



# Aberdeen Harbour Expansion Project

## Marine Scotland Act Part 4 Marine Licensing

Licence Number: 05964/16/0 Reference No: 05964

### Document Details

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# Aberdeen Harbour Expansion Project

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### 1. Introduction

Dragados UK Limited (DUK), on behalf of Aberdeen Harbour Board (AHB) are progressing the design and construction works associated with the Aberdeen Harbour Expansion Project (AHEP). As part of the continual work refining the design, variations are proposed to the timing of the dredging activities alongside minor variations to the dredge areas and dredge depths at AHEP. This document describes the proposed variations and explains why they are considered non-material.

The current Marine Licence for dredging and disposal activities (Licence Number 05964/16/0, Ref. No: 05964) was granted by Scottish Ministers on 4<sup>th</sup> November 2016. The information within the Marine Licence was based upon the reference design assessed in the Environmental Statement (ES) and Additional Environmental Information Report (AEIR) for the AHEP and includes authorisation to '*...carry out dredging within the Scottish marine area and to deposit dredge spoil ....as described in Part 2 of the attached Schedule*'. AHB awarded the construction contract for the AHEP to DUK in December 2016, with construction starting in May 2017.

### 2. Material or Non-Material Change

There is limited guidance available on what should be considered a material or non-material change in the Scottish marine consenting process; however, there is some guidance from other UK consenting authorities which is useful to consider. The Department for Communities and Local Government (DCLG) have produced Guidance on Changes to Development Consent Orders under the Planning Act 2008<sup>1</sup>. To decide whether a change is material or non-material, DCLG advise that the following should be considered:

#### Environmental statement

- *12. A change should be treated as material if it would require an updated Environmental Statement (from that at the time the original Development Consent Order was made) to take account of new, or materially different, likely significant effects on the environment.*
- *13. There may be cases where the change proposed to a Development Consent Order will result in likely significant effects on the environment that are entirely positive. In these cases, an updated Environmental Statement will still be required and the application will need to be treated as a material change in order to ensure that the regulatory requirements on Environmental Impact Assessment are met. However, depending on the circumstances, such material changes may be ones where no examination needs to be held (see paragraphs 55-63 [of the DCLG guidance]).*

#### Habitats and protected species

- *14. A change to a Development Consent Order is likely to be material if it would invoke a need for a Habitats Regulations Assessment. Similarly, the need for a new or additional licence in respect of European Protected Species is also likely to be indicative of a material change. Applicants should consider discussing the need for a Habitats Regulations Assessment or a protected species licence with the appropriate statutory nature conservation body before any application for a change is prepared.*

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[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/485064/Making\\_changes\\_guidance\\_to\\_Development\\_Consent\\_Orders.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/485064/Making_changes_guidance_to_Development_Consent_Orders.pdf)

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### Compulsory acquisition

- 15. A change should be treated as material that would authorise the compulsory acquisition of any land, or an interest in or rights over land, that was not authorised through the existing Development Consent Order. This is because consideration of the need for compulsory acquisition must include a right for the person whose land or rights are being acquired to express their views at a hearing, and this is not provided for under the 2011 Regulations governing non-material changes (where there is no examination).

### Impact on business and residents

- 16. The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material. In some cases, these impacts may already have been identified, directly or indirectly, in terms of likely significant effects on the environment. But there may be other situations where this is not the case and where the impact of the change on local people and businesses will be sufficient to indicate that the change should be considered as material. Additional impacts that may be relevant to whether a particular change is material will be dependent on the circumstances of a particular case, but examples might include those relating to visual amenity from changes to the size or height of buildings; impacts on the natural or historic environment; and impacts arising from additional traffic.

Each of these potential impacts is considered below in the context of the variations proposed at AHEP, apart from Compulsory Acquisition which is not applicable.

## **3. Proposed Variation to Existing Dredge and Dredge Disposal Marine Licence**

### **3.1 Timing**

The current Marine Licence for dredging and disposal is valid from 6<sup>th</sup> February 2017 until 5<sup>th</sup> September 2018. This provides for 19 months of dredging and disposal. During the period between February 2017 and December 2017, dredging and disposal has taken place over a 12-day period from 5<sup>th</sup> September to 16<sup>th</sup> September 2017.

DUK propose to vary the duration of the dredging and disposal Marine Licence to run from 4<sup>th</sup> September 2017 to 4<sup>th</sup> October 2019. This will encompass:

- Dredging and disposal activity that has already taken place (2 weeks from 5<sup>th</sup> September 2017 to 16<sup>th</sup> September 2017);
- Dredging and disposal in the 2018 season (8 months from March 2018 to October 2018); and
- Final dredging and disposal in the 2019 season (likely to be a limited duration dredge which will take place between the months of March to September 2019 for a maximum of 8 months).

Therefore, excluding the small-scale 2-week dredging campaign in September 2017, the overall dredging and disposal period proposed (March 2018 to September 2019) does not exceed the 19 months as stated on the existing Marine Licence, and during that 19 months there will be a period of approximately 5 months over the winter of 2018-2019 when no dredging and disposal will take place.

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### Does the proposed variation of the dredge timing change the conclusion of the AHEP Environmental Statement?

Whilst there is a change in the start and end date of the planned dredging activity, the overall duration of the activity has not changed and will be 19 months or less, as per the existing dredging Marine Licence (2 weeks of dredging in 2017, 8 months in 2018 and up to 8 months in 2019).

We have reviewed the conclusions of the AHEP ES (as summarised in Chapter 25) and the AEIR to assess if any of the assessments are likely to change as a result of the dredging or disposal taking place up to October 2019. The parameters considered in the ES and AEIR for dredging and disposal are as follows:

- ES Chapter 3 Section 3.6, and Chapter 7 Table 7.9:
  - Dredging anticipated to take place over 19 months, seven days a week, as a 24-hour operation
  - Dredged material to be disposed of at sea at an existing licensed disposal site (CR110)
- AEIR
  - Total volume of material to be dredged: 2,850,000 m<sup>3</sup>, of which 250,000 m<sup>3</sup> estimated to be rock
  - Total volume of material to be disposed at site CR110: 2,191,000 m<sup>3</sup> (the remainder of the dredged material will be reused)

These parameters remain valid for dredging and disposal up to October 2019.

The sediment plume modelling carried out for the ES (Appendix 7D) modelled a mean spring-neap tidal cycle to represent average hydrodynamic conditions. The assessments presented in the ES relating to suspended sediment concentrations and seabed deposition considered a 19-month period of continuous dredging and disposal, not a particular timeframe when it would occur.

Similarly, the underwater noise modelling carried out for the ES (Appendix 13-B), and the corresponding assessments relating to underwater noise in the ES, considered a 19-month period of continuous dredging and disposal, not a particular timeframe when it would occur.

### Habitats and protected species - Does the proposed variation of the dredge timing change the conclusion of the Appropriate Assessment?

Marine Scotland undertook an Appropriate Assessment (AA) prior to issuing the Marine Licence(s) for the AHEP project. Whilst dredging and disposal operations are considered, the AA focusses mostly on the proposed marine blasting and marine impact pile driving (the latter has now been removed from the construction methodology). The timing of blasting and marine impact piling are considered in the Population Viability Analysis (PVA) for marine mammals but elsewhere in the AA, timing of dredging and disposal operations is not considered and DUK therefore understand that altering the end date for the dredging activity would not impact upon the conclusions of the AA.

### Does the proposed variation of the dredge timing change the conclusion of the ES in terms of impact on business and residents?

Within Chapter 20 of the ES, the impacts from plant noise including dredging have been assessed as Major Adverse for certain sensitive receptors. DUK do not believe that changing the end date for the dredging operations to October 2019 will change this conclusion. In 2017 there has been limited disturbance for local businesses and residents in terms of marine activities, and DUK have received

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very few comments from the public about other disturbance. There has been noise monitoring undertaken at sensitive receptors such as the Girdleness Lighthouse Community, and noise thresholds have been maintained to the satisfaction of Aberdeen City Council.

Construction of the AHEP (marine and land-based activities) commenced in May 2017 and will continue until May 2020. Both the existing and revised timescales for dredging and disposal fall within this period of construction activities, so the proposal to undertake dredging and disposal to October 2019 does not alter the overall duration of the construction phase.

### 3.2 Dredge area and depth

DUK has adapted the ES design to remove the need for any marine impact piling through the use of caissons and an open quay constructed using rotary piling. When installing caissons there is a requirement to dredge to a deeper depth than originally proposed, as a firm, level base must be created for the caissons to sit on. This means the area below the caissons must be dredged and then refilled with graded rock thus creating a firm bottom for the caissons to be placed upon.

For ease of reference, an overview of the AHEP dredge layout is provided in Figure 1: Overall Dredge Layout. The following variations are proposed to the dredge depths and areas:

#### North Breakwater - Removed

##### Existing Licence

- *Dredging of North Breakwater location to achieve seabed depth of approximately 15.0 metres below CD.*

##### Proposed Variation

- This area will be removed as it is either no longer required or covered by other areas.

**South Breakwater – No change proposed to Licence** (although actual dredge area is now slightly smaller)

- *Dredging of South Breakwater location to achieve a seabed depth of approximately 14.0 metres below CD*

**Harbour Basin** (See Figure 2: Harbour Basin & Figure 3: North Quay)

##### Existing Licence

- *Dredging of Harbour Basin location to achieve a seabed depth of approximately 9.0 metres below Chart Datum (CD).*

##### Proposed Variation

- There is a minor variation proposed to the Harbour Basin with an extension to the north of the site under the area where caissons will be installed. (North Quay – See Figure 3: North Quay)
- The area under the East quay and South East Pier is removed from the Harbour Basin dredge.

**East Quay & Entrance Channel** (See Figure 4: East Quay and Figure 5: Entrance Channel)

##### Existing Licence

- *Dredging of East Quay and Entrance Channel locations to achieve seabed depth of approximately 9.0 metres below CD.*

##### Proposed Variation

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- The East Quay area is extended to incorporate the footprint of the caissons and dredge depth changed to 12.95m
- The Entrance Channel has a minor variation to take into account a small area at the edge of the proposed channel that was previously omitted from the licence.

