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Section 7 Appendix 7.1 Benthic and Sediment Sampling Strategy

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Memo

HASKONINGDHV UK LIMITED
INDUSTRY, ENERGY & MINING

To	:	Natural England, Marine Management Organisation, Environment Agency
From	:	Matt Simpson / Chris Adnitt
Date	:	14 March 2014
Copy	:	Steve Rayner
Our reference	:	9Y0989/Sediment quality and benthic ecology sampling specification (Rev 0)
Subject	**:**	**York Potash Port Facility EIA: proposed sampling strategy for sediment quality and benthic ecology**

1. Introduction

This note sets out a revised proposed strategy to sampling for sediment quality and benthic ecology for the York Potash Port Facility Environmental Impact Assessment (EIA). The strategy has been amended from that described in our note of 26 November 2013 due to evolution to the project design, notably a reduction in the footprint of the proposed capital dredging. The comments you provided to us on the 26 November note have been reflected in the proposed approach set out below.

York Potash Limited (YPL) (a subsidiary of Sirius Minerals Ltd) proposes to develop a port facility on Teesside for the export of polyhalite bulk fertilizer (the product). The proposed port facility, which would export up to 12 million tonnes per annum (mtpa), would comprise a marine terminal at Bran Sands on the Tees Estuary to provide facilities to export the product, storage facilities and a conveyor system to transfer the product to the marine terminal from a materials handling facility to be located at Wilton.

The proposed volume of product exceeds the threshold stated within the *Planning Act 2008* with regard to export of bulk material from harbour facilities (5 mtpa). This means that the port facility constitutes a Nationally Significant Infrastructure Project, requiring a Development Consent Order (DCO). The regulatory authority for a DCO is the Planning Inspectorate (PINS)

As part of the application for the DCO, an EIA process is currently underway to assess the potential impacts of the construction and operational phases of the development within the study area (**Figure 1**). The marine works would include construction of the marine terminal using either piling techniques supporting an open suspended deck structure or construction of a combi-piled wall with retaining fill material (i.e. reclamation). Both options for the marine terminal would require capital dredging of a section of the approach channel adjacent to the marine terminal and to create the berthing area. For the suspended deck option, some dredging would also be required to create a stable slope through the foreshore area.

In support of the EIA, YPL wishes to proceed with a programme of sediment sampling for physical and chemical analysis of the proposed dredged material together with benthic sampling and analysis within potentially affected areas. The results of the sampling and analysis will provide information to enable assessment of the potential impact on marine fauna resulting from

the proposed works both in terms of the direct and indirect impacts. The sediment quality data will enable investigation of alternative uses for the dredged material prior to proposing offshore disposal, as well as informing the EIA process (e.g. water quality effects and implications under the Water Framework Directive).

