Best Practical Environmental Option (BPEO) for Berths 2/3 for Port of Cromarty Firth (PoCF), Invergordon.
Marine Scotland Plough Dredge Application Ref. 00009232 09/09/21.

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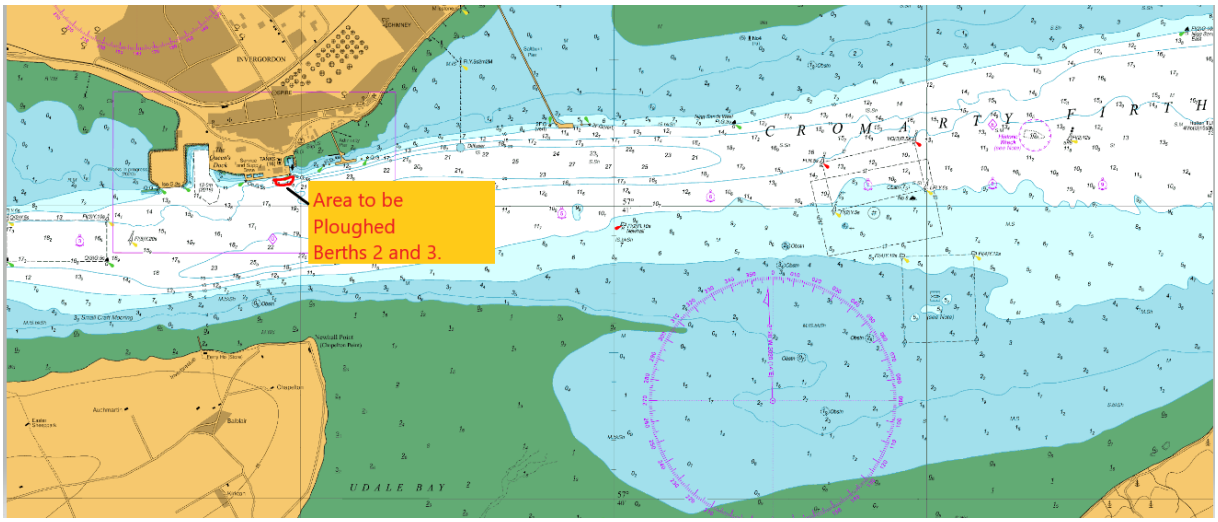
Issue Version	Date	Comment
1.0	22/4/21	Application submitted.
1.1	07/9/21	More details provided on disposal options.
1.2	28/02/22	Addition information added for plough dredge sea disposal. Sampling results and conclusion.

1. Introduction

1.1 Background

The Port of Cromarty Firth is the statutory Port Authority for the Cromarty Firth. The port serves the oil and gas, offshore renewables and cruise sectors. In in non-pandemic year we facilitate over 100 cruise vessels to visit the Hightlands. We have helped support the off shore support industry for over 46 years and in this time we have provide a safe nationally important transport assest for Scotland. Vessels must have a safe water depth to enter and leave ports, hence the requirement to plough dredge. The area to be dredged bisects berths 2 and 3 at the Invergordon service base which is in daily use by commercial vessels. The area to be dredged has a high spot (around 0.9-1.0m above the surrounding seabed) which could form a hazard to safe navigation for visiting vessels, especially for the higher tonnage large draft vessels or offshore structures. This BPEO document is to comply with the Marine Scotland Act (2010), Part 4 [as amended] and looks at what practical alernatives to sea disposal there may be.