### **South East Pier – New Area (see Figure 6: South East Pier)**

#### Proposed Variation

- Dredging of South East Pier to achieve a seabed depth of approximately 11.45m below CD



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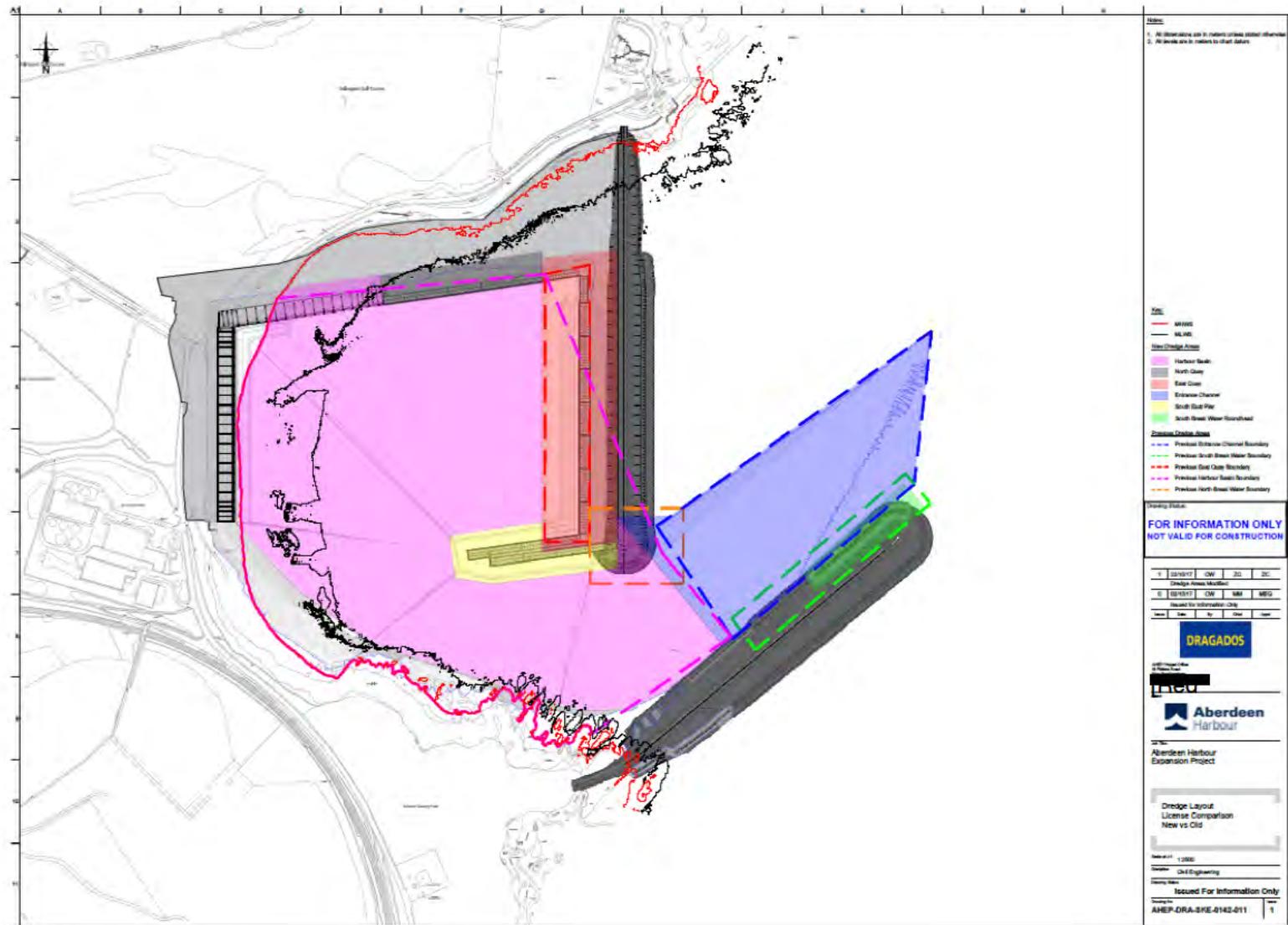


Figure 1: Overall Dredge Layout – Comparison of New vs Old



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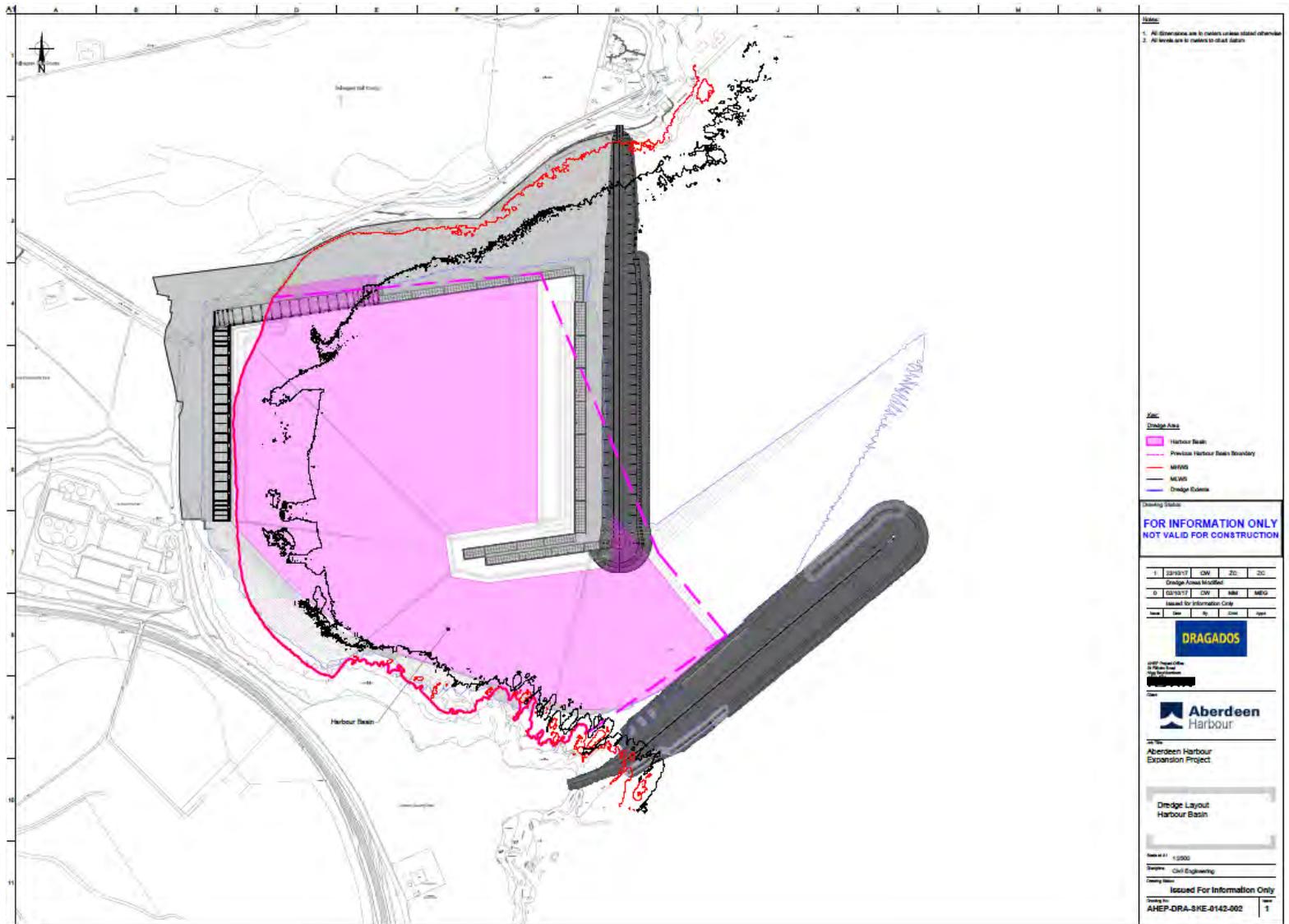


Figure 2: Harbour Basin



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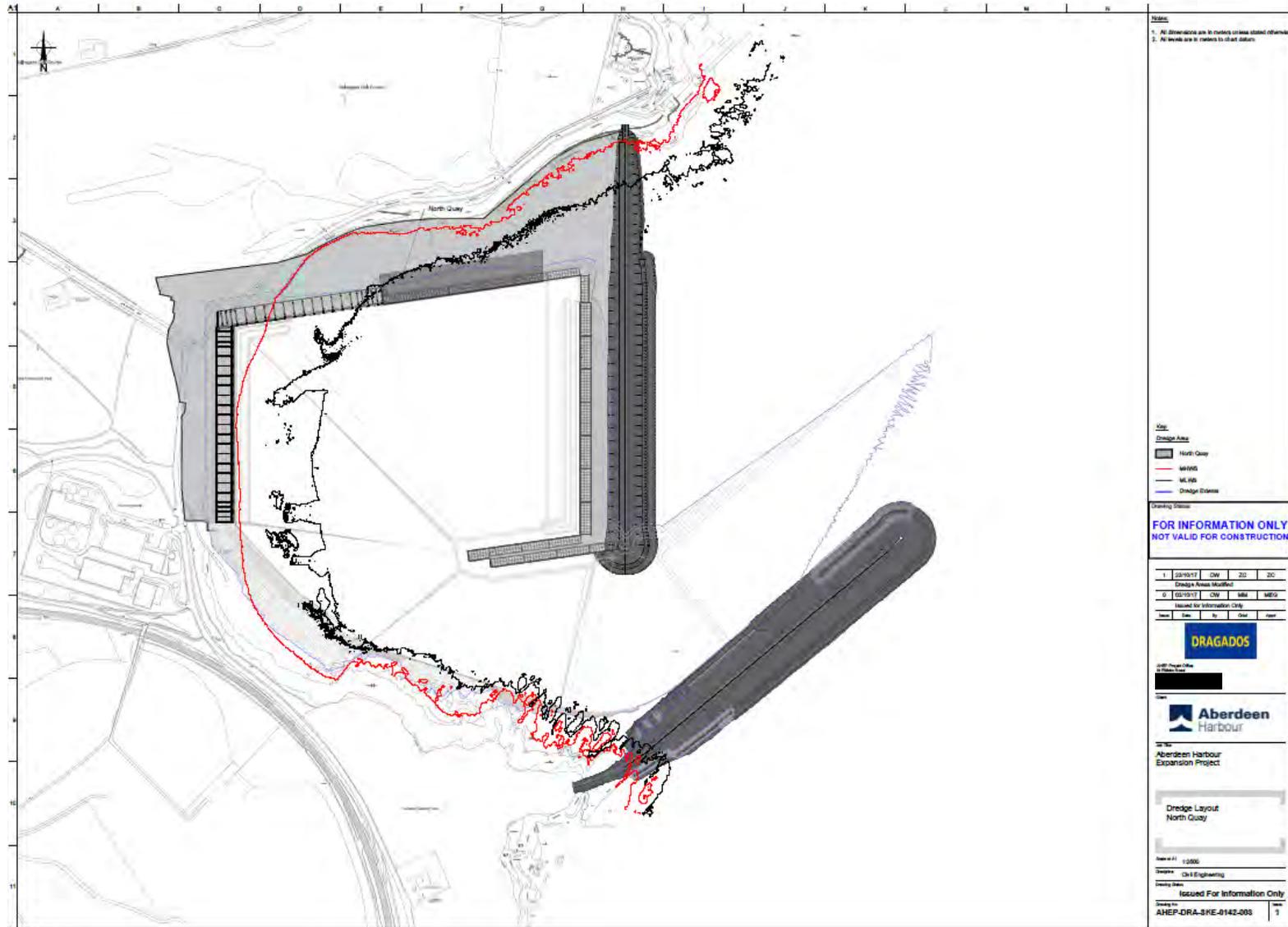


