Greenock Ocean Terminal
Best Practicable Environmental Options Report - Dredging

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1 INTRODUCTION

1.1 Scope of Report

Clydeport Operations Limited are required to undertake a Best Practicable Environmental Option (BPEO) assessment for the disposal of dredged material originating from two areas of dredging required at Greenock Ocean Terminal.

The purpose of this report is to review each of the available potential disposal options for the dredged materials. The options which are not considered to be practicable are rejected and the reasons for doing so are explained.

Those options which are practicable are examined in detail and assessed against the following considerations:-

- Environmental;
- Strategic; and
- Cost.

The report then compares the practicable disposal options and draws a conclusion on the BPEO.

1.2 Background to Application

Clydeport Operations Limited are currently looking to upgrade the facilities at Greenock Ocean Terminal in response to an increase in the popularity of the destination for cruise ships. The increase in cruise ships visiting Greenock Ocean Terminal is understood to be impacting upon Clydeport commercial operations and the construction of a dedicated cruise ship berth will improve the overall harbour operations during the cruise season.

Table 1.1: Proposed Dredge Sites and Approximate Dredge Volumes

Site Name	Dredge Volume (m3)
Dredge Area 1 (Quayside)	23,875
Dredge Area 2 (North of Main Channel)	130,000

Dredging would be carried out potentially by a combination of Trailer Suction Hopper Dredger, Cutter suction dredger, Grab Hopper Dredger and Back-hoe Dredger as appropriate. Plough dredging is carried out in support of Trailer Suction Hopper Dredger operations and for limited and / or urgent dredging projects in between larger scale maintenance projects.

The sites are outwith the Inner Clyde Site of Special Scientific Interest (SSSI) / Special Protection Area (SPA).

Drawings are included in Appendix A.

1.3 Source of Materials

Samples from the proposed dredge area were collected in two Phases, June 2018 and October 2018 and submitted for analysis in line with Marine Scotland's Guidance. The results from this exercise are provided in Appendix B.

Sediments sampled within the proposed dredge area are reported as ranging from gravel over Boulder Clay in Dredge Area 1 and varying thicknesses of sand over clay in Dredge Area 2.

The following exceedances of the Sediment Action Levels were noted:

1.3.1 Metals

The majority of metals were below their respective RAL 1 with the following notable exceptions:

- Arsenic - 7 of 29 samples recorded arsenic levels above REV AL1. The maximum concentration recorded was 32.2 mg/kg.
- Chromium - 3 of 29 samples recorded chromium levels above REV AL1. The maximum concentration recorded was 374 mg/kg.
- Copper –3 of 29 samples recorded copper levels above REV AL1. The maximum concentration recorded was 55.5 mg/kg.
- Lead –2 of 29 samples recorded lead levels above REV AL1. The maximum concentration recorded was 62.2 mg/kg.
- Nickel – 11 of 29 samples recorded nickel levels above REV Al1.The maximum concentration recorded was 227 mg/kg.

RAL 2 levels were exceeded for the following metals and samples:

- Chromium – SS03B -0-0.5m – 374 mg/kg
- Nickel – SS01A 0-0.5m – 227mg/kg

Tributyl Tin (TBT)

All samples were recorded below RAL 1with the maximum concentration recorded as 0.008 mg/kg

Polyaromatic Hydrocarbons (PAHs)

10 of 29 samples recorded at least one PAH species above RAL 1. The maximum concentration was 3.97 mg/kg for fluoranthene.

Polychlorinated Biphenyls

All samples recorded individual PCB congeners below Action Level 1. The highest recorded congener was 4.82 µg/kg for PCB 153.

Total Hydrocarbons (THC)

4 of 29 samples recorded hydrocarbons above Rev AL1. The maximum concentration was 535 mg/kg.

These exceedances will be considered further in Section 4 Further Assessment.

2 DISCUSSION OF AVAILABLE DISPOSAL OPTIONS

The BPEO process is geared towards identifying a preferred overall strategy from the perspective of the environment as a whole, as opposed to detailed optimisation of any one selected scheme. It is a structured and systematic process to identify and compare strategic options in a transparent manner. Alternatives are evaluated in terms of their projected implications for the environment together with consideration of practicability, social and economic issues as well as within a wider strategic context.

The key stages of a BPEO are:

- Identification of options;
- Screening of options;
- Selection of assessment criteria;
- Analysis and evaluation of criteria; and
- Evaluation of BPEO.

Further details on methodology are provided within each section.

2.1 Identification and screening of Available Disposal Options

A number of options are available for disposal of dredged sediments. The options considered are provided in Table 2.1 along with justification for screening out those options which have not been taken forward for further consideration.

Table 2.1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Estuary/ Riverbank	Leave in situ	Not an option due to the project specific requirements to accommodate larger vessels. Leaving in-situ would not enable the proposed development to occur.	No
	Infilling of an existing dry dock/harbour facility	No projects/suitable sites have been identified for use of the dredge material at this stage and which would fit with current project timelines.	No
	Beach Nourishment	Large areas of the Firth of Clyde and Inner Estuary are designated sites (SSSI, SPA, RAMSAR) and hold both national and international importance to nature conservation. Specific beach nourishment projects would require to be supported by Environmental Assessments as a minimum to inform how the project could affect the environment as a result of disturbance to the intertidal area, changes to the sediment levels, the variable composition and quality of the material and measures devised from the assessment outcomes to minimise impacts on the environment. The dredge material comprises a mixture of gravel, sand, silt and very soft to stiff boulder clay. Fine sediments and boulder clay are not suitable materials for beach nourishment in the traditional sense. Clydeport Operations Limited were contacted to establish if they were aware of any current projects where dredge arisings could be made use of in this manner, however none were identified. Discussions have been held regarding the future potential use of silts for nourishment/restoration of mudflats/saltmarshes in the estuary for habitat improvements. This is at very early stage discussions and firm options are not currently understood to be available due to the timescales required to complete this project. Peel Ports Group Limited and Clydeport Operations Limited are currently looking into re-use options within the estuary to enable future dredge operations to consider reuse as a suitable alternative disposal route for dredge arising's.	No
Land	Landfill Disposal	This is possible but it is unlikely that this option will offer long term solution due to lack of space at landfills. Landfill space is currently at a premium and does not offer a sustainable solution either	Yes

		financially or environmentally for the disposal of dredged arisings. Dredged material likely to require treatment first in a dewatering facility. Significant cost associated with set up of dewatering facility at the quayside plus transportation and additional costs associated with gaining the necessary planning and regulatory consents.	
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component and very high water content.	No
	Application to Agricultural Land	The dredged material would need to be treated to reduce salt concentrations to acceptable levels. Would require detailed chemical analysis and assessment as well as a Waste Management License Exemption. Would require special precautions during spreading in relation to the risk of odour and watercourses / aquifers. The availability of land for this option will be limited within a reasonable haulage distance of the dredge arisings. Large volumes each year are unlikely to be viable to dispose of in this manner and would potentially have a detrimental effect on existing terrestrial habitats.	No
	Recycling	Recycling of dredged material is theoretically possible, however, due to the varied lithology's there would need to be either segregation during dredging works to minimise the entrainment of fine grained material into the sands, or energy and water rich processing on land. This is not currently understood to be an established disposal and reuse route in the Clyde estuary at present and is not likely to be something which could be established in the project timeframes due to the requirement for various permitting requirements including waste management licencing, discharge consents for process water as well as increased road transportation for delivery of waste material and collection of processed material. Recycling options can be incorporated into the River Clyde Sediments group discussion for future consideration.	No
Sea	Aquatic disposal direct to seabed.	Relatively low cost, minimal transportation requirements compared to all other options and potential for low environmental risk. The closest spoil ground Cloch Point (MA021) is located approximately 10 km the site with an assigned licensed annual capacity of 830,000 tonnes.	Yes

2.2 Summary of Identified BPEO Options

Two options were taken forward for further detailed BPEO assessment as follows:-

- Landfill Disposal; and
- Sea Disposal.

