Aberdeen Harbour Expansion Project

Construction Method Statement

TABLE OF CONTENTS

1. PURPOSE

This Construction Method Statement (CMS), prepared by Dragados UK, details the construction methodology for the Aberdeen Harbour Expansion Project (AHEP). It has been produced to inform stakeholders regarding the procedures and programme of the AHEP construction phase.

Figure 1 – Aerial view of the bay prior to construction

2. DESCRIPTION OF WORKS

The main activities and work packages for the construction of AHEP include:

- Dredging the existing bay to design depths varying from -9 to -10.5m chart datum (CD). The dredged material is expected to comprise of sand/alluvium, glacial till and rock materials.
- Profiling the existing Southern slopes of the bay. This is intended to reduce wave reflection within the central berthing and approach channel areas of the development by absorbing incoming waves.
- Construction of two rubble mound breakwaters 634 metres (North Breakwater) and 640 metres (South breakwater). The purpose of these structures is to protect the new facilities from damaging North Sea metocean conditions.
- Construction of approximately 886m of closed and 538m of open quays1 to provide a combined total of over 1424m of quayside capable of berthing vessels.
- Land reclamation activities to provide a paved area immediately to the rear of the quayside installations. This will use materials recovered from dredging operations supplemented by imported materials.
- Provision of ancillary welfare accommodation, quayside furniture and water tank installations for the facilities operational stages.
- Numerous stages of off-site highway work to allow free flowing traffic around the new facilities during construction and operation. This will include improved access for Heavy Goods Vehicles (HGVs).

Figure 2 – Imposed aerial view of the bay after completion of construction

[1] C osed quays have a foundat on w th a so d construct on, wh ch presents a so d barr er to seawater under the deck. An open quay has a deck supported on p es, wh ch a ows seawater to pass through the unders de of the deck.

3. SITE LAYOUT

3.1 SITE ESTABLISHMENT AND WELFARE

There will be three temporary compounds used for the duration of the construction period:

1) Central Compound: area surrounding the junction of St Fitticks Road, Coast Road and Greyhope Road currently used for recreational purposes. The Central Compound will host the site offices (for management and engineering staff) and project welfare facilities (for operatives and skilled labour).

2) North Compound: area located in the existing Walker Park currently used for recreational purposes. The North Compound will house the visitor centre, an area to temporarily fabricate accropodes (concrete blocks) as a contingency measure, a storage area for the construction activities, and a construction workshop area.

3) South Compound: area located south of Nigg Bay currently used for agricultural purposes. This area will contain the accropode fabrication and storage facilities.

The location of the compounds in relation to the main construction activities means the site is accessible and serviced by one of the three compound areas without the need for a shuttle or mobile welfare services. Wheel-wash facilities will be implemented at the exit points as shown on Appendix 1 (A, B, C and D) to prevent dirt and debris from leaving the work areas.

See Appendix 1 (A, B, C and D) for proposed plans of the 3 construction compounds.

3.2 ACCESS TO THE SITE

AHEP is accessible by several routes for light goods and personal vehicles travelling from the city centre and South. The site is limited to one single route from the south for HGV traffic.

The site will be signposted with all relevant restrictions shown in advance though a Traffic Management Plan. This includes the installation of semi-permanent traffic signs on poles and a dedicated customer enquiries telephone line.

3.2.1 Access for LGV

Light goods vehicles (LGVs) and cars are permitted to access the site without restriction. If travelling from the South the route in section 3.2.2 will be followed. If travelling from the North or City Centre then the route detailed below and in figure 3.2.1A should be followed:

- Cross the A956 road bridge over the River Dee and take the first exit from the Roundabout onto South Esplanade West.
- Follow South Esplanade West until its Junction with Victoria Road under traffic signal
- Turn right at the traffic signals and follow Victoria Road in a Southeasterly direction. Follow signage for desired site access point.

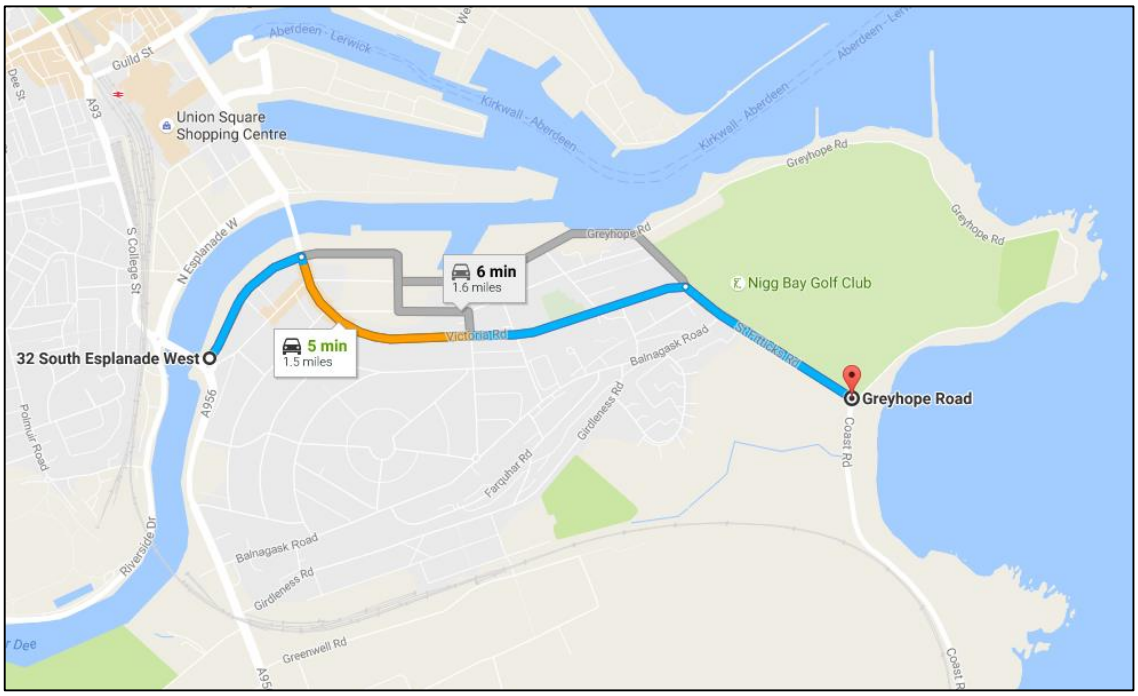


Figure 3.2.1– Access for LGVs and cars

3.2.2 Access for HGV

HGVs are restricted to one point of access to and from the site only. This access route has been agreed and documented with regulatory bodies and **MUST** be adhered to at all times. Under no circumstances will any HGV access the site by any other means unless fully authorised by the site team and appropriate regulatory authorities.

The route to be followed is as detailed in figure 3.2.2A

- Travel East on Hareness Road from the A956
- Continue East leaving 2No roundabouts at their second exits
- At the T-Junction between Hareness and Coast Road, turn North (left)
- Follow Coast Road in a northerly direction passing over a railway bridge controlled by traffic signals. NOTE THIS STRUCTURE HAS A WEIGHT LIMIT OF 40T
- On leaving the railway bridge, follow signage for desired site access points (section 3.3)

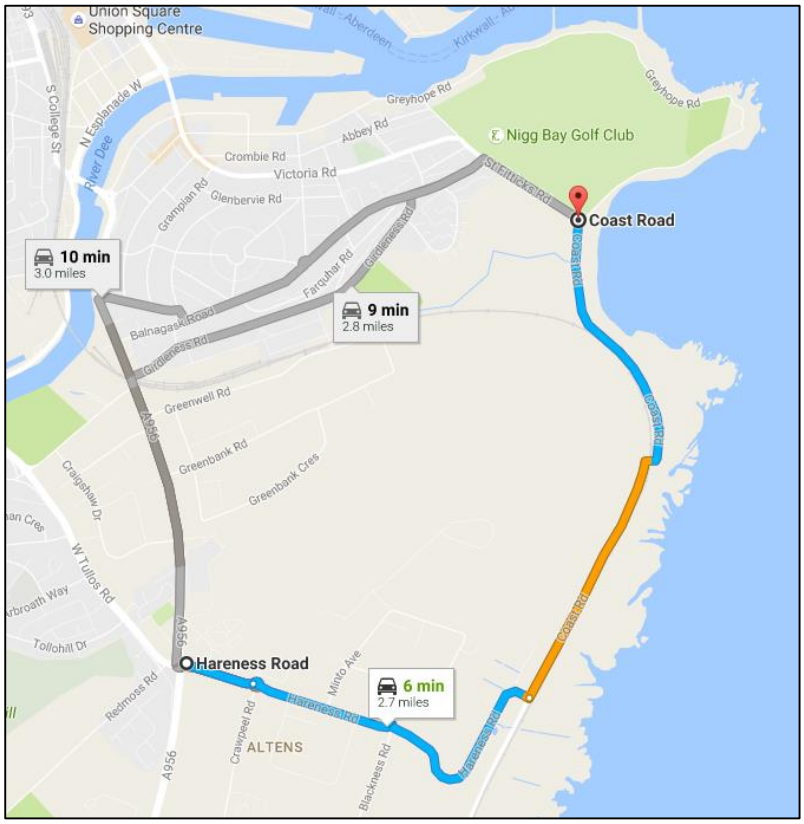


Figure 3.2.2 – Designated access route for HGVs to access Nigg Bay (Shown in blue and orange)

3.3 ACCESS TO CONSTRUCTION AREAS

Access within the site is provided by several temporary access routes, each serviced either by Coast Road or Greyhope Road.

The temporary access routes (Table 3.3A) will be formed of a granular material and will be maintained to ensure that maximum accessibility is available. The routes form an additional 5 access points for the site to those listed in 3.2.

Route	Termination Point	Information
MC00	South Breakwater	Accessible only for entry Southern Compound site. HGVs will use this route travelling from the south to deliver core material to the southern breakwater. All vehicles will use MC10 to leave the working area.
MC10	Fabrication Yard	Access to the fabrication facilities for all vehicles. Access to the southern breakwater for vehicles traveling from the north.
MC30	Southern Slopes (Land Blasting)	Access for land blasting equipment to profile the Southern slopes which is not practical to complete from the marine environment.
MC50	North Breakwater	Access for HGVs and general traffic delivering material or requiring access to the North Breakwater.
MC60	Project Offices	Accessible from Greyhope Road which will be closed at its junction with St. Fitticks. This access route will allow traffic to enter the project's office management facilities.

Table 3.3 – Description of temporary access routes.

4. PROGRAMME OF WORKS

The programme duration of 176 weeks began with contract award 20th December 2016. The detailed programme is provided on Appendix 3 and summarised below.

The initial priorities are to:

- complete the discharge of relevant pre-construction planning conditions,
- commence the enabling works and surveys,
- achieve statutory consultees acceptance and approval of the project's Health & Safety, Quality and Construction Environmental Management Plans, and
- installation of temporary perimeter fencing to secure the site boundaries and earth works in the compound areas (anticipated in April 2017).
-

The completion of these activities leads on to the construction period for the temporary access routes. In addition the Central and Southern Compounds will be prepared for welfare and pre cast yard installations respectively. It is expected that by late April/May 2017 that the site offices will be operational and the fabrication of precast elements will be underway.

On completion of site installation activities in early to mid-2017, general construction activities and marine works will commence. The general construction activities include:

- fabrication of precast elements, such as accropodes (which continues into late 2018),
- the realignment of Coast Road and St Fitticks Road, and
- relocation of services and the temporary installation of utility supplies for the UFI, Marine Scotland and other buried services.

The first phase of marine construction activities are planned to be undertaken in the favourable weather window from May to September 2017. This will include dredging, drilling and blasting of the sea bed for north quay. The initial emphasis will be focused on the north breakwater including placement of core breakwater material and direct deposit of quarry material.

The marine activities are expected to be suspended by the end of September 2017 following the installation of armour and accropodes. It is anticipated at this stage that the breakwater levels will be completed to +6.5/7.5m CD and the first phase of the crown wall[2] will be complete. Construction of temporary rock protection will also be completed to protect the works during the winter season.

Over the winter of 2017, the caisson fabrication commences in mainland Spain. Preparatory and fabrication works are anticipated to run from December 2017 to July 2018. From April to August 2018 there are 4 planned voyages delivering at total of 22 caisson units.

The second phase of marine construction are planned from early 2018 to summer 2018. In this phase the north breakwater will be completed, followed by the southbreakwater.

The north breakwater will provide shelter in Nigg bay enabling quay installations to begin. In April 2018 preparatory works for the east quay will commence and first caissons will be installed. Quay installation will occur between June 2018 and March 2019. Dredging

[2] A crown wa s a concrete structure nsta ed on the top of a rubb e mound breakwater. It can reduce the mpacts of wave overtopp ng and prov des a f at surface wh ch a ows access to the breakwater.

activities will continue during the course of 2018 with some of the dredge material used to backfill the quays. Drainage, civil works and pavement installations complete the closed quay structure ready for building, furniture and installations beginning in April 2019.

Quayside activities and finishes will complete the programme. This includes the installation of water tanks, buildings and mechanical and electrical works which run from March 2019 through to April 2020. This will allowing a project handover to Aberdeen Harbour Board in May 2020.

These activities will be followed by the installation by Aberdeen Harbour Board of navigation aids, lights, CCTV and security. This are anticipated to be completed at least eight weeks prior to the planned AHEP completion date of 10th May 2020.

4.1 WORKING HOURS

The construction programme takes into account realistic working hours and third party restrictions. Based on Dragados' previous experience we are confident that these working hours will allow the project to meet all key construction dates including incorporating a two week Christmas and one week Easter shutdown period.

Proposed working hours are detailed below, with general activities (any activity not listed within Table 4.1A) being run 6 days per week from 07:00 to 19:00 Monday to Friday, and 09:00 to 16:00 on Saturdays with no Sunday working. As construction works progress, there is the potential for these working hours to be amended depending on progress.

Work Aspect	Activity	Working Hours
Dredging	Drilling and blasting	During daylight hours
	Dredging	24 hours, 7 days a week
Breakwater	Marine placement	24 hours, 7 days a week
	Direct placement	16 hours, 6 days a week
	Rock and Accropode armour placement	20 hours, 7 days a week
	Crown Wall	16 hours, 6 days a week
Closed quays	Bedding layer and cells filling	16 hours, 6 days a week
	Cope beam	12 hours, 6 days a week
Casting yard	Precast Fabrication	16 hours, 5 days a week
Caissons	Fabrication, transport and setting	24 hours, 7 days a week

Table 4.1 – Representation of construction working hours

5. CONSTRUCTION ACTIVITIES

5.1 ENABLING WORKS

5.1.1 Road Works

There are two main roadwork activities proposed (see Appendix 2 for plans):

- Works to the existing Coast Road to the South of AHEP, requiring the existing pavement surface to be widened to accommodate an increase in HGV traffic between Hareness Road and Doonies Farm.
- Realignment works to move the existing Coast, Greyhope and St. Fitticks Road(s) profiles to accommodate harbour entrance facilities.

5.1.1.1 Widening Works to Coast Road

Pre-construction, traffic management will be in place and Coast Road closed, allowing safe and non-restricted access to the area for contractor(s). Site clearance works will be carried out, such as removal of boundary wall/fence, signpost, signage and other street furniture. Following clearance activities, earthwork activities will be completed involving the removal and importation of material(s) to form required profiles.