Figure 3: North Quay



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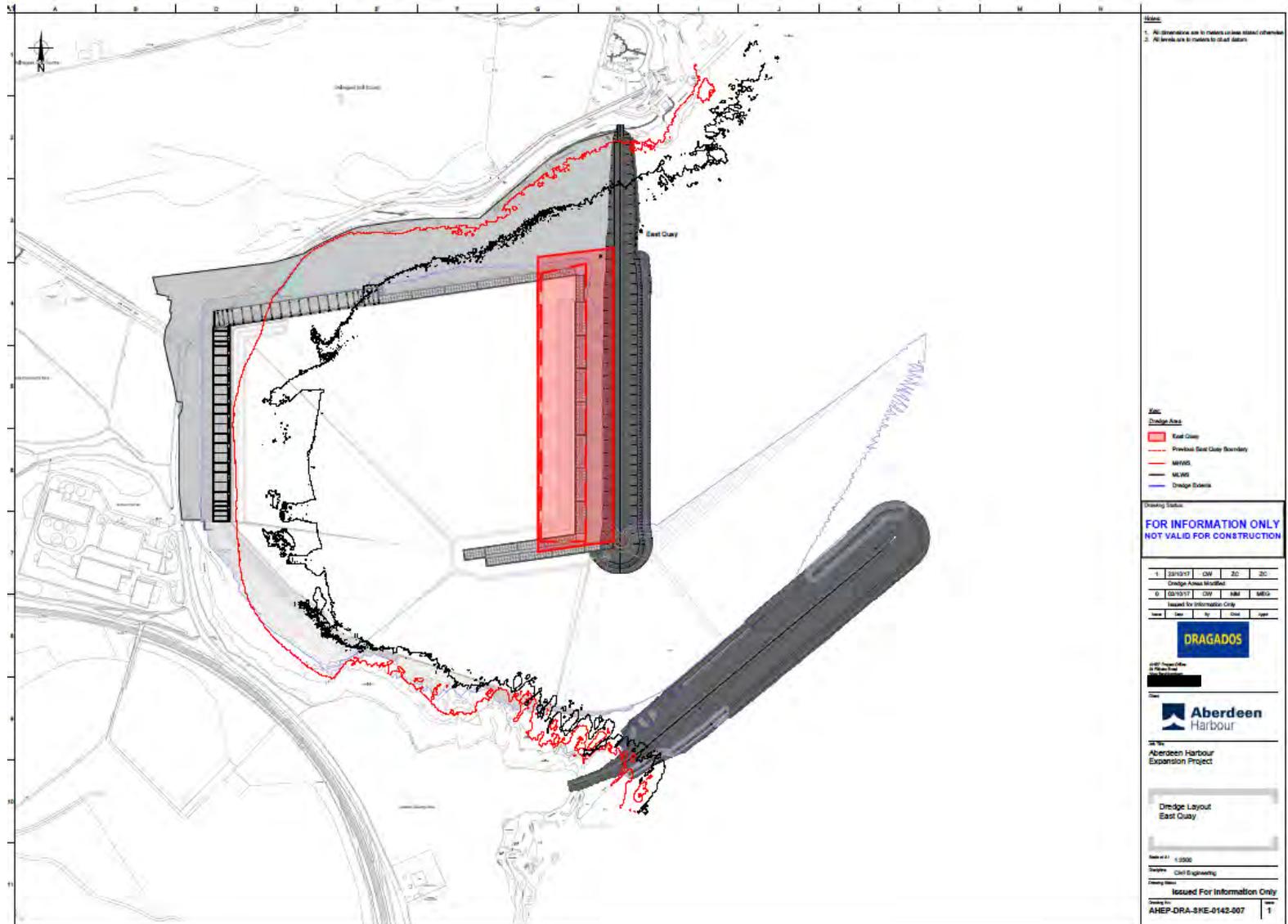


Figure 4: East Quay



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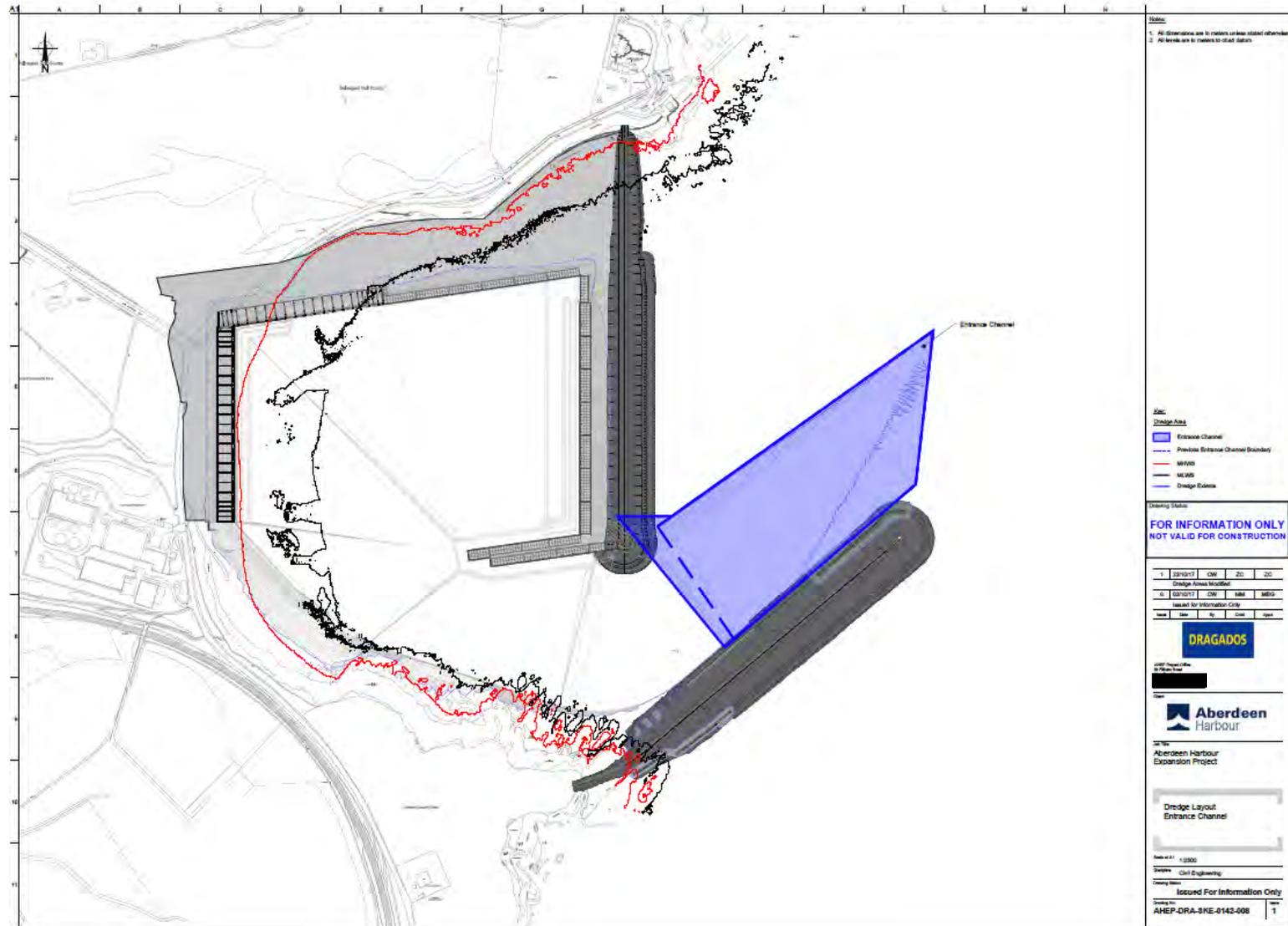


