core to provide protection at the earliest opportunity. The armour stone could be placed from floating plant.

3.6 Dredging

The scenarios assessed in this ES are based on capital dredging occurring concurrently with the breakwater construction. The inner basin will be dredged to 9 m below CD, the eastern berth to 10.5 m below CD, and the approach channel to 10.5 m below CD. Figure 3.8 shows the areas of the bay that will undergo dredging. There will be areas that require localised deeper dredge pockets to facilitate construction, as shown in Figure 3.8.

Dredging activity is anticipated to take 19 months in total and dredging could take place 7 days a week throughout the year with up to 3 barges operating at any one time, including the potential for 24 hour operations. It is likely that the trailer suction hopper dredgers (TSHDs) will be in operation at the project site first in order to remove the initial less consolidated layer. Backhoe dredgers will then be used to excavate the rock layer down to the target depth (along with any drilling and blasting required to loosen the rock).

3.6.1 Re-use and Disposal of Dredged Material

The total volume of material to be dredged is 2,300,000 m^3, of which 109,000 m^3 is rock (see below). AHB have assessed the relative environmental benefits and effects of different re-use or disposal options within a Best Practicable Environmental Option (BPEO) report (Arch Henderson, 2015). Whilst the re-use of excavated material will be prioritised wherever viable, contractors may elect to use infill and rock materials from other sources to meet the MPS. Therefore the plume dispersion modelling (ES Appendix 7-D: Sediment Plume Modelling) is based on a worst case scenario of all excavated material (except rock) being disposed of at AHB's licensed disposal site (shown on Figure 3.7); however, in reality it is likely that the contractor will reuse a proportion of the material in the reclamation, so this is a highly conservative assumption. This is assessed in Chapter 7: Water and Sediment Quality.

It is anticipated that 109,000 m^3 of the material to be dredged is rock, located in the areas shown on Figure 3.9. All rock will be used within the harbour works and will not be disposed offshore.