Once levelling has occurred, the existing blacktop surface will be removed through milling. The milling machine will run the route removing the required quantities of blacktop surface. The output material will be discharged directly into the back of a truck for removal from site for recycling.

Once the road surface has been reduced to required levels, blacktop components will be delivered via truck to the location. The material will be placed into the hopper of a paver and installed in the required thickness along the route. Following the paver, a roller will compact the material. The process will be continued until the pavement is complete in each individual characteristic layer.

On completion of the running layer, line markings and surface textures will be undertaken, signage reinstated, traffic management removed and the Coast Road opened to the public.

5.1.1.2 Road Realignment to Coast, Greyhope and St. Fitticks Roads

Pre-construction, traffic management will be in place to allow safe working areas for the workforce and public around the realignment works. Site clearance works will be carried out including stripping of topsoil and furniture removal. All material will be stockpiled locally or managed according to the Waste Management Plan. Then earthwork will be completed including the removal and importation of material(s) to form required profiles. Milling activities will take place on existing carriageway tie in locations to form required profiles for the running surface transition.

Once the road surface has reached desired levels, blacktop will be placed at the required thickness along the route. Following the paver, a roller will compact the material. The process will be continued until the pavement is complete. Line markings and surface textures will be installed. Running simultaneously, boundary restraints and signage will be reinstated for full transition of traffic management to align vehicles to the new carriageway.

Some existing services along the Coast Road and St Fitticks Road need to be diverted to enable the existing junction re-alignment. Trial pits will be dug to determine the exact location of the existing services. The new cable trench will then be excavated, new services laid and new connections made by a specialised statutory services provider. The new lines will be tested and commissioned before they are brought into service.

5.1.2 Preparation of Contractors Working Areas

Prior to construction, boundary fencing will be installed around the working area. Depending on ground conditions, the fencing will be installed by mechanical or hand excavation means at post locations and secured with a concrete/post mix. Site access points (ie entrances) will be installed by excavators and trucks removing/importing material to form required ground profiles.

Within the site boundary, excavators and bulldozers will profile the land and install drainage. Bulldozers will push all material to a local point where excavators will load for removal future storage and reuse. Where the land is not workable by a bulldozer, a mechanical excavator will break out hard material and load directly to a truck. Mechanical excavators will locally form all service trenches.

On reaching required ground levels, imported material will be placed by truck for spreading via bulldozer. The bulldozer will be followed by a roller to compact the material to the required bearing pressure(s). Services will be installed and connected with local backfill completed by excavator.

Areas requiring higher bearing capacity will be completed and finished through concrete slabs. A blinding layer will be installed consisting of mass concrete mix delivered via a concrete truck and placed via excavator bucket. The concrete pour will be completed using direct discharge where possible. All concrete trucks will be sent back to the batching plant for washout.

The temporary office and welfare cabins will be modular. These will be installed using a Hiab or a 40 Ton crane on cast in situ footings. The cabins will then be fitted before brought into use.

The fabrication shed will compromise a steel structure with frames at 5m spaced PVC coated sandwich façade and roof and cast in situ footings. This will be erected using a Hiab or a 40 Ton crane.

The 3 construction compounds will require the following connections to the existing services:

- **Northern Compound**: will require a foul connection to the St Fitticks sewer to discharge the water from the temporary accropodes fabrication yard. This discharge will be through a surface pipe along the north side of Greyhope Road. The power supply will be provided by the local distribution operator (SSE) using an existing distribution route along Greyhope Road. Rainwater will be collected by the compound drainage system and discharged into the Girdleness outfall.
- **Central Compound**: will require an effluent trade connection into St Fitticks sewer. The power supply will be provided by SSE using an existing distribution route along St Fitticks Road.

- **Southern Compound:** will require a foul and effluent discharge into the existing 900mm combined sewer. The water to be discharge will be processed through a water treatment set before discharge. The power supply will be provided by SSE using an existing distribution route along the Coast Road. Rainwater will be collected by the compound drainage system and discharged into the sea, once approved.

5.1.3 Temporary and Permanent Coastal/Cycle Route Alignment

A primary network of paths borders the site location, consisting of the National Cycle Network and Coastal Path. The paths will be developed so that no section of the network will be closed before a new section is open to the public. Both the temporary and permanent makeup of paths are similar in nature and construction.

The layout of the cycle path can be found in Appendix 2. The approach to management of vehicles and cyclist/pedestrians is described in Traffic and Transport Management Plan.

5.1.3.1 Cycle Path Construction

Path installation will mainly be completed outside the current cycle route and will be independently fenced from surrounding activities. Where works are required on the existing cycle route, a segregation system will be introduced to allow half of the path width to be worked on while the other remains open.

Excavation and fill profiles will be completed using a small excavator and dump truck. The dump truck will transport a local stockpile in manageable volumes to be placed as required to form the permanent works. Likewise, manageable volumes will be removed in reverse order. On achieving required land profile, similar techniques will be used to place path make up. A roller will then be used to provide the required bearing pressure.

The cycle path section is shown on Figure 5.1.3.1

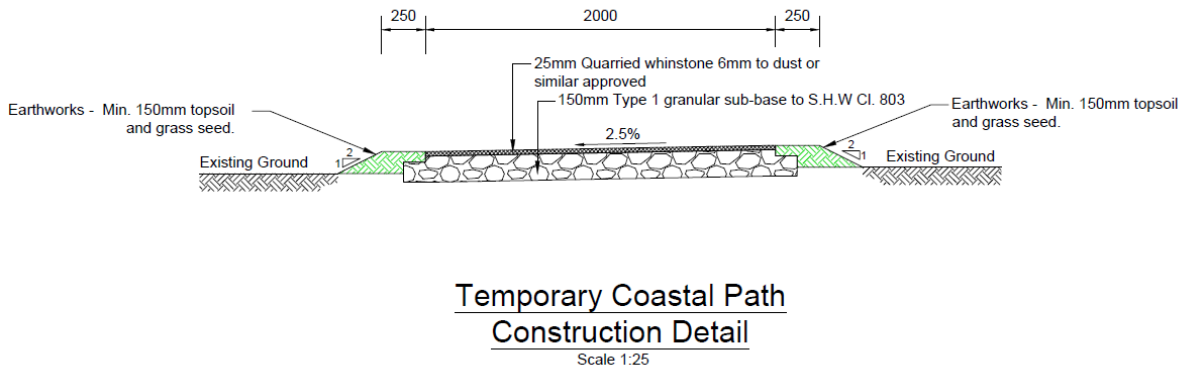


Figure 5.1.3.1 – Cycle Path Section

5.2 BREAKWATER CONSTRUCTION

Two breakwaters will be built to protect the harbours inner basin from the North Sea metocean conditions.

At 1274m combined length, the breakwaters firstly require a trench to be formed in shallow water to support the accropode units. On completion of the trench the core of the structure will be placed on the seabed using quarry material sized between 0.1-500kg. Secondary protection will be provided by placement of a heavier grade of rock sized between 0.3-3,000kg using the land dumping technique. The final layer of protection is provided by 8-12m^3 accropode units. The North breakwater will also include a crown wall system.

The cross section in Figures 5.2 shows the placement of the material in the north and south breakwaters.

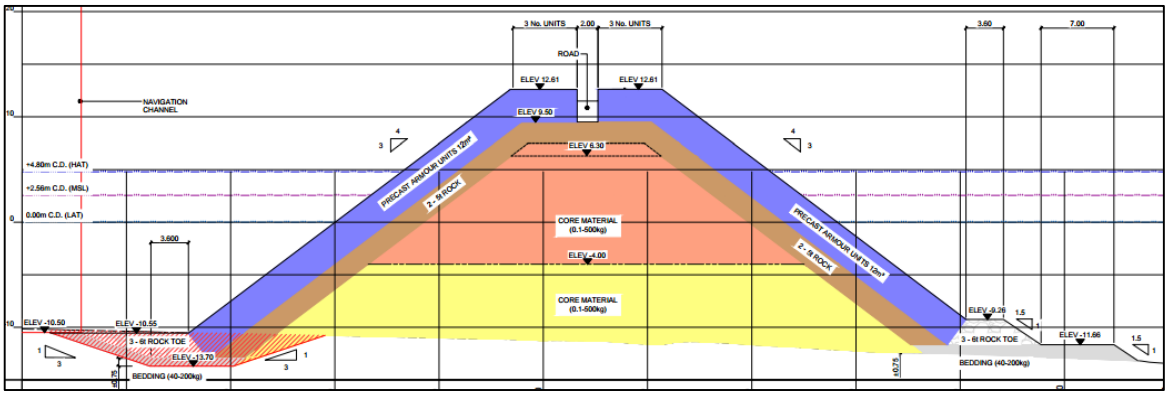


Figure 5.2 – South Breakwater Cross Section

Both breakwaters are anticipated to be completed in the 2017 and 2018 weather windows. Design levels show that the following quantities of material are required:

	Element (t)	
	North BW	South BW
Core Material	213 156	340 934
Bedding Material	7 581	13 640
Secondary Protection	51 580	86 134
8m3 Accropode	3 077	1 508
10m3 Accropode		2 410
12m3 Accropode		1 502

5.2.1 Rock Trench Formation – South Breakwater

Accropode units provide protection to the breakwater core material. In order to stabilise the accropodes, formation of a rock trench is required for the southern breakwaters outer footprint. As shown in figure 5.2.1, the trench reacts by "locking in" the bottom accropode layers which supporting those above.

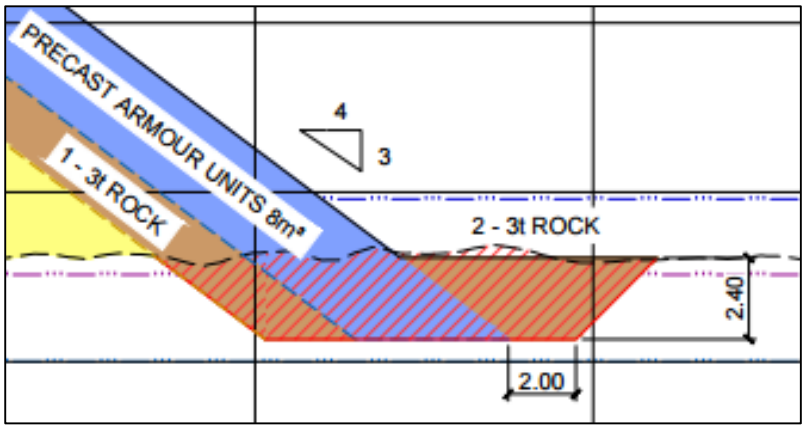


Figure 5.2.1 – Example of rock trench

5.2.2 Core Material Placement

Two separate methods of installation will be used to deal with the different bathymetric features of the construction location as follows:

- in shallower waters core material will be installed by direct placement by road going vehicles (see section 5.2.3), and
- in deeper waters core materials will initially be installed by marine placement to levels which then become suitable for direct placement by road (see section 5.2.4).

The cross sections in figures 5.2 and 5.1B show the level each of material deposited by each method. Material which is placed by road going vehicles is shown in yellow, and those installed by marine placement is orange.

5.2.3 Direct Placement of Core Material

Dump trucks and quarry vehicles will access the breakwater/land interface using the temporary access routes MC50 and MC00. These vehicles will progress to discharge material at varying locations dependant on the breakwater progression, from the land outwards towards the breakwater head. The material will be pushed by a bulldozer to the required location. Following this a long reach excavator will grade the core material to form the required design slopes for which allow installation of further material.

Figure 5.2.3 – Example of direct placement approach carried out by Dragados

5.2.4 Marine Placement of Core Material

Marine placement increases bed levels to those reachable and manageable by direct placement (see section 5.2.3 above).

The marine placement of core material will be achieved by using a split hopper barge (see figure 5.2.4). The barge will be loaded with core material from an auxiliary quay located in the North compound of the site via dump trucks and quarry vehicles. This auxiliary quay will be built with concrete blocks. Once fully loaded, the barge will then position itself in the required location before opening its hull and releasing the core material into position. The barge will work from the land outwards.

Figure 5.2.4 – Example of quarry vehicles loading a split barge hopper for future discharge

5.2.5 Secondary Armour Placement

The secondary armour placements runs in tandem with core material placement. A heavy duty crawler crane will place secondary and toe[3] armour material. The secondary and toe armour will ensure the previously placed and shaped core material is contained. The toe armour acts as a stability mechanism.

Using orange peel grab(s) (figure 5.1.3A) or rock skip(s) the cranes will work together to place the material on the seaward and harbour boundaries of the breakwaters. The material will range from 0.3-3000kg in weight.

Figure 5.2.5 – Example of armour placement using orange peel grab carried out by Dragados

5.2.6 Armour Unit Placement (Accropodes)

The accropode units act as the primary layer of defence. They will be installed by a heavy duty crane already positioned on the breakwaters for previous construction activities. Fitted with specialized lifting tackle, the crane will install the accropode units one at a time as they are delivered from the fabrication yard on a specialised heavy duty trailer. Positioned with advanced GPS equipment, the accropode will be installed in its final location.

[3] The toe armour s part of the secondary armour ocated at the base of the breakwater on the seaward s de

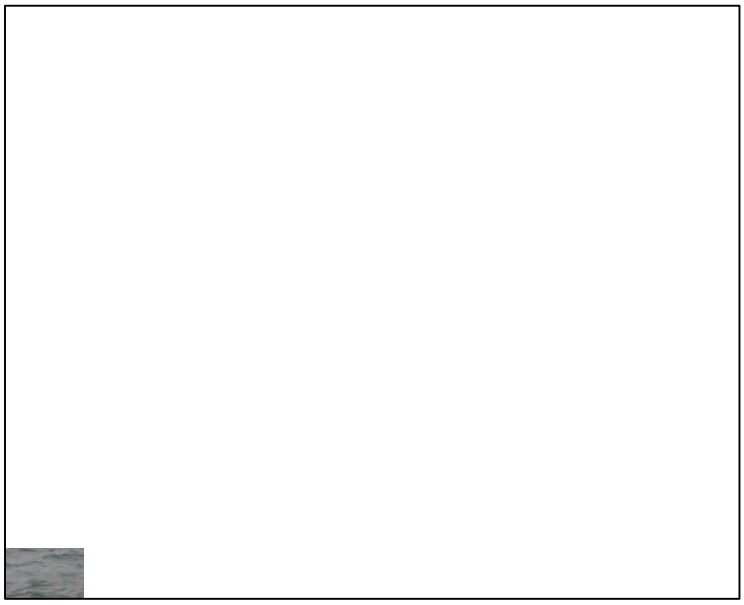


Figure 5.2.6 – Placement of Accropode units

5.2.7 Construction of Crown Wall

The north breakwater crown wall will be constructed over two separate seasons in weather windows of 2017 and 2018. The coronation slab (a concrete slab on top of the breakwater) is expected to be completed in the first season in 2017. The crown wall is anticipated to be completed in the second weather wind in 2018. The coronation slab will allow the initial protection of the core material during the winter, enabling the crown wall body to be completed in the following weather wind.

5.2.7.1 Coronation Slab

The coronation slab will be constructed by use of a traditional formwork system[4]. Manageable lengths of formwork will be constructed by concrete placed directly from a concrete truck/pump and finished to level. Successful curing of the pour will enable the formwork to be removed and constructed within the next section until the coronation slab is completed.