Figure 5: Entrance Channel



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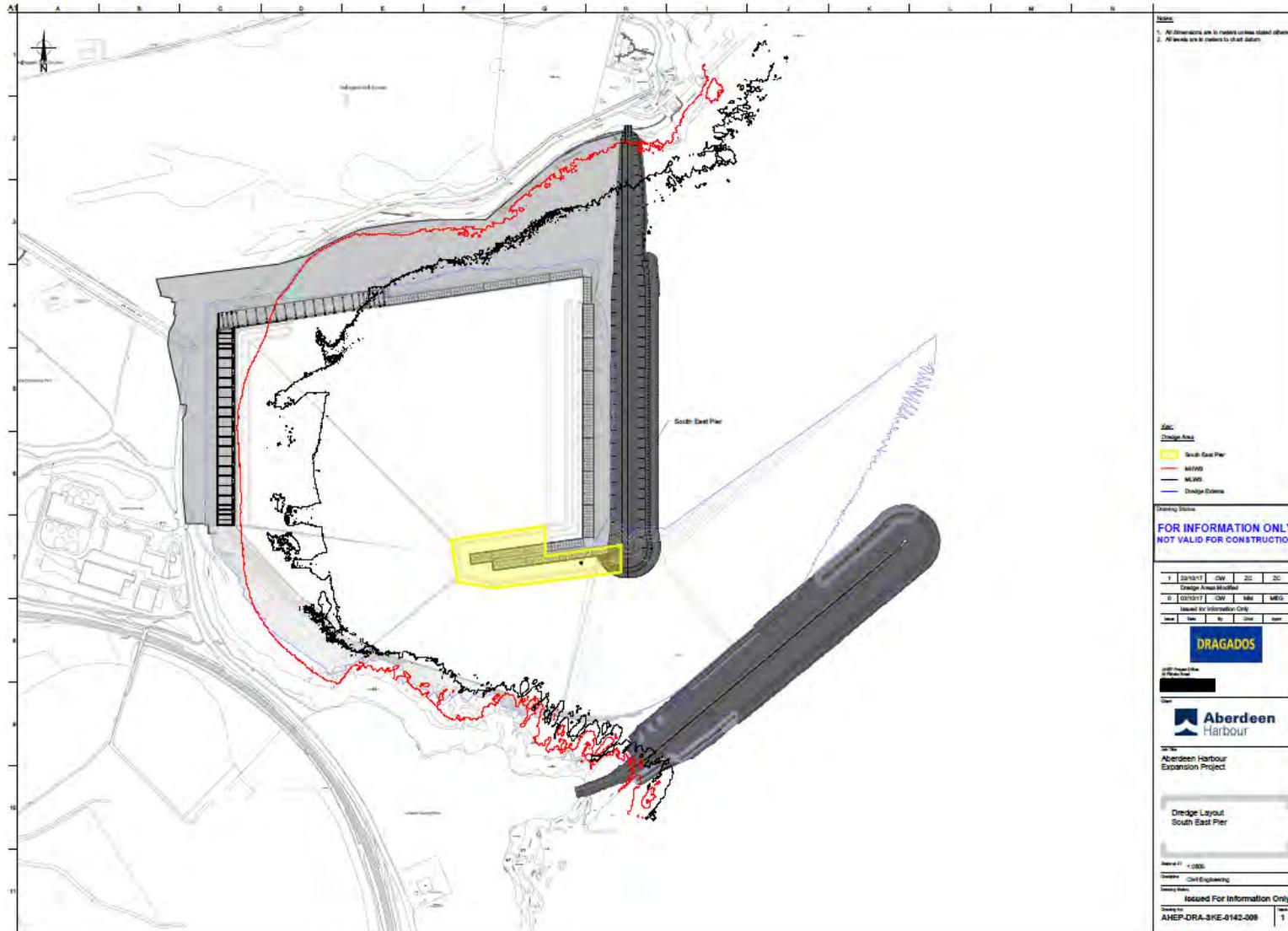


Figure 6: South East Pier

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### Does the proposed variation of the dredge depth/area change the conclusion of the AHEP Environmental Statement?

The proposed variations to the dredge depths and areas does not increase the overall volume of material to dredged from Nigg Bay and disposed at the licensed site CR110 as described within the ES and AEIR.

As DUK will be dredging to a deeper depth at the East Quay and South East Pier, Arup have conducted a review of the physical and chemical quality of the dredged material to ensure it is suitable for disposal at sea at site CR110. The detailed analysis is provided in Appendix A and a summary of the results is provided below.

The review of the available ground investigation information has confirmed that the sediment in the additional dredge areas is glacial till deposits, similar in nature to the material previously sampled and tested. As such, the chemical concentrations are expected to be similar.

The previous marine sediment contamination assessment undertaken by AHB (which was accepted by Marine Scotland Science) concluded that due to the localised extent of materials which contained contaminants above respective Effects Range Medium (ERM)/Effects Range Low (ERL) guidelines, and the significant dilution that will occur during dredging and disposal, there will be limited risk of adverse marine biological impacts (e.g. benthic communities) associated with material being dredged.

The assessments presented in the ES and AEIR only considered the sediment quality data down to the dredge levels proposed at that time. There were, however, some limited samples collected from greater depths and these results have been reviewed to assess the risks to benthic communities and the marine environment. In summary, the majority of testing of material between -9m and -14m CD recorded levels of contaminants typically below Marine Scotland Revised Action Level 1 and no contaminants elevated above Action Level 2. Some very slight exceedences above Action Level 1 were identified; however, the data suggest that overall the levels of contaminants within the glacial soils at depth are typically lower than those in the shallower horizons. As such, there is no evidence to suggest that levels would increase below the depths tested, and therefore no reason to deviate from the previous environmental assessments performed by AHB, which highlight that contaminants above Action Levels or ERM/ERL guidelines within the material to be dredged and disposed are isolated and relatively localised within the vertical and horizontal planes. Furthermore, the mixing and substantial dilution of any isolated contaminants during all stages of the dredging and disposal process (including deeper materials) would not lead to any increased risks to biological communities or the marine environment in relation to contamination.

### Habitats and protected species - Does the proposed variation of the dredge depth/area change the conclusion of the Appropriate Assessment?

Marine Scotland undertook an AA prior to issuing the Marine Licence(s) for the AHEP project. Whilst dredging operations are considered, the AA focusses mostly on the proposed marine blasting and marine impact pile driving (the latter has now been removed from the construction methodology). DUK do not believe that minor variations to the dredge depth and areas will impact upon the conclusions of the AA. As described above the total volume to be dredged and disposed is unchanged.

In relation to contaminants, as described above there is no evidence to suggest that sediment contamination levels would increase below the depths tested, and therefore no reason to deviate

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from the previous environmental assessments performed by AHB. The conclusions in the AA relating to sediment chemical quality are, therefore, unchanged.

In relation to suspended sediment concentrations (SSC), within the AA potential impacts on fish, birds and marine mammals associated with protected sites are considered, and conclusions drawn that the predicted increases in SSC are unlikely to result in any significant effects. For marine mammals, it is noted that the small risk from disposal activities will be managed by a Marine Mammal Observer keeping watch for marine mammals prior to discharge taking place. These conclusions will not be changed by varying the dredge depth and area.

Does the proposed variation of the dredge depth/area alter the conclusion of the ES in terms of impact on business and residents?

Amending the dredge depth and areas will not impact upon the conclusions of the ES in relation to impacts on business and local residents. As described above, the overall volume and duration of dredging and disposal is not changed by the proposed variations to the dredge depth and areas.

#### 4. Conclusion

Having considered the proposed variations to the Marine Licence for dredging and disposal in the context of the assessments presented in the ES and AEIR, using best available UK guidance, it is concluded that the variations do not affect:

- The conclusions of the ES or AEIR;
- The conclusions of the AA; or
- The conclusion of the ES in terms of impact on business and residents.



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## Appendix A

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Subject Dredge Depth & Area Amendments

Date 27 November 2017

Job No/Ref 253300-00

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### Extension of Dredge Depth

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#### Introduction

Aberdeen Harbour Board (AHB) currently hold a Marine Licence to carry out dredging and to deposit dredged spoil substances or objects within the Scottish Marine Area in connection with the Aberdeen Harbour Expansion Project (Licence Number: 05964/16/0 Ref No: 05964).

The current Marine Licence states that:

*Capital dredging and dredging spoil disposal for Aberdeen Harbour Expansion Project (“AHEP”), Nigg Bay, Aberdeen including the following activities:*

- *Dredging of Harbour Basin location to achieve a seabed depth of approximately 9.0 metres below Chart Datum (CD)*
- *Dredging of East Quay and Entrance Channel locations to achieve seabed depth of approximately 10.5 metres below CD.*
- *Dredging of North Breakwater location to achieve seabed depth of approximately 15.0 metres below CD*
- *Dredging of South Breakwater location to achieve a seabed depth of approximately 14.0 metres below CD’*

At the time of the original marine licence application, it was proposed to construct the quays using sheet piles which would be installed by impact piling. However, the contractor appointed to undertake the construction works, Dragados, will use an alternative method of construction. The East Quay and South East Pier (see Figure 1) will be constructed by placing concrete caissons on the sea bed. The environmental impact of this method is considered to be lesser than the original sheet pile solution as it eliminates the requirement for marine impact piling, thereby minimising underwater noise produced during construction, and associated effects on marine mammals and fish.

However, the use of concrete caissons requires the dredge depths to be extended at following two locations:

- *Dredging of East Quay. Increase seabed depth of approximately 10.5 metres below CD to 12.95m below Chart Datum (CD).*
- *Dredging of South East Pier. Increase seabed depth of approximately 9.0 metres below (CD) to 11.45m below CD.*

The East Quay and South East Pier areas need to be excavated to these depths to provide a well sorted, firm, flat bottom for the caissons to sit on.

**Subject** Dredge Depth & Area Amendments

**Date** 27 November 2017

**Job No/Ref** 253300-00

Dragados have reviewed the volume of material dredged to date and anticipate that even with the deeper dredge proposed at the East Quay and South East Pier, the total dredge volume will not exceed the volume of material which is permitted under the current marine licence (East Quay – 1,202,000 wet tonnes). In addition, the increased dredge depth proposed does not increase the overall maximum volume to be deposited at the sea disposal site (4,702,737 wet tonnes).

## Stratigraphy

In general the ground conditions in the area comprise the following sequence:

- Marine Deposits (typically *medium dense grey slightly gravelly SAND*)
- Upper Drumlithe Sand and Gravel (medium dense to very dense brown locally slightly silty fine to coarse SAND and GRAVEL with cobbles and boulders)
- Glacial till (stiff very high strength reddish brown and brown slightly gravelly sandy CLAY, with occasional bands of very dense sand and gravel.)
- Ness Sand and Gravel (very dense light grey sandy GRAVEL with medium cobble content and low boulder content, and brown very silty fine to medium SAND) [present below the proposed dredge levels]
- Bedrock (igneous in nature and comprises schist, granite and gneiss) [present below the proposed dredge levels]

The locations of the ground investigations are shown on Figure 2. Figures 3 and 4 show geological cross sections and the proposed dredge depths at the East Quay and South East Pier.

## Results of Chemical Testing

Aberdeen Harbour Board previously undertook an assessment in support of the Marine Licence applications. This marine sediment assessment compared seabed contamination test data from the 2013<sup>1</sup> and 2016<sup>2</sup> Ground Investigation surveys to published Effects Range Medium (ERM) and Effects Range Low (ERL) sediment toxicity datasets (Goreham-Test 1998<sup>3</sup>, Long et al 1998<sup>4</sup>) to assess the potential risks that contaminants posed to benthic communities and the marine environment<sup>5</sup>. This assessment only considered the available data down to the proposed dredge levels at that time. There were however, some limited samples collected from greater depths and therefore these results have been reviewed to assess the risks to benthic communities and the marine environment.

Chemical testing was undertaken for the following determinands:

- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc)
- 16 Priority Polyaromatic Hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs 28, 52, 101, 118, 138, 153, 180)
- Tributyl Tin (TBT)

The assessment of the results of the chemical testing are presented in full in Appendix A.

The results of the chemical testing have also been presented on the cross sections within Figures 5 to 10. This shows that where potential contaminants were recorded between actions level 1 and

**Subject** Dredge Depth & Area Amendments

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action level 2, they were predominantly encountered within the shallower sediment deposits. With the exception of one location, the deeper samples generally recorded the potential contaminants below action level 1.