A brief summary of the necessary works or methodology for each option being taken forward for detailed BPEO assessment is provided below.

2.2.1 Landfill Disposal

Dredged material is considered to be controlled waste for the purpose of transport, storage and disposal as per Section 34 (7) of the Environmental Protection Act 1990. The Landfill (Scotland) Regulations 2003 require the classification and characterisation (i.e. inert, non-hazardous or hazardous) of the dredged material to be determined prior to landfill acceptance.

Disposal to landfill would require several stages in material handling operations:-

- Dredging and transport to shore;
- Transfer to shore to a dewatering facility;
- Dewatering;
- Transfer of dewatered material to storage area for stockpiling;
- Loading of lorries and transport to landfill site; and
- Disposal at Landfill site.

Transport to the shore would require the identification of an available jetty facility suitable for receiving material directly to the dewatering facility. Two options are available for off-loading; namely grabbing the spoil from the barge or hopper or pumping directly ashore.

The dewatering facility would require being purpose built and capable of receiving large quantities of bulk material. Currently no facility exists on the Clyde. Settlement tanks, with the aid of sluices and rotational management, would allow solids to settle out and the water element drain off and return to the River Clyde. Temporary mobilisation of bespoke mechanical dewatering equipment could also be utilised but at greater cost. The dewatered dredged sediment would then be removed from the facility and stockpiled for transfer via lorry to a suitably licensed landfill.

We understand that the type of vehicle most suitable for transporting the dewatered dredged material is either a rigid bodied tipper or an articulated tanker both with a 16 tonne load capacity. It is estimated that the dredge volume equates to c. 277,000 tonnes of material and would require approximately 13,850 return trips would typically be required to transport the dewatered dredged material to landfill.

The number of landfills within a viable distance of the River Clyde is considered to be low. In addition the available capacity of each site is limited by the amount of material it can receive per annum. Due to the proposed quantity of material to be dredged it is therefore unlikely that any landfill within viable distance of the River Clyde will have the capacity to receive the dredged material.

2.2.2 Sea Disposal

This option handles material in a single stage namely transport to the disposal site. The existing licensed disposal site is 1.6 nautical miles North of Cloch Point. It is located in naturally deep water with ease of access, has a large capacity and is anticipated to be active for the foreseeable future.

3 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

3.1 Detailed BPEO Assessment

Each of the identified options was assessed against the criteria detailed in Table 3.1 below.

Table3.1: BPEO Detailed Assessment Criteria

Primary Criteria	Description and Attributes
Strategic	Operational aspects, including handling, transport etc. Availability of suitable sites/facilities General Public/local acceptability Legislative Implications Summary of the outcome of consultation with third parties
Environmental	Safety Implications Public Health Implications Pollution/ Contamination Implications General Ecological Implications Interference with other legitimate activities e.g. fishing Amenity/Aesthetic Implications
Costs	Operating costs e.g. labour, site operations, environmental monitoring Capital e.g. Transport, equipment hire

3.1.1 BPEO Strategic Assessment

Table 3.2 below provides details of the strategic assessment for each option taken forward for the detailed BPEO assessment:

Table 3.2: BPEO Strategic Assessment

Criteria	Landfill	Sea Disposal
Operational Aspects (inc. handling and transport)	Would involve double handling of material through dewatering and transportation to landfill. A facility would need to be built for dewatering purposes. Would also increase the number of HGV's on the road network.	There would be no double handling of the dredged material. Transportation to the disposal site would be by dredger or barge(s) depending on methodology.
Availability of suitable sites/facilities	The geotechnical composition of the dewatered River Clyde dredged material is considered to be suitable for disposal via this route. However, there is typically a limit to the amount of waste that can be accepted both on a daily and annual basis at a landfill. The landfill capacity will therefore not be able to accommodate the quantity of material generated by the River Clyde dredging activities and another disposal option will be required for the surplus material.	The marine disposal site has been designed to accommodate the quantities typically generated by dredging operations. The geotechnical composition of the River Clyde dredged material is suitable for disposal via this route.
General Public /Local acceptability	Increase traffic on haul routes therefore potential for increase in public complaints.	Traditionally accepted disposal route for dredged material and limited public impact.
Legislative Implications	Contravenes the principles of minimising waste and long term commitments by the government to reduce land filling.	This is an accepted disposal route as long as a licence is obtained.

3.1.2 BPEO Environmental Assessment

Table 3.3 details the environmental assessment for each option taken forward for detailed BPEO assessment.

Table 3.3: BPEO Environmental Assessment

Criteria	Landfill	Sea Disposal
Safety Implications	Double handling of material increases the potential for accidents to occur. Work would be undertaken in accordance with H&S legislation.	Minimal handling of material required as it is directly placed at the disposal site. Work would be undertaken in accordance with H&S legislation.
Public Health	Measures will be required to limit human contact during transfer of material from dredger to dewatering facility and transportation to landfill. Security measures typically employed at licensed landfills which will minimise human contact once accepted and emplaced at site.	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.
Pollution/contamination	Pumping ashore to dewatering facility and transportation to landfill will all require energy. Road transport increases the carbon footprint of this disposal option. Potential for spillages to occur.	Pollutant concentrations limited to acceptable levels through regulatory licensing processes. Low disturbance of sediments by natural processes limits spread in existing disposal ground, although it is acknowledge some dispersal will occur.
General Ecological Implications	Licensed landfill would be away from protected species and habitats with measures in place to prevent or minimise pollution of the surrounding environment.	Disposal at Cloch Point site has historically been used and is the closest licensed disposal site

Interference with other legitimate activities	Potential from limited short term local impact to commercial operations in the area of the dredged material handling and road hauling principally related to noise and dust potential.	Designated disposal site, as such there is considered no significant impact to commercial vessels or commercial fishing.
Amenity / Aesthetic Implications	Odour release from dewatering facility. Increase traffic noise during transportation from dewatering facility to landfill facility. Potential for spillages on haul route. No significant additional visual/ odour/noise effects as using existing landfill site.	Limited short term visual / odour / noise effects as dredged material is transported by dredger and disposed of below sea level.

3.1.3 BPEO Cost Assessment

Costs were assessed for each of the options taken forward for detailed BPEO assessment. The BPEO assessment considered the typical costs associated with dredging, transportation to the disposal site, construction of treatment facilities (where applicable) and methods employed to protect the environment for each of the identified options. As costs are generally "Commercially Sensitive" the rates are based on experience within industry (as opposed to formal quotations).

For the purposes of comparing costs associated with each option a benchmark of 100,000 tonnes (approximately 50,500m^3) of dredged material has been set.