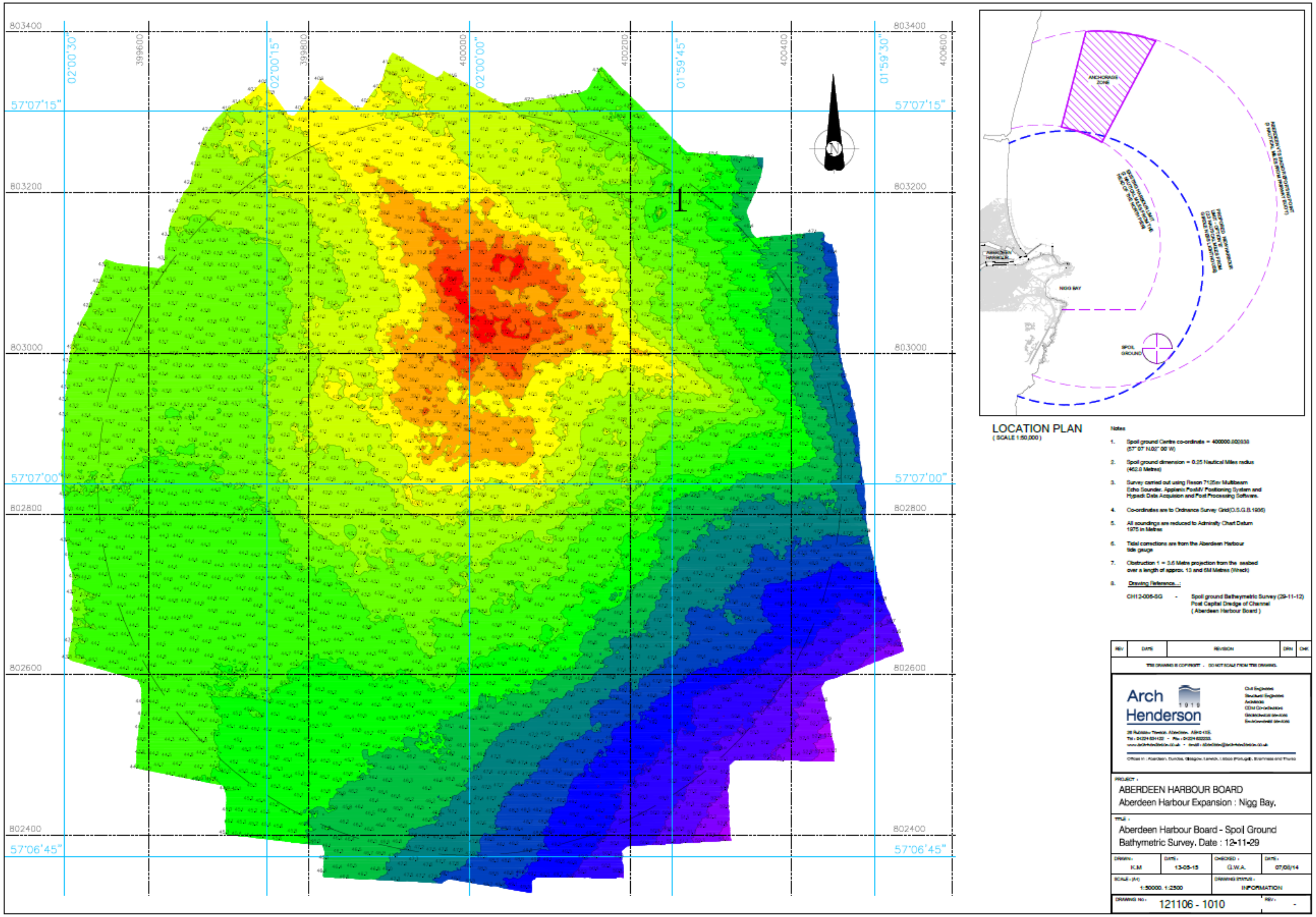

Figure 3.7: Licensed dredge disposal area

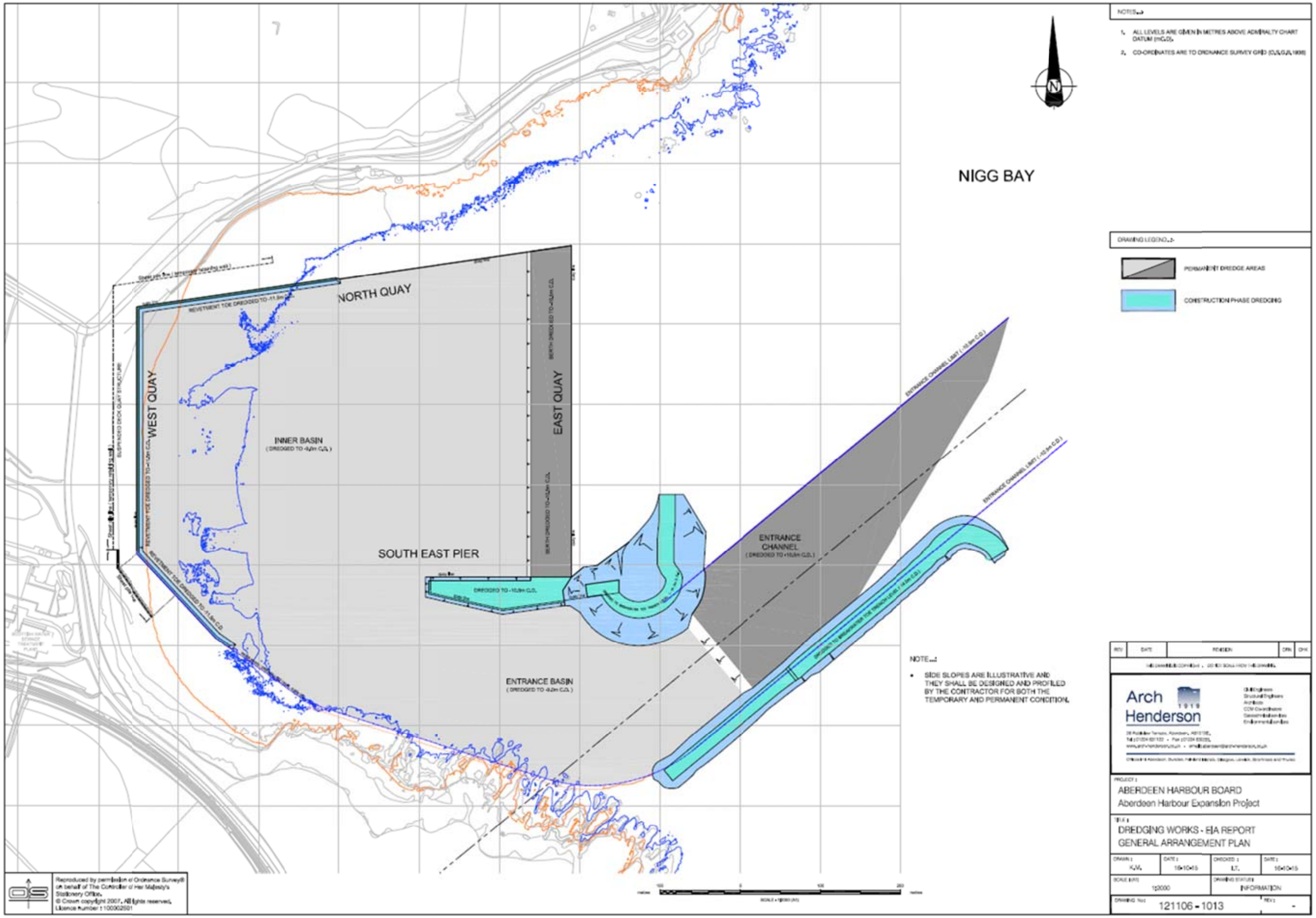

Figure 3.8: Dredged Areas

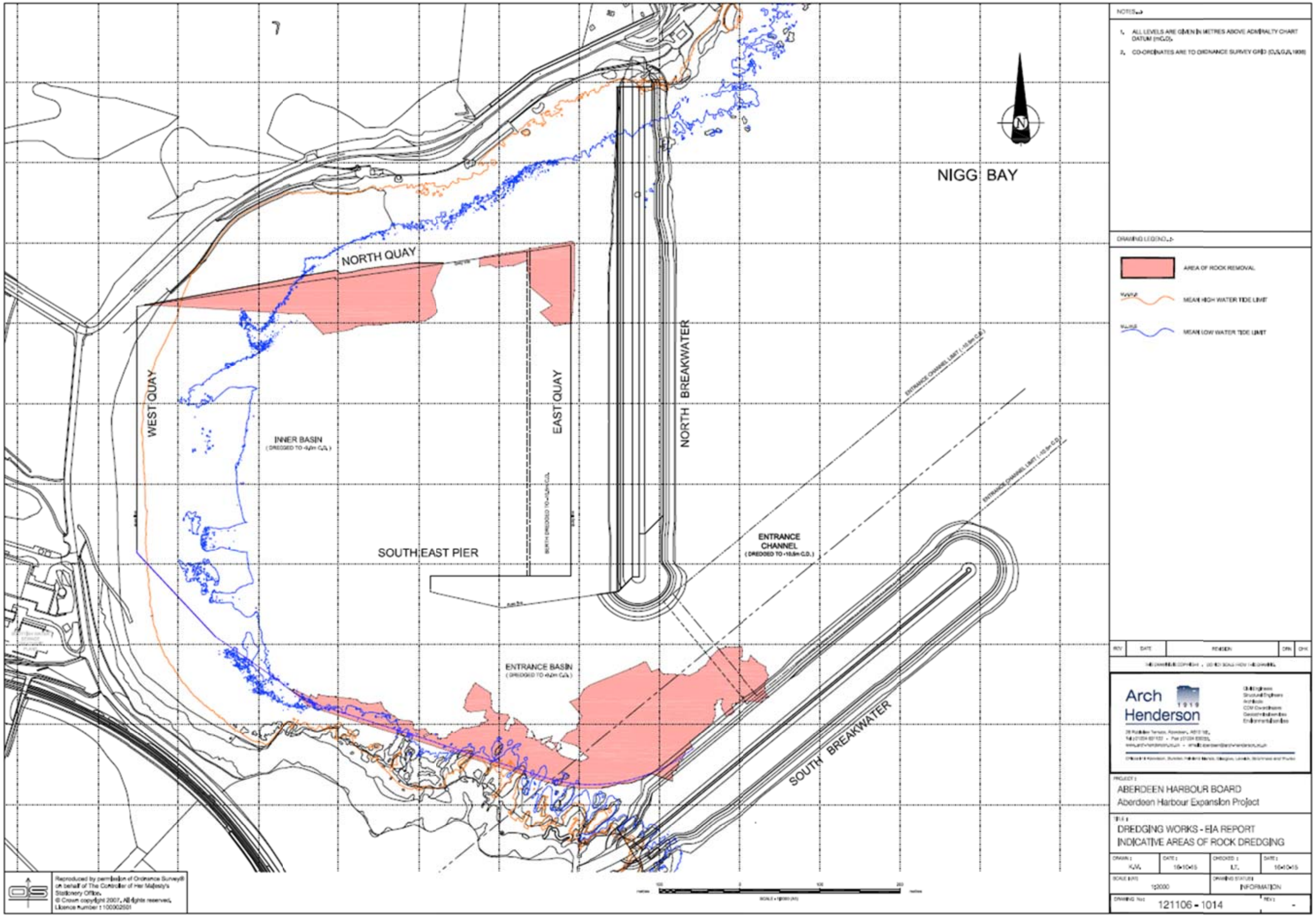

Figure 3.9: Areas of rock dredging

3.6.2 Illustrative Dredging Method

It is likely that both a TSHD and backhoe dredger will be used for dredging operations (please refer to Table 3.4 and Table 3.5 for a typical specification).

3.6.2.1 Trailer Suction Hopper Dredger

Where possible, unconsolidated material will be removed using a TSHD. This type of dredger has a suction pipe with a draghead at the end of the pipe which hangs off the vessel, with the pipe and draghead trailing along the seabed. A pump is used to draw the seabed material up the suction pipe where material is discharged into the hopper.

The assessments used in this ES are based on publicly available datasheets for a typical TSHD with the specification outlined in Table 3.4, notably a hopper capacity of 5,600 m^3. Whilst contractors may employ alternative TSHDs, the specification outlined in Table 3.4 is likely be similar to that of any TSHD suitable for the D&B contract.

Table 3.4: Typical specification of the type of TSHD likely to be used

Features	Main Specifications	
Mechanical dredge pump through 2 engines	**Gross Tonnage**	5,000 tonnes
Two jet pumps	**Length Overall**	97.50 m
Three main engines: Two are dedicated for propulsion and the third drives the dredge pump during trailing During shore discharge, two main engines will drive the dredge pump and the third engine is available for propulsion/positioning of the vessel	**Breadth**	21.50 m
	Hopper Capacity	5,600 m^3
	Suction Pipe Diameter	1,000 mm
	Max. Dredging Depth	33 m
	Discharge Systems	Bottom doors/pump ashore
	Sailing Speed Loaded	13.0 knots

3.6.2.2 Backhoe Dredger

A backhoe dredger will be used to remove the more consolidated material. This is typically a stationary dredger which has a hydraulic excavator with a digging bucket at the end and is positioned on top of a turntable attached to one end of the pontoon. The pontoon uses spud legs to keep it stable and stay in position. Once the bucket has been lowered and has dug up/removed material, the bucket is lifted, then swung over to and placed in a barge which is located alongside the pontoon. As this is a stationary dredger, the dredging area will be the limit of reach of the bucket. Once this limit is reached the pontoon will be repositioned. Typically this type of dredger can operate in up to approximately 20 m water depth. This method tends to create less turbid conditions than the TSHD. The material removed will be disposed of through the bottom opening of the barge (into which the dredged material is placed) at the licenced offshore disposal site or reused within the harbour works.

