BAE Govan
Best Practicable Environmental Options (BPEO) Report

February 2024

CONTROL SHEET

Client: BAE Systems Ltd
Project Title: BAE Govan
Report Title: Best Practicable Environmental Options (BPEO) Report
Document number: 14052
Project number: 178900

Issue Record

Issue	Status	Author	Reviewer	Approver	Issue Date
1	FinalV2	MMF	GD	GD	29/2/24
2					

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1 INTRODUCTION

1.1 Terms of Reference

This Best Practicable Environmental Option report (BPEO) has been prepared by EnviroCentre Ltd with regard to undertaking pre-dredge sampling at the existing shipyard site at Govan on the River Clyde, on behalf of BAE Systems Ltd.

Pre-dredge sampling was undertaken across the dredge areas in December 2023 to inform this Best Practicable Environmental Options (BPEO) Assessment and the marine licence application that will permit the dredging works to be undertaken. These relate to an application for a Maintenance Dredge Licence.

The purpose of this report is to review 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.

The following details the proposed dredge areas and maximum volumes present for the Govan site (note the application may incorporate a lower volume than this estimate). In addition the table details the proposed number of sample locations.

Table 1-1 Summary of Dredge Volumes and Sample Numbers

Dredge Area	Approximate Total Dredge Volume (m^3)	No. Proposed of Sample Locations
BAE Govan	Up to 24,999	5

The site is not located within any designated sites.

1.2 Action Levels – AL1 vs AL2

Two action levels are currently used to assess the suitability of sea-based disposal of dredged sediment material: Revised Action Level 1 (RAL1) and Revised Action Level 2 (RAL2).

Sediment with contaminant concentrations below RAL1 is generally considered to be below background levels for contamination and is suitable for disposal at sea.

For samples recording contaminant concentrations between RAL1 and RAL2, additional risk assessment may be required including further sampling and testing to fully identify pockets of contamination or implementation of bioassays to assess the materials suitability for sea disposal.

Material recording contaminant concentrations above RAL2 is generally considered to be unsuitable for disposal to sea. If the sea disposal route is to be pursued, further testing along the lines of bioassay accompanied by a robust justification for selecting sea disposal as the BPEO may be required. This would need to be supported further with additional information regarding any mitigation measures which could be put in place as part of these works. This would require further discussion and agreement with Marine Directorate.

1.3 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre Limited.

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2 SAMPLING LOCATIONS AND METHODOLOGY

Sediment sampling was undertaken on in December 2023. The following section details the sampling methodology used to retrieve sediment samples. Works were undertaken in line with the Sampling Plan agreed with Marine Directorate Licencing Operations Team however there were some access restrictions at the Govan site which resulted in changes to some specific sampling locations (see Section 2.6).

2.1 Proposed Sample Locations

Proposed sample locations are given in the table below.

Table 2-1: Proposed Sample Stations

Dredge Area	Sample Station ID	Latitude	Longitude	Sample Type	Depth of Intrusive Location from Bed Level to proposed target dredge level
BAE Govan	VC1A	55°52′02″N	004°19′25″W	VC	2m
	VC2A	55°52′02″N	004°19′30″W	VC	2m
	VC3A	55°52′03″N	004°19′30″W	VC	2m
	GB1A	55°52′04″N	004°19′29″W	Grab	1m
	GB2A	55°52′05″N	004°19′27″W	Grab	1m

The sampling works were subject to some constraints, as summarised in Section 2.6.

2.2 Sample Collection

All grab samples were collected using a 0.045 m^2 stainless steel Van-Veen grab or which was emptied into a plastic bucket for logging and sub sampling following best practice. Vibrocore samples were extruded into a core holder and split into two halves and photographed.

Sample logs are provided in Appendix B.

2.3 Field Information

The following field data was recorded for each sample obtained:

- A unique sample ID;
- Sample location;
- Sample coordinate in latitude and longitude in degrees, minutes and decimals of minutes;
- Date, time and depth of collection;
- Sampler's ID;
- Sediment description;
- Sample photographs; and,
- Details of any deviation from sampling protocol.

2.4 Sample Preparation

Grab samples and cores were photographed and logged prior to sub-sampling.

Samples for metals and particle sized analysis were sub-sampled using a plastic spoon and stored in plastic tubs. Samples for organic analysis were collected using stainless steel spoons and stored in amber glass jars.

Sampling equipment (spoons etc.) were cleaned with fresh water between samples to minimise the risk of cross contamination.

Once samples had been placed within appropriate containers, they were labelled and placed immediately into cool boxes for dispatch to the project laboratory (Socotec).