5.2.7.2 Crown Wall

The crown wall will be completed with a specialised travelling formwork system adapted to suit the specific job. The formwork will use the coronation slab and previous crown wall pour as guide to travelling along the element structure. The formwork is self-sufficient and is semiautomatic in operation with personnel and tools situated within (see Figure 5.2.7.2). The concrete will be transported by truck and placed via pump or conveyor.

[4] Formwork s the term g ven to mou ds n wh ch concrete s poured

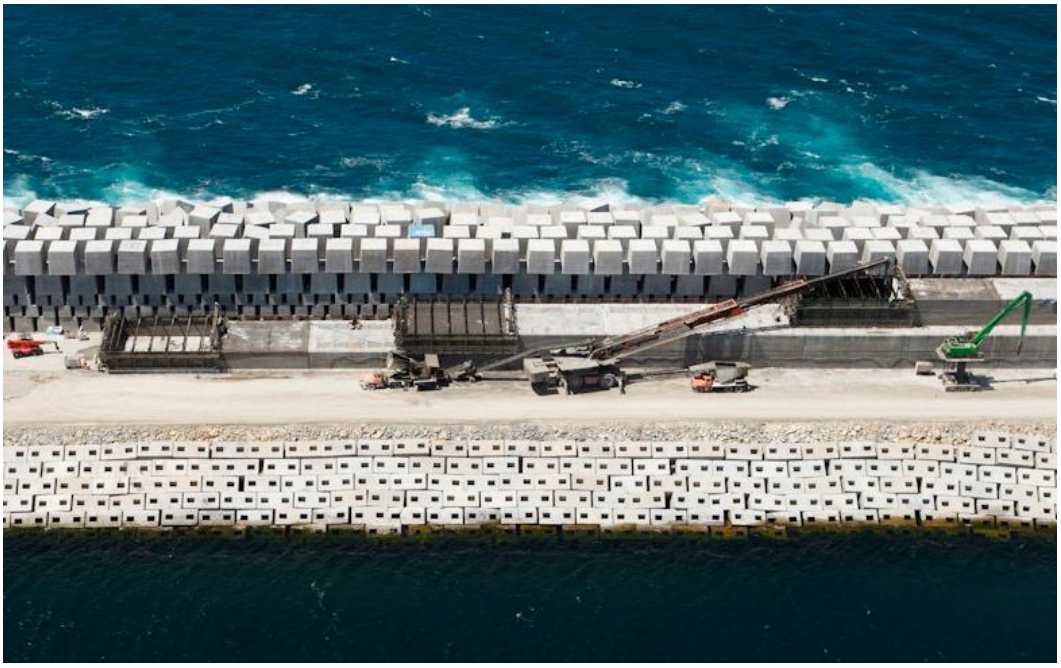


Figure 5.2.7.2 - *Crown Wall Construction*

5.3 DREDGING ACTIVITIES

It is anticipated that dredging activities within the bay will remove three main types of material: sand & alluvium, glacial till and rock. Removal and workability of each respective material requires a different method of removal in both approach and plant selection. Please see Dredging & Dredge Spoil Disposal Management Plan for further detailed information.

Figure 5.3 and table 5.3 indicates the position of the materials which require removal from the bay. This information has been produced from borehole and trial pit information.

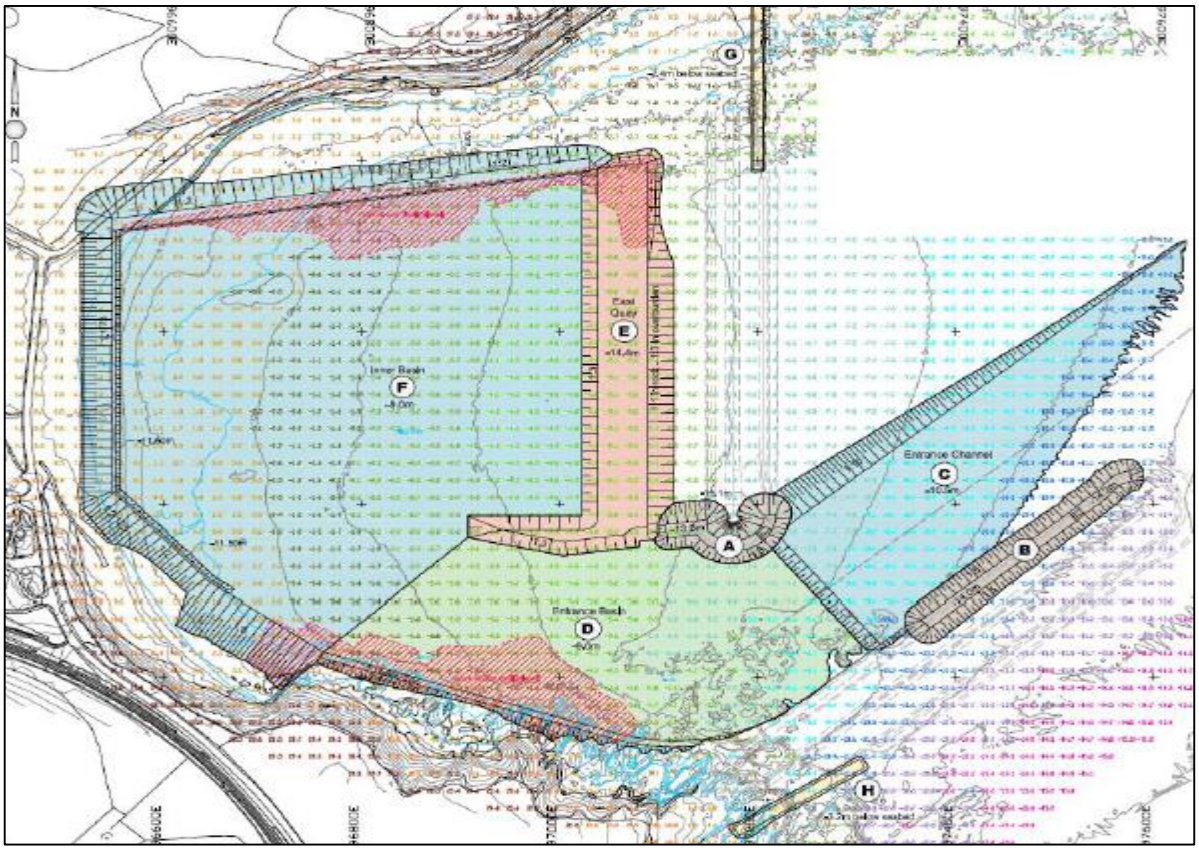


Figure 5.3 – Plan view of work showing dredging area – materials shown in table 5.3

Material	A	B	C	D	E	F	G	H
Sand/Alluvium								
Glacial Till								
Rock								

Table 5.3–Materials which are anticipated to be encountered in zones A-H as shown in figure 5.3

Spread over the bay, all materials are anticipated to be removed in the 2017 and 2018 weather windows. Completion of dredging activities is anticipated to be achieved before the start of 2019.

5.3.1 Dredging Sand & Alluvium

Deposits of sand and alluvium are found within the top layers of the sea bed in Nigg Bay. Given their granular nature they are ideally removed by use of the trailing suction hopper dredge (TSHD) (see figure 5.4.5).

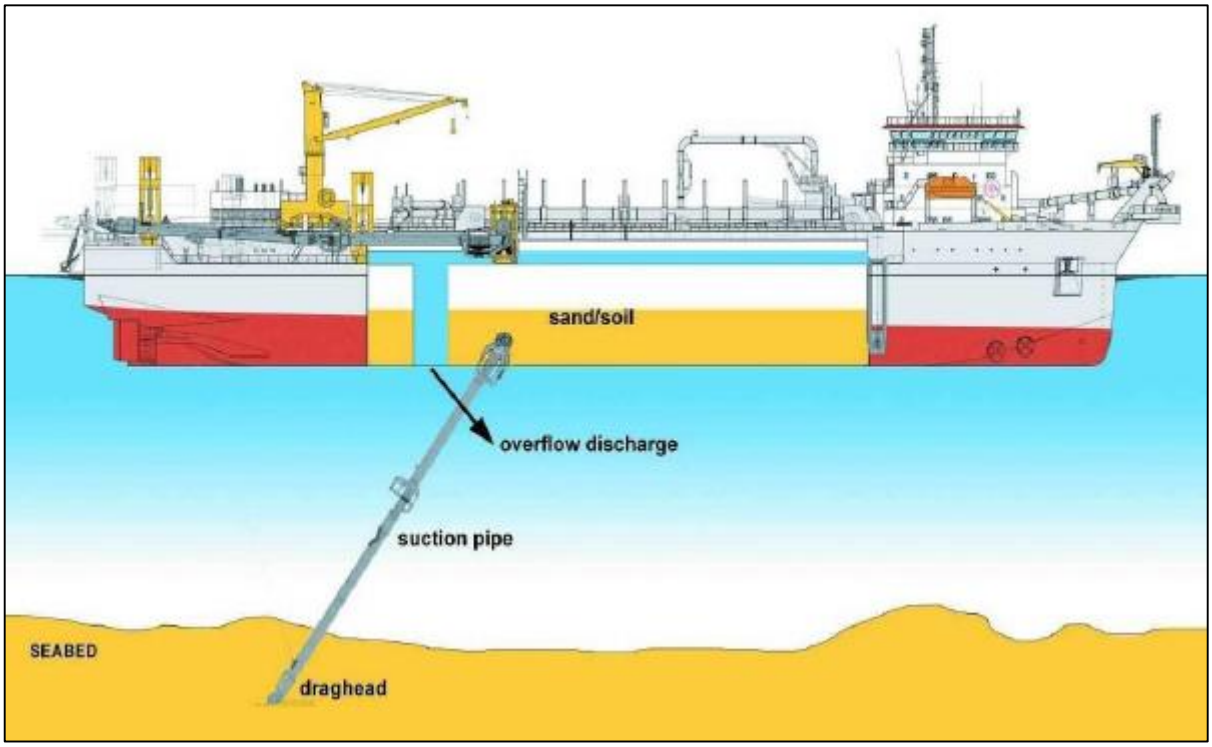


Figure 5.3.1 Draghead representation

A self-propelled vessel, the TSHD will remove the granular material from the bed of the bay by trailing a draghead along the seabed. The draghead will be connected to the vessel by means of a suction pipe into the hull of the vessel. Comprising of several moving parts, the draghead will fit closely to the seabed contours. It uses a range of teeth and water jets to loosen the granular material. The loosened deposits are then vacuumed from the seabed up the suction pipe to the vessels hull by on-board sand pumps.

The material brought aboard the vessel will be stored locally in the vessels hull in a large compartment known as the hopper well. Emptying the material will carried out in one of two ways:

- Bottom discharge at an offshore disposal site - The vessel will position over the disposal site (see section 5.3.4), and the bottom of the vessel will open up to discharge the stored material. Internal water jets will wash down the compartment before the bottom of the vessel is resealed for further dredging activity.

- Pumping onshore/into onshore vessel- The vessel will connect to a floating coupling which directs a pipeline to the shore side/structure. Jets within the vessel compartment will add water and fluidise the dredge material. The fluidised material will then be offloaded from the vessel through this series of pipework.

5.3.2 Dredging Glacial Till

Layers of glacial till can be found within the bay under the aforementioned layers of sand and alluvium. Due to its firm nature, many of the deposits are not fully recoverable by use of a TSHD, and best suited to a cutter suction dredgers (CSD).

A self-propelled vessel, the CSD is equipped with a rotating cutter head, for cutting and fragmenting hard material. The fragmented material is sucked up by means of dredge pumps, and discharged into split hopper barges that are moored alongside the CSD. These split hopper barges unload the soil at the offshore disposal site. During dredging the CSD vessel remains on station, secured by a 'spud' mooring lowered to the seabed. The dredger swings sideways by means of winches and anchors, and the cutter head cuts and removes the soil.

Figure 5.3.2 – CSD Zheng He (Courtesy of Jan de Nul)

5.3.3 Drilling Rock

Below the sand/alluvium and glacial till layers, more dense and tough rock material can be found flowing down to the bedrock layers. This material is note feasible to remove by TSHD or Backhoe Dredger (BHD) methods. As such a drilling and blasting operation is required.

A non-self-propelled jack up barge will be positioned by tug or another self-propelled vessel, and secured via spud legs. The jack up will support a moveable drill tower (see figure 5.3.4).

5.3.4 Dredge Disposal Volumes and Disposal Site

Dredge Area	Dredge Depth (metres below CD)	Clay and Silt (<0.063mm)	Sand (0.063<Sand> 2.0mm)	Pebbles, Cobbles & Boulders (<2.0mm)	Quantity to be dredged (wet tonnes)
Harbour Basin	9.0	14%	69%	17%	4,520,000
East Quay	10.5	14%	69%	17%	1,202,000

Entrance Channel	10.5	14%	69%	17%	280000
North Breakwater	15.0	14%	69%	17%	40000
South Breakwater	14.0	14%	69%	17%	78000

Maximum quantity of capital dredge spoil to be deposited at authorised disposal site CR110-Aberdeen.

4,702,737 wet tonnes / 2,190,000 m ^{3}.

Figure 5.3.4 – Drilling Tower

5.3.5 Drilling & Blasting

The drilling and blasting works will be done from a platform on the jack up with the drill tower using the following procedure:

- Before drilling starts, the outer guidance tube is lowered on the seabed and pushed into the overlaying layer, down to the rock level, by means of air wash
- The vertical position of the outer guidance tube is used for recording the top of rock level. This level is logged in the blasting plan chart, and is later used to calculate the amount of explosive
- When the drilling of a hole is finished, the drill rod is removed, and the hole is ready for charging
- An igniter/starter is placed in the bottom of the hole and the hole is charged by pumping the explosive
- The drill rig is moved on top of the next hole position and the drilling and charging operation is repeated

- Upon completion of the row, the second row is drilled and charged, after that the pontoon is moved to its next spud position, by means of stepping round one lowered spud at a time.

Once the explosives have been detonated, a BHD vessel will remove and load the blasted material in barges for reuse at AHEP (see figure 5.3.5). A non-self-propelled BHD will be positioned by a tug or other self-propelled vessel. The BHD will be fixed to a location by three spud legs. The spud legs together with an excavator bucket located on the BHD are capable of "walking" in parallel lines. This capability dictates that the dredging pattern must be completed in parallel lines.

Working in lanes of 10-15m, the excavator positioned at the tip of the barge will remove material over 5m lengths into self-propelled split barge vessel(s). The excavator will be controlled via GPS systems for optimum control, with the other controls being similar to that of a land based alternative. Once the material within the reach of the excavator has been removed, the vessel will remove its front spud leg from the seabed and "walk" backwards to uncover new ground.

Figure 5.3.5 – BHD and split barge

5.4 QUAY INSTALLATION

The quay arrangement will be constructed in one of two ways:

- A closed quay solution spanning the south east, east and north quays, and
- An open quay solution spanning the west and western section of the north quay.

The closed quay will provide around 886m of berthing capacity with the open quay around 538m.

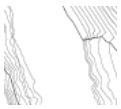


Figure 5.4 – Closed and open quay general arrangement (North top of page)

5.4.1 Closed Quay

The closed quay will be formed by a series of concrete caissons. These vary in dimensions to reflect specific loads and harbour characteristics they must represent when placed. A general caissons is formed with hollow concrete cells and is typically 51.35m long. It has variable widths up to 14.7m and 16.5m in height (see figure 5.3.1A). Once positioned, the hollow cells are filled with material to "sink" the caisson and ground it on the seabed floor to form a permanent quayside structure.