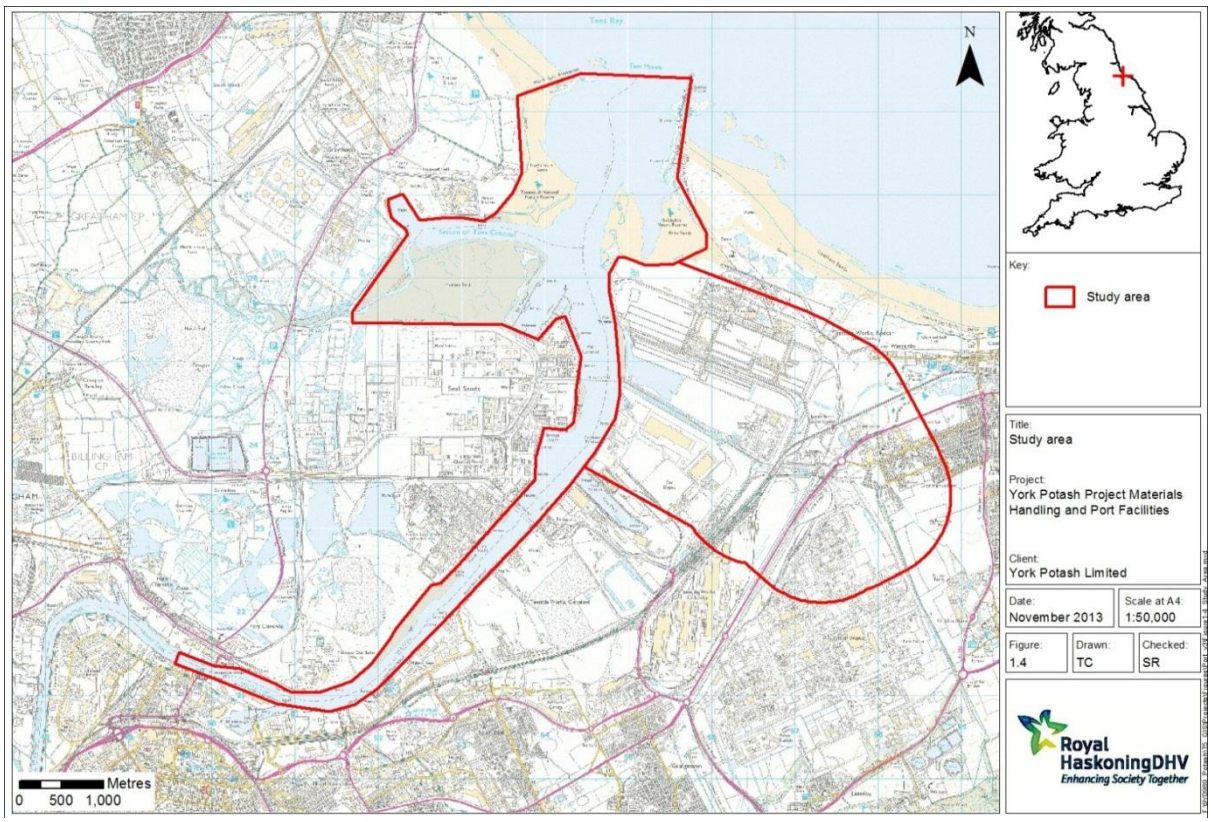

Figure 1 Study area for EIA for proposed development

The purpose of this note is to set out our existing knowledge regarding sediment quality and benthic ecology in the area and, based on this, to propose a sampling strategy for agreement with PINS and its primary advisors.

2. Overview of the proposed marine works

Capital dredging of the berth pocket and a section of the approach channel will be required to allow vessels to gain access to the marine terminal. Dredging would also be required to create the stable slope beneath the quay for the open suspended deck option.

The volume of material to be dredged is estimated at up to approximately 800,000 m^3 to create the berth pocket and stable slope beneath the quay for the open suspended deck option. For the reclamation option, there is no requirement to create the stable slope and the dredge volume to create the berth pocket for this option would be approximately 400,000 m^3. In addition to the volumes quoted above, a further approximately 400,000m^3 of material would be dredged from the channel (this would apply to both quay options).

The dimensions of the berth pocket are anticipated to be approximately 574m long x 50m wide (dredged to a depth of -16m Chart Datum (CD)), while the navigation channel is proposed to be

dredged over an area of approximately 360m long x 244m wide (dredged to a depth of -14.1m CD).

The navigation channel at the location where dredging is proposed is currently at -10.4m CD so would require removal of approximately 4m of sediment. The existing bed levels within the proposed berth pocket and at the location of the proposed quay vary between +0.9m CD and approximately -11.6m CD.

The method of dredging will be confirmed once the site investigation phase is completed. However, dredging is likely to be undertaken using either a backhoe, cutter suction or trailing suction hopper dredger (or a combination of these dredgers). Alternative uses for the resulting material will be investigated through the EIA process and informed by information on the physical and chemical properties of the dredged material. If there are no practicable alternative uses, it is proposed that the dredged material could potentially be transported to a licensed offshore disposal site (Tees Bay A or C – **Figure 2**).