The assumptions to calculate the costs are as follows:-

Dredging costs are estimated to be £3.21 per m^3;

Ship transportation costs from the dredged area to disposal / transfer site have been calculated based on £1.85 per tonne;

Costs associated with construction and operation of a dewatering facility are estimated to be in the order of £1,000,000 or greater;

Cost associated with transfer of dewatered material to lorry are based on a wheeled shovel (costing £47 per hour) operating 2 hours per day for 6 days per week for ten weeks;

Transportation costs from a dewatering facility to landfill are estimated to be £4.85 per tonne; and

Landfill gate fees are estimated to be £30 per tonne for a non-hazardous landfill (Note Maintenance dredgings are currently exempt from landfill tax as defined in HM Customs and Excise Notice LFT1, A general guide to landfill tax, November 2018, Section 8[1]).

Table 3.4 provides details on the Cost assessment for each option taken forward for detailed BPEO assessment.

[1] https://www.gov.uk/government/publications/excise-notice-lft1-a-general-guide-to-landfill-tax/excise-notice-lft1-a-general-guide-to-landfill-tax#exemptions

Table 3.4: BPEO Cost Analysis (based on 100,000 tonnes only)

Activity	**Landfill Disposal (£)**	**Sea Disposal (£)**
Dredging	160,500	160,500
Transport by vessel to disposal site	185,000	185,000
Reception facility	70,000	-
Harbour / Dock Closure	-	-
Dewatering Facility	1,000,000	-
Transfer of material to lorry	5,640	-
Transportation Cost	485,000	-
Landfill Gate Fee	3,000,000	-
Total Costs	**4,906,140**	**345,500**

Note: The above costs do not take into account the cost required to gain planning or licensing consents or potentially to purchase land (where applicable). They also do not take account of the influence volumes will have on costs (economies of scale).

3.2 BPEO Assessment Discussion

For each of the above assessment criteria the options were qualitatively and semi-quantitatively (for costs) assessed against feasibility/preference and awarded a ranking ranging from 1 – 4; 1 being the most acceptable and 4 being the least acceptable option. The assignment of rank was on the basis of professional judgement.

The individual assessment criteria rankings for each option were added up to give an overall hierarchy of preference. Table 3.5 below provides a summary of the BPEO assessment.

Table 3.5: BPEO Summary

Criteria	**Landfill Disposal**	**Sea Disposal**
Environment	4	2
Strategic	4	2
Costs	4	1
TOTAL SCORE	**12**	**5**

Disposal to landfill is considered to be the least suitable option for the dredged material. It contravenes the principles of minimising waste and reducing landfilling. Several stages in material handling operations would be required to dispose of the material by this route. The cost associated with setting up a suitable treatment facility to dewater the dredged material is significant. Transportation of material by road is also undesirable as a result of increased traffic and the potential for accidental spillages. Landfill capacity is also typically limited and potentially unable to accommodate the quantities of material typically generated by the River Clyde dredging operations. Any surplus dredged material will therefore require to be disposed of via an alternative route.

Deposition of the dredged material at a licensed marine disposal site is traditionally acceptable. The licensed marine disposal site has been designed to allow easy access as well as being capable of accommodating the quantities of material typically generated by dredging activities. Material handling is limited to transportation thereby reducing the risk for pollution incidences occurring. Pollutant concentrations are also limited to acceptable levels through regulatory requirements. On comparison with other disposal options the cost associated with sea disposal of the dredged material is considered to be the most financially viable.

Sea Disposal has therefore been identified as being the most suitable option for the final end use of the dredged material.

3.3 Conclusions

The Best Practicable Environmental Option for disposal of the River Clyde dredging's has therefore been assessed as sea disposal. As identified in the sediment chemical quality section, further assessment is deemed necessary to confirm the suitability of the sediment for sea disposal. The following section details this assessment.

It should be noted that a Clyde Beneficial Use of Dredged Material Initiative has been established by Clydeport Operations Limited and includes a diverse group of stakeholders including regulators and local authorities with a view to identifying reuse opportunities in the Clyde Estuary. It is currently at an early stage, but sites where beneficial reuse may be an option are currently being identified. These include habitat restoration opportunities (RSPB), and potential land reclamation (Peel Land and Property) so that sites can be identified and their requirements documented as well as the type of material required.

4 FURTHER ASSESSMENT

As detailed in Section 1, on the basis of the exceedances of Action Level 1 (and the two individual sample exceedance of Action Level 2), further assessment to determine the suitability of the material for sea disposal is deemed a requirement.

The approach for this further assessment is outlined as follows:

- Provide an overview of the proposed dredge works and the identified disposal site including existing chemical monitoring data for the site where available; and
- Compare existing chemical data with other recognised sediment assessment criteria including those listed below. Summary tables are provided in Appendix B.

Background Assessment Concentration (BAC) - BACs were developed by the OSPAR Commission (OSPAR) for testing whether concentrations are near background levels. Mean concentrations significantly below the BAC are said to be near background. However, it should be noted that river catchments have their own unique geochemical finger prints and are also governed by the geology within the catchment, so in theory one set of background level values is not applicable to all situations;

Effects Range Low (ERL) - ERLs were developed by the United States Environmental Protection Agency (USEPA) for assessing the ecological significance of sediment concentrations. Concentrations below the ERL rarely cause adverse effects in marine organisms. Concentrations above the ERL will often cause adverse effects in some marine organisms;

Probable Effects Level (PEL) – PELs (Marine) have been adopted from the Canadian Environmental Quality Guidelines http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/) If a concentration is recorded above the PEL this is the probable effect range within which adverse effects frequently occur. The Threshold Effect levels (TELs) have been included in the summary table in Appendix B, but have not been used as part of the further assessment as they typically fall below the RAL1

Review of potential risks to the list of receptors identified in "Water Framework Directive Assessment: estuarine and coastal waters (https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters) to draw conclusions from available information and provide recommendation for proposed disposal routes.

4.1 Background Data – Dredge and Disposal Site

Cloch Point Disposal site is located in the Firth of Clyde and is licensed annually to receive close to 830,000 tonnes of dredge material. Less than half of the annual licensed capacity has been used in the past 3 years. The proposed Dredge will incorporate two discrete dredge pockets at Greenock Ocean terminal. Drawing 169410-20 details the location and footprint of the Cloch Point Disposal site.

Marine Scotland noted that in Scotland the preference for disposal site selection is those which are dispersive, and as such it is assumed that the Cloch Point disposal ground is dispersive.

Chemical analysis data for samples collected at from the disposal ground were provided for review by Marine Scotland, to enable an assessment of the existing conditions at the site to be undertaken. A high level review of these data highlights the following with the summary table presented as Table C in Appendix B with observations as follows:

- Average concentrations at Cloch Point exceed the ERL for chromium, copper, mercury, lead, zinc and benzo(a)pyrene (PAHs)
- Average concentrations at Cloch Point exceed the PEL for lead and benzo(a)pyrene (PAHs)
- The maximum concentrations of the following contaminants exceed the PEL at Cloch Point chromium, copper, mercury, lead and zinc as well as PCBs (ICEs 7) and various PAH species including benzo(a)pyrene.