2.5 Analysis Requirements

The laboratory analysis undertaken as part of this assessment was as follows:

- Metals - Arsenic, Chromium, Cadmium, Copper, Mercury, Nickel, Lead, Zinc;
- Organotins - Tributyl Tin & Dibutyl Tin (TBT);
- Polycyclic Aromatic Hydrocarbons (PAH USEPA 16);
- Polychlorinated Biphenyls (PCB ICES 7);
- Total Hydrocarbons (THC);
- Moisture Content;
- Particle Size Analysis (PSA);
- Total Organic Carbon (TOC); and
- Asbestos (presence/absence).

Samples were dispatched to Socotec's Marine Laboratory for analysis, which holds UKAS accreditation for analysis of marine sediment samples.

2.6 Deviations from the Sampling Plan

Access to a portion of the proposed Govan dredge area was limited during the works due to the presence of a barge and a bubble curtain associated with the Govan Basin infilling works. As such locations were moved to areas of the dredge pocket that were accessible at the time of works.

The following table details the actual locations that were carried out during the works.

Dredge Area	Sample Station ID	Latitude	Longitude	Sample Type	Depth of Intrusive Location from Bed Level to proposed target dredge level
BAE Govan	VC1B	55° 53.080563	-4° 26.594084	VC	2m
	VC2B	55° 53.871088	-4° 30.469537	VC	2m
	VC3Aa	55° 53.408054	-4° 28.491159	VC	2m
	GB1A	55° 53.989437	-4° 28.970639	Grab	1m
	GB2A	55° 54.898975	-4° 27.068577	Grab	1m

Sample locations are shown in Appendix A.

3 RESULTS

All chemical analytical results were assessed against Revised Action Levels (RAL) criteria as adopted by Marine Scotland. The results are summarised below and within the Summary Tables provided in Appendix C.

Summary reports detailing exceedances in the Marine Scotland format have been submitted along with the supporting information for the application. Please note that there is a formatting issue in the sheet which incorrectly highlights samples with results in exceedance of RAL2. This is noted where samples have a "<" denoting less than the limit of detection. So while the sheet indicates there is a breach of RAL2, there are no RAL2 exceedances with samples being below detectable limits where a "<" is denoted unless otherwise specified.

Where contaminants have RALs as adopted by Marine Scotland, recorded exceedances above these criteria are summarised in Table 3-1.

All chemical data is reported and assessed on a dry weight basis.

Further consideration of these exceedances undertaken in Section 4.

Table 3-1: Exceedances of Revised Action Levels – BAE Govan

Contaminant	No. of Exceedances (of 11 samples)	
	RAL 1	RAL 2
Arsenic	0	0
Cadmium	11	0
Copper	11	0
Chromium	11	0
Lead	9	0
Mercury	7	0
Nickel	11	0
Zinc	11	0
PAH (All Species Maximum)	11	0
PCBs	10	0
TBT	0	0
THC	11	0
DBT	0	0

All of the samples recorded exceedances of various RAL1 criteria.

3.1 Asbestos

Asbestos (chrysotile) was detected in one sample – Govan VC2B 0.6-1.1.

4 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.

4.1 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 4-1 along with justification for screening out those options which have not been taken forward for further consideration.

Table 4-1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Harbour / Quayside	Leave in situ	Not an option due to the project maintenance dredge level requirements	No
	Infilling of an existing dry dock/harbour facility/development site (beneficial re-use)	We are not currently aware of any proposed developments in the local area which could accommodate this material. Given the % of fine material within the sediments being well in excess of 8% (typical acceptable value for engineering fill) it is considered that the engineering quality of the material will not be suitable for the majority of potential infill options.	No
	Beach Nourishment	Areas of the Firth of Clyde and North Ayrshire Coastline are designated sites (SSSI, LNR) 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 material to be dredged comprises a mixture of gravel, sand and silt. Fine sediments (i.e. silt) is not generally suitable for beach nourishment in the traditional sense.	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 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.	Yes

Location	Options	Screening Assessment	Carry forward?
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component and very high-water content. This makes it unsuitable for treatment/disposal by this route.	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 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 Firth of Clyde 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.	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 7 km from the closest proposed dredge site with an assigned licensed annual capacity of 830,000 tonnes.	Yes

4.2 Summary of Identified BPEO Options

Following review of the available options, two options were identified for further detailed BPEO assessment which are as follows:

- Landfill
- Sea Disposal

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

4.2.1 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 within this area. 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 sea. 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. 49,998 tonnes (approximately 24,999m^3) of material and approximately 3,125 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.

4.2.2 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.

5 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

5.1 Detailed BPEO Assessment

Each of the identified options was assessed against the criteria detailed in Table 5-1 below.