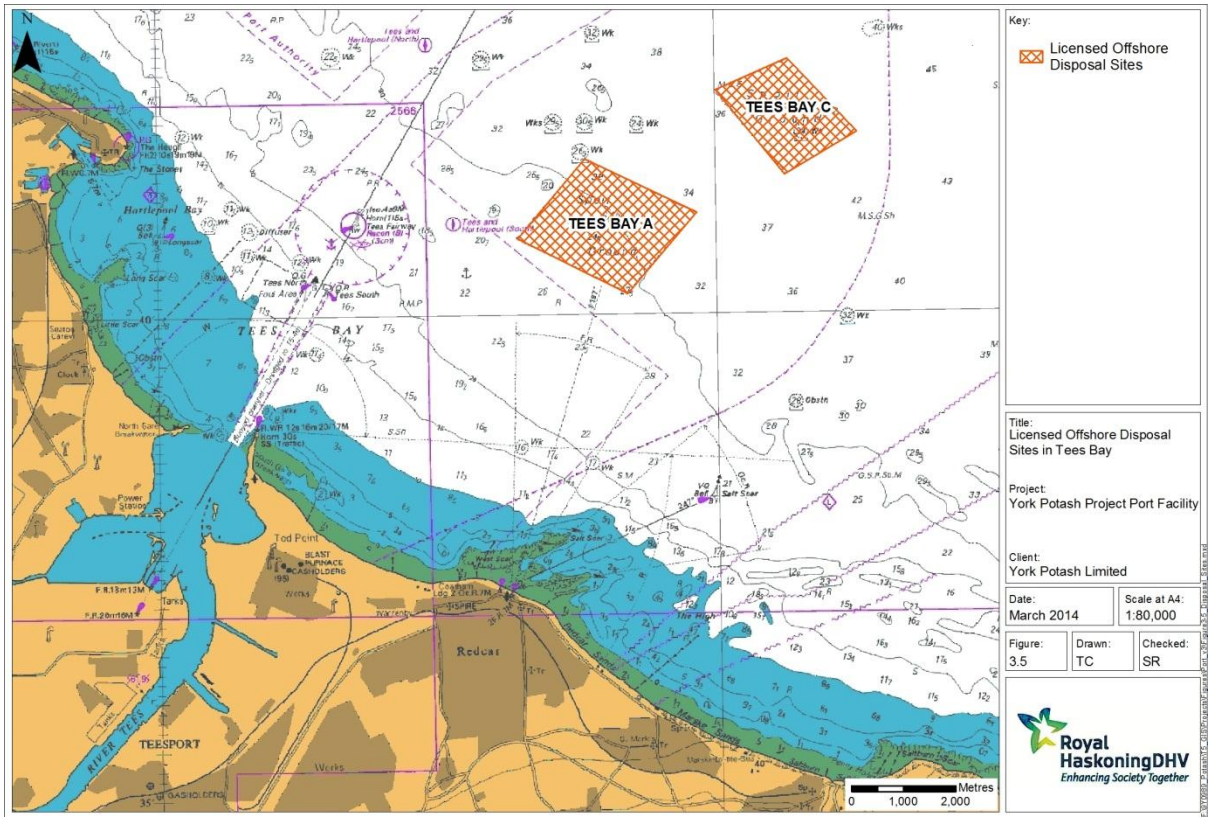

Figure 2 **Location of licensed offshore disposal sites in Tees Bay**

During the operational phase there is likely to be a requirement for periodic maintenance dredging within the berthing pocket and approaches. The volume of maintenance dredging required on an annual basis will be predicted during the EIA process.

3. Sediment quality data

3.1 Previous sediment quality surveys

The Tees Estuary has historically received a considerable amount of waste discharges containing contaminants due to the heavily industrialised nature of the surrounding environment. Whilst significant improvements have been made to waste management and wastewater discharges, this legacy remains in areas of estuarine sediments that remain undisturbed. This is less of an issue where sediment is regularly removed, such as within the existing navigation channel.

There have been a number of sediment quality studies undertaken in the Tees Estuary over the years which have generally shown decreasing levels of contaminants within the sediments (Tansley, 2003).

Sediment samples were collected as part of the EIA for the Northern Gateway Container Terminal (NGCT) during 2006 (Royal Haskoning, 2006) along the navigation channel (downstream of the Tees Dock area) and within the area proposed for the container terminal. The sediment sampling locations for this survey are presented in **Figure 3**. Overall, the chemical data indicated some level of contamination within the samples recovered, particularly in terms of heavy metals. However, levels were not deemed high enough to prohibit the material from being disposed of to sea. As a result, a licence was issued for disposal of dredged material at the designated offshore disposal sites in Tees Bay.