Figure 5 and 8 show that all of the PCB and TBT concentrations were recorded below action level 1.

Figures 6 and 9 show that although some of the individual PAHs were recorded between action level 1 and action level 2, below -9m CD the results were all below action level 1.

Figures 7 and 10 show that although some of the heavy metals were recorded at concentrations between action level 1 and action level 2 down to the proposed dredge depths, none of the concentrations exceed action level 2.

## Discussion

The review of the available ground investigation information has confirmed that the sediment in the new proposed dredge zone is glacial till deposits, similar in nature to the material previously sampled and tested and therefore we would expect the chemical concentrations to be similar.

The previous marine sediment contamination assessment undertaken by AHB<sup>6</sup> (which was accepted by Marine Scotland Science) concluded that due to the localised extent of materials which contained contaminants above respective ERM/ERL guidelines and the significant dilution that will occur during dredging that there will be limited risk of adverse marine biological impacts (eg benthic communities) associated within material being dredged.

In summary, a review of the deeper sample data from the 2016 survey has identified that the majority of testing of deeper material between -9m and -14m CD recorded levels of contaminants typically below action level 1 and nothing elevated above action level 2. Some very slight exceedences above action level 1 parameters were identified; however, the data suggest that overall the levels of contaminants within the glacial soils at depth are typically lower than those in the shallower horizons. The reduced levels of contamination at depth beneath Nigg Bay highlight that with regards to contamination there is no evidence to suggest that levels would increase below the depths tested, any therefore no reason to deviate from the previous environmental assessment performed by AHB, which highlights that contaminants above action levels within the material to be dredged and disposed of are isolated and relatively localised within the vertical and horizontal planes. Furthermore, the mixing and substantial dilution of any isolated contaminants during all stages of the dredging and disposal process (including deeper materials) would not lead to any increased risks to biological communities or the marine environment in relation to contamination.

The deeper materials to be excavated would be subject to the same testing and compliance procedures outlined within the Dredging and Dredge Spoil Disposal Management and Monitoring Plan (part of the Construction Environmental Management Plan) and it is therefore suggested that as none of the evidence indicates the presence of significant contamination to be present at depth that no further investigatory testing of materials is required to permit the excavation and disposal of deeper materials at the licenced disposal facility.

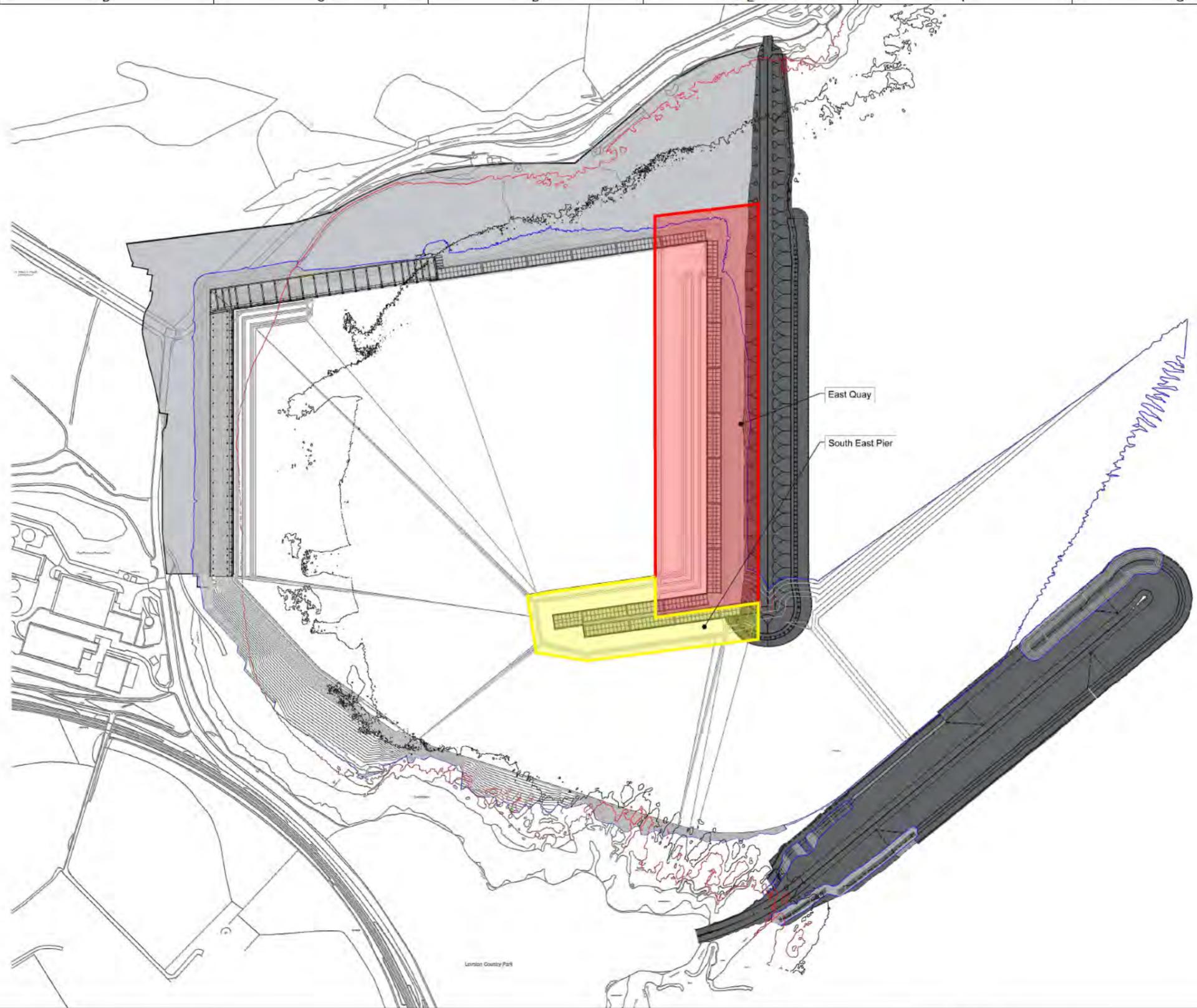
**Subject** Dredge Depth & Area Amendments

**Date** 27 November 2017

**Job No/Ref** 253300-00

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**Key**

<span style="display:inline-block; width:15px; height:10px; background-color:red; border:1px solid black;"></span> East Quay
<span style="display:inline-block; width:15px; height:10px; background-color:yellow; border:1px solid black;"></span> South East Pier
<span style="display:inline-block; width:15px; border-bottom:1px solid red;"></span> MHWS
<span style="display:inline-block; width:15px; border-bottom:1px solid black;"></span> MLWS
<span style="display:inline-block; width:15px; border-bottom:1px solid blue;"></span> Dredge Extents

11	20/10/17	KC	JSG	ZC
Issued for Information				
Rev	Date	By	Chkd	Appd

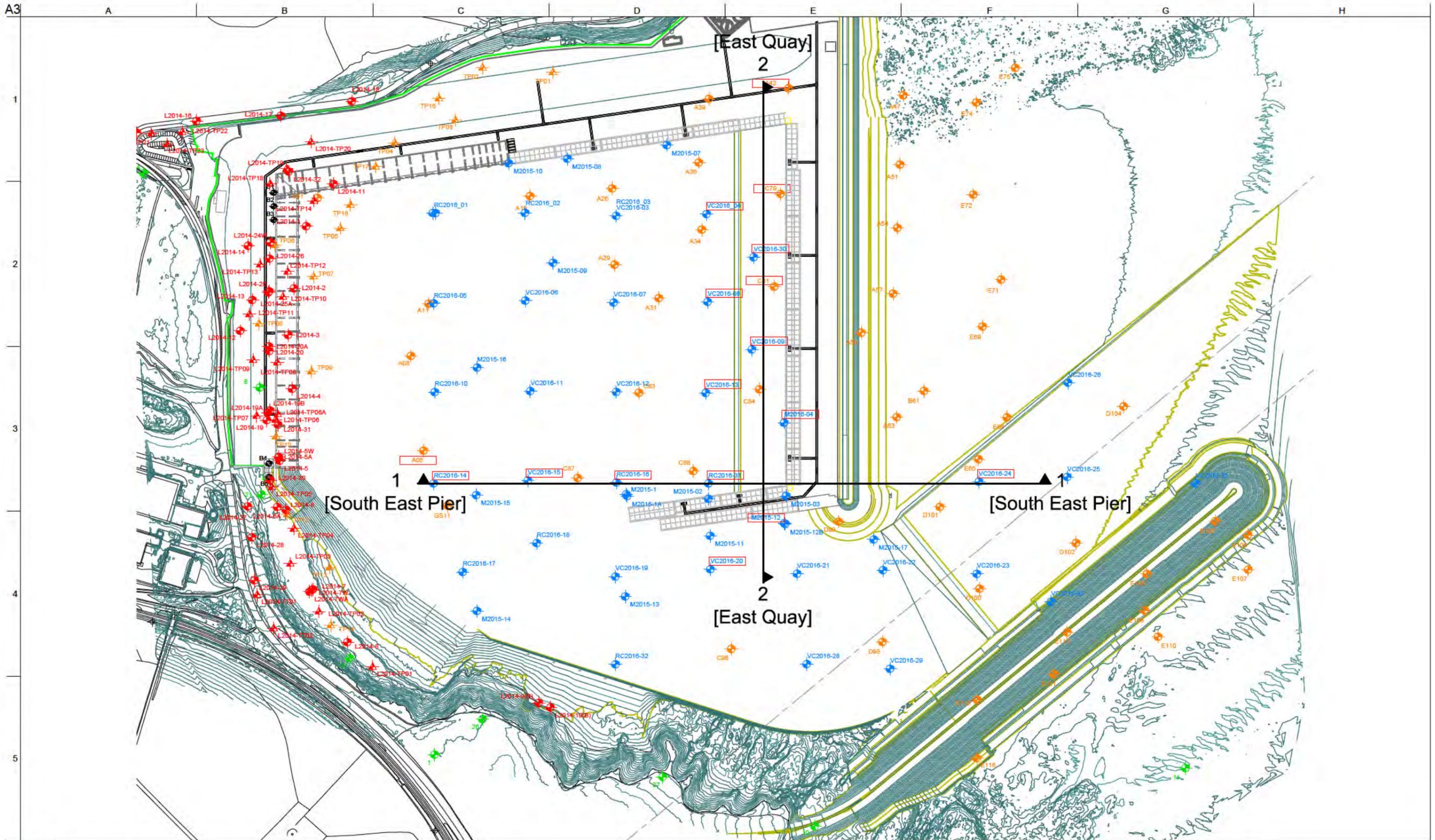
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Project Title  
**Aberdeen Harbour Expansion Project**

Client  
**Dragados UK & Ireland**

Drawing Title  
**Dredge Areas**

Scale at A3 1:5000	
Role	Geo
Suitability	S2 - For Information
Arup Job No	Rev
<b>253300-00</b>	<b>11</b>
Name	
<b>Figure 1</b>	



**Key**  
 Exploratory holes shown on sections

**Notes**  
 A number of deep boreholes with no sediment analysis testing data have been included on the cross sections to show overall ground conditions.