Figure S1: Location Chart of the Port of Cromarty and the Proposed Plough Dredge. North is to the top of the chart



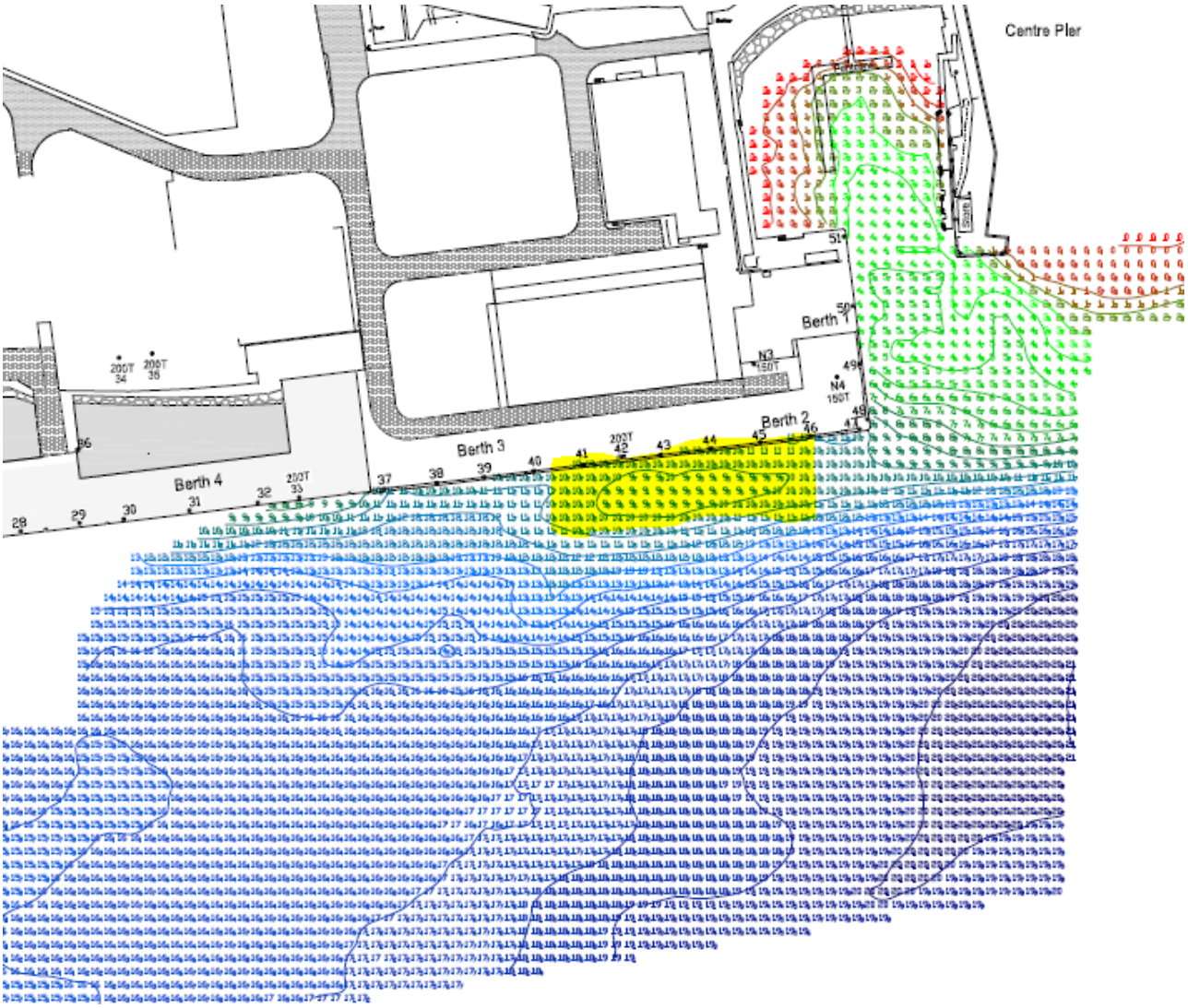


Figure S2: Plan View of the Port of Cromarty Firth, Invergordon Service Base, Showing the Elevated Seabed High Point Area (marked in yellow highlight) Opposite Berths 2 and 3. Note- North is to the top of this plan.