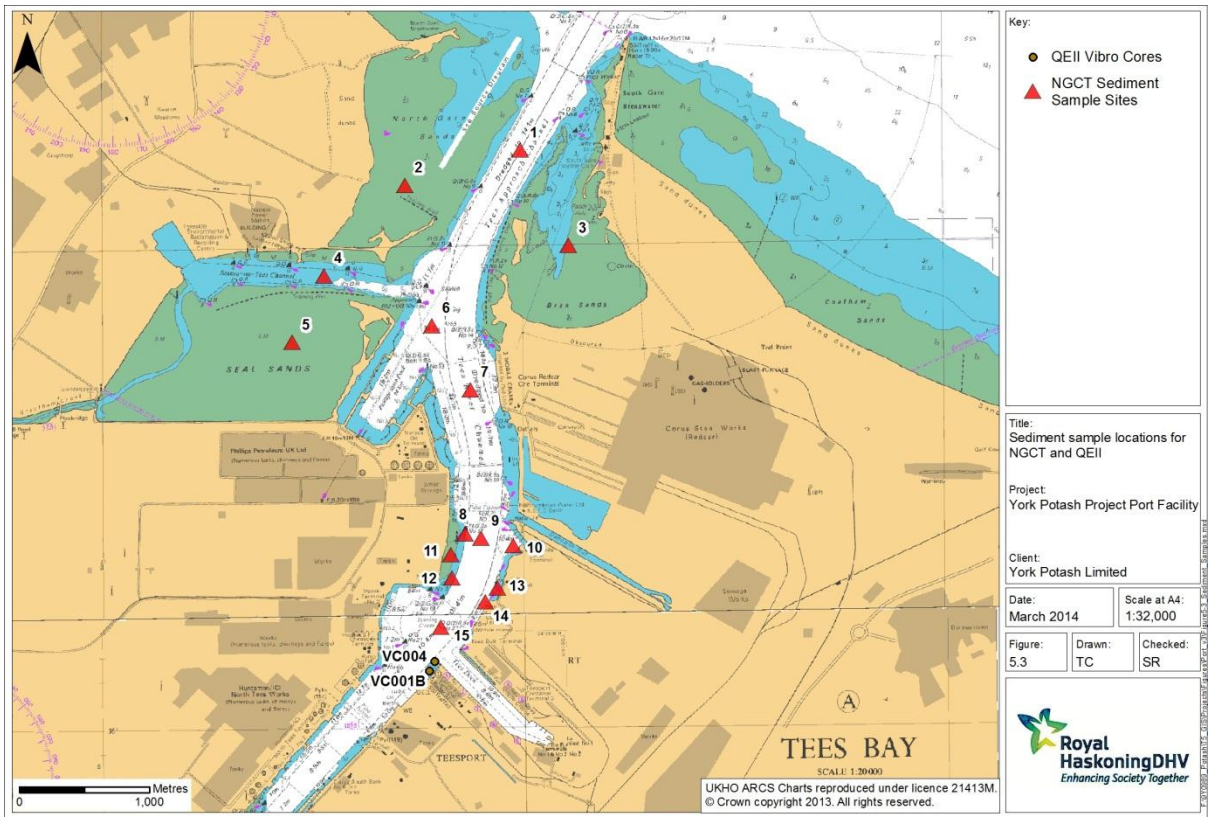

Figure 3 **Sediment sample locations for the NGCT EIA and QEII Jetty EIA**

A sediment quality survey was carried out in December 2008 to characterise the area that is proposed to be dredged as part of the QEII jetty refurbishment project. In consultation with Cefas, it was agreed that vibrocore and surface grab samples would be taken from the proposed dredge area. The vibrocores sampled down to 4m below Ordnance Datum or as deep as the sediment layer went, whichever horizon was reached first. The results from two of the vibrocores

(locations shown on **Figure 3**) identified that all metals analysed for (not including DBT and TBT) were above Action Level 1. There were also a number of samples with concentrations of contaminants which exceeded Action Level 2.

The data indicated that there was a pattern of increasing contamination with depth in two vibrocores sampled. Only one sample recorded any polyaromatic hydrocarbon (PAH) at a concentration which was below Action Level 1. Only the Mercia mudstone constituent of the proposed dredge was licensed for offshore disposal; the overlying unconsolidated material was precluded from disposal at sea and alternative methods of disposal needed to be sought.

Bed sampling results in the vicinity of the proposed scheme show bed sediments in the area to comprise predominantly (65% to 70%) silt, with some (20%) clay and the remainder sand and gravel (Halcrow, 1991). These observations match the particle size distribution results from seabed grabs undertaken in this vicinity for previous studies (Royal Haskoning, 2009).