The structure of the caissons will be formed offsite in Spain.

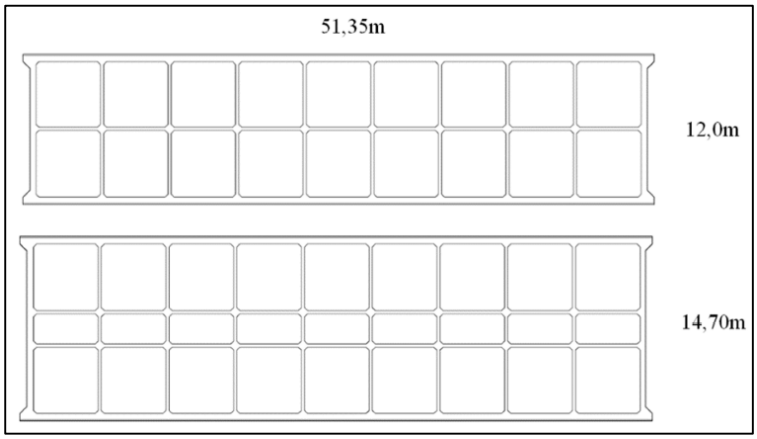


Figure 5.4.1 – General caisson arrangement

5.4.2 Towage to UK

The caissons will be delivered to the UK in groups of six on a semi-submersible vessel (figure 5.3.1.1A). A total of 22 caissons will be delivered over four trips. The caissons will be shipped direct to the vicinity of Nigg Bay, where they will be grouped with mooring lines for immediate towage to site (see section 5.4.3). If required, the caissons may be temporarily stored in other marine areas.

The risk of introduction of non-natives will be managed through implementation of risk assessments as described in the Marine Invasive Non-Native Species and Biosecurity Management Plan.

Figure 5.4.2 – Submersible vessel

5.4.3 Towage to site

Towage to site will be completed by tug boats. The caissons will be secured and pushed/pulled to more sheltered conditions within the bay which will be protected by the north and south breakwaters. In order to install them the caissons will be towed one at a time and installed immediately in their final locations.

Figure 5.4.3 – Towage of Caissons to site

5.4.4 Caisson Embankment (final location preparation)

Prior to positioning the caissons on site the dredging activities documented in section 5.3 will form a trench below the caisson footprint. To provide continuous contact between the dredged trench and caisson base, a rock embankment and fine bedding layer is required (figure 5.3.1.3A).

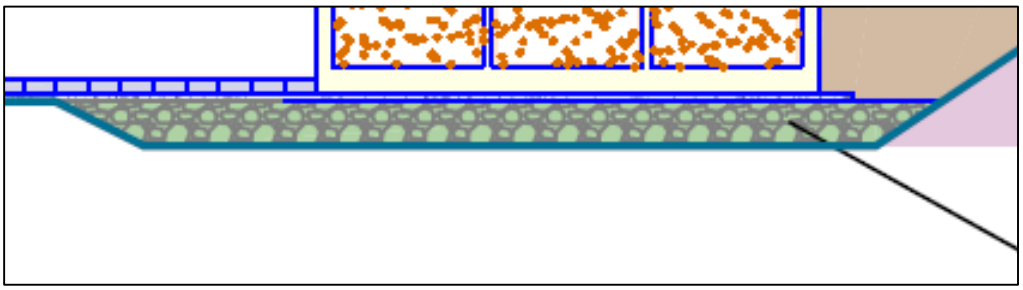


Figure 5.4.4A – Caisson and sea bed interaction

Layers of rock and bedding will be installed by the same methodology and with the same marine vessel. Installation will be using an accurate discharge vessel which is manoeuvrable in all directions to precise precision (figure 5.4.4B). The vessel contains fall pipes and conveyor systems to accurately place the material as required with no need for further levelling.

The vessel will be loaded with material before setting sail to the installation location where in depth survey and discharge operations will commence.

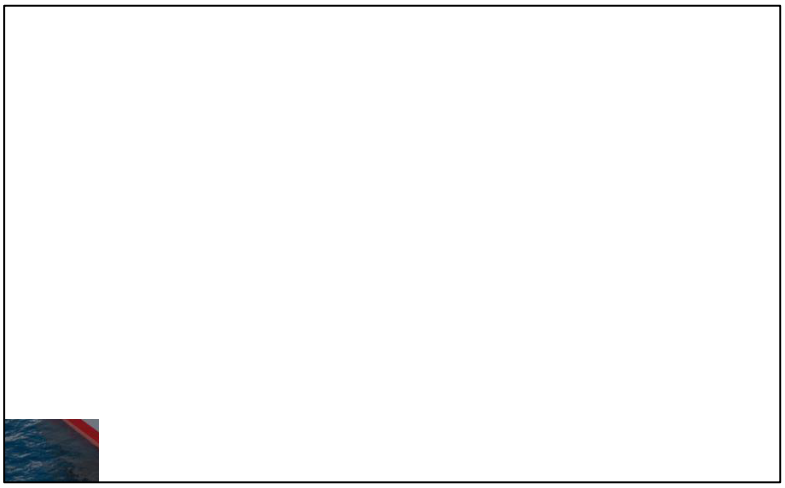


Figure 5.4.4B – Marine discharge vessel for rock and bedding material layers

5.4.5 Sinking of Caisson in position

The sinking of caissons in their final position will be conducted by filling all the caissons cells with sea water. Ballasting is undertaken by filling three independent groups of cells in order to maintain control the sinking operation. Once the caisson has been filled with water and sunk, two methods can be used to secure the caisson.

- The first scenario uses dredged and rock material and various items of plant. A spud pontoon loaded with a crane will positioning itself next to the caissons seaward boundary. A hopper barge will then position alongside the pontoon which will contain the dredged and rock material as loaded by a BHD vessel. Once positions are confirmed, the cable crane fitted with a bucket will transfer the material from barge to caisson.
- The second scenario uses sand and silt material. A TSHD will position a maximum of 200m from the caisson. The vessel will then connect via a floating pipeline to a landside network which will have an output within the caissons (see figure 5.3.1.4B). A series of jets will then fluidise the material stored from dredging activities and the vessel will pump this through the pipelines into the cells.

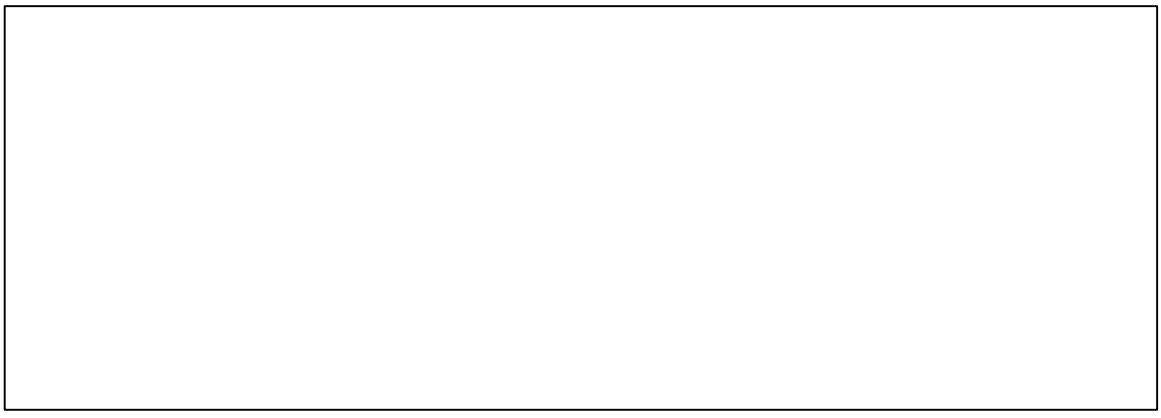


Figure 5.4.5 – Trailing Suction Hopper Dredge discharge

In both scenarios the caissons are full of water before being filled with granular material. During the filling of the caissons the water is displaced by the granular material.

5.4.6 Open Quay

The open quay will be formed by a series of concrete piles capable of supporting the quay deck. The deck is formed of a transversal and secondary beam arrangement with a false work and concrete slab system (see 5.4.6.3). The formation of a revetment profile (see 5.4.6.2) introduces the open properties of the quayside which have wave absorption properties.

Figure 5.4.6 – Open Quay Details

5.4.6.1 Installation of Piles

The piles will be installed using a rotary bored cast-in-situ concrete method (please see Piling Management Plan for detailed information). The process will be as follows:

- The drill auger excavates the soil and rock to create an open bore at the required design depth
- To prevent collapse of the bore, temporary steel casing will be installed into the ground. In the case of deep bores where temporary steel casing may not be suitable, the use of a support fluid such as vinyl polymer or, more commonly, bentonite drilling fluid may be used
- Once the auger has reached design depth a cleaning bucket is used to ensure cleanliness of the base
- If bentonite be used to support the bore then the slurry is re-circulated and replaced within the bore to avoid any impact on concrete quality
- The reinforcement cage is lowered into the open bore
- Concrete is delivered into the bore by discharge into a hopper feeding a tremmie pipe. The concrete is poured from the base of the bore to surface
- The temporary steel casing is removed, leaving the concrete pile in situ

5.4.6.2 Formation of Revetment

On completion of pile installation in local areas, the revetment profile (see figure 5.3.2) will be formed using a long reach excavator to form the required slopes. Where the excavator cannot create the slope, dredging apparatus will be mobilised.

The excavated surface will then be protected with an initial filter layer, installed using a rock skip/tray. The primary layer is placed over the initial filter using an orange peel capable of placing 1000-3000kg rock. Both forms of rock placement will be suspended from a suitable mobile crane (figure 5.3.2.2A)

Figure 5.4.6.2 – Methods of rock placement

5.4.6.3 Placement of Transversal and Secondary Beams

Transversal and secondary beams will be placed by a mobile crawler crane. The transversal beam will be placed firstly after a hydraulic cutter has been used to crop the pile heads. The beam will then be positioned over the two pile heads with any gaps sealed with concrete once the diaphragm is poured. Once two transversal beams have been installed the secondary beams can be installed one at a time using an additional crawler crane. The beams will be installed individually working from the landside out towards the quayside. The same crane will then be utilised to install the permanent formwork between the secondary beams to support a slab pour (figure 5.3.2.3A)

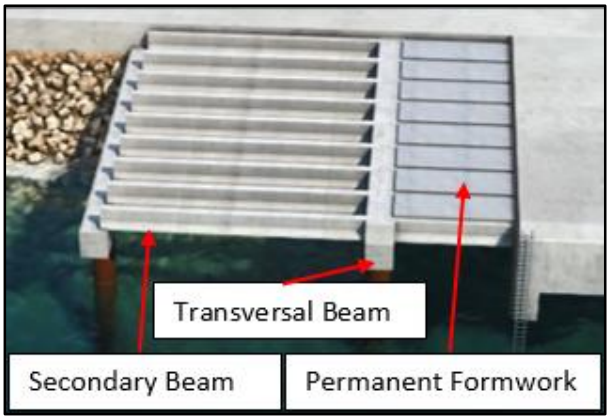


Figure 5.4.6.3 – Open Quay Beam Arrangement

5.4.7 Placement of Deck Slab

The deck slab will be poured on top of the beam and formwork arrangement shown in figure 5.3.2.3. A system of temporary formwork will be constructed in panels to contain a pumped concrete mixture. On successful curing, the formwork will be removed and repositioned for the next pour.

5.5 RECLAMATION

Reclamation activities will be carried out by one of two methods, either importing quarry material or using marine dredged material.

5.5.1 Reclamation using imported material

Dump trucks and quarry vehicles will progress to discharge material at varying locations dependant on the reclamation progression. The material will be pushed by a bulldozer to the required location where an excavator will grade the material to form the required profiles for installation of further material.

5.5.2 Reclamation using locally dredged material

Where the preference is to use locally dredged material, a TSHD will position a maximum of 200m from the reclamation. The vessel will then connect via a floating pipeline to a landside network which will have an output within the area required (figure 5.3.1.4B). A series of jets will then fluidise the material stored from dredging activities and the vessel will pump this through the pipeline. After each discharge, the vessel will disconnect, continue to dredge and then reconnect. This material will be consolidated by preloading or by vibro-compaction.

5.6 PAVEMENT

The quay pavement will begin on completion of the reclamation, the pavement will be completed by direct discharge of concrete trucks in a controlled manor which will be finished and controlled by specialised items of plant (figure 5.6). The plant will be laser guided, with expansion and crack joints introduced by road saws at later dates.

Figure 5.6 – Pavement construction activities

5.7 SURFACE FEATURES

Harbour infrastructure above +4.7m is referred to as part of the 'Surface Features'. Key elements associated with this are;

- Service Trenches
- Harbour Drainage
- Water Supply Infrastructure
- Electrical Distribution
- Security Infrastructure
- Weighbridges
- Harbour Buildings

In specific areas, notably drainage outfalls and service trench will extend below +4.7m as noted below.

5.7.1 Service Trenches

Service trenches are provided to distribute piped services to moored vessels via bunkering pits around the quay as defined within the Employers Requirements.

Service trench size is defined by the Employer as 1.45m wide and 1.8m clear height. Service trenches accommodate water supply pipework, fuel supply pipework and in some cases fuel/oil discharge pipework. Space is provided for specified future pipework for uses such as transfer of drilling mud.

Service trenches are proposed to be constructed in concrete with heavy duty removable covers at key locations to enable installation and ongoing maintenance and repair.

5.7.2 Harbour Drainage

The harbour storm drainage network is a gravity drainage system with the quay areas drained to continuous industrial-grade slot drains with collection pipework running through oil interceptors prior to discharge to sea.

In locations where it is necessary for the drainage to cross the service trench, the drainage will pass beneath the services trench, dictating the level mainly for the outfalls.

5.7.3 Water Supply Infrastructure

Within the harbour area provision is made for water storage for supply to visiting vessels. Supply pipework is to be provided via the service trenches noted above. Provision will be made for foundations for water storage tanks as define within the Employers Requirements in the Northeast area of the harbour site as defined on the works drawings. Dependant on ground conditions and imposed loadings, the water tank foundations may be based on a piled or raft design solution, to be determined through detailed design.

5.7.4 Electrical Supply Distribution

Distribution infrastructure will be incorporated in the works to facilitate the distribution of electrical power around the harbour in compliance with the Employers Requirements. This duct network will be integrated with that required to supply harbour lighting and comms systems (subject to the required separation and segregation).