The assessments undertaken in this ES are based on publicly available datasheets for a typical backhoe dredger suitable for the D&B contract. Whilst contractors may employ alternative backhoe dredgers, the specification is likely to be similar to that outlined in Table 3.5.

Table 3.5: Typical specification of the type of backhoe dredger likely to be used

Main Specifications		Main Specifications	
Gross Tonnage	1,090 tonnes	**Bucket Capacity Mud Bucket**	22 m^3
Length Overall	55 m	**Bucket Capacity HD Bucket**	9 m^3
Breadth	17 m	**Maximum Dredging Depth**	26 m
Normal Draught	3 m	**Anchoring System**	3 spuds/tilting spud
Type of Excavator	Liebherr P995		

3.6.3 Drilling and Blasting

The rock to be dredged (see Section 3.6.1) will require pre-dredge treatment through drilling and blasting methods in order for the material to be removed. Some drilling will be undertaken from land. Marine drilling is likely to take place from a barge or jack-up.

Drilling will be undertaken in preparation of blasting works. Drilling will continue until all the pre-selected number of holes have been completed. The holes will have been pre-selected based on the type of geology of the seabed in question and vibration limits.

Drilling and blasting activities could be undertaken at any point during the dredging programme (Phase 4, Table 3.2). However, in accordance with the EMP, blasting operations will only be undertaken during daylight hours, under normal conditions. (Blasting may need to be done at other times for safety reasons.) All other noisy activities will be halted during blasting.

3.7 Harbour Quays

The west and north west quays will be open quays with a suspended deck. The north east and east quays will be solid quayside.

Onshore plant will include batching plants, concrete mixers, mobile cranes and crawler cranes from 20 tonnes to 400 tonnes or larger, tipper trucks and flatbed lorries. The quays and paved areas will provide over 140,000 m^2 of working space.

3.7.1 Open Harbour Quay

A cross-section and elevation of a typical section of the open harbour quay is shown in Figure 3.10. The indicative construction sequence is as follows:

i. Installation of sheet piled wall;

ii. Structural piling;

iii. Formation of revetment;

iv. Installation of suspended slab/deck;

v. Formation of solid quay behind the sheet piled wall; and

vi. Installation of fenders.

3.7.2 Solid Quayside

Figure 3.12 presents illustrative drawings of closed-faced solid quaysides. The indicative construction sequence is as follows:

i. Installation of solid piled wall;

ii. Infill behind the wall; and

iii. Installation of slab.

Material to be used as infill when constructing the quays and the indicative volume of this material is shown in Table 3.6.

Table 3.6: Material and volumes of infill for quay construction

Harbour Area To Be Infilled	General Fill [m^3]
North quay construction	386,750
East quay construction	435,600
West quay construction	34,700
North and west quay construction (suspended deck area)	55,750
Total	**912,800**