There is no existing sediment quality data available within the footprint of the proposed berth pocket at Bran Sands.

4. Proposed approach to sediment quality survey and assessment

The sample methodology follows the OSPAR Guidelines for the Management of Dredged Material (as adopted at the 2004 meeting of the OSPAR Commission) and has been developed to suit the site and the study requirements.

The OSPAR guidance state that the number of samples required should be determined based upon the quantity of sediment to be dredged. Given the amount of material to be dredged, this would equate to a requirement to take between 16 and 30 samples in total (nothing this is a guide only).

The areas to be dredged are different in respect of their previous history. The channel area is dredged for maintenance purposes on a regular basis whereas the berth pocket is in a previously undredged area.

For the proposed berth pocket area and area that may be dredged beneath the proposed quay (for the open suspended deck option), six vibrocores will be taken and two vibrocores will be taken from the approach channel as shown in **Figure 4** (these location are indicative and, for the sites located in shallower water in particular, may need to be modified based on available water depth). Sub-samples will be taken from the surface and at 0.5m intervals through the core down to maximum proposed dredged depth (or until bedrock is reached).

Sediment samples will be analysed by a UKAS accredited laboratory for the following parameters:

- Total organic carbon;
- Particle size analysis;
- Metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc);
- Polychlorinated biphenyls (25 congeners including ICES 7) (PCB);
- Polycyclic aromatic hydrocarbons (PAH);
- Total hydrocarbon content (THC);
- Organotins (tributyl tin and dibutyl tin); and,
- Organochlorine pesticides.

The data will then be compared to two sets of standards that are available to inform the EIA, namely:

- Cefas Guideline Action Levels for the disposal of dredged material (Cefas, undated);
- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME, 2002).

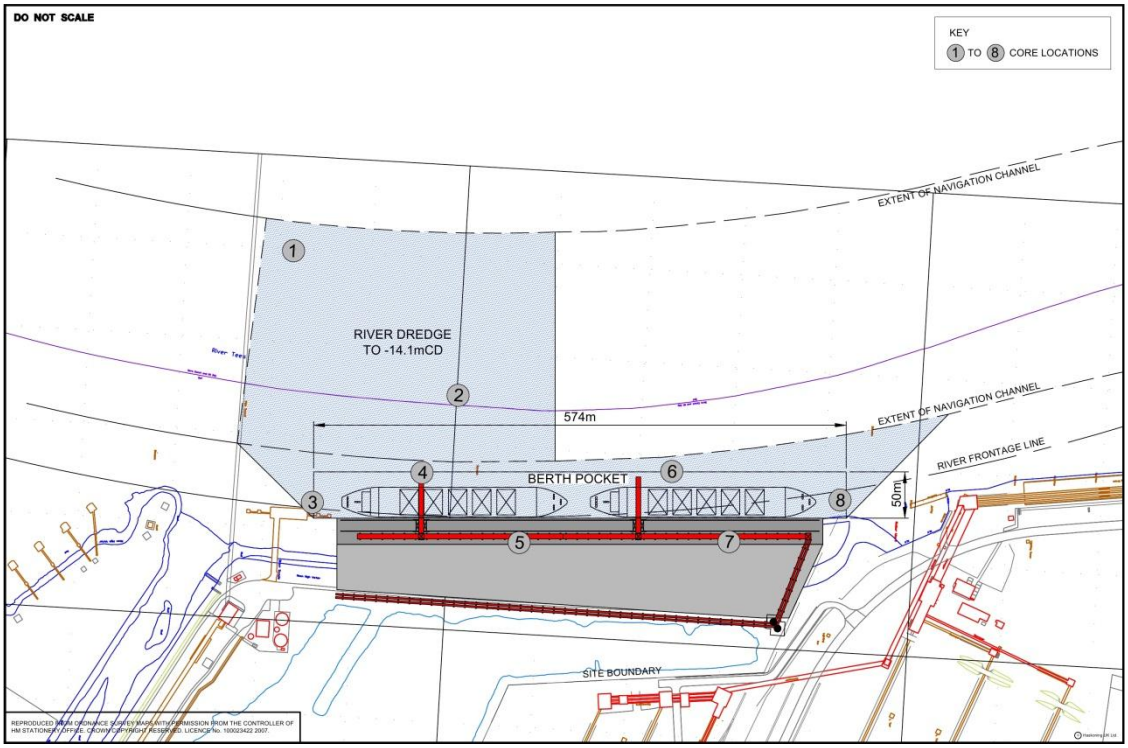

Figure 4 **Proposed vibrocores within and adjacent to the proposed berthing pocket and in adjacent areas**