5.7.5 Security Infrastructure

Key elements of security infrastructure to be installed include;

- Main Gate Entry Barriers and controls
- Harbour perimeter security fencing
- CCTV provision and monitoring as defined in the Employers Requirements

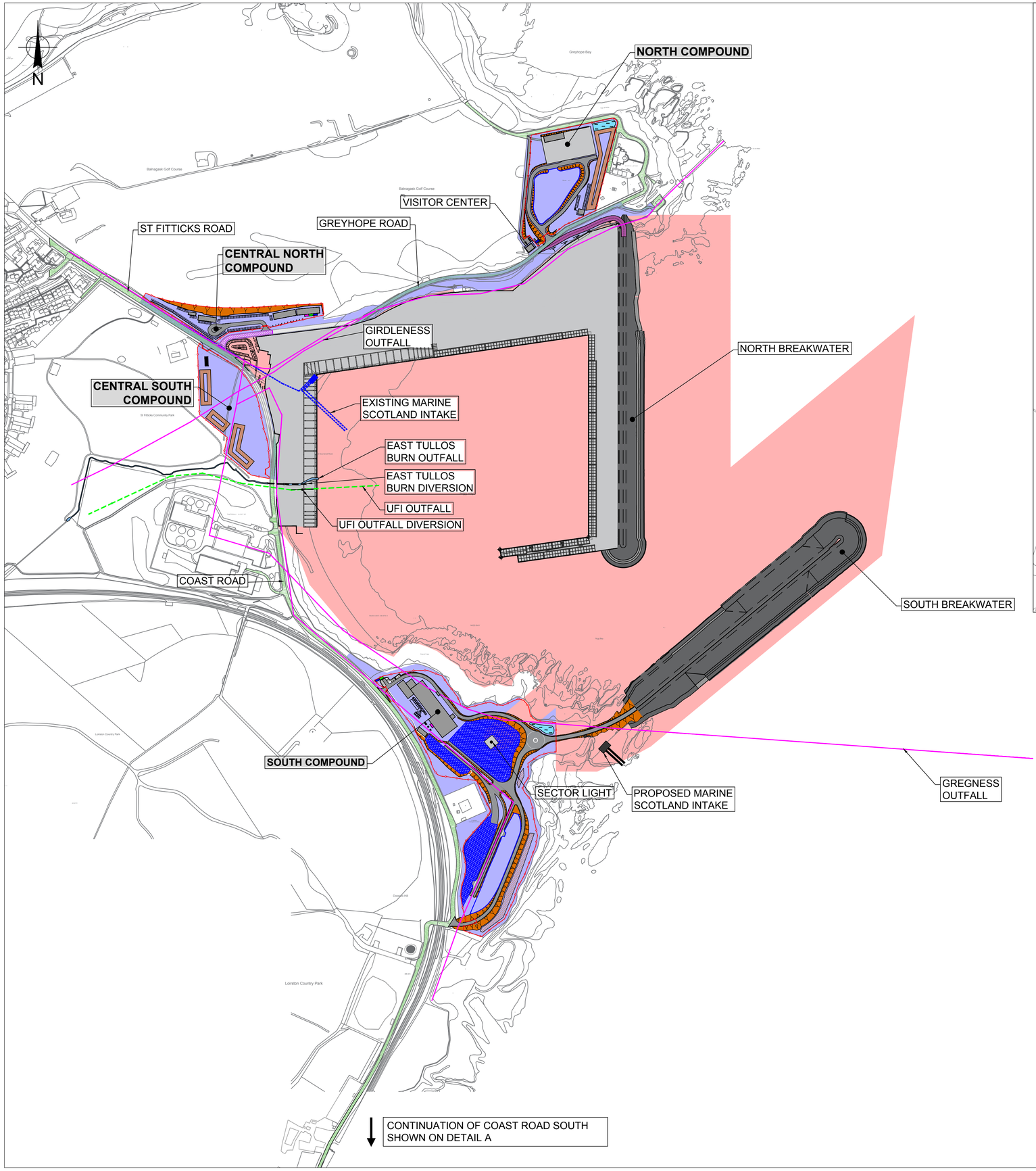
5.7.6 Weighbridges

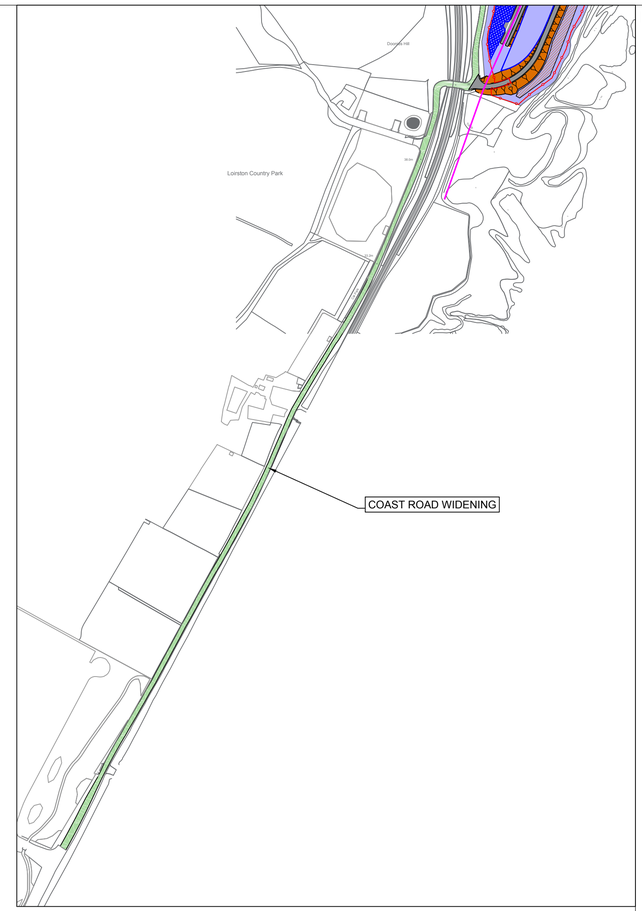
Provision of 2 weighbridges will be made in accordance with the Employers Requirements

5.7.7 Harbour Buildings

Provision of buildings on the harbour will be made in accordance with the Employers Requirements, to include entrance security provision an on-site welfare accommodation.

APPENDIX 1 A, B, C AND D – COMPOUNDS AREAS LAYOUT





DETAIL A
CONTINUATION OF COAST ROAD SOUTH

NOTES:

KEY:

- HRO BOUNDARY
- TEMP. LEASE BOUNDARY
- GIRDLENESS SEWER
- UFI
- MARINE SCOTLAND INTAKE
- SITE COMPOUND FENCE
- EXISTING PUBLIC ROAD
- ROAD DIVERSIONS
- NORTH BREAKWATER ACCESS
- POWER CONNECTION
- WATER SUPPLY
- DISCHARGE CONNECTION
- ACCROPODE STORAGE AREA
- TOPSOIL STOCKPILE
- SITE ACCESS ROAD

Rev.	Date	By	Chkd	Appd	Description
5	21.02.17	TWC	MEG	ACO	Layout updated to ARUP design
4	09.02.17	TWC	MEG	ACO	Layout updated
3	26.01.17	TWC	ACO	ACO	Central compound boundary updated & carpark extended.
2	24.01.17	TWC	ACO	ACO	UHI & ETB diversions added.
1	20.01.17	TWC	ACO	ACO	Site Layout

DRAGADOS
Citrus House
Greenbank Road
East Tullos Industrial Estate
Aberdeen
AB12 3BG
Tel: +44 (0) 1224 439980

Client
Aberdeen Harbour

Job Title
Aberdeen Harbour Expansion Project

Site Layout

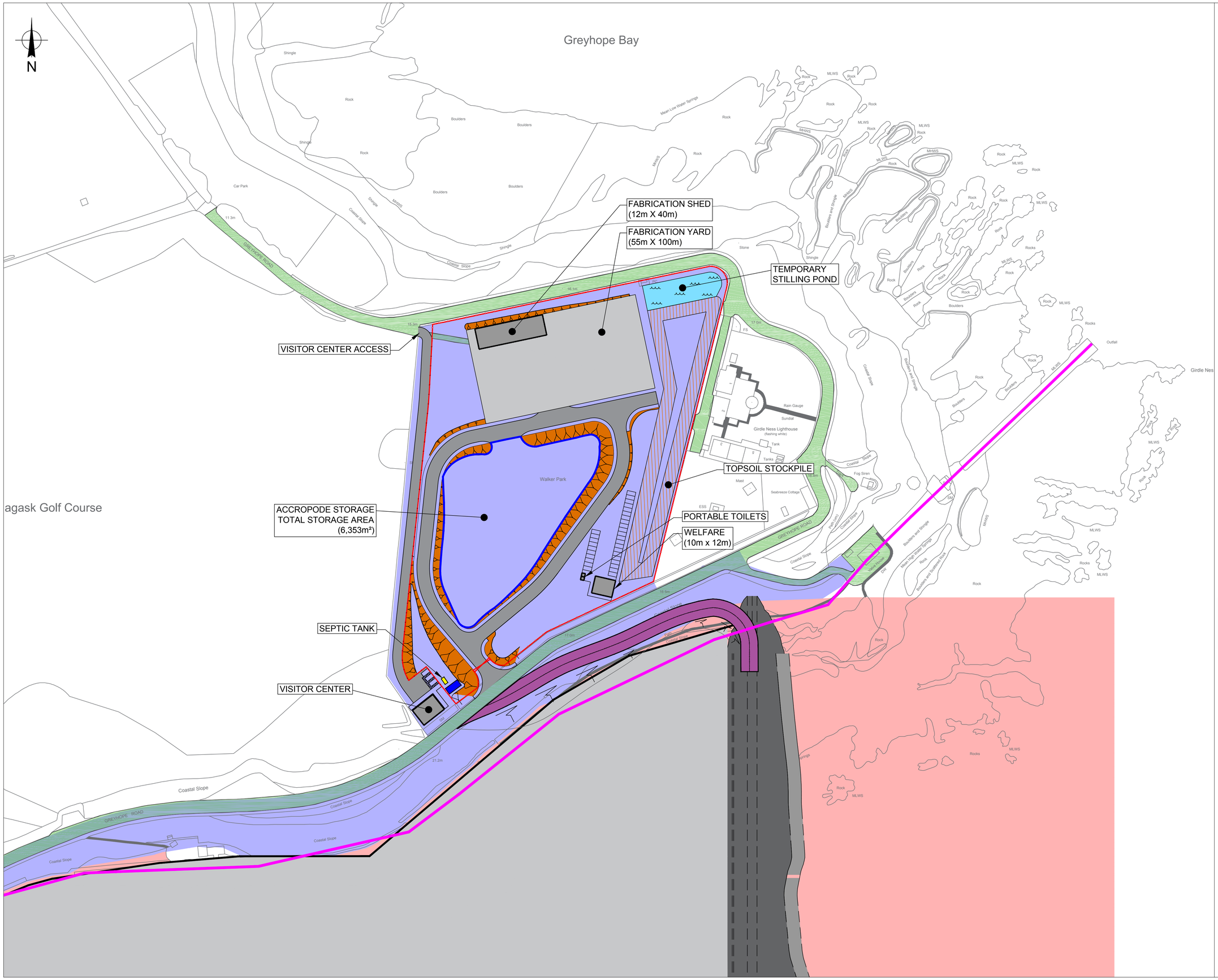
Scale at A1 1:1000

Discipline Civil Engineering

Drawing Status

Drawing No **AHEP-DRA-SKE-001**

Revision **05**



NOTES:

KEY:

- HRO BOUNDARY
- TEMP. LEASE BOUNDARY
- GIRDLENESS SEWER
- UFI
- MARINE SCOTLAND INTAKE
- SITE COMPOUND FENCE
- EXISTING PUBLIC ROAD
- ROAD DIVERSIONS
- NORTH BREAKWATER ACCESS
- POWER CONNECTION
- WATER SUPPLY
- DISCHARGE CONNECTION
- ACCROPODE STORAGE AREA
- TOPSOIL STOCKPILE

Rev.	Date	By	Chkd	Appd	Description
4	21.02.17	TWC	MEG	ACO	Layout updated to ARUP Design
3	09.02.17	TWC	MEG	ACO	Layout Updated
2	26.01.17	TWC	ACO	ACO	Visitor center dimensions updated
1	20.01.17	TWC	ACO	ACO	Site Layout

DRAGADOS

Citrus House
Greenbank Road
East Tullos Industrial Estate
Aberdeen
AB12 3BG
Tel: +44 (0) 1224 439980

Client

Aberdeen Harbour

Job Title

Aberdeen Harbour
Expansion Project

North Compound

Scale at A1 1:1000

Discipline Civil Engineering

Drawing Status

Drawing No **AHEP-DRA-SKE-002**

Revision **04**

N

WAREHOUSE
(15m x 6m)

WELFARE
(36m x 9.6m)
280 WORKERS

OFFICES
(45m x 12m EACH)
120 STAFF

WHEEL WASH

TOPSOIL STOCKPILE

STORAGE AREA

ST FITTICKS ROAD

Well

Skateboard Park

Path

Playground

Grave Yard

St Fittick's Church
(remains of)

Coastal Slope

18.2m

St Fitticks Community Park

Nigg Wastewater Treatment Plant

Main Low Water Springs

nd Scattered Rock

NOTES:

KEY:

- HRO BOUNDARY
- TEMP. LEASE BOUNDARY
- GIRDLENESS SEWER
- UFI
- MARINE SCOTLAND INTAKE
- SITE COMPOUND FENCE
- EXISTING PUBLIC ROAD
- ROAD DIVERSIONS
- NORTH BREAKWATER ACCESS
- POWER CONNECTION
- WATER SUPPLY
- DISCHARGE CONNECTION
- ACCROPODE STORAGE AREA
- TOPSOIL STOCKPILE
- SITE ACCESS ROAD

Rev.	Date	By	Chkd	Appd	Description
4	21.02.17	TWC	MEG	ACO	Layout updated to ARUP Design
3	09.02.17	TWC	MEG	ACO	Layout Updated
2	26.01.17	TWC	ACO	ACO	Boundary extended and carpark added
1	20.01.17	TWC	ACO	ACO	Site Layout

DRAGADOS

Citrus House
Greenbank Road
East Tullos Industrial Estate
Aberdeen
AB12 3BG
Tel: +44 (0) 1224 439980

Client

Aberdeen Harbour

Job Title

Aberdeen Harbour
Expansion Project

Central Compound

Scale at A1 1:1000

Discipline Civil Engineering

Drawing Status

Drawing No **AHEP-DRA-SKE-003**

Revision **04**

N

WELFARE
(15m x 15m)

WHEEL WASH

FABRICATION SHED
(115m x 38m)

AGGREGATE STORAGE
(15m x 35m)

BATCHING PLANT
(42m x 22m)

CONCRETE ASH DOWN AREA
(15m x 35m)

LAB
(8.2m x 20.4m)

WATER STORAGE TANK (Ø3m)

WATER TREATMENT PLANT (3m x 1.5m)

TEMPORARY
STILLING POND

Z=32.00m
AREA= 1960m²
183 ACCROPODE CAPACITY

Z=29.50m
AREA= 10599m²
1174 ACCROPODE CAPACITY

Z=34.50 m
AREA= 4910m²
433 ACCROPODE CAPACITY

Z=32.00 m
AREA=5887m²
ACCROPODE STORAGE
AND CASTING AREA

Nigg Bay

Doonies Hill

Loirston Country Park

Communications Masts

Greyness
Coastguard Station

Bridge of One Hair

NOTES:

KEY:

- HRO BOUNDARY
- TEMP. LEASE BOUNDARY
- GIRDLENESS SEWER
- UFI
- MARINE SCOTLAND INTAKE
- SITE COMPOUND FENCE
- EXISTING PUBLIC ROAD
- ROAD DIVERSIONS
- NORTH BREAKWATER ACCESS
- POWER CONNECTION
- WATER SUPPLY
- DISCHARGE CONNECTION
- ACCROPODE STORAGE AREA
- TOPSOIL STOCKPILE

Rev.	Date	By	Chkd	Appd	Description
4	21.02.17	TWC	MEG	ACO	Layout updated to ARUP Design
3	09.02.17	TWC	MEG	ACO	Layout Updated
2	26.01.17	TWC	ACO	ACO	Fab. shed dimensions updated
1	20.01.17	TWC	ACO	ACO	Site Layout