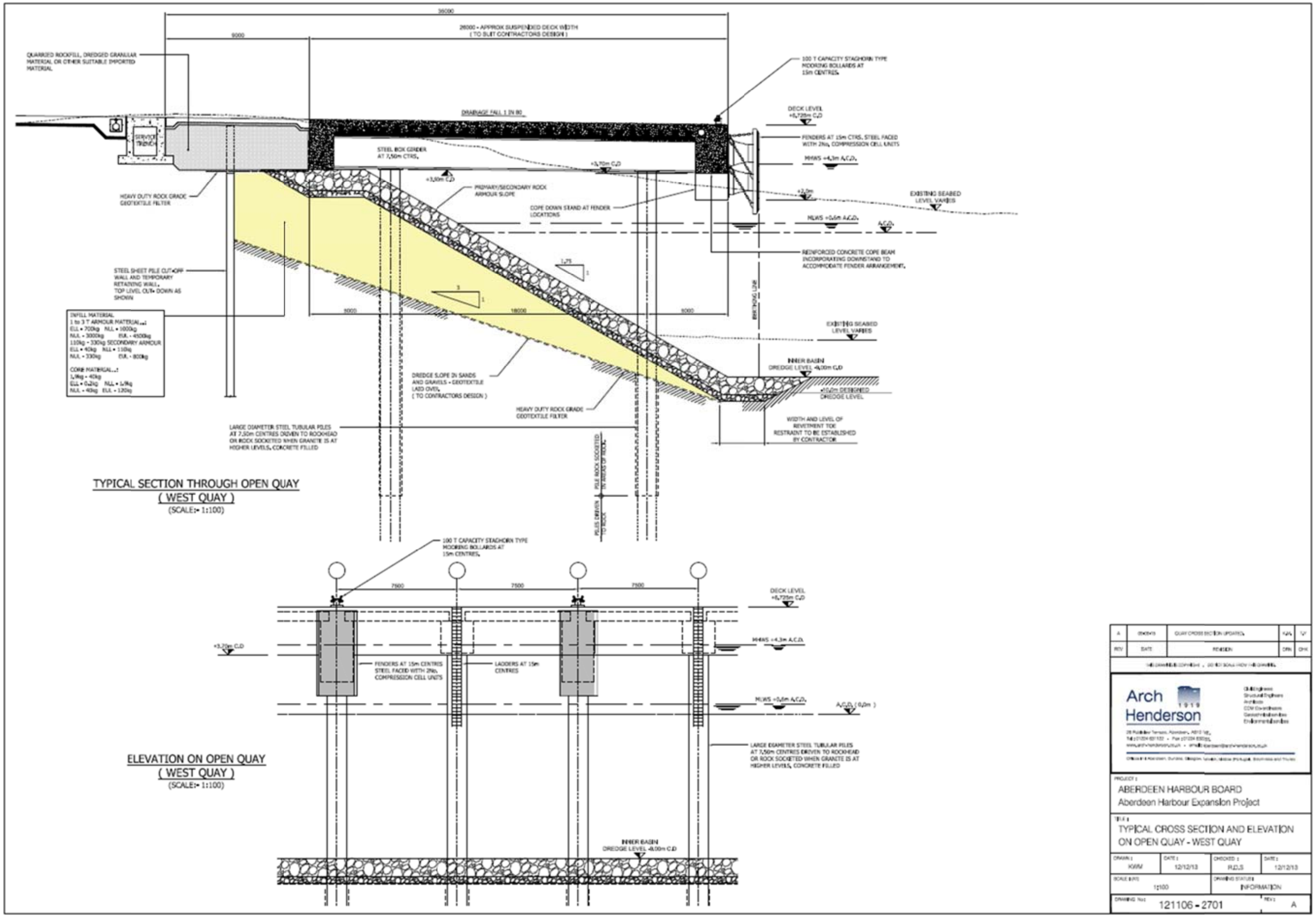

Figure 3.10: Illustrative cross-section and elevation of a typical section of an open quay – West Quay

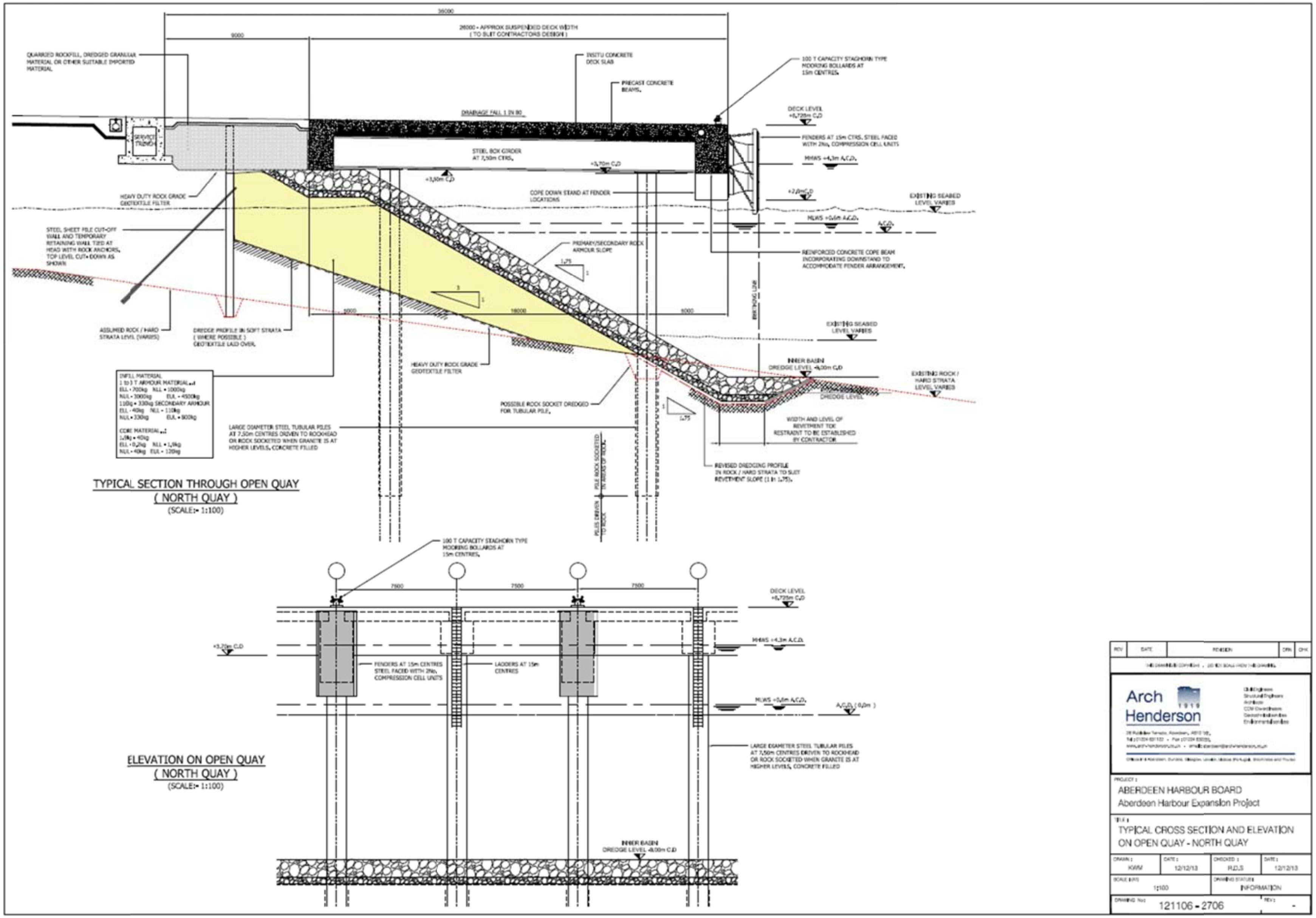

Figure 3.11: Illustrative cross-section and elevation of a typical section of an open quay – North Quay