5. Previous Benthic Ecology Survey

The Tees Estuary comprises intertidal sand and mudflats, rocky shore, saltmarsh and sand dunes. The estuary has been significantly modified over the last 150 years by activities such as land-claim, construction of breakwaters and training walls. Over 80% of the intertidal sedimentary habitats of the Tees Estuary have been reclaimed over this period.

Benthic invertebrates and habitat

The remaining intertidal areas in the estuary are composed of mud and sand, with mats of *Enteromorpha* sp. on sheltered mudflats (notably at Seal Sands). The strand-line and foreshores of North and South Gare (either side of the estuary mouth) and the mudflats of Seal Sands and Bran Sands are backed by their respective dune systems and series of open wet grasslands at Seaton Common and on Cowpen Marsh.

As with intertidal habitats, the subtidal environment is heavily modified with extensive areas subject to regular dredging and sediment removal. Analysis of macrobenthic data from the Tees Estuary suggests that between 1979 and 2001 there was a trend of increasing biological diversity

of infaunal invertebrates, with less domination by opportunistic species and some sensitive species starting to become present (NMMP, 2004). This change reflects the improvements in water quality in the last 20 years. It is considered, however, that the subtidal benthic communities within the navigation channel and existing berth pockets along the banks of the Tees Estuary will be representative of highly disturbed conditions as a result of frequent maintenance dredging.

There is no baseline data with regard to the benthic invertebrate community or condition of habitat within the development footprint for the proposed scheme. However, of relevance to the baseline environment are the results of a benthic survey undertaken in December 2008 as part of the QEII jetty refurbishment EIA which demonstrated that the biological communities within the proposed QEII jetty berth area were of relatively low diversity, broadly characteristic of chemically or physically disturbed conditions and very similar in faunal composition to previously surveyed fine sediment locations within the estuary (Royal Haskoning, 2009). Results indicated a light to moderate level of existing pollution impact, with the infaunal communities possibly undergoing a slow recovery from a prolonged period of historical impacts from past use in the vicinity. Samples contained no vulnerable or rare species, or any of known conservation interest.

6. Proposed approach to benthic ecology sampling and analysis

It is proposed that grab samples are taken at 32 sampling locations (20 locations in and adjacent to the proposed berthing pocket and 12 locations along and adjacent to the approach channel) as shown in **Figures 5 and 6**. The sampling locations cover the area to be directly affected by the marine works (piling, dredging and the quay construction) and the adjacent areas most likely to be indirectly affected (e.g. through sediment deposition).