1.2 History

This area was last dredged more than 8 years ago and it is expected that it is solely natural esturine sediment deposition which has resulted in this accumulation of sediments. The composition of the dredge material is currently unknow, however once approval has been agreed for our sampling plan we will provide the physical parameters of the plough dredge material. It is not exected that this area will naturally "scour" due to tidal movements, hence the reason for the Port making this application to plough dredge.

1.3 Sampling Analysis Results

Fugro GB Marine Limited were contracted to analyse the pre-dredge sediment samples (project number 210683). A total of four sediment samples were obtained within and out with the proposed plough dredge area. The results of which are summarised below-

1) No asbestos was recorded in any sample.
2) A total of 36 trace metals were tested and within these sample there were a total of 2 samples above Action Level 1 (**AI1**). These were for the metals Chromium and lead.
3) For polyaromatic hydrocarbons (**PAH**), 2 samples out of 68 were found to be above the lower screening level of AI1. These were for the substances, fluorant and pyrene which were within grab sample identification *Number 2*.
4) For all samples (total of 32) the substance organohalogens were found to be below AI1 levels.

Table S1.1. Sediment Sample Contaminants Above Action Levels.

Contaminant Detected	Action Level Breached (blue AI1)	Value (units)	Marine Scotland Action Levels (mg/Kg dry weight)[#]	Canadian[*] Sediment Guidelines Range (ISQGs and PEL). mg/Kg
Chromium	AI1	85.1 (mg/Kg dry weight)	70	52.3-160
Lead	AI1	73.6 (mg/Kg dry weight)	50	30.2-112
Fluorant (Fluoranthene)	AI1	0.184 (mg/Kg)	0.1	0.113-1.494
Pyrene	AI1	0.148 (mg/Kg)	0.1	0.153-1.398

[#]Marine Scotland Pre disposal Sampling Guidance Ver 2 Nov.
[*]2017https://www.esdat.net/environmental%20standards/canada/ccme/sedqg_summary_table.pdf

1.4 Results

From section 1.3 above, it can be seen that the majority of samples were below the Marine Scotland substance action levels and hence are not "flagged" to be of concern to the environment. A total of 4 substances were above AI1. This is summarised it Table S1.1 above. In general substances that are found to be above AI1 and below AI2 should be suitable for disposal within the marine environment. This is the case for chromium, lead, fluranthene and pyrene. Environment Canada[*] published in 2002 sediment quality guidelines on the probable effect of sediment pollutants in the marine environment. These guidelines are widely quoted as reference standards for dredging activities in relation to adverse effects on biota. They quote lower Interim Sediment Quality Guidelines (**ISQGs**) and upper limit Probable Effects level (**PEL**) guidelines for saltwater guidelines. Table S1.1 provides the range of these lower ISQGs and PEL upper limits. None of the 4 elevated sediment samples as part of this pre licenced dredge project breached these upper PEL levels.

1.5 Conclusion

The proposed dredge method is by plough, whereby the marine sediment will be displaced a short distance from the where it currently lies. As such it is likely that any local elevated levels of pollutants within the sediment will remain the same after the proposed dredging campaign within the local sediment at berths 2 to 3. This is assuming that the pollutant levels are homogeneous in distribution, which may not be the case. There will be resuspension of sediment during the ploughing process and

hence some of these contaminates re-entering the water column before settling out. This area is influenced by a good tidal current and it should be expected that there will be a large dilution of any localised re suspended contaminants. This is a relatively small area to be ploughed and it is estimated that there will be a total of 1093 tonnes of material moved to maintain a safe harbour depth for visiting vessels. Due to the relatively small size of dredge the potential for large displacement of pollutants should therefore be lower.

2. Disposal Options

Table S1.2 - Showing a Summary of Disposal Options.