DRAGADOS

Citrus House
Greenbank Road
East Tullos Industrial Estate
Aberdeen
AB12 3BG
Tel: +44 (0) 1224 439980

Client

Aberdeen Harbour

Job Title

Aberdeen Harbour
Expansion Project

South Compound

Scale at A1 1:1250

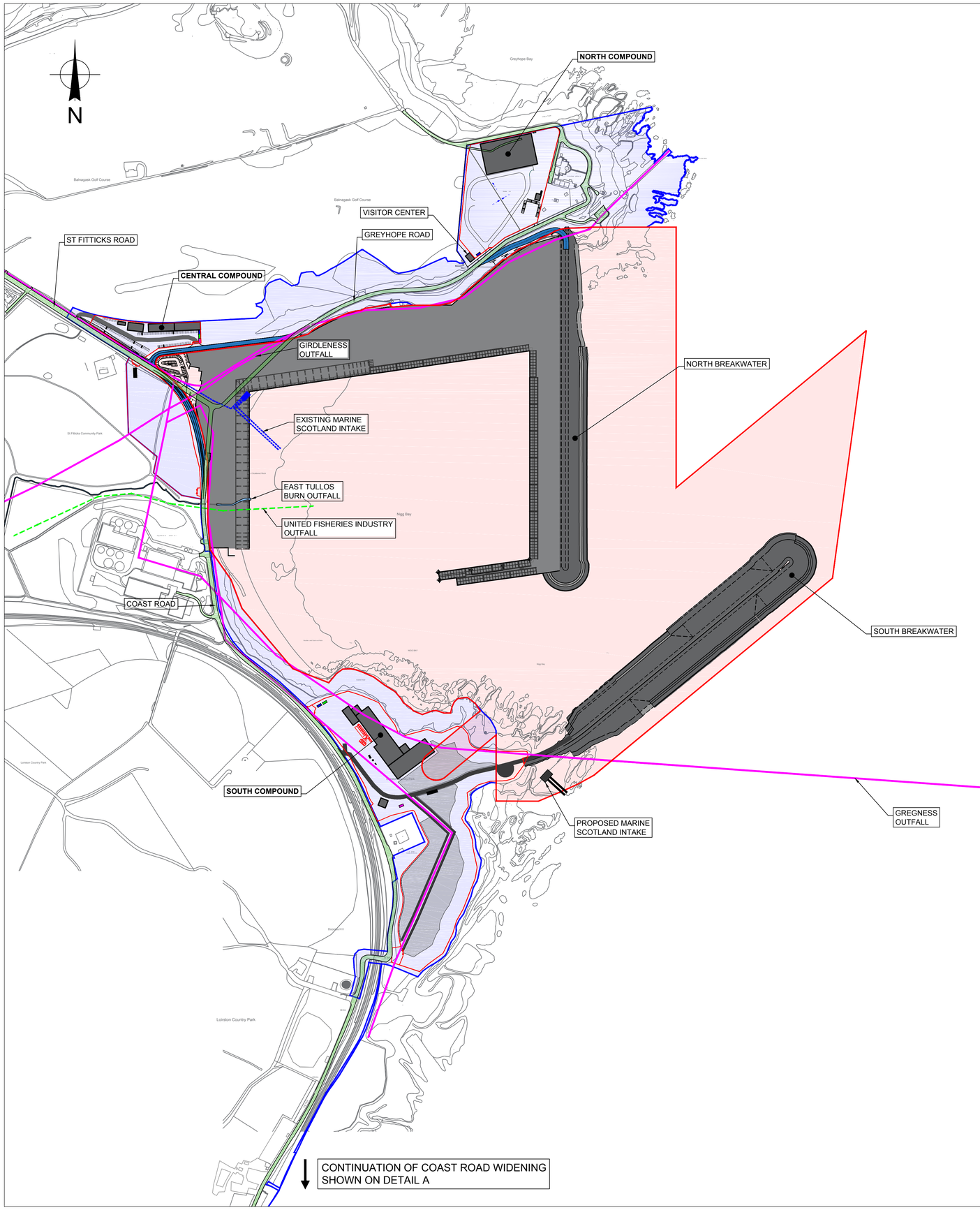
Discipline Civil Engineering

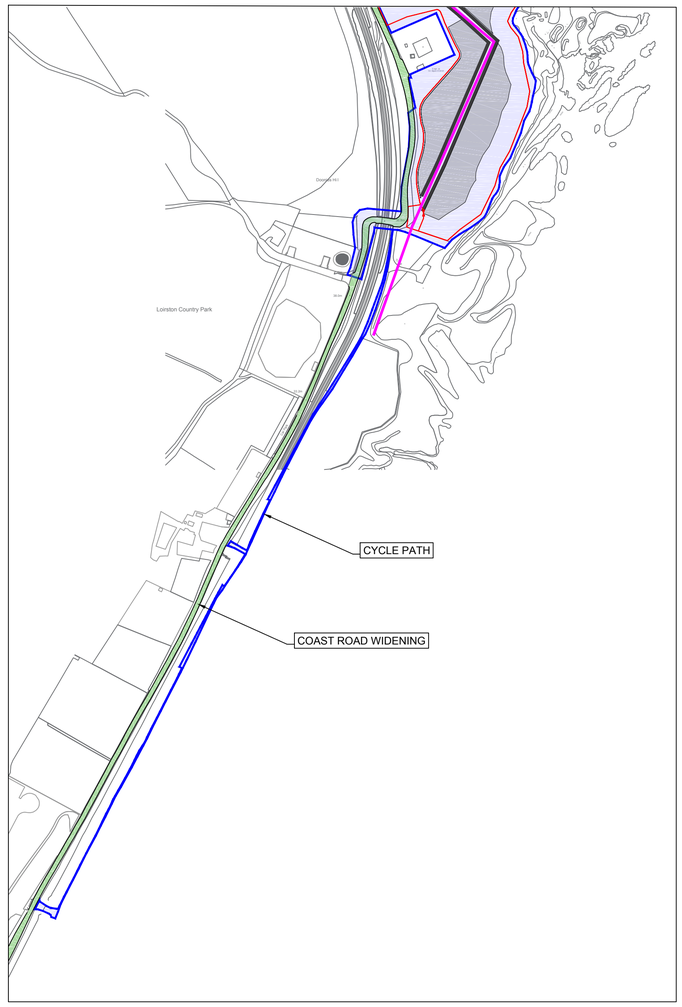
Drawing Status

Drawing No **AHEP-DRA-SKE-004**

Revision **04**

APPENDIX 2 – ROAD WORKS LAYOUT





DETAIL A
CONTINUATION OF COAST ROAD WIDENING

NOTES:

KEY:

- HRO BOUNDARY:
- PPIP BOUNDARY:
- GIRDLENESS SEWER:
- UFI:
- MARINE SCOTLAND INTAKE:
- SITE COMPOUND FENCE:
- EXISTING PUBLIC ROAD THROUGH SITE:
- ROAD DIVERSIONS:

Revision	Date	By	Chkd	Appd
1	20.01.17	TWC		

DRAGADOS
Citrus House
Greenbank Road
East Tullos Industrial Estate
Aberdeen
AB12 3BG
Tel: +44 (0) 1224 439980

Client

Aberdeen Harbour

Job Title

Aberdeen Harbour Expansion Project

Site Plan

Scale at A1

Discipline: Civil Engineering

Job No

Drawing Status

Drawing No: **DRA-SKE-0001**

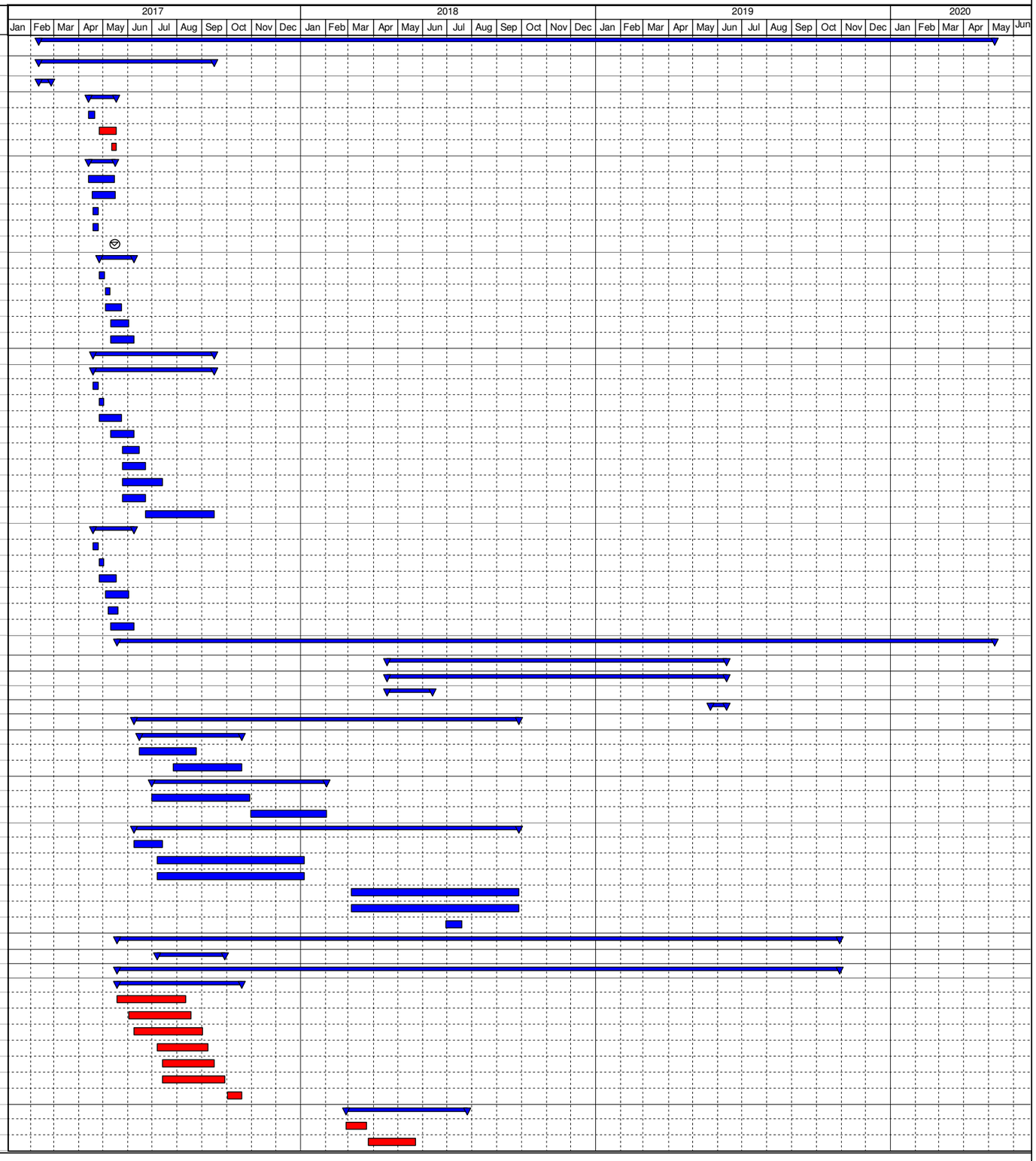
Issue

APPENDIX 3 – PROGRAMME

DRAGADOS

AHEP - Enabling works & Construction

#	ID	Description	Original Duration	Start	Finish
1	**Aberdeen DRA-PRG-00001 rev3 - zc - MS**		796	10/02/17	08/05/20
2	**Pre-Construction / Enabling Works**		151	10/02/17	15/09/17
3	**Coast Road Widening**		17	10/02/17	26/02/17
4	**Temporary Road - North Breakwater Access**		22	13/04/17	17/05/17
5	PC-NBWAR-00050	NBW Access Installation of Concrete Slab	5	13/04/17	21/04/17
6	PC-NBWAR-00060	NBW Access Construction access road	15	26/04/17	17/05/17
7	PC-NBWAR-00070	NBW Access Wheel Wash Facilities	4	12/05/17	17/05/17
8	**Cycle Path / Road Alignment Works**		21	13/04/17	16/05/17
9	PC-CPRA-00040	Cycle Path / Road Alignment - StFitticks Road, Coast Road & Greyhope Road (cycle path & road rea	20	13/04/17	15/05/17
10	PC-CPRA-00010	Cycle Path / Road Alignment - Underpass to Railway Bridge (Section 1a & 1b)	20	18/04/17	16/05/17
11	PC-CPRA-00020	Cycle Path / Road Alignment - Temporary cycle path around South compound area (Section 2)	5	19/04/17	25/04/17
12	PC-CPRA-00030	Cycle Path / Road Alignment - Permanent cycle path (Section CR3)	5	19/04/17	25/04/17
13	PC-CPRA-00070	Cycle Path / Road Alignment - Close Old Cycle Path Route	0		16/05/17
14	**North Compound**		30	26/04/17	08/06/17
15	PC-NC-00010	North Compound - Perimeter & Other Temporary Fencing	5	26/04/17	03/05/17
16	PC-NC-00020	North Compound - Wheel Wash Facilities	4	04/05/17	09/05/17*
17	PC-NC-00030	North Compound - Civil Works (Drainage, Car Parking, Storage / Laydown areas etc)	15	04/05/17	24/05/17
18	PC-NC-00040	North Compound - Temorary MEP supplies / connections to North Compound	15	11/05/17	01/06/17*
19	PC-NC-00050	North Compound - Warehouse/Welfare Facilities	20	11/05/17	08/06/17
20	**South Compound**		105	19/04/17	15/09/17
21	**Construction**		105	19/04/17	15/09/17
22	PC-SC-C-00010	South compound - Perimeter & Other Temporary Fencing	5	19/04/17	25/04/17
23	PC-SC-C-00020	South compound - Wheel Wash Facilities	4	26/04/17	02/05/17
24	PC-SC-C-00030	South compound - Civil Works (Drainage, Car Parking, Storage / Laydown areas etc)	20	26/04/17	24/05/17
25	PC-SC-C-00090	South compound - Office Block / Welfare	20	11/05/17	08/06/17*
26	PC-SC-C-00040	South compound - Temorary MEP supplies / connections to South Compound	15	25/05/17	15/06/17*
27	PC-SC-C-00050	South compound - Batching Plant	20	25/05/17	22/06/17
28	PC-SC-C-00060	South compound - Fabrication Shed	35	25/05/17	13/07/17
29	PC-SC-C-00080	South compound - Laboratory	20	25/05/17	22/06/17*
30	PC-SC-C-00070	South compound - Carousel M&E Assembly	60	23/06/17	15/09/17
31	**Central Compound**		35	19/04/17	08/06/17
32	PC-CC-00010	Central Compound - Perimeter & Other Temporary Fencing	5	19/04/17	25/04/17*
33	PC-CC-00020	Central Compound - Wheel Wash Facilities	4	26/04/17	02/05/17*
34	PC-CC-00030	Central Compound - Civil Works (Drainage, Car Parking, Storage / Laydown areas etc)	15	26/04/17	17/05/17*
35	PC-CC-00040	Cetral Compound - Office Block	20	04/05/17	01/06/17*
36	PC-CC-00050	Central Compound - Temorary MEP supplies / connections to Central Compound	10	08/05/17	19/05/17*
37	PC-CC-00060	Central Compound - Welfare Facilities	20	11/05/17	08/06/17*
38	**Construction**		732	18/05/17	08/05/20
39	**Auxiliary works for harbour construction**		284	18/04/18	12/06/19
40	**Auxiliary quay**		284	18/04/18	12/06/19
41	**Auxiliary quay - Construction**		38	18/04/18	12/06/18
42	**Auxiliary quay - Removal**		14	23/05/19	12/06/19
43	**Dredging & Blasting**		325	09/06/17	28/09/18
44	**Dredging & Blasting - Land works**		90	15/06/17	19/10/17
45	C-DB-L-00010	South West Drilling & Blasting	50	15/06/17	24/08/17
46	C-DB-L-00020	South West Excavation	60	27/07/17	19/10/17
47	**Drill & Blasting**		144	30/06/17	01/02/18
48	C-DB-M-00010	Drill & Blasting - North	86	30/06/17	30/10/17
49	C-DB-M-00020	Drill & Blasting - South	58	31/10/17	01/02/18
50	**Dredging**		325	09/06/17	28/09/18
51	C-DR-00010	TSHD-Dredging of sand & alluvium - 1st season	25	09/06/17	13/07/17
52	C-DR-00020	BHD-Dredging of glacial till & boulders + Dredging of Blasted material - 1st season	120	07/07/17	05/01/18
53	C-DR-00025	CSD-Dredging of glacial till & boulders - 1st season	120	07/07/17	05/01/18
54	C-DR-00040	BHD-Dredging of glacial till & boulders + Dredging of Blasted material - 2nd season	145	05/03/18	28/09/18
55	C-DR-00045	CSD-Dredging of glacial till & boulders - 2nd season	145	05/03/18	28/09/18
56	C-DR-00030	TSHD-Dredging of sand & alluvium - 2nd season	15	29/06/18	19/07/18
57	**North Breakwater**		607	18/05/17	29/10/19
58	**NBW - Marine works**		60	07/07/17	29/09/17
59	**NBW - Land Works**		607	18/05/17	29/10/19
60	**NBW - Land Works - 1st Phase**		110	18/05/17	20/10/17
61	C-NBW-M-1-00010	NBW - LW - 1st Ph - Core material	60	18/05/17*	11/08/17
62	C-NBW-M-1-00020	NBW - LW - 1st Ph - Filter 1-3 t rock sea side. Land	55	02/06/17	18/08/17
63	C-NBW-M-1-00030	NBW - LW - 1st Ph - Temporary rear armour 0.3-1 t	60	09/06/17	01/09/17
64	C-NBW-M-1-00040	NBW - LW - 1st Ph - Bedding layer (P.K. 4 50 - 0.)	45	07/07/17	08/09/17
65	C-NBW-M-1-00050	NBW - LW - 1st Ph - Toe Armour	45	14/07/17	15/09/17
66	C-NBW-M-1-00060	NBW - LW - 1st Ph - Accropode II (8 m3)	55	14/07/17	29/09/17
67	C-NBW-M-1-00070	NBW - LW - 1st Ph - Winter Closure	15	02/10/17	20/10/17
68	**NBW - Land Works - 2nd Phase**		105	26/02/18	26/07/18
69	C-NBW-M-2-00010	NBW - LW - 2nd Ph - Remove Winter Closure	20	26/02/18	23/03/18
70	C-NBW-M-2-00020	NBW - LW - 2nd Ph - Core material	40	26/03/18	23/05/18