4.2 Analytical Data Review

Existing analytical data for the proposed dredge site is provided in Summary Table A in Appendix B. This data has been summarised against RAL 1 & 2, the BAC, ERL and PEL. As detailed previously, the data has not been reviewed against the Canadian TEL as these numbers are typically lower than RAL1. A summary of the findings is detailed below:

4.2.1 Action Level 1

The majority of metals were below their respective RAL 1 with the following exceptions:

- Arsenic - 7 of 29 samples recorded arsenic levels above RAL 1.
- Chromium - 3 of 29 samples recorded chromium levels above RAL 1.
- Copper –3 of 29 samples recorded copper levels above RAL 1.
- Lead –2 of 29 samples recorded lead levels above RAL 1.
- Nickel – 11 of 29 samples recorded nickel levels above RAL 1.
- 10 of 29 samples recorded at least one PAH species above RAL 1.

4.2.2 Action Level 2

RAL 2 levels were exceeded for the following metals and samples:

- Chromium – SS03B -0-0.5m – 374 mg/kg
- Nickel – SS01A 0-0.5m – 227mg/kg

4.2.3 ERL & PEL Review

The ERL, where one is available, was exceeded for chromium (3 samples), copper (1 sample), lead (4 samples) and up to 5 samples for various PAH species

The PEL was exceeded, where one is available, for chromium (2 samples) and 1 sample for various PAH species including benzo(a)pyrene.

4.3 Averages

Review of the averaged data for all the data has been undertaken i.e. considering the material as a single volume for disposal. The concentrations of the various contaminants of concern are quite variable, the review of average data against the available adopted assessment criteria are as follows:

- Averaged concentrations exceeded RAL1 for chromium, nickel and various PAH species
- Nickel and some PAH species averages exceed the BAC
- No average concentrations exceed the ERL where one is available.

- No average concentrations exceed the PEL where one is available.
- All samples recorded concentrations below RAL2 where they exist.

4.4 Chemical Assessment Conclusions

A number of samples record exceedances of RAL1 including metals, PAHs and THC. Two surface samples (SS01A - nickel) & (SS03B - chromium) recorded single exceedances RAL 2.

While a number of ERL exceedances have been recorded as well as a limited number of PEL exceedances have also been recorded, there are no average concentrations recorded which exceed the either the ERL or PEL.

Review of the background contaminant levels at the disposal site has identified that there are contaminants of concern in exceedance of the adopted ERL and PELs for the key contaminants of concern (chromium and PAHs). There is no PEL currently available for Nickel but the average concentration of the proposed dredge material is 36.3 mg/kg compared to 54.6 mg/kg at Cloch Point, based on available data. Additionally, the average concentrations of lead and PAH species across the disposal site are noted to be above the PEL.

Further consideration of the potential risks associated with the proposed disposal is considered in the following sections.

4.5 Water Framework Directive Assessment

As outlined in the Water Framework Directive Assessment: estuarine and coastal waters, there are several key receptors which can be impacted upon including the following:

- Hydromorphology
- Biology – habitats
- Biology – fish
- Water quality
- Protected areas

Each of these points are considered in Table 4.1 below:

Table 4.1: Receptor Risk Assessment

Key Receptor	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Hydromorphology (Source Area and Disposal Site)	Morphological conditions, for example depth variation, the seabed and intertidal zone structure tidal patterns, for example dominant currents, freshwater flow and wave exposure	No	The areas proposed to be dredged are already subject to dredging, although this proposed work will include a degree of deepening and widening, the disposal site is a sacrificial part of the Clyde Estuary designated and licensed for this purpose.

Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	No	Not considered to be a significant risk considering the dredge areas are part of the main channel which is already subject to maintenance dredging, and the disposal site is a sacrificial disposal site which has been used for the deposition of sediments. Key contaminants of concern within the disposal ground sediments are noted to exceed the PEL for various metals as well as PAHs and PCBs.
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	Contaminants noted to exceed CEFAS RAL1 within sediment samples

Protected Areas	If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment. • special areas of conservation (SAC) • special protection areas (SPA) • shellfish waters • bathing waters • nutrient sensitive areas	Yes	The proposed disposal site is not located within 2km of an SAC or SPA, marine protected area or RAMSAR sites. The disposal site is located approximately 4.5Km from the closest designated bathing water at Lunderstoun Bay. The dredge and disposal sites are not designated as shellfish water. The closest shellfish water is located at Kyles of Bute and Loch Striven over 20km to the south and west of the disposal site. The locations of dredging activity area is located within 2km of the Inner Clyde SPA and River Clyde Ramsar site, with the closest designated feature c. 1.5km east up stream noted at Cocklebank. The Inner Clyde Estuary has been notified as a Special Protection Area (SPA) under the EC Wild Birds Directive and as a RAMSAR site under international designation. The dredging activities are focussed to the existing and adjacent to the maintained channel area of the River Clyde. The birds of the estuary feed on the eelgrass, mussel beds, and on the abundant invertebrate fauna of the intertidal mudflats, sandflats and saltmarsh which are not included with the proposed works. On this basis there is not considered to be potential for significant impact to the designated sites from the dredge activity. Provided in Appendix C is information from SNH previously provided regarding the potential for impact to designated sites adjacent to the navigable channel and acceptable means of dredging.

Source: Taken from https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

4.6 Potential Risk to Water Quality and Marine Life

The potential risks to water quality at both the dredge sites and disposal site are further considered as all other receptors have been screened out of the assessment.

The coastal classification of this area of water in and around the disposal ground is"good" in 2008 (SEPA) & 2015 as detailed on Scotland's Environment (http://www.environment.scotland.gov.uk/)

Although there are contaminants of concern above the RAL1 and one sample each with metals over RAL2 for nickel and chromium for sediment disposal, it is considered that these levels will not contribute to an overall degradation of water quality as the potential for dilution in the Firth of Clyde is very considerable. When the sediment results are reviewed on average to assess the sediment mass as a whole body for disposal then all results are below the ERL and PEL. On this basis the risks from the sediment as a dredge mass are considered to be low, with the associated dilution potential providing further mitigation.

The key contaminants for impacting water quality are considered to be metals as these have the potential to dissolve/desorb from sorption sites, whereas the organic contaminants (PAHs and PCBs) have a greater affinity for the organic materials which they are bound to, and are more likely to remain strongly bound to the sediment, or if become dissolved, quickly adsorbed onto organic matter within the water column or sediments.

Additionally, the sediment quality within the disposal ground which is also noted to contain levels of contaminants of concern, with some recorded to exceed the PEL, does not appear to have impacted on the Water Quality classification of good in this area.

The key risk is considered to be an increase in turbidity/suspended solids during the disposal activity, although this is likely to cause localised degradation in water quality, it is considered that this will be a short term event and has been factored in to the selection and location of the agreed disposal ground.

The sediment material primarily ranges clay to gravel with the dominant fraction recorded as sand. The following table summarises the physical sediment type versus the proposed dredge volume.

Table 4.2: Summary of PSD Data

Dredge Area	Name of Dredge Area	Clay and Silt (<0.063mm)	Sand (0.063mm<Sand<2mm)	Pebbles, Cobbles and Boulder >2.0mm)	Quantity to be dredged m^3
1	Dredge Area 1 (Quayside)	13%	51%	36%	23,875
		3,104 m^3	12,176 m^3	8,595 m^3	
2	Dredge Area 2 ((North Channel)	42%	54%	4.0%	130,000
		54,600 m^3	70,200 m^3	5,200 m^3	

Consultation previously undertaken with Marine Scotland in November 2017 indicated there was no recent information regarding modelling or dispersion studies for the area. On this basis, there is no current information available to inform the potential for dispersion of sediment outwith the disposal grounds (i.e. water current velocity, stratification in water column, weather impacts etc). The disposal site is a sacrificial disposal ground and as such there is considered to be an allowance for some lateral dispersal of materials within the area of disposal.