Management Method	Pros	Cons
A. Dredge the material by grab for disposal at the Sutors, near Cromarty	Less dredge vessel and barge movements (hence less noise and air pollutants from vessel engines).	More transiting distance, up to 20Km for a round trip from the dredge site to the Sutors disposal point). More noise and air pollution from the dredge vessel. Marine noise to aquatic mammals.
B.Plough Dredge (**the current proposed option- pending consent**)	Sediment stays in situe, ie not removed from the marine environment. It is simply moved a relatively short distance 0.1-0.2 Km. No vessel transit to the Sutors.	There may be more noise as the vessel ploughs the area. More localised combustion pollutants from the vessels engine(s). Marine noise to aquatic mammals.
C.Dredge the material by grab for disposal at a local Above High Water Level area for land reclamation.	Perhaps a shorter vessel transit distance than option A. above.	Most of the intertidal areas around the firth have protected status, hence deposit may be problomatic. Odour and aesthetic issues percived by the public. May be issues for dredger and barge access due to shallow draft, hence safety issues. Vessel and barge will introduce noise disturbance, to the marine environment and within the air.
D. Disposal of dredged material to land.	Could improve soil texture. Landowner will receive funding for deposit	Is the material suitable for agricultural benefit? Possible issues are salinity and may contain pollutants, such as, micro plastics. May be limited nutrients for agricultural benefit. Would require Heavy Goods Vehicle transport as well as grab to move dredge material to HGV.

		Area to dewater and store the solids may be difficult to manage. Could block harbour drains and interceptors. Noise and pollution for local residents. Increased carbon emissions. Possible odour problems at deposit site. For landfill disposal this goes against the current Scottish Government guidance on waste minimisation, waste creation and our circular economy. Landfill disposal would entail HGV transport to and its associated environmental impact as well as its costs. HGV transport from the dredge site to a landfill would result in "double handling" of the sediment, this would have a financial cost.
E. Keep the Status Quo (do nothing)	No disturbance of the seabed, hence no mobilisation of pollutants. Best option for decarbonisation. Benthic habitat protected. Saves on capital dredge, licence cost, laboratory cost, sample grab cost and admin costs.	Increased likelyhood of vessel safety near misses, dangerous occurances and Maritime Coastguard reportable incidents. Health and Safety at Work Act (1974) employer's duty to protect the health, safety and welfare of their employees as well as visitors to the workplace. Loss of the Ports reputation to provide a safe working environment of stakeholders and colleagues. Loss of local trade and commerce and well and international income. Regional loss in employment. Loss of a Highland transport hub, due to loss of infrastructure.

3. Environmental Aspects of this Plough Dredge

The utilisation of a plough dredging process is seen as the most suitable environmental management process for the continued safe navigation of vessels within berths 2 and 3 at the Port of Cromarty Firth. It is believed that it is more carbon efficient, in that there will be less vessel transits from Invergordon to the disposal ground at the Sutors (20Km round trip). Where we were to agree a disposal area above high water level for reinstatement of eroaded coatline, this would also entail a greater amount of fuel and transit to move the dredged material. This method of plough dredging may be quicker to complete, as there will be less "downtime" for a conventional mechanical grab between the dredge barge being emptied at the sea disposal site and it'd return to the dredge site for re-fill, this should make this a more cost effective option.

4. BPEO- Conclusion for the Plough Dredge

There is a requirement to allow safe access to the Port of Cromarty's harbour, unsafe navigation, due to restricted water depth, can result in accidents as well as challenging operations for Masters of vessels. It is proposed within this licence application that the elevated seabed area, in front of berths 2 and 3, is lowered by a vessel and plough dredge. This type of operation is recognised as a standard routine method in the UK and further afield. This method both limits resultant fuel related carbon and local air quality emissions. As we are reminded that we are in a "Climate Emergency" this option is the best for the environment, our local stakeholders in and around Invergordon and for the Port of Cromarty Firth Authority, as we move to "Net Zero Emissions". Plough dredging this relatively small area will be quicker than other dredging methods, and as such, will offer value for money to the Port of Cromarty Firth, which has Trust Port status.