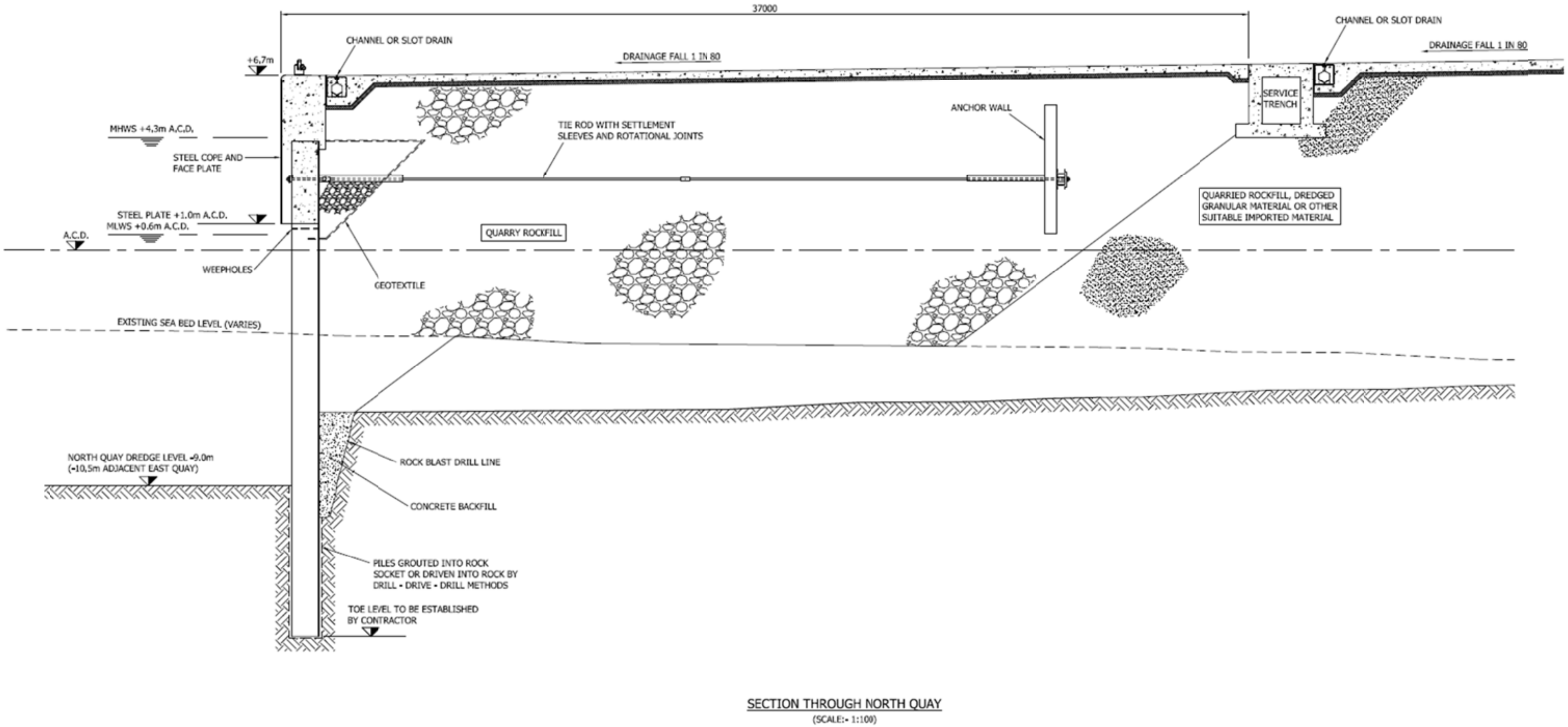

Figure 3.12: Typical cross-section through North Quay

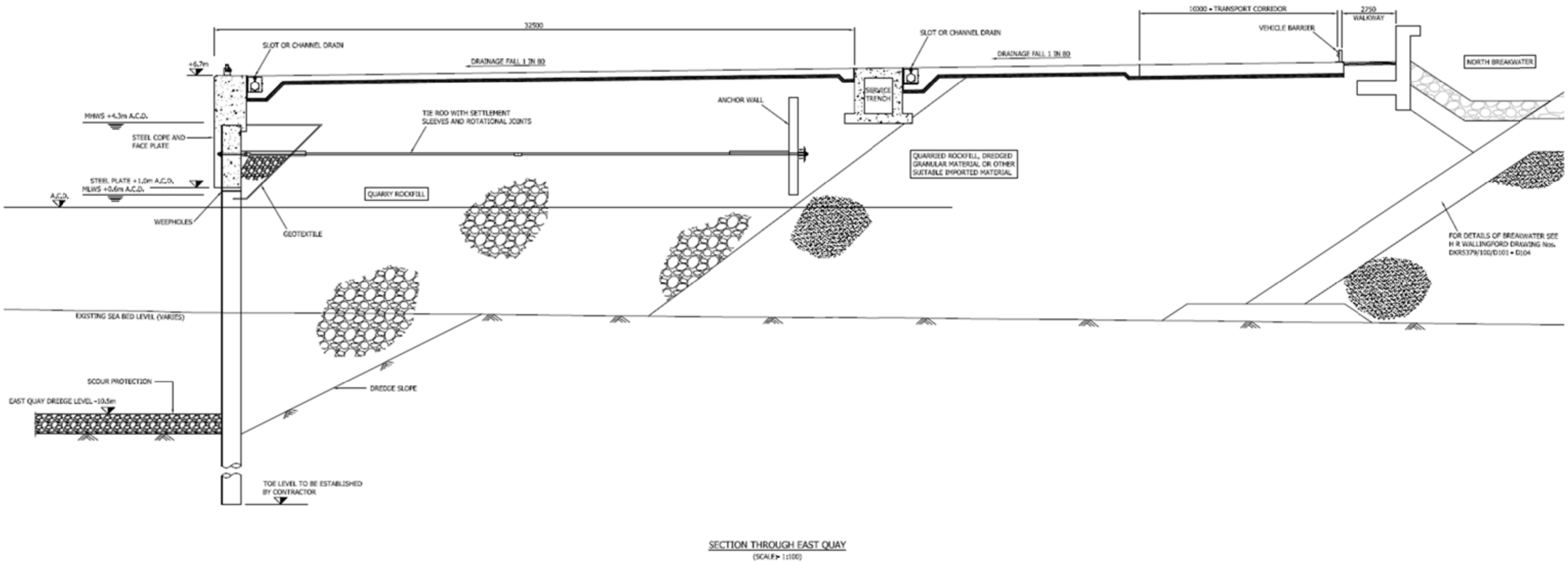

Figure 3.13: Typical cross-section through East Quay

3.8 Infrastructure

Table 3.7 provides a summary of the indicative infrastructure likely to be present at the harbour. Indicative locations are shown in Figure 3.3. The two heavy lift areas mentioned are areas of reinforced quayside to support temporary mobile cranes. The visual effects of all temporary plant are assessed in Chapter 17: Seascape, Landscape and Visual Effects.

Table 3.7: Indicative infrastructure

Infrastructure Type	Number	Dimensions	Indicative Location
Fuel tanks	3	20 m diameter by 10 m high	North quay
Composite bulk tanks	48	9 m high and 4.8 m in diameter, with 1 m between tanks Total area: 45.4 m by 33.8 m	North quay
Water tanks	4	12.2 m diameter by 11.5 m high	North quay
Substation	1	3 m by 4 m by 3 m	North quay
Welfare building	1	15 m in length, 7.5 m width and 3 m high	North quay
Car park, new road layout (Greyhope Road)	56 car parking spaces (3 for the mobility impaired, 5 motorcycle bays and bike rack for 6 cycles)	2,350 m^2	Corner of the north and west quay
Gatehouse	1	8.5 m in length, 4.3 m in width and 3 m in height	Corner of the north and west quay
Welfare building	1	15 m in length, 7.5 m width and 3 m high	Corner of the north and west quay
Weighbridge	2	4 m by 4 m by 2.5 m	Corner of the north and west quay
Heavy lift areas (areas of reinforced quayside to support temporary mobile cranes)	2	60 m by 30 m	East and north quay
Monopiles/spar buoys	4	Spaced evenly, parallel to the Greg Ness shoreline towards the west quay	Southern section of the harbour

3.8.1 General Items

The harbour will operate as a cargo handling and cruise vessel facility 24 hours per day and 7 days per week, so there is the potential for activity at any time of the day or night. Cargo handling equipment is likely to be encountered on all areas of the harbour quayside. This will include:

- Mobile cranes and specialist mobile bulk handling systems used for loading and discharging cargo from vessels within the harbour;
- Flatbed lorries: delivering and uplifting cargo from vessels within the harbour;