The sediment type in both dredge areas are formed of 50% sand or more with an average of 52.5%. This material forms a total dredge volume of 82,376 m^3 .Given the prevalence of coarser grain material from these locations it is considered that the sediment will fall out of suspension quickly at the disposal site with limited lateral spread.

The remaining 57,704 m3 of dredge material is composed of sediment primarily formed from clay and silt. This material is considered to have a longer suspension period than the sand formed materials. Gravel and larger fractions will sink rapidly within a reduced potential for dispersal.

It is noted that the Cloch Point disposal grounds have been utilised for the maintenance dredge disposal from the River Clyde for a number of previous exercises (including the period of the most recent SEPA classification of the disposal grounds as “good”).

The previous sediment quality report and BPEO compiled by Envirocentre in November 2017 identified elevated metals and PAHs exceeding AL1 for sediment within several of the maintenance dredge sites throughout the river, indicating similar chemical quality findings to the samples collected in the June and October 2018 sampling exercise. Water quality does not appear to have been impacted as a result of previous maintenance dredge exercise.

On the basis of the information from previous maintenance dredge disposal to the Cloch Point site, it is considered that the potential for impact to the Water Environment outwith the disposal grounds from the clay/silt formed sediment is considered low.

On this basis, the associated risk with degradation of water quality directly associated with the proposed disposal is considered to be Low i.e. unlikely to cause a significant adverse effect on the overall water quality.

4.7 Conclusions and Recommendations

Review of available information has highlighted that although several chemical contaminants exceed RAL1 and two individual surface samples record individual metals in exceedance of RAL2, assessment of key receptors identified from the Water Framework Directive assessment for estuarine and coastal waters concluded that there is a low risk to the key receptor of Water Quality. The chemical levels in the sediment are not considered likely to have a significant adverse impact on the sediment quality already located within the disposal grounds and it is recognised that this part of the sea floor is a sacrificial site for the disposal of dredge material.

While the risk to migratory fish (particularly salmon) was screened out at the start of the risk assessment process, it should be considered as best practice that these are considered during the dredging works and that timing for these is considered as far as practicable to mitigate against any potential risks.

Over all, based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment recommendation for sea disposal is considered to be the preferred option.

The Best Practicable Environmental Option for disposal of the dredging for the Greenock Ocean Terminal dredge has therefore been assessed as sea disposal. This option is considered to have no significant long term impact on the marine environment; the disposal site is readily accessible from all the dredging areas and is the most cost effective option.

When the sediment results are reviewed on average to assess the sediment mass as a whole body for disposal then all results are below both the ERL and PEL values where they may exist. Any impacts related to the disposal of the material are considered to be short lived and similar in magnitude to previous maintenance dredge campaigns which did not result in significant impact to the water quality. On this basis of the chemical quality assessment and associated risk assessment the proposed dredge material from the two dredge areas at Greenock Ocean Terminal are considered suitable for disposal at the Cloch site.

Additionally, Clydeport Operations Limited are currently looking in to potential beneficial reuse options for future dredged material. This initiative is attended by a diverse group including Marine Scotland and is currently at early stages of development. The next meeting is scheduled for early January 2019 with a view to identifying beneficial reuse options and laying the foundations for future reuse opportunities.

5 REFERENCES

Marine Scotland (2017). *Pre-DredgeSampling Guidance Version 2*: Scottish Government.

Marine Scotland (2015). *Guidance for Marine Licence Applicants Version 2*: Scottish Government.

APPENDICES

A FIGURES

SS_ID	Type	Easting	Northing	Latitude	Longitude
SS01A	Borehole	228084.42	676634.74	55 57.11812953N	004 45.22366084W
SS02	Grab	228051.21	676689.87	55 57.14709857N	004 45.25764091W
SS03B	Borehole	227897.29	676911.21	55 57.26299556N	004 45.41385564W
SS04A	Borehole	228020.58	677109.74	55 57.37255511N	004 45.30310608W
SS05	Borehole	228078.18	676951.79	55 57.28873361N	004 45.24177938W
SS06	Grab	228000.14	677060.85	55 57.34579070N	004 45.32086072W
SS07	Borehole	228113.94	676893.91	55 57.25832863N	004 45.20523544W
SS08	Borehole	228172.1	676775.98	55 57.19606972N	004 45.14489937W
SS09	Borehole	228211.16	676696.25	55 57.15397338N	004 45.10436446W
SS10A	Borehole	228280.63	676595.3	55 57.10109540N	004 45.03382675W
SS11	Borehole	228350.18	676523.72	55 57.06403951N	004 44.96432783W
SS13	Grab	228004.69	676788.92	55 57.19944767N	004 45.30608530W

55 57.3845 N
004 45.3083 W

55 57.3682 N
004 45.3554 W

55 57.29975924N
004 45.36879219W

55 57.25713250N
004 45.44970465W

55 57.12641573N
004 45.18146946W

55 57.07695081N
004 45.24917584W

55 56.98992903N
004 44.75652561W

55 56.94553540N
004 44.79563034W

Do not scale this map

Legend

- Borehole
- Grab
- Dredge Area
- Bathymetric Contour (at 1m interval)

Notes
1. Bathymetric Data provided by Peel Ports (as per HM1034-1-12)
2. Bed level is shown to chart datum

Client: Peel Ports Group

Project: Greenock Ocean Terminal Cruise Extension

Title: Sediment Sampling Locations & Dredge Areas

Status: Final

Drawing No.: 169410-021

Revision: B

Scale: 1:3,000

A3

Date: 19 Nov 2018

Drawn: Redac

Checked: Red

Approved: Re

ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045

Site	Easting	Northing	Latitude	Longitude
MA021 - Cloch Point	220443.379883	678880.302917	55.969328	-4.877447