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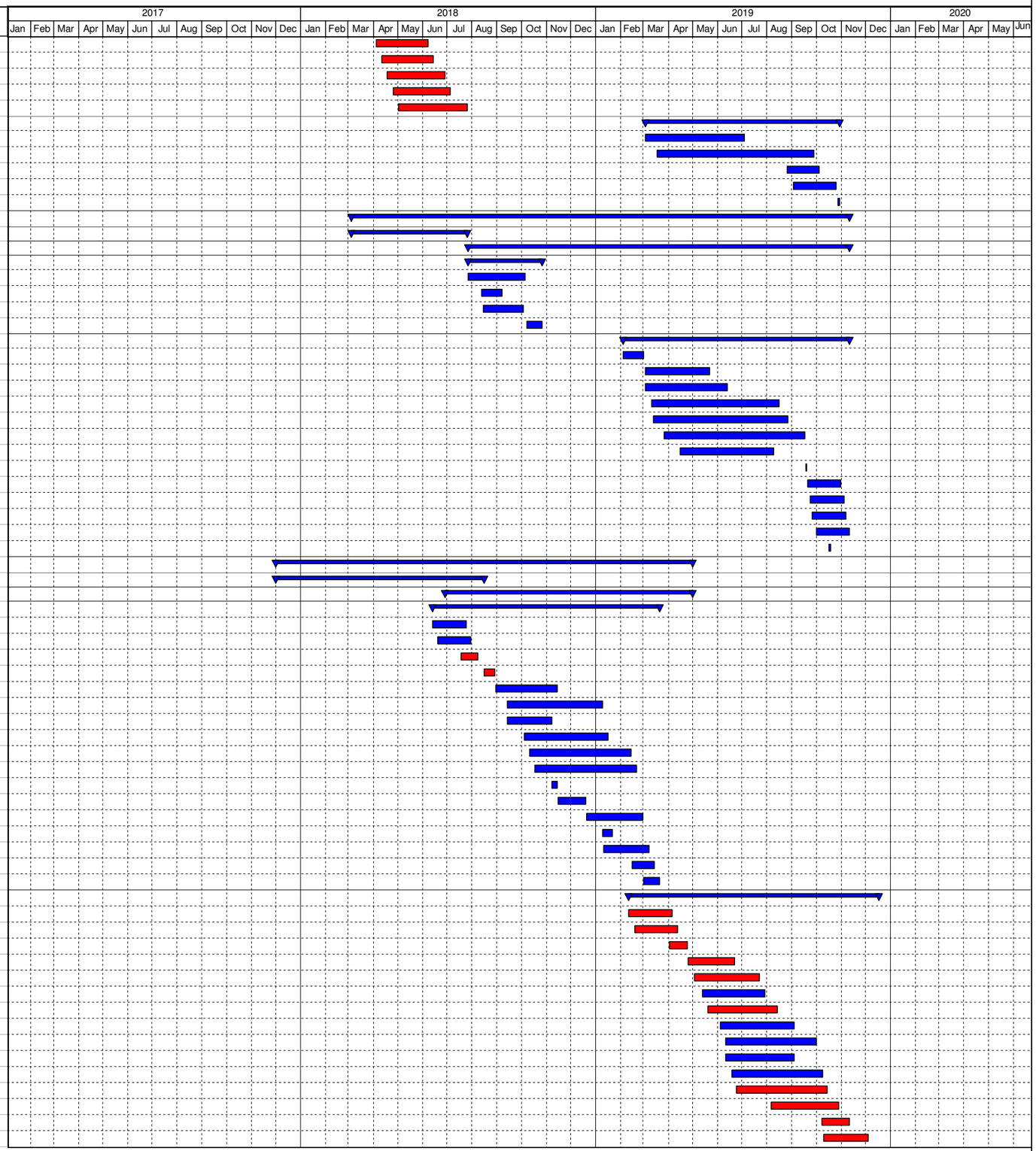
AHEP - Enabling works & Construction

#	ID	Description	Original Duration	Start	Finish
71	C-NBW-M-2-00030	NBW - LW - 2nd Ph - Filter 1-3 t rock sea side. Land	45	04/04/18	07/06/18
72	C-NBW-M-2-00040	NBW - LW - 2nd Ph - Temporary rear armour 0.3-1 t	45	11/04/18	14/06/18
73	C-NBW-M-2-00050	NBW - LW - 2nd Ph - Bedding layer (P.K. 450 - 0.)	50	18/04/18	28/06/18
74	C-NBW-M-2-00060	NBW - LW - 2nd Ph - Toe Armour	50	25/04/18	05/07/18
75	C-NBW-M-2-00070	NBW - LW - 2nd Ph - Accropode II (8 m3)	60	02/05/18	26/07/18
76	**NBW - Crown Wall**		167	04/03/19	29/10/19
77	C-NBW-M-CW-00010	NBW - Crownwall slab to +6.5 / +7.50	85	04/03/19*	04/07/19
78	C-NBW-M-CW-00020	NBW - Crownwall (+7.50 / +17.50)	135	18/03/19	27/09/19
79	C-NBW-M-CW-00030	NBW - Crownwall - Filter 1-3t	30	26/08/19	04/10/19
80	C-NBW-M-CW-00040	NBW - Crownwall - Accropode II (8m3)	40	02/09/19	25/10/19
81	C-NBW-M-CW-00050	NBW - Crownwall - Foundation block (Beacon)	2	28/10/19	29/10/19
82	**South Breakwater**		421	05/03/18	11/11/19
83	**SBW - Marine works (Under -4.00 m CD) from PK 0+553 to PK 0+000**		100	05/03/18	26/07/18
84	**SBW - Land Works**		321	27/07/18	11/11/19
85	**SBW - Land Works - 1st Phase from PK 0+635 to PK 0+000**		65	27/07/18	26/10/18
86	C-SBW-M-1-00010	SBW - Land Works - 1st Ph - Core material to +6.30m CD	50	27/07/18*	05/10/18
87	C-SBW-M-1-00020	SBW - Land Works - 1st Ph - Bedding layer land from PK 0+625 to PK 0+553	20	13/08/18	07/09/18
88	C-SBW-M-1-00030	SBW - Land Works - 1st Ph - Toe Armour Sea Side (16m3)	35	15/08/18	03/10/18
89	C-SBW-M-1-00040	SBW - Land Works - 1st Ph - Winter Closure	15	08/10/18	26/10/18
90	**SBW - Land Works - 2nd Phase Backwards From PK 0+000 to PK 0+635**		196	04/02/19	11/11/19
91	C-SBW-M-2-00010	SBW - Land Works - 2nd Ph - Remove Winter Closure	20	04/02/19*	01/03/19
92	C-SBW-M-2-00020	SBW - Land Works - 2nd Ph - Core material to +6.30m CD	55	04/03/19	22/05/19
93	C-SBW-M-2-00030	SBW - Land Works - 2nd Ph - Toe Armour Sea Side (16m3)	70	04/03/19	13/06/19
94	C-SBW-M-2-00050	SBW - Land Works - 2nd Ph - Filter Sea Side to +6.30 m CD	110	11/03/19	16/08/19
95	C-SBW-M-2-00060	SBW - Land Works - 2nd Ph - Filter Harbour Side to +6.30 m CD	115	13/03/19	27/08/19
96	C-SBW-M-2-00070	SBW - Land Works - 2nd Ph - Accropodes II 8,12 & 16 m3 to 6.30 m CD	120	27/03/19	17/09/19
97	C-SBW-M-2-00040	SBW - Land Works - 2nd Ph - Toe Armour Harbour (8m3)	80	15/04/19	09/08/19
98	C-SBW-M-2-00080	SBW - Land Works - 2nd Ph - Foundation block roundhead (Beacon)	2	18/09/19	19/09/19
99	C-SBW-M-2-00090	SBW - Land Works - 2nd Ph - Core material to +7.4 m CD	30	20/09/19	31/10/19
100	C-SBW-M-2-00100	SBW - Land Works - 2nd Ph - Filter Sea Side to +9.50 m CD	30	24/09/19	04/11/19
101	C-SBW-M-2-00110	SBW - Land Works - 2nd Ph - Precast concrete road	30	26/09/19	06/11/19
102	C-SBW-M-2-00120	SBW - Land Works - 2nd Ph - Accropodes II 16,12 & 8 m3	30	01/10/19	11/11/19
103	C-SBW-M-2-00130	SBW - Land Works - 2nd Ph - Foundation block (Beacon)	2	17/10/19	18/10/19
104	**Caissons Fabrication and Transport to site**		342	01/12/17	01/05/19
105	**Caissons fabrication (including formwork change)**		170	01/12/17	16/08/18
106	**Caissons - Transport to Nigg Bay**		207	28/06/18	01/05/19
107	**South East Pier + East Quay**		191	13/06/18	21/03/19
108	C-SEPEQ-00010	South East Pier + East Quay - Rock bedding layer	30	13/06/18*	24/07/18
109	C-SEPEQ-00020	South East Pier + East Quay - Levelling layer	29	20/06/18	30/07/18
110	C-SEPEQ-00030	South East Pier + East Quay - Set caissons (Nos 21-16)	15	18/07/18	08/08/18
111	C-SEPEQ-00040	South East Pier + East Quay - Set caissons (Nos 15-10)	10	16/08/18	29/08/18
112	C-SEPEQ-00050	South East Pier + East Quay - Cells filling and joints	55	30/08/18	14/11/18
113	C-SEPEQ-00060	South East Pier + East Quay - Quarry run backfill	75	13/09/18	09/01/19
114	C-SEPEQ-00070	South East Pier + East Quay - Connection S.E.P to North Breakwater (precast blocks+mass concrete)	40	13/09/18	07/11/18
115	C-SEPEQ-00100	South East Pier + East Quay - Scour protection	65	04/10/18	16/01/19
116	C-SEPEQ-00110	South East Pier + East Quay - Cope beam (i/beacons foundations)	80	11/10/18	13/02/19
117	C-SEPEQ-00120	South East Pier + East Quay - Concrete slabs	80	18/10/18	20/02/19
118	C-SEPEQ-00080	South East Pier + East Quay - South corner (precast blocks + mass concrete)	5	08/11/18	14/11/18
119	C-SEPEQ-00090	South East Pier + East Quay - Southwest Corner (precast blocks + mass concrete)	25	15/11/18	19/12/18
120	C-SEPEQ-00140	South East Pier + East Quay - Services	40	21/12/18	28/02/19
121	C-SEPEQ-00130	South East Pier + East Quay - Geotextile	8	10/01/19	21/01/19
122	C-SEPEQ-00150	South East Pier + East Quay - Filling between cope beams /i/quarry run top + geotextile)	40	11/01/19	07/03/19
123	C-SEPEQ-00160	South East Pier + East Quay - Quay accesories (bollards, ladders)	20	15/02/19	14/03/19
124	C-SEPEQ-00170	South East Pier + East Quay - Pavement	15	01/03/19	21/03/19
125	**East Quay + North Quay**		217	11/02/19	17/12/19
126	C-EQNQ-00010	East Quay + North Quay - Rock bedding layer	40	11/02/19*	05/04/19
127	C-EQNQ-00020	East Quay + North Quay - Levelling layer	40	18/02/19	12/04/19
128	C-EQNQ-00030	East Quay + North Quay - Set caissons (Nos 9-4)	15	02/04/19*	24/04/19
129	C-EQNQ-00040	East Quay + North Quay - Cells filling and joints	40	25/04/19	21/06/19
130	C-EQNQ-00050	East Quay + North Quay - Quarry run backfill	55	03/05/19	22/07/19
131	C-EQNQ-00060	East Quay + North Quay - Geotextile	55	13/05/19	29/07/19
132	C-EQNQ-00070	East Quay + North Quay - General filling to 0.40m above MHWS	60	20/05/19	13/08/19
133	C-EQNQ-00080	East Quay + North Quay - Scour protection	65	04/06/19	03/09/19
134	C-EQNQ-00090	East Quay + North Quay - Concrete cope beam	80	11/06/19	01/10/19
135	C-EQNQ-00100	East Quay + North Quay - Treatment of fill material	60	11/06/19	03/09/19
136	C-EQNQ-00110	East Quay + North Quay - Concrete slabs	80	18/06/19	08/10/19
137	C-EQNQ-00120	East Quay + North Quay - Service trench	80	24/06/19	14/10/19
138	C-EQNQ-00130	East Quay + North Quay - General fill + Capping layer	60	06/08/19	28/10/19
139	C-EQNQ-00140	East Quay + North Quay - Carrier drain and cable ducts	25	08/10/19	11/11/19
140	C-EQNQ-00160	East Quay + North Quay - Quay accessories (bollards, ladders, barriers)	40	10/10/19	04/12/19