- HGVs: delivering and uplifting cargo from vessels within the harbour;
- Light vans: delivering cargo or providing maintenance and servicing to vessels;
- Tankers:- delivering bulk goods and liquids to the vessels or removing liquids and waste from vessels; and
- Forklift trucks: loading and unloading vehicles servicing vessels in the harbour.

In addition to the general cargo operations, there will be:

- Coaches collecting and returning passengers from visiting cruise ships;
- Security staff based within the gatehouse and undertaking patrols when appropriate;
- Staff looking after the facility maintenance and boatmen assisting with vessel moorings;
- Third Party Stevedore Companies loading and unloading vessels; and
- Coaches and taxis facilitating crew changes on vessels.

The internal port roadways and footpaths will be painted with marked routes and barriers will be installed where necessary. There will be a 2.9 m high security fence around the site perimeter to protect the harbour as well as the public, and to prevent access to breakwaters (access gates will be provided for maintenance). The fence will be constructed in accordance with the requirements of the International Ship and Port Facility Security Code (ISPS).

3.8.2 Lighting

Illumination of the harbour will meet required safety specifications and will be provided by Light-Emitting Diodes (LEDs) on columns at intervals around the site. Lighting will be provided to give 50 lux at working areas; lighting will be directional and dimmable. It is likely that lighting columns will be 25 m high at 40 m centres. There is likely to be additional lighting around the site entrance for security, safety and signage.

Leading sector lights will be installed on land to the west of the southern breakwater for navigation purposes. These leading lights will illuminate along the centre line of the approach channel in between the north and south breakwater.

Lighting will be required throughout the construction phase during periods of low light.

The potential effects of lighting have been assessed in Chapter 11: Terrestrial Ecology and Chapter 17: Seascape, Landscape and Visual Effects, and the subsequent design and specification of lightening systems will be informed by these assessments wherever practicable.