Legend

- MA021 - Cloch Point
- Disposal Site Buffer (370.4m)
- Greenock Ocean Terminal

Do not scale this map

Client
Peel Ports Group

Project
Greenock Ocean Terminal
Cruise Extension

Title
Cloch Point Disposal Site

Status
Final

Drawing No.
169410-020

Revision

Scale
1:30,000

A3

Date
29 Oct 2018

Drawn
R

Checked
Red

Approved
Re

ENVIRO Centre
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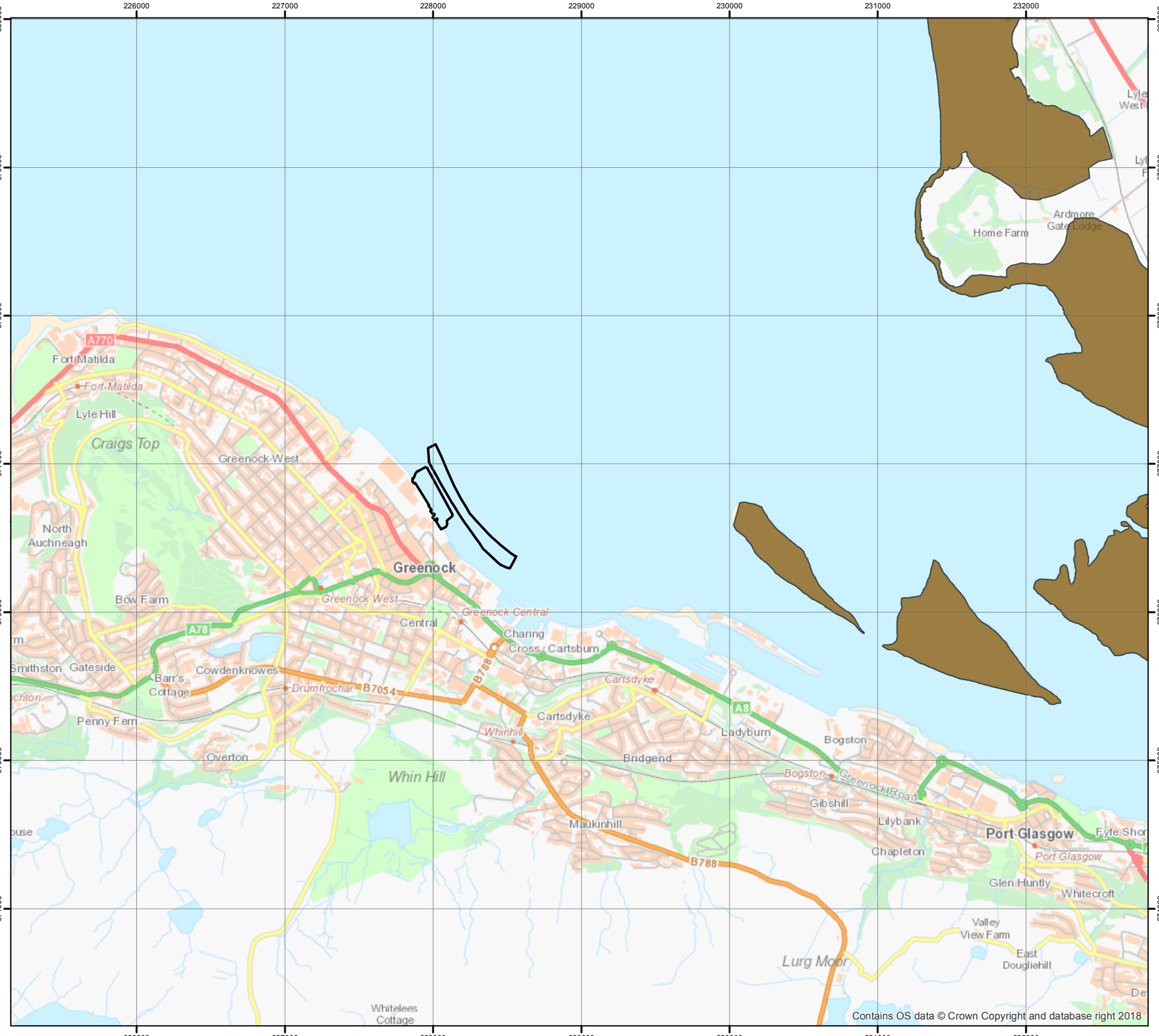

Legend

- Dredge Area
- Inner Clyde SPA

Do not scale this map

Client
Peel Ports Group

Project
Greenock Ocean Terminal
Cruise Extension

Title
Dredge Area and
Inner Clyde Special Protection Area (SPA)

Status
FInal

Drawing No.	Revision
169410-022	

Scale		Date
1:25,000	A3	19 Nov 2018

Drawn	Checked	Approved
R	Red	Re

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B SEDIMENT QUALITY DATA SUMMARY TABLES

Table A

Greenock Ocean terminal

Sampling Results Incorporated with BPEO Assessment

	AL1	AL2	BAC	ERL	PEL	Dredge Area 1: SS01A 0-0.5m	SS01A 0.5-1.0m	SS02	SS06	SS13	SS03B 0-0.5m	SS03B 1.05-1.55m	SS03B 1.55-2.05m
Source			CSEMP	CSEMP	Canada								
Arsenic	20	70	25		41.6	5.6	5.4	7.1	6.8	11.0	2.1	3.5	2.9
Cadmium	0.4	4	0.31	1.2	4.2	0.16	0.08	0.06	0.04	0.11	0.05	0.05	0.04
Chromium	50	370	81	81	160	187	28.1	107	17.8	48	374	17.6	22.9
Copper	30	300	27	34	108	29.2	26.5	22.3	9.6	55.5	29.4	30.6	30.8
Mercury	0.25	1.5	0.07	0.15	0.7	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Nickel	30	150	36	-	-	227	31.8	104	13.5	51.7	13.6	15.8	22.3
Lead	50	400	38	47	112	57.6	9.6	22.7	16.3	62.2	8.5	5.8	6.2
Zinc	130	600	122	150	271	100	54.6	67.5	43.2	110	32.6	33.1	40
Napthalene	0.1		0.08	0.16	0.391	0.115	0.00187	0.0147	0.00274	0.00897	0.001	0.00148	0.0033
Acenaphthylene	0.1				0.128	0.222	0.001	0.00727	0.00306	0.00551	0.001	0.001	0.001
Acenaphthene	0.1				0.0889	0.0745	0.001	0.00735	0.00169	0.0206	0.001	0.001	0.001
Fluorene	0.1				0.144	0.253	0.001	0.0122	0.0036	0.0123	0.001	0.001	0.00152
Phenanthrene	0.1		0.032	0.24	0.544	2.12	0.00911	0.0705	0.0285	0.0678	0.00409	0.0117	0.0163
Anthracene	0.1		0.05	0.085	0.245	0.753	0.00123	0.0246	0.00487	0.0227	0.001	0.001	0.001
Fluoranthene	0.1		0.039	0.6	1.494	3.97	0.00786	0.132	0.0398	0.145	0.00467	0.0055	0.00484
Pyrene	0.1		0.024	0.665	1.398	3.71	0.00723	0.139	0.0392	0.138	0.00392	0.00271	0.00233
Benzo(a)anthracene	0.1		0.016	0.261	0.693	1.76	0.00297	0.0676	0.0177	0.0788	0.00162	0.001	0.001
Chrysene	0.1		0.02	0.384	0.846	1.79	0.00492	0.0733	0.0215	0.0859	0.00301	0.00309	0.00212
Benzo(b)fluoranthene	0.1		-	-	-	1.61	0.00713	0.0976	0.0192	0.0925	0.00499	0.00558	0.00355
Benzo(k)fluoranthene	0.1		-	-	-	0.791	0.002	0.0386	0.00697	0.0433	0.00135	0.001	0.001
Benzo(a)pyrene	0.1		0.03	0.384	0.763	2.08	0.00376	0.102	0.0163	0.0894	0.00212	0.001	0.001
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	1.27	0.00281	0.0797	0.00979	0.0618	0.00216	0.00141	0.00101
Benzo(ghi)perylene	0.1		0.08	0.085	-	1.27	0.00481	0.0905	0.0151	0.073	0.00331	0.00326	0.00266
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.256	0.001	0.0163	0.00255	0.0145	0.001	0.001	0.001
TPH	100		-	-	-	535	18.3	110	23.6	84.1	14.1	10.4	16.7
PCBs	0.02	0.18	-	-	0.189	0.02207	0.00222	0.0038	0.00085	0.00304	0.00329	0.00181	0.00222
TBT	0.1	0.5	-	-	-	0.00766	0.001	0.00152	0.001	0.00128	0.001	0.001	0.001