I1	20/10/17	KC	JSG	ZC
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Project Title  
**Aberdeen Harbour Expansion Project**

Client  
**Dragados UK & Ireland**

Drawing Title  
**Exploratory Hole Location Plan**

Scale at A3 1:4000

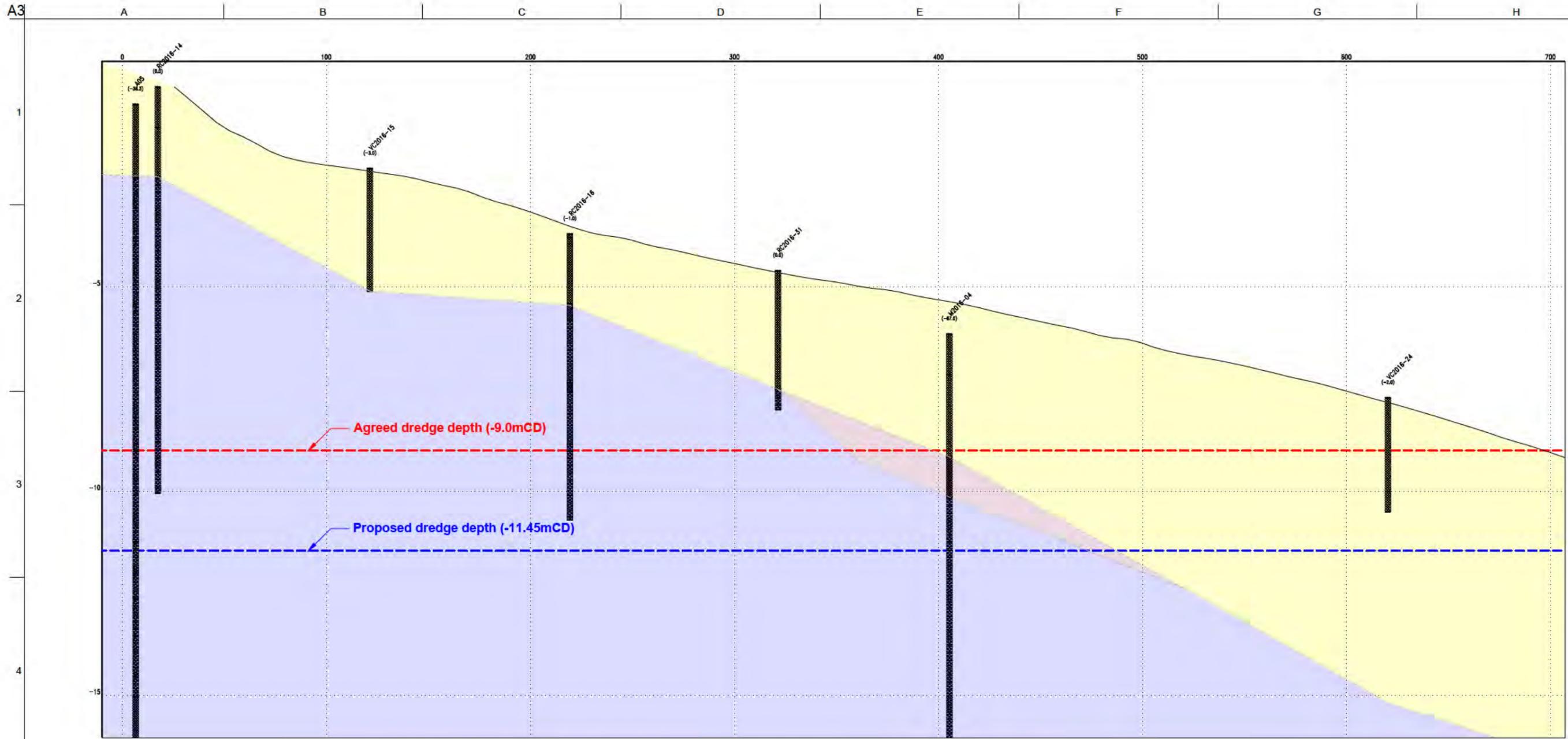
Role Geo

Suitability S2 - For Information

Anup Job No  
**253300-00**

Rev  
**I1**

Name  
**Figure 2**



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

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Project Title  
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Client  
Dragados UK & Ireland