3.8.3 North Quay Infrastructure

The indicative locations of quayside infrastructure are shown on Figure 3.3

Quayside services such as fuel, composite bulks, brine and power will be incorporated into a service trench that will run around the harbour with spur points to the quayside at regular intervals. Dimensions of quayside infrastructure are provided in Table 3.7.

Three fuel tanks will be provided (by a third party) in a bunded compound to the rear of the north quay. These tanks will be approximately 20 m diameter and 10 m high and will provide bunker fuel to ships. Provision is also made for a bunded area 35 m by 25 m to accommodate the composite bulk tanks. The 48 composite bulk tanks are anticipated to be 4.8 m diameter and 9 m high.

Four water storage tanks will be installed on the quayside to supply potable water to vessels. These tanks are expected to be in the order of 12.2 m diameter and 11.5 m high. Located near to the water tanks will be a substation approximately 4 m length, 3 m wide and 3 m high, and a welfare block 15 m length, 7.5 m width and 3 m high (both single storey).

3.8.4 Corner of the North and West Quays

A temporary road closure will be sought for the north of Greyhope Road for the duration of the construction phase. A stopping up order will be sought for the south end of Greyhope Road and for the junction of St. Fittick's and the Coast Road (if required) as both of these roads will be subject to a permanent diversion.

Access and egress from the development after completion will be via a security control area on the north western side of the site (as shown on Figure 3.3) secured by fencing which will comply with the International Ship and Port Facility Security (ISPS) Code. This area will include a gatehouse, weighbridge cabin and welfare building. The gatehouse is required for access and egress of the site and it is anticipated that this will be 8.5 m length, 4.3 m width and 3 m high. The weighbridge is anticipated to be 4 m length, 4 m width and 2.5 m high. The one storey welfare/administration building is planned for quayside staff and will occupy a footprint of approximately 24 m by 10 m; the building itself will be 15 m length, 7.5 m width and 3 m high.

3.8.5 Southern Section of the Harbour

A secondary gate to the quayside will be built to provide an alternative entrance in the case of emergencies/blockage of main entrance. This will also provide access from the Coast Road for occasional buses serving cruise vessels, or to accommodate abnormal loads. A maintenance route to the southern breakwater will also be built at the south of the site, with access from the Coast Road for occasional maintenance.

Spar buoys will be installed at regular intervals from the southern breakwater to the west quay, as shown on Figure 3.3.

3.9 Vessel Traffic

The annual vessel traffic forecast for the new harbour is approximately 550 commercial vessels, 1,700 platform supply vessel (PSV)/offshore vessels, 40 diving support vessels (DSV) and 33 cruise ships. This is in addition to the 8,000 per year vessels visiting the existing harbour (i.e. it is not intended that the new harbour will divert vessels away from the existing harbour).

The harbour use is designed to be flexible so that any type of vessel can berth anywhere, subject to draught and length. The maintained dredge depth within the harbour will be 9.0 m below CD, with the eastern quay dredged to 10.5 m below CD to accommodate deeper draught vessels. The maximum vessel length that can be accommodated will be 300 m long. Quay occupancy is estimated to be at 65%.

For further details of the baseline and future case for navigation please refer to the Appendix 21-A: Shipping and Navigation Technical Report.

3.10 Terrestrial Traffic

The designated route for all construction HGV trips would be via Coast Road and Hareness Road to the south of the site and onto Wellington Road. Within Altens Industrial Estate there would also be potential to use Crawpeel Road or Blackness Road to reach Wellington Road via Souter Head Road. No construction HGVs would be permitted to enter or exit via Torry or Cove.

As previously stated in Section 3.5.2, the assessments in this ES are based on a worst case scenario of all materials being delivered by road during the construction phase. Predictions for operational phase traffic volumes are based on Aberdeen City Council's existing traffic model predictions for Altens in 2020, incorporating all committed development and predicted road vehicle movements associated with the new harbour (see Appendix 18-A: Transport Assessment).

Predictions for future harbour-related vehicle movements were based on traffic associated with the existing harbour, and were agreed with Aberdeen City Council before future traffic modelling was undertaken. The vehicle movements associated with this level of activity were assessed as not significant and are explained more fully in the traffic impact assessment (Chapter 18: Traffic and Transport).

Localised carriageway widening is proposed, utilising land that is available within the highway boundary on the section of Coast Road between Hareness Road and the railway bridge. No new roads are proposed outside of the site boundary. Local realignment and relocation of the traffic lights and markings at the railway bridge are also proposed. A reduction to the speed limit on Coast Road is proposed (see Chapter 18: Traffic and Transportation for further details).

3.11 References

1. ARCH HENDERSON, 2015. *Aberdeen Harbour Expansion – Nigg Bay Harbour Dredging Best Practicable Environmental Option (BPEO) Report.* Report number: 121106.
2. HR WALLINGFORD, 2015a. *Aberdeen Harbour Nigg Bay Development: Reference Design – Breakwater.* Report Number: DKR5379-RT103-R02-00.
3. HR WALLINGFORD, 2015b. *Design Basis and Functional Requirements – Breakwater.* Report Number: DKR5379-RT001-R02-00.
4. HR WALLINGFORD, 2015d. *Outline breakwater construction methodology.* Report in progress.