	Dredge Area 2: SS04A - 0-0.5	SS04A - 3.5-4.0	SS04A - 6.5-7.0	SS05 - 0-0.5	SS05 - 3.0-3.5	SS05 - 5.5-5.8	SS07 - 0-0.5	SS07 - 3.0-3.5	SS07 - 5.1-5.6	SS08 - 0-0.5
Arsenic	19.6	28.4	9.7	12.4	14.8	14.4	12.3	15.6	21.2	20.4
Cadmium	0.19	0.17	0.16	0.12	0.05	0.11	0.07	0.09	0.08	0.1
Chromium	45	35.4	40	27.9	33	32.3	21.7	26.1	32.6	35
Copper	16.2	15.9	21.9	13.5	12.8	13.9	13.6	15.5	14.8	14.9
Mercury	0.07	0.09	0.13	0.06	0.11	0.07	0.05	0.05	0.08	0.04
Nickel	30	26.1	35.9	20.9	20.2	21.1	18	19.7	24.6	25
Lead	48.4	47.2	41.2	28.7	38.1	41.8	22.7	36.6	47	43.2
Zinc	115.9	127.3	78.7	73.6	91.2	95.5	57.4	82.4	111.4	108.3
Napthalene	0.00321	0.0391	0.0311	0.00213	0.014	0.00549	0.0396	0.0138	0.00245	0.00594
Acenaphthylene	0.001	0.0287	0.00211	0.001	0.00169	0.00166	0.013	0.0011	0.001	0.00181
Acenaphthene	0.00129	0.0178	0.00639	0.00143	0.00304	0.00223	0.0157	0.004	0.00132	0.00265
Fluorene	0.0023	0.0235	0.0264	0.0023	0.00515	0.00449	0.0279	0.0041	0.00168	0.00396
Phenanthrene	0.0165	0.15	0.119	0.0198	0.0491	0.0248	0.257	0.0279	0.0167	0.0415
Anthracene	0.00377	0.0342	0.0151	0.00303	0.00869	0.00567	0.0328	0.00686	0.00344	0.00946
Fluoranthene	0.0169	0.146	0.0582	0.0181	0.0386	0.0251	0.165	0.033	0.0127	0.0397
Pyrene	0.03	0.398	0.0574	0.0214	0.0641	0.0416	0.195	0.0461	0.0216	0.0698
Benzo(a)anthracene	0.00994	0.109	0.0317	0.00907	0.0197	0.013	0.112	0.0175	0.00754	0.0193
Chrysene	0.0148	0.148	0.0514	0.0145	0.0303	0.0191	0.135	0.0252	0.0114	0.0316
Benzo(b)fluoranthene	0.0175	0.207	0.0504	0.0121	0.0288	0.0184	0.136	0.0219	0.0123	0.0283
Benzo(k)fluoranthene	0.00655	0.106	0.012	0.00412	0.00999	0.00816	0.0723	0.00709	0.00496	0.00979
Benzo(a)pyrene	0.0146	0.236	0.0292	0.00881	0.0226	0.0177	0.134	0.0159	0.0102	0.02
Indeno(1,2,3cd)pyrene	0.0109	0.13	0.0208	0.00607	0.0138	0.0112	0.0792	0.0103	0.0075	0.0123
Benzo(ghi)perylene	0.0167	0.154	0.0624	0.0122	0.0234	0.0183	0.0927	0.0204	0.0126	0.0211
Dibenzo(a,h)anthracene	0.00236	0.0237	0.00712	0.00173	0.00398	0.003	0.0184	0.003	0.00175	0.00334
TPH	25.5	86.7	101	16.8	32.1	27.3	197	50.8	20.1	31.6
PCBs	0.001074	0.000692	0.000787	0.000707	0.007276	0.000881	0.000609	0.000702	0.000564	0.000986
TBT	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001

	SS08 - 1.5-2.0	SS08 - 2.4-2.9	SS09 - 0-0.5	SS09 - 1.1-1.6	SS09 - 1.7-2.2	SS10A - 0-0.5	SS10A - 1.5-2.0	SS10A - 2.4-2.9	SS11 - 0-0.5	SS11 - 0.75-1.25	SS11 - 1.5-2.0
Arsenic	20.2	6.6	16.5	10.2	10.4	21.5	12.6	15.5	19.3	22.8	32.2
Cadmium	0.16	0.08	0.13	0.18	0.13	0.08	0.14	0.16	0.09	0.04	0.04
Chromium	39.3	28.5	29.7	43.9	43.4	28	40.6	42	35.3	33.2	26.4
Copper	17.6	23.3	14.6	22.6	23.7	25.5	19.3	20.5	12.7	12.1	13.1
Mercury	0.013	0.01	0.01	0.01	0.01	0.08	0.011	0.01	0.01	0.02	0.01
Nickel	35.4	26.4	19.6	39.2	40.8	24.7	36.3	40.6	19.5	22.8	27
Lead	18.1	9.9	31.1	27.4	23.8	25.8	16.8	17.3	30	33.3	24.3
Zinc	83.8	54.8	96.5	80.8	78.4	97.9	78.1	85.4	106.4	114.3	96.9
Napthalene	0.016	0.001	0.0154	0.0277	0.0303	0.00462	0.0249	0.0127	0.0113	0.00636	0.00172
Acenaphthylene	0.001	0.001	0.00383	0.0015	0.0011	0.001	0.001	0.001	0.0064	0.00797	0.001
Acenaphthene	0.00267	0.001	0.00467	0.00538	0.0044	0.00214	0.00428	0.00227	0.00365	0.00291	0.001
Fluorene	0.00863	0.001	0.00805	0.017	0.0161	0.00231	0.0144	0.00835	0.00643	0.0058	0.001
Phenanthrene	0.0479	0.0112	0.0459	0.0813	0.0762	0.0256	0.0684	0.0421	0.025	0.0395	0.015
Anthracene	0.0036	0.001	0.0111	0.00641	0.0061	0.004	0.00608	0.00298	0.00997	0.0111	0.00181
Fluoranthene	0.0186	0.0111	0.0385	0.0418	0.0361	0.025	0.0269	0.0191	0.036	0.0412	0.0147
Pyrene	0.0313	0.00559	0.0488	0.0497	0.0485	0.0251	0.0425	0.0271	0.0957	0.082	0.0158
Benzo(a)anthracene	0.0172	0.00134	0.0183	0.0252	0.024	0.0133	0.023	0.015	0.0175	0.0292	0.00808
Chrysene	0.0231	0.0087	0.0245	0.0372	0.0356	0.0185	0.0325	0.0228	0.0265	0.0355	0.0139
Benzo(b)fluoranthene	0.0375	0.0138	0.0215	0.0469	0.0488	0.0155	0.0471	0.0305	0.0454	0.0544	0.0132
Benzo(k)fluoranthene	0.00825	0.00218	0.00782	0.0103	0.012	0.00577	0.012	0.00754	0.0169	0.032	0.00446
Benzo(a)pyrene	0.0198	0.00115	0.0166	0.0253	0.0271	0.0109	0.026	0.0211	0.0451	0.0564	0.00852
Indeno(1,2,3cd)pyrene	0.0138	0.00324	0.00993	0.0203	0.0202	0.00669	0.0192	0.0143	0.0292	0.035	0.00604
Benzo(ghi)perylene	0.0442	0.00765	0.0182	0.0638	0.0647	0.0118	0.064	0.0515	0.0334	0.0386	0.0108
Dibenzo(a,h)anthracene	0.00472	0.001	0.00278	0.00629	0.00616	0.00194	0.00639	0.00471	0.00543	0.00656	0.00163
TPH	41.6	2.36	27	68.8	69.4	19.5	66.9	27.1	33.2	33	16.9
PCBs	0.001041	0.000656	0.001212	0.000808	0.000904	0.000604	0.001004	0.001179	0.002133	0.001405	0.000696
TBT	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.001