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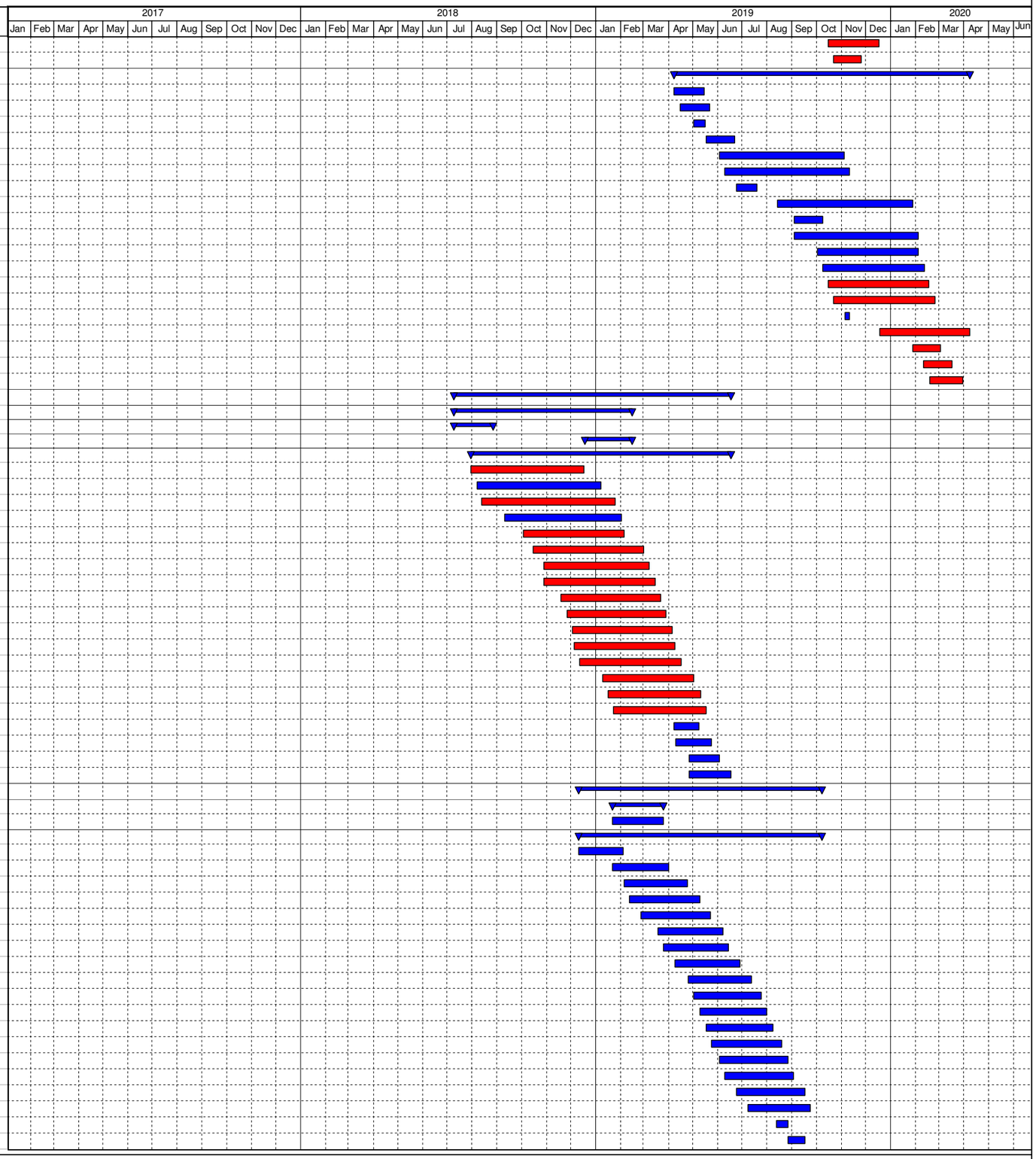
AHEP - Enabling works & Construction

#	ID	Description	Original Duration	Start	Finish
141	C-EQNQ-00170	East Quay + North Quay - Pavement	45	16/10/19	17/12/19
142	C-EQNQ-00150	East Quay + North Quay - Kerbs, Channels, Edgings, Footways and Paved Areas	25	22/10/19	25/11/19
143	**Rest of North Close Quay**		247	08/04/19	07/04/20
144	C-RCNQ-00010	Rest of North Close Quay - Rock bedding layer	25	08/04/19	15/05/19
145	C-RCNQ-00020	Rest of North Close Quay - Levelling layer	25	15/04/19	22/05/19
146	C-RCNQ-00030	Rest of North Close Quay - Set caissons (Nos 3-1)	10	02/05/19	16/05/19
147	C-RCNQ-00040	Rest of North Close Quay - Cells filling and joints	25	17/05/19	21/06/19
148	C-RCNQ-00060	Rest of North Close Quay - Quarry run backfill	110	03/06/19	04/11/19
149	C-RCNQ-00070	Rest of North Close Quay - Geotextile	110	10/06/19	11/11/19
150	C-RCNQ-00050	Rest of North Close Quay - Concrete retaininig wall	20	24/06/19	19/07/19
151	C-RCNQ-00080	Rest of North Close Quay - General filling to 0.40m above MHWS	110	14/08/19	28/01/20
152	C-RCNQ-00100	Rest of North Close Quay - Scour protection	25	04/09/19	08/10/19
153	C-RCNQ-00090	Rest of North Close Quay - Treatment of filling material	100	04/09/19	04/02/20
154	C-RCNQ-00120	Rest of North Close Quay - Cope beam	80	02/10/19	04/02/20
155	C-RCNQ-00130	Rest of North Close Quay - Concrete slabs	80	09/10/19	11/02/20
156	C-RCNQ-00140	Rest of North Close Quay - Service trench	80	15/10/19	17/02/20
157	C-RCNQ-00150	Rest of North Close Quay - General fill + Capping layer	80	22/10/19	24/02/20
158	C-RCNQ-00110	Rest of North Close Quay - Concrete block interface open quay	5	05/11/19	11/11/19
159	C-RCNQ-00190	Rest of North Close Quay - Pavement	70	18/12/19	07/04/20
160	C-RCNQ-00160	Rest of North Close Quay - Carrier drain and cable ducts	25	28/01/20	02/03/20
161	C-RCNQ-00170	Rest of North Close Quay - Kerbs, channels, edgings, footways, and paved areas	25	11/02/20	16/03/20
162	C-RCNQ-00180	Rest of North Close Quay - Quay accessories (bollards, ladders)	30	18/02/20	30/03/20
163	**West Quay**		231	09/07/18	17/06/19
164	**Shore Mooring bollards**		148	09/07/18	14/02/19
165	**Shore Mooring Bollards No.1 and No.2**		35	09/07/18	27/08/18
166	**Shore Mooring Bollards No.3, 4 & 5**		33	18/12/18	14/02/19
167	**West Quay - Land Works**		216	30/07/18	17/06/19
168	C-WQ-LW-00010	West Quay - Land Works - Pilling Operation	100	30/07/18	17/12/18
169	C-WQ-LW-00020	West Quay - Land Works - Top pile breakout	100	07/08/18	07/01/19
170	C-WQ-LW-00030	West Quay - Land Works - Excavation+ dredging among piles	110	13/08/18	25/01/19
171	C-WQ-LW-00040	West Quay - Land Works - Heavy duty rock grade geotextile filter	95	10/09/18	01/02/19
172	C-WQ-LW-00050	West Quay - Land Works - Core material	80	03/10/18	05/02/19
173	C-WQ-LW-00060	West Quay - Land Works - Filter layer	90	15/10/18	01/03/19
174	C-WQ-LW-00070	West Quay - Land Works - Primary armour 1 - 3 t	85	29/10/18	08/03/19
175	C-WQ-LW-00080	West Quay - Land Works - Concrete beams installation	90	29/10/18	15/03/19
176	C-WQ-LW-00090	West Quay - Land Works - Concrete infill box	80	19/11/18	22/03/19
177	C-WQ-LW-00100	West Quay - Land Works - Precast beams installation	80	26/11/18	29/03/19
178	C-WQ-LW-00110	West Quay - Land Works - Installation of collaborating deck slabs	80	03/12/18	05/04/19
179	C-WQ-LW-00120	West Quay - Land Works - Sea side cope beam construction	80	05/12/18	09/04/19
180	C-WQ-LW-00130	West Quay - Land Works - Harbour side cope beam construction	80	12/12/18	16/04/19
181	C-WQ-LW-00140	West Quay - Land Works - Quarry rockfill	80	09/01/19	02/05/19
182	C-WQ-LW-00150	West Quay - Land Works - In situ concrete deck slab	80	16/01/19	10/05/19
183	C-WQ-LW-00160	West Quay - Land Works - Service trench	80	23/01/19	17/05/19
184	C-WQ-LW-00170	West Quay - Land Works - Bedding layer	20	08/04/19	08/05/19
185	C-WQ-LW-00180	West Quay - Land Works - Scour protection	30	10/04/19	24/05/19
186	C-WQ-LW-00190	West Quay - Land Works - Quay accessories (fenders, bollards 100t, 20 ladders + capstan)	25	26/04/19	03/06/19
187	C-WQ-LW-00200	West Quay - Land Works - Pavement	35	26/04/19	17/06/19
188	**North Open Quay**		200	11/12/18	07/10/19
189	**North Open Quay - Marine Works**		45	22/01/19	25/03/19
190	C-NOQ-M-00010	North Open Quay - Marine pilling	45	22/01/19	25/03/19
191	**Land Works**		200	11/12/18	07/10/19
192	C-NOQ-L-00010	North Open Quay - Filling for working platform	30	11/12/18*	04/02/19
193	C-NOQ-L-00020	North Open Quay - Pilling	50	22/01/19	01/04/19
194	C-NOQ-L-00030	North Open Quay - Top pile breakout	55	05/02/19	24/04/19
195	C-NOQ-L-00040	North Open Quay - Excavation+ dredging among piles	60	12/02/19	09/05/19
196	C-NOQ-L-00050	North Open Quay - Core material	60	26/02/19	23/05/19
197	C-NOQ-L-00060	North Open Quay - Filter layer	55	19/03/19	07/06/19
198	C-NOQ-L-00070	North Open Quay - Primary armour 1-3 t	55	26/03/19	14/06/19
199	C-NOQ-L-00080	North Open Quay - Concrete beams installation	55	09/04/19	28/06/19
200	C-NOQ-L-00090	North Open Quay - Concrete infill box	55	25/04/19	12/07/19
201	C-NOQ-L-00100	North Open Quay - Precast beams installation	58	02/05/19	24/07/19
202	C-NOQ-L-00110	North Open Quay - Sea Side cope beam construction	58	10/05/19	31/07/19
203	C-NOQ-L-00120	North Open Quay - Harbour side cope beam construction	58	17/05/19	08/08/19
204	C-NOQ-L-00130	North Open Quay - Quarry rockfill	60	24/05/19	19/08/19
205	C-NOQ-L-00140	North Open Quay - Installation of collaborating deck slabs	60	03/06/19	26/08/19
206	C-NOQ-L-00150	North Open Quay - In situ concrete deck slab	60	10/06/19	02/09/19
207	C-NOQ-L-00160	North Open Quay - Service trench	60	24/06/19	16/09/19
208	C-NOQ-L-00190	North Open Quay - Quay accessories (fenders, bollards and ladders)	55	08/07/19	23/09/19
209	C-NOQ-L-00170	North Open Quay - Bedding layer	10	13/08/19	26/08/19
210	C-NOQ-L-00180	North Open Quay - Scour protection	15	27/08/19	16/09/19



AHEP - Enabling works & Construction

#	ID	Description	Original Duration	Start	Finish
211	C-NOQ-L-00200	North Open Quay - Pavement	30	27/08/19	07/10/19
212	**Superstructure Harbour Area**		310	09/01/19	07/04/20
213	**Superstructure - Water Tanks**		35	18/12/19	18/02/20
214	**Superstructure - Buildings**		155	09/07/19	25/02/20
215	**Superstructure - Retaining walls**		154	09/01/19	19/08/19
216	**Superstructure - Surface Markings**		10	25/03/20	07/04/20
217	**Superstructure - Install Site Wide Traffic Signs**		10	25/03/20	07/04/20
218	**Superstructure - Metal Crash Barriers**		5	01/04/20	07/04/20
219	**Harbour Entrance / Perimeter**		151	27/08/19	07/04/20
220	**Entrance Works**		40	27/08/19	21/10/19
221	**Perimeter Fencing - Permanent**		20	11/03/20	07/04/20
222	**M&E Works**		260	20/03/19	07/04/20
223	**M&E - Power Distribution**		80	18/09/19	21/01/20
224	**M&E - Cabling**		115	20/05/19	29/10/19
225	**M&E - Pipework**		130	20/03/19	24/09/19
226	**M&E - Aids To Navigation**		10	22/10/19	04/11/19
227	**M&E - Lighting Installations Floodlights/Masts**		17	27/09/19	21/10/19
228	**M&E - Electrical Charging Point Vehicle**		7	27/08/19	04/09/19
229	**M&E - CCTV Installations**		20	17/09/19	14/10/19
230	**M&E - Turnstile & Access**		5	27/08/19	02/09/19
231	**M&E - Automatic Traffic Barriers**		5	27/08/19	02/09/19
232	**M&E - Weighbridge Installations**		15	27/08/19	16/09/19
233	**M&E - Vehicle No. Plate Rec. Power Point (Foundations)**		5	27/08/19	02/09/19
234	**M&E - Fire Alarm System - Fire Fighting System**		20	29/01/20	25/02/20
235	**M&E Commissioning**		130	25/09/19	07/04/20
236	**Finishing Works**		10	25/03/20	07/04/20
237	**M&E Works (by AHB)**		278	22/03/19	08/05/20
238	**M&E (AHB) - Aids to Navigation**		262	22/03/19	15/04/20
239	**M&E (AHB) - CCTV Installations**		40	11/03/20	08/05/20
240	**M&E (AHB) - Turnstile & Access**		40	11/03/20	08/05/20
241	**M&E (AHB) - Automatic Traffic Barriers**		40	11/03/20	08/05/20
242	**M&E (AHB) - Weighbridge Installations**		40	11/03/20	08/05/20
243	**M&E (AHB) - Vehicle Number Plate Recognition (VNPR) Power Point**		40	11/03/20	08/05/20
244	**M&E (AHB) - Communications**		40	11/03/20	08/05/20
245	**Demobilisation & Reinstatement of Compounds**		56	18/02/20	08/05/20
246	**Compounds**		56	18/02/20	08/05/20
247	**Permanent Coastal Path rerouting and upgrading**		10	24/04/20	08/05/20