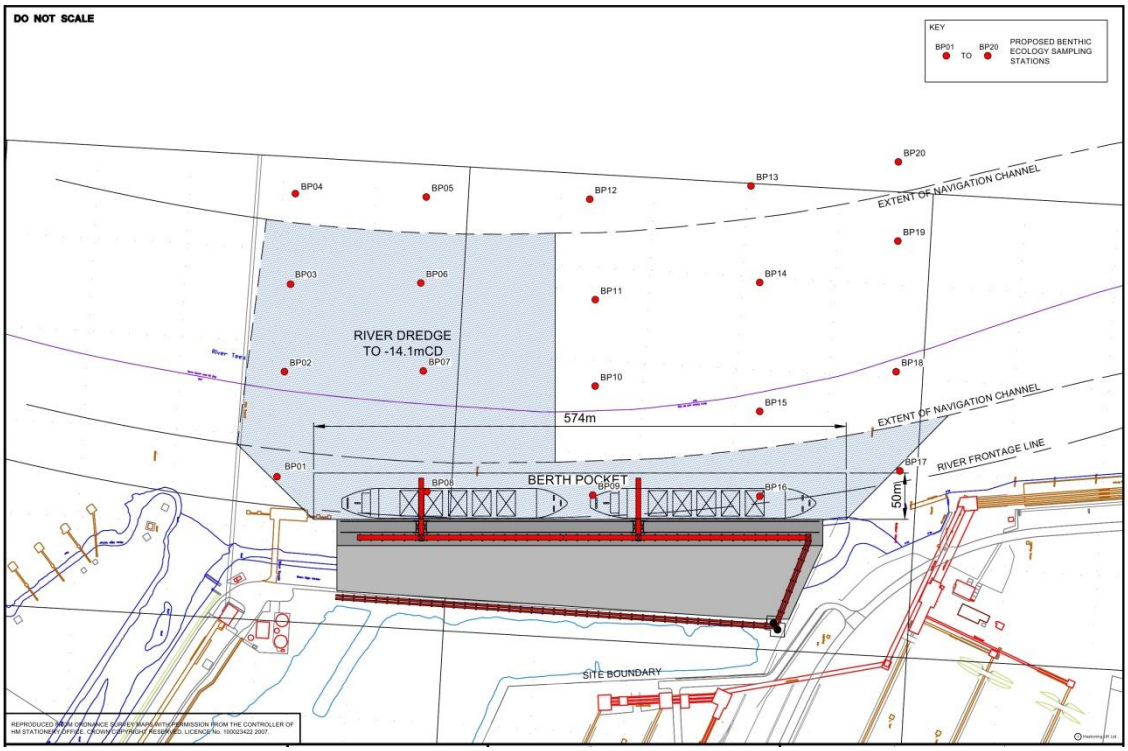

Figure 5 **Proposed benthic ecology sampling stations at the location of the proposed berthing pocket and in adjacent areas**