	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Arsenic	13.83	7	0	2	-	0
Cadmium	0.10	0	0	0	0	0
Chromium	52.47	3	1	3	3	2
Copper	20.41	3	0	5	1	0
Mercury	0.04	0	0	5	0	0
Nickel	36.33	11	1	7	N/A	N/A
Lead	29.02	2	0	9	4	0
Zinc	82.62	0	0	1	0	0
Napthalene	0.02	0	-	1	0	0
Acenaphthylene	0.01	0	-	N/A	N/A	1
Acenaphthene	0.01	0	-	N/A	N/A	0
Fluorene	0.02	0	-	N/A	N/A	1
Phenanthrene	0.12	1	-	15	2	1
Anthracene	0.03	0	-	1	1	1
Fluoranthene	0.18	1	-	10	1	1
Pyrene	0.19	1	-	21	1	1
Benzo(a)anthracene	0.09	1	-	17	1	1
Chrysene	0.09	1	-	18	1	1
Benzo(b)fluoranthene	0.09	1	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.04	0	-	N/A	N/A	N/A
Benzo(a)pyrene	0.11	1	-	7	1	1
Indeno(1,2,3cd)pyrene	0.07	1	-	2	1	N/A
Benzo(ghi)perylene	0.08	1	-	4	4	N/A
Dibenzo(a,h)anthracene	0.01	0	-	N/A	N/A	1
TPH	62.31	4	-	N/A	N/A	N/A
PCBs	0.0022	1	0	N/A	N/A	0
TBT	0.0015	0	0	N/A	N/A	N/A

Note: Underlined Values are < LOD

PEL Data Source: http://ceqg-rcqe.ccme.ca/en/index.html#void

Summary Table B

Greenock Ocean Terminal Average Concentrations

All units in mg/kg

	AL1	AL2	BAC	<ERL	PEL	Dredge Average	Exceed Al1?	Exceed Al2?	Exceed BAC?	Exceed ERL ?	Exceed PEL?
Source			CSEMP	CSEMP	Canada						
Arsenic	20	70	25	-	41.6	13.8	No	No	No	-	No
Cadmium	0.4	4	0.31	1.2	4.2	0.1	No	No	No	No	No
Chromium	50	370	81	81	160	52.5	**Yes**	No	No	No	No
Copper	30	300	27	34	108	20.4	No	No	No	No	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.04	No	No	No	No	No
Nickel	30	150	36	-	-	36.3	**Yes**	No	**Yes**	N/A	N/A
Lead	50	400	38	47	112	29.0	No	No	No	No	No
Zinc	130	600	122	150	271	82.6	No	No	No	No	No
					-						
Napthalene	0.1	-	0.08	0.16	0.319	0.016	No	N/A	No	No	No
Acenaphthylene	0.1	-	-	-	0.128	0.011	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.007	No	N/A	N/A	N/A	No
Fluorene	0.1	-	-	-	0.144	0.016	No	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.122	**Yes**	N/A	**Yes**	No	No
Anthracene	0.1	-	0.05	0.085	0.245	0.034	No	N/A	No	No	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.178	**Yes**	N/A	**Yes**	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.188	**Yes**	N/A	**Yes**	No	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.085	No	N/A	**Yes**	No	No
Chrysene	0.1	-	0.02	0.384	0.846	0.095	No	N/A	**Yes**	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.095	No	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.043	No	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.106	**Yes**	N/A	**Yes**	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.066	No	N/A	No	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.079	No	N/A	No	No	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.014	**Yes**	N/A	N/A	N/A	No
PCBs	0.02	0.18	-	-	0.189	0.002	No	No	N/A	N/A	No
TBT	0.1	0.5	-	-	-	0.0015	No	No	N/A	N/A	N/A

Summary Table C

Cloch Point Contaminant Summary - Source: Marine Scotland

	Site Name	As mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg	Hg mg/kg	Ni mg/kg	Pb mg/kg	Zn mg/kg	ICES7 ug/kg	TBT+ mg/kg	(a)Pyrene (mg/kg)
ERL	Cloch Point	-	1.2	81	34	0.15	-	47	150	-	-	0.384
PEL		41.6	4.2	160	108	0.7	-	112	271	189	-	0.763
Min		0.00	0.08	43.08	3.83	0.01	15.89	45.74	43.97	8.61	9.82	0.17
Average		15.18	0.69	151.51	68.83	0.61	35.25	154.58	259.60	46.89	55.93	0.84
Max		28.36	1.52	243.03	163.31	2.84	54.56	302.99	1214.74	191.05	342.71	3.09

C PREVIOUS CONSULTATION RESPONSES

Redacted

From: Redact Red
Sent: ed acte 15 November 2018 15:47
To: Redacted
Subject: FW: Clyde Dredging 5 year consent

From R
Sent: 14 November 2017 16:18
To: Redacted
Subject: FW: Clyde Dredging 5 year consent

Redacte
d

Please see below

Best Regards

From: Redacted
Sent: 14 November 2017 16:16
To R
Subject: FW: Clyde Dredging 5 year consent

Redacted

Thanks for getting in touch about this. If I understand things correctly, the dredging (like the disposal) now requires a licence from Marine Scotland. In the event that Marine Scotland issue a licence you will not require a separate SSSI consent from SNH (a rare example of reducing bureaucracy!). When assessing the licence application Marine Scotland will consult SNH for our views on the SSSI/SPA. Assuming similar methods are proposed to those used previously, I wouldn't anticipate any concerns from SNH.

Best wishes

Red
acte

Scottish Natural Heritage
Dualchas Nàdair na h-Alba

Redacted | Operations Officer – Strathclyde & Ayrshire | Scottish Natural Heritage |
Caspian House| Clydebank Business Park | Clydebank | G81 2NR |
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www.snh.scot

Redacted | Dualchas Nàdair na h-Alba | Taigh Caspian |
Pàirc Gnothachais Bhruach Chluaidh | Bruach Chluaidh | G81 2NR |
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www.snh.scot

Year of History, Heritage and Archaeology 2017

www.facebook.com/ScottishNaturalHeritage | www.twitter.com/SNH_Tweets

From: Redacted
Sent: 08 November 2017 16:00
To: Redacted
Cc: Redacted
Subject: Clyde Dredging 5 year consent

Good afternoon Reda
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Clydeport Operations Ltd, as the statutory Harbour Authority for the River Clyde and outer Firth, are currently renewing the maintenance dredging and disposal license. Previously (2011) Clydeport have sought consent from SNH in accordance with Section 13 (1) of the Nature Conservation Act (Scotland) 2004 for the dredge operations to take place during winter months in the vicinity of the Inner Clyde SSSI/SPA.

As part of the renewal process could I please ask if we can instigate the procedure to further extend the Consent for 5 years

Thanks and Regards

Redacted
Group Hydrographic and Dredging Manager

Peel Ports Group

Redacted
Redacted

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