Drawing Title  
Geological Cross Section 1-1  
South East Pier

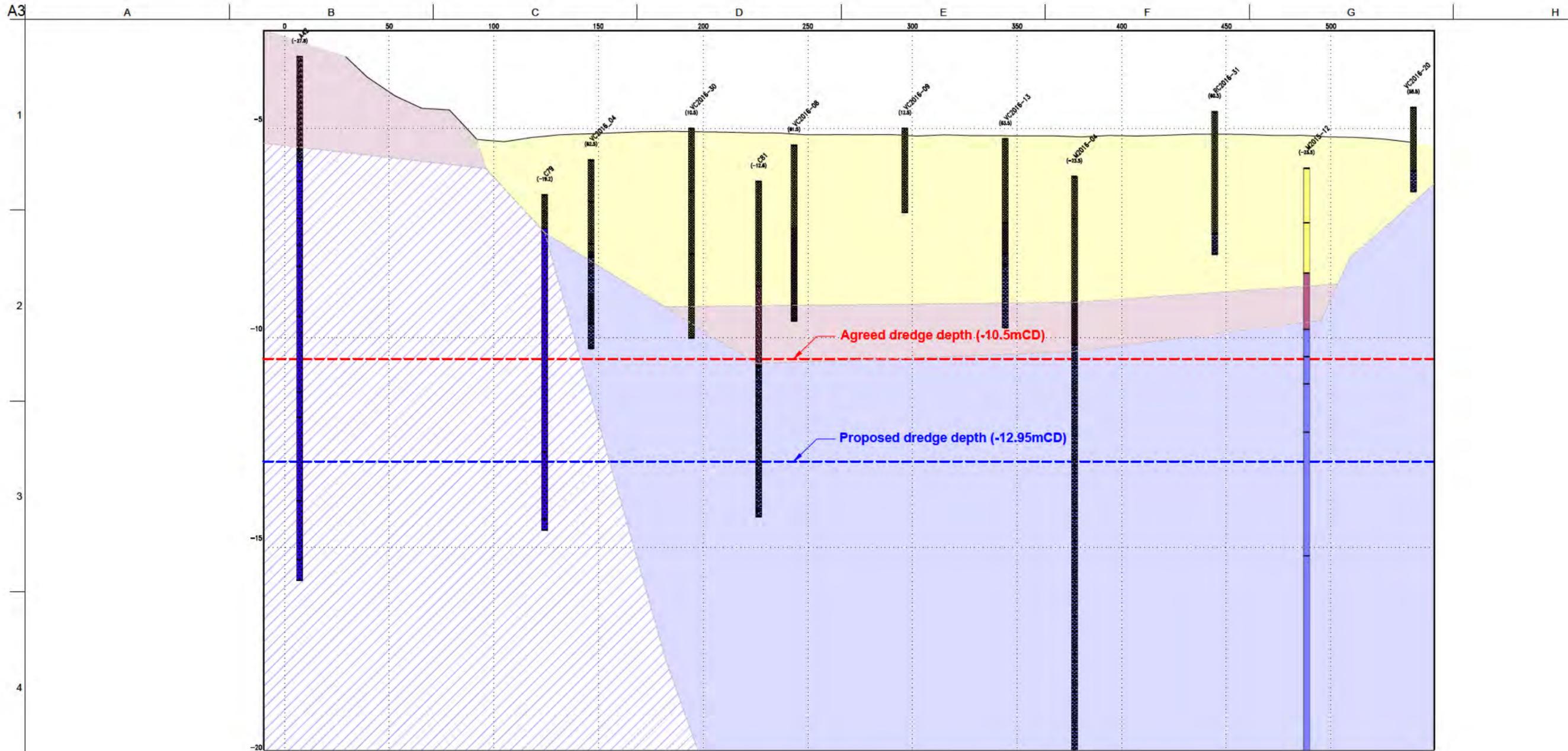
Scale at A3 1:100V 1:2000H

Role Geo

Suitability S2 - For Information

Arup Job No 253300-00 Rev 11

Name  
Figure 3



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

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Dragados UK & Ireland

Drawing Title  
Geological Cross Section 2-2  
East Quay

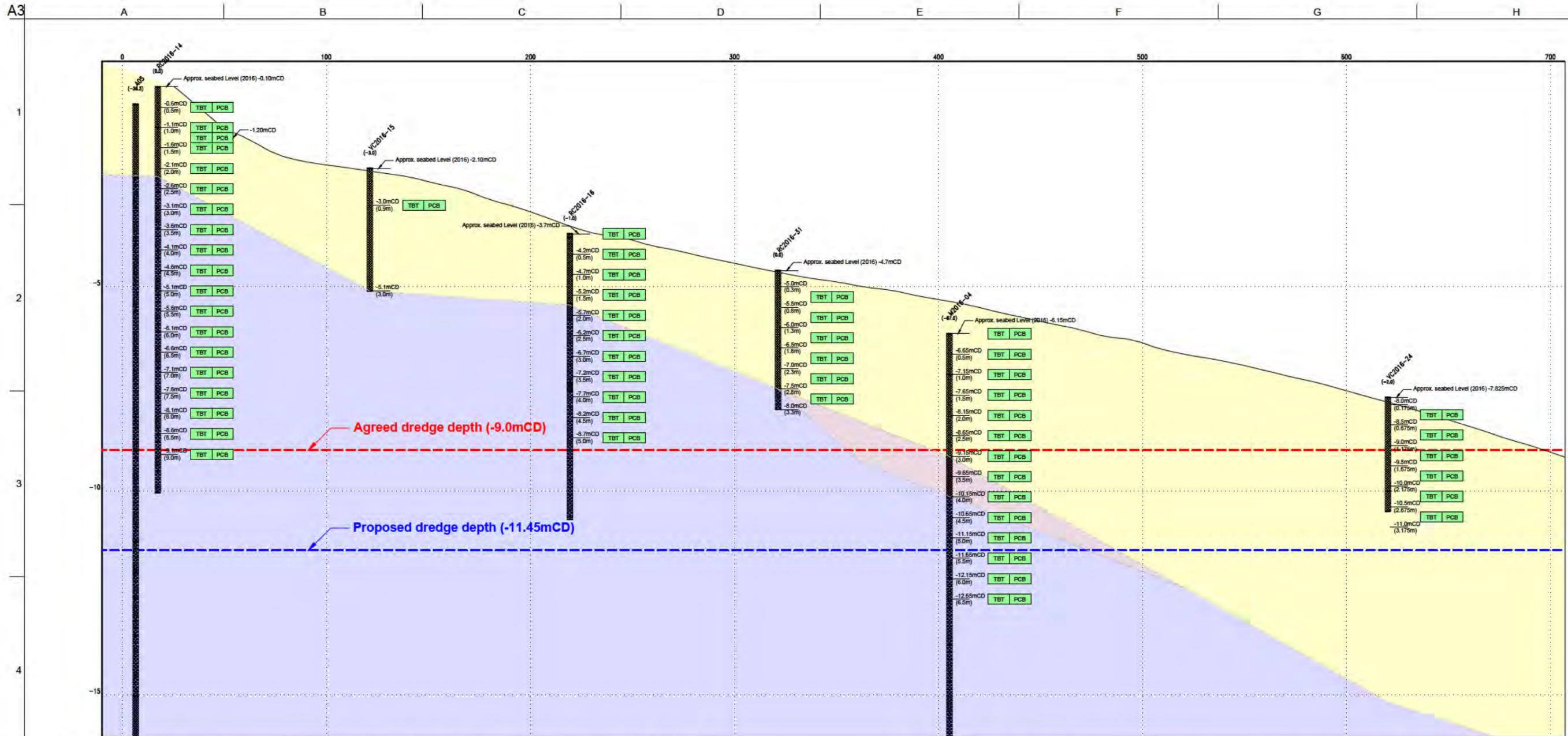
Scale at A3 1:100V 1:2000H

Role Geo

Suitability S2 - For Information

Arup Job No 253300-00 Rev 11

Name  
**Figure 4**



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Determinands Analysed**

TBT - Tributyltin  
 PCB - Polychlorinated Biphenyls  
 PCBs 28, 52, 101, 118, 138, 153, 180

**Concentrations of Determinands**

- Below Action Level 1
- Between Action Level 1 and 2
- Above Action Level 2

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

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Client  
 Dragados UK & Ireland

Drawing Title  
 Results of sediment analysis  
 in vicinity of South East Pier  
 TBT & PCBs

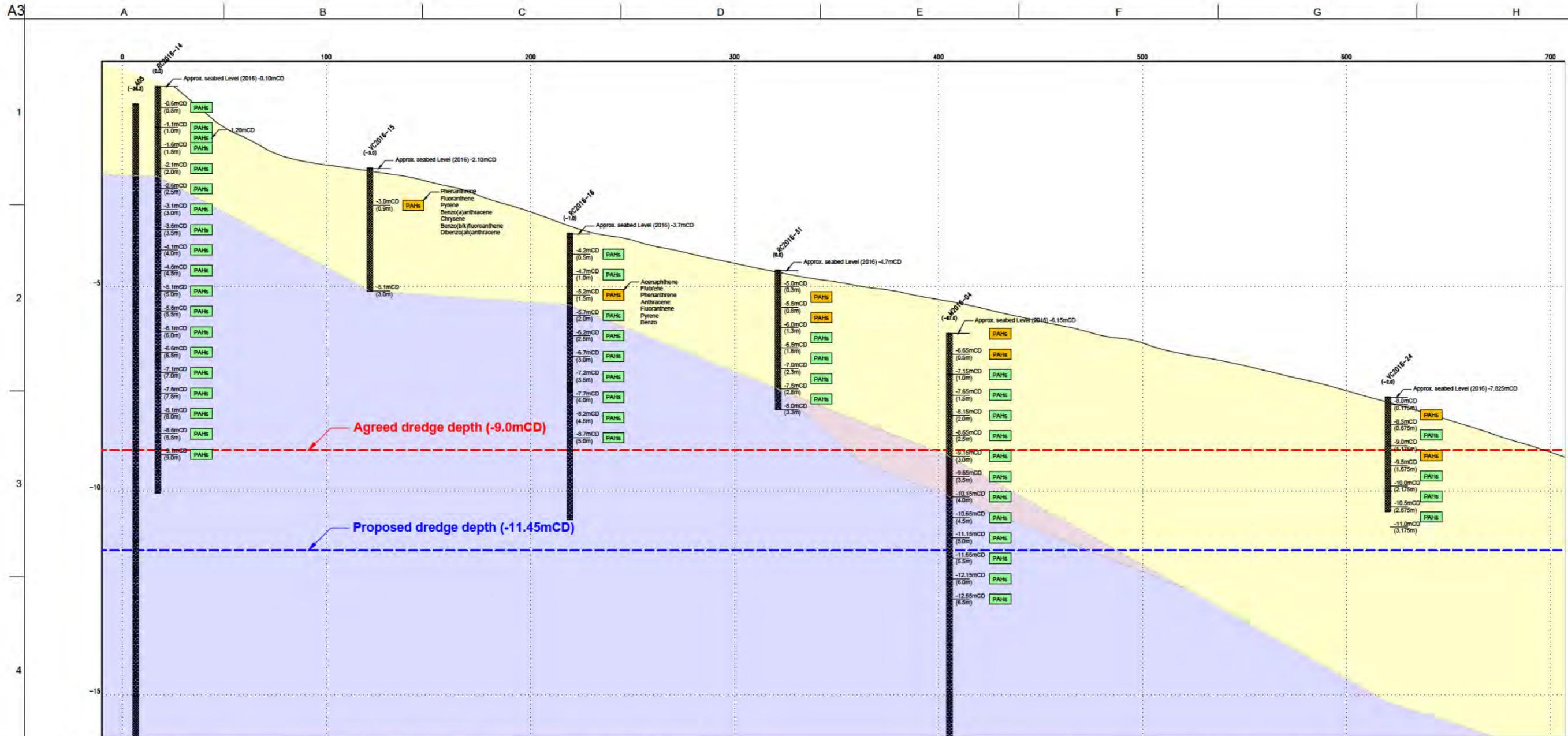
Scale at A3 1:100V 1:2000H

Role Geo

Suitability S2 - For Information

Arup Job No 253300-00 Rev 11

Name  
**Figure 5**



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Determinands Analysed**

16 Priority PAHs

**Concentrations of Determinands**

- 16 priority PAHs below Action Level 1
- 1 or more of the 16 priority PAHs above Action Level 1

\*Note - No Action Level 2 values for PAHs

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

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Project Title  
Aberdeen Harbour Expansion Project

Client  
Dragados UK & Ireland

Drawing Title  
Results of sediment analysis  
in vicinity of South East Pier  
PAHs

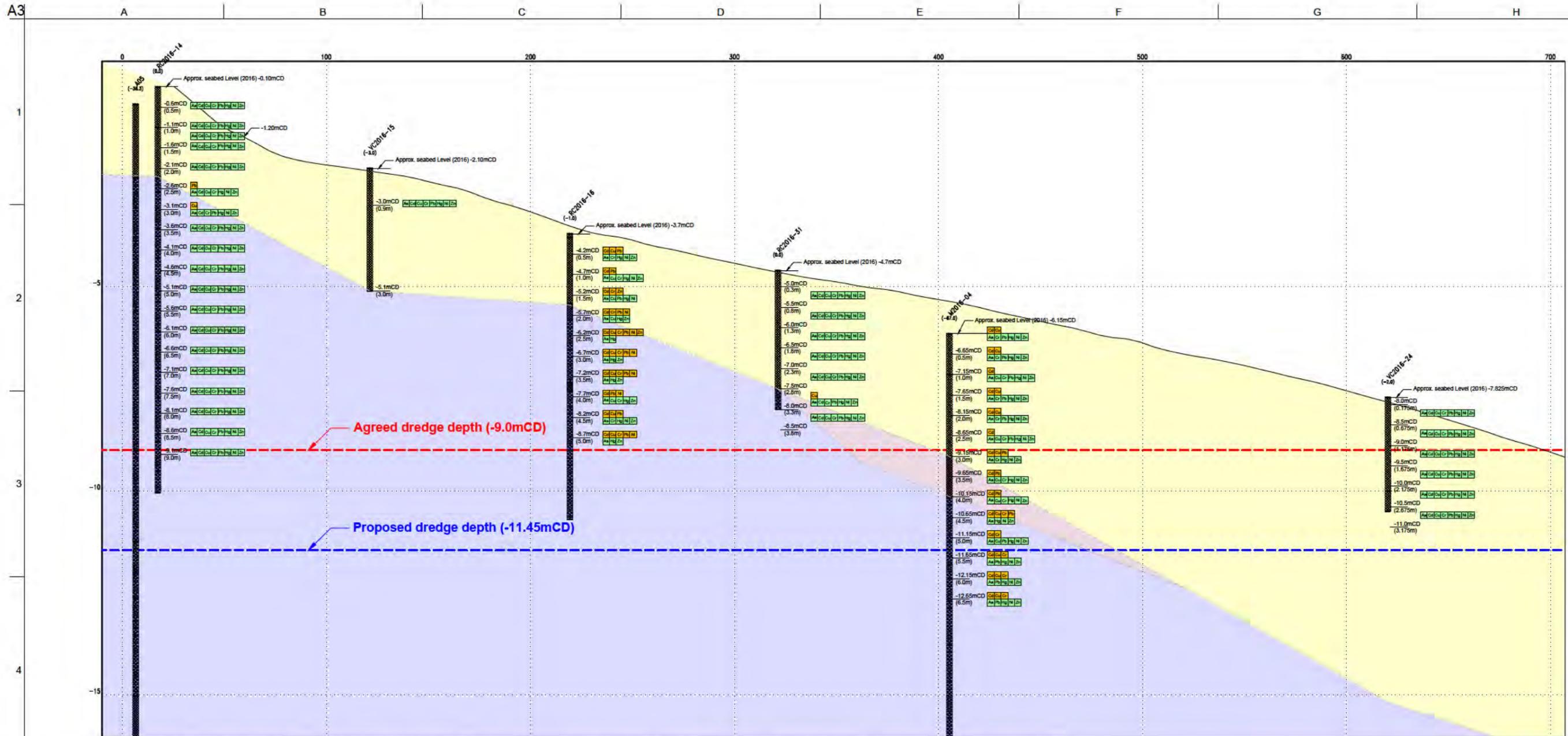
Scale at A3 1:100V 1:2000H

Role Geo

Suitability S2 - For Information

Arup Job No 253300-00 Rev 11

Name  
**Figure 6**



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Determinands Analysed**

- As - Arsenic
- Cd - Cadmium
- Cr - Chromium
- Cu - Copper
- Pb - Lead
- Hg - Mercury
- Ni - Nickel
- Zn - Zinc