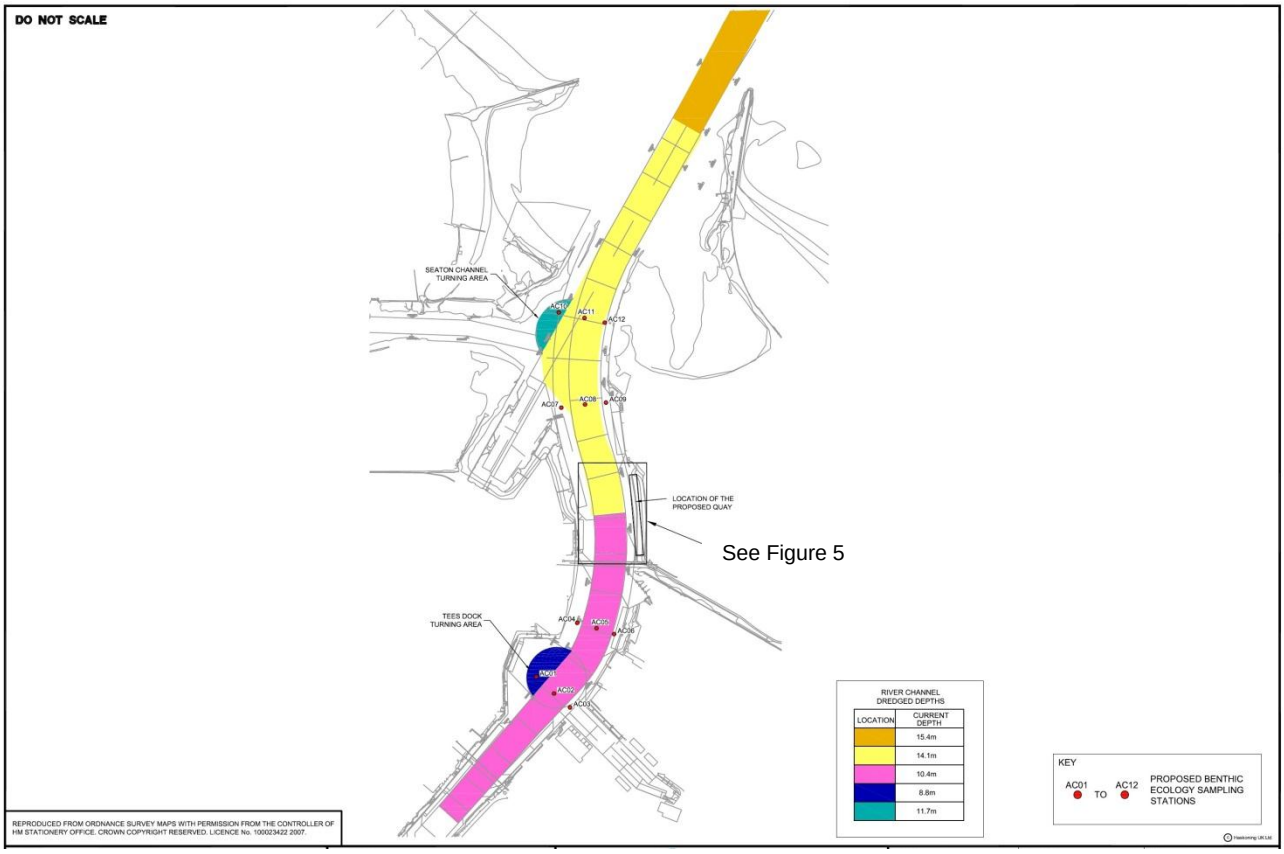

Figure 6 **Proposed benthic ecology sampling stations upstream and downstream of the location of the proposed quay construction and capital dredging**

For the purposes of establishing this widespread baseline, one sample will be taken at each site. The position of all sample stations will be programmed into the vessel dGPS system and will be confirmed on site. The position of actual sampling will be recorded.

A 0.1m^2 Day grab will be used for subtidal sampling. Upon retrieval, the sample will be released onto a 0.5mm mesh stainless steel sieve and be examined for suitability and photographed to determine sample volume, visual characteristics of the sediment and the presence of anoxia and epifauna.

A sub-sample of the sediment will be retained for Particle Size Analysis (PSA) to enable any sediment community associations to be determined. A cut-off 100ml syringe would be used to remove sediment from the undisturbed surface of the Day grab sample for PSA analysis. This sub-sampling will be done following 'acceptance' of the sample (i.e. by measuring the depth of bite following retrieval and ensuring the sample exceeds 10cm depth).

The remainder of the sample will then be placed onto the sieve with a photograph taken and other information taken (i.e. description of the sample) before being collected in a storage vessel where it will be preserved in formalin prior to further sieving and analysis in the laboratory.

All samples will be transported to a suitable laboratory that adopts the procedures set out in the UK National Marine Biological Analytical Quality Control scheme.

A total of 10 benthic trawl will be deployed across the site to cover the location of the proposed terminal, the berthing pocket and area that is proposed to be dredged within the approach channel. The trawls will be evenly distributed across the sampling area and a 5 minute trawl undertaken. A 20mm mesh with 5mm cod end will be used and specimens will be counted.

Macrofauna
Identification of infaunal specimens will be undertaken in the laboratory following the methodology below:

- Samples will be re-sieved over 0.5mm mesh and transferred to 70% alcohol;
- Fauna will be extracted from the sample, identified to species level and enumerated;
- Results will be entered into an Excel spreadsheet for later analysis;
- A reference collection of species identified will be retained;
- Any encrusting or epifauna within the samples will be identified, presence/absence noted and this data also recorded on the spreadsheet;
- A full species list will be produced; and,
- Individuals per species and ash free dry weight biomass will be reported.

Statistical analysis of the data will be undertaken using accepted tools for uni- and multivariate analysis, such as PRIMER and SPSS following guidance by Boyd (2002) and Davies et al (2001). In addition indicator species for contaminated sediment will be noted.

Particle Size Analysis
Sampling of sediments for PSA is an essential accompaniment to macrofaunal surveys. Small-scale heterogeneity at the seabed dictates that a PSA sediment sub-sample should be collected from the same sample as that collected for the benthic fauna. This allows the macrofaunal data to be accurately referenced against variations in particle size characteristics.

Sub-sampling for PSA is described above. If cobbles (>63 mm) are present in the sample, they will not be included as part of the PSA subsample. Cobbles will be measured across their smallest axes so that they can be included in later data analyses.

The full particle size distribution (at 0.5 phi intervals) will be reported for each sample. Statistics will be calculated as follows:

- Full particle size distribution;
- Mean particle size;
- Sorting coefficient;
- Skewness;
- Modal size; and
- Kurtosis.

7. Consultation

We would appreciate your comments on the above proposed sampling strategies in order that YPL can proceed with the surveys to an agreed strategy.

Yours sincerely
On behalf of HaskoningDHV UK Ltd

Matt Simpson
Principal Environmental Scientist

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