**Concentrations of Determinands**

- Below Action Level 1
- Between Action Level 1 and 2
- Above Action Level 2

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

11	20/10/17	KC	JSG	ZC
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Rev	Date	By	Chkd	Appd

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Project Title  
Aberdeen Harbour Expansion Project

Client  
Dragados UK & Ireland

Drawing Title  
Results of sediment analysis  
in vicinity of South East Pier  
Heavy Metals

Scale at A3 1:100V 1:2000H

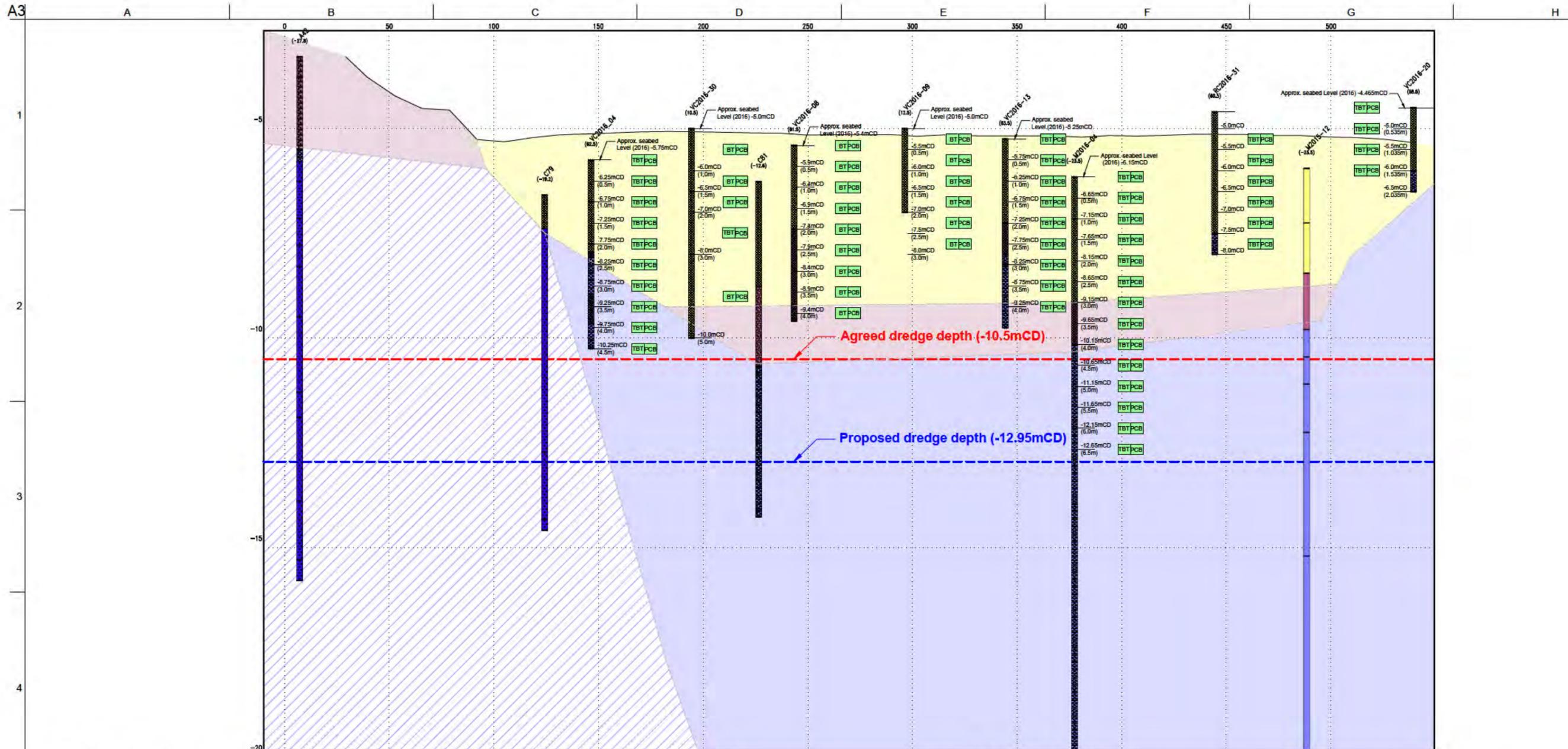
Role Geo

Suitability S2 - For Information

Arup Job No 253300-00 Rev 11

Name

Figure 7



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Determinands Analysed**

TBT - Tributyltin  
 PCB - Polychlorinated Biphenyls  
 PCBs 28, 52, 101, 118, 138, 153, 180

**Concentrations of Determinands**

- Below Action Level 1
- Between Action Level 1 and 2
- Above Action Level 2

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

11	20/10/17	KC	JSG	ZC
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Project Title  
**Aberdeen Harbour Expansion Project**

Client  
**Dragados UK & Ireland**

Drawing Title  
**Results of sediment analysis  
 in vicinity of East Quay  
 TBT & PCBs**

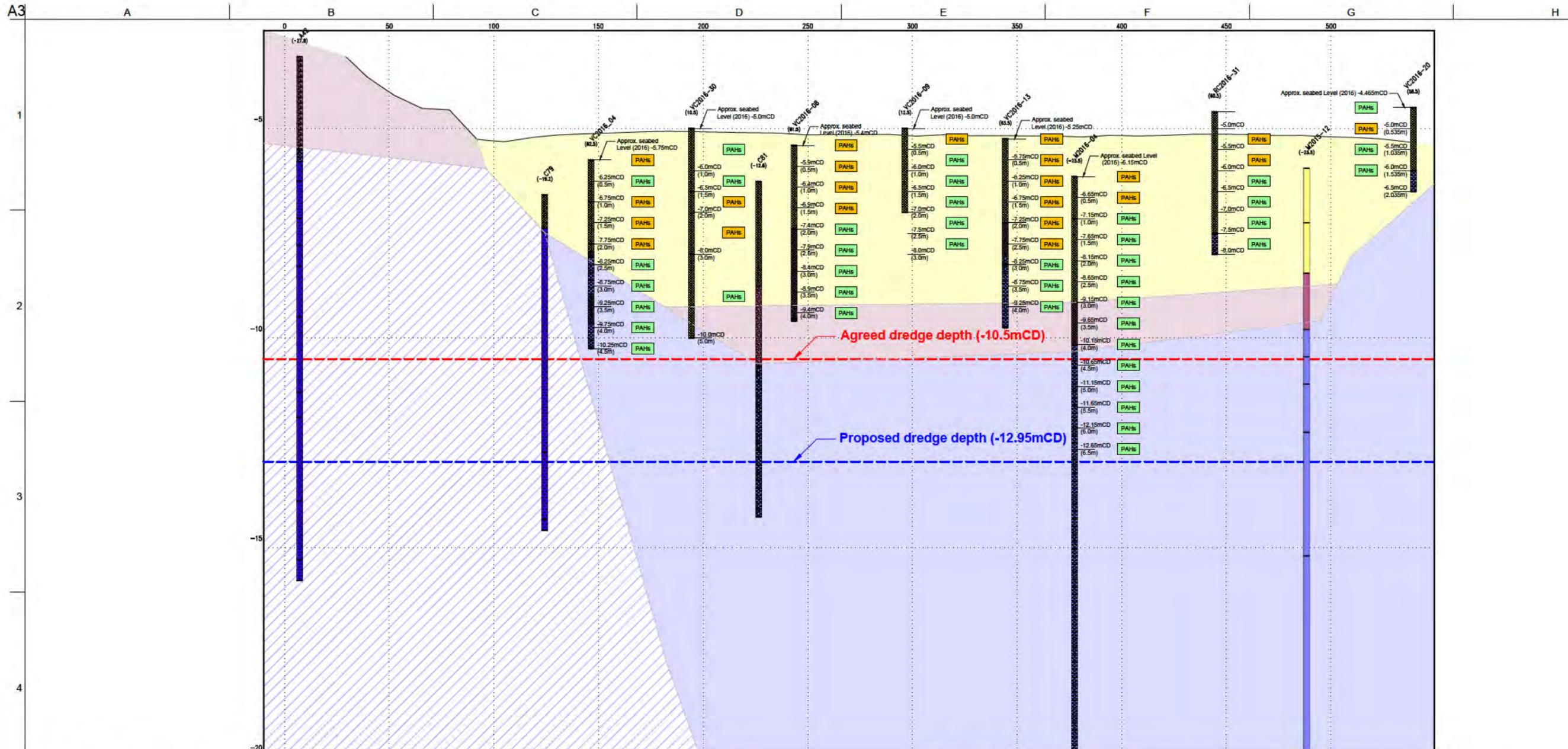
Scale at A3 1:100V 1:2000H

Role Geo

Suitability S2 - For Information

Arup Job No **253300-00** Rev **11**

Name **Figure 8**



**Legend - Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Legend - Borehole Ground Conditions**

- Marine Deposits
- Fluvioglacial Deposits
- Glacial Till
- Bedrock

**Determinands Analysed**

16 Priority PAHs

**Concentrations of Determinands**

- 16 priority PAHs below Action Level 1
- 1 or more of the 16 priority PAHs above Action Level 1

\*Note - No Action Level 2 values for PAHs

**Notes**

1. All levels are given in metres above the admiralty chart datum (mCD) unless noted otherwise.
2. Geotechnical information derived from site investigation reports - Soil Engineering (2014) and Fugro (2016).
3. Ground conditions are derived for the cross-section location. Boreholes off-set from the cross-section location may show slightly different ground conditions.

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Project Title  
Aberdeen Harbour Expansion Project

Client  
Dragados UK & Ireland

Drawing Title  
Results of sediment analysis  
in vicinity of East Quay  
PAHs

Scale at A3 1:100V 1:2000H

Role Geo

Suitability S2 - For Information

Arup Job No 253300-00 Rev 11

Name  
**Figure 9**