Table 5-1: 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

5.1.1 BPEO Strategic Assessment

Table 5-2 provides details of the strategic assessment for each option taken forward for the detailed BPEO assessment:

Table 5-2: 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. Four jetties which could be suitable for landing the spoil have been identified within 30 km of the dredge site; these are: • BAE SYSTEMS, Clyde Yards; • Faslane, Gare Loch. Owned and operated by MoD; • James Watt Dock, Greenock. Owned and operated by Peelports Clydeport Limited; and • Inchgreen Owned and operated by Peelports Clydeport Limited. Faslane and BAE Systems have been discounted by their owners as being unavailable for this type of activity. The James Watt Dock has previously been used for the unloading of aggregates and has been confirmed as being suitable but a temporary storage area is not readily available. Inchgreen may be suitable but further discussions on availability and storage area available are required.	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.

Criteria	Landfill	Sea Disposal
Availability of suitable sites/facilities	The geotechnical composition of the dewatered dredged material is considered likely 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. Although the quantity of material to be dredged is relatively small, it is likely that other waste types will be prioritised for acceptance at landfill.	The marine disposal site has been designed to accommodate the quantities typically generated by dredging operations. The chemical analysis of the sediments from the proposed dredge sites would indicate that the material is likely to be acceptable for testing pending further risk assessment for contaminants present at levels between Action Level 1 and Action Level 2.
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 landfilling.	This is an accepted disposal route as long as a Marine Licence is obtained.

5.1.2 BPEO Environmental Assessment

Table 5-3 below details the environmental assessment for each option taken forward for detailed BPEO assessment.

Table 5-3: 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.

Criteria	Landfill	Sea Disposal
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. Suitability of material would need agreed with landfill manager.	Pollutant concentrations in dredged material to be disposed are limited to acceptable levels through regulatory licensing processes. Information with regards to the type of disposal site with regards to its effects on sediments has not been provided. Previous correspondence with Marine Scotland has previously concluded that disposal sites in Scotland are Dispersive.
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 for limited short term local impact to commercial and ferry operations in the area of the dredged material handling and road hauling principally related to noise and dust potential.	Disposal at Cloch Point site has historically been used and is the closest licensed disposal site.
Amenity / Aesthetic Implications	Odour release from dewatering facility. Increase in 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.

5.1.3 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 49,998 tonnes (approximately 24,999m^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 7 hours per day for 5 weeks (though minimum hire charges may make this cost significantly greater);
- 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 SLfT3006 – Dredgings – Material removed from water, August 2018).

Table 5-4 provides details on the Cost assessment for each option taken forward for detailed BPEO assessment:

Table 5-4: BPEO Cost Analysis (based on 49,998 tonnes only)

Activity	Landfill Disposal (£)	Sea Disposal (£)
Dredging	160,494	160,494
Transport by vessel to disposal site	-	92,496
Dewatering Facility	100,000	-
Transfer of material to lorry	8,225	-
Transportation Cost	242,495	-
Landfill Gate Fee	1,499,940	-
Total Costs	**2,011,154**	**252,990**

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).

5.2 BPEO Scoring

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 to 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 5-5 provides a summary of the BPEO assessment.

Table 5-5: BPEO Summary

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

5.3 BPEO Assessment Discussion

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 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 incidents 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 out of the main options available. Additionally, the material is retained within the marine environment where it can be naturally redistributed over time.

6 FURTHER ASSESSMENT

As detailed in Section 1, on the basis of the exceedances of Action Level 1 and 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 C.

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 fingerprints 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 C, but have not been used as part of the further assessment as they typically fall below the RAL1.

The following section contains a 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). The conclusions drawn from the available information will provide a recommendation on proposed disposal routes.

6.1 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.

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 from the disposal ground in 1995, 1997, 2003, and 2005 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 the table in Appendix D 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.

6.2 Analytical Data Review

Existing analytical data for the proposed dredge site is provided in Summary Table A in Appendix C. 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 exceedances is detailed below:

6.2.1 Action Level 1

Exceedances of RAL1 can be summarised as follows:

- Arsenic (As): 0 of 11 samples recorded As concentrations above RAL1.
- Cadmium (Cr), Chromium (Ch), Copper (Cu), Lead (Pb) and Zinc (Zn): 11 of 11 samples recorded concentrations above RAL1.
- Mercury (Hg): 9 of 11 samples recorded concentrations above RAL1.
- Nickel (Ni): 7 of 11 samples recorded Ni concentrations above RAL1;
- PAHs: 11 of 11 samples tested recorded at least one PAH species above RAL1; and
- PCBs: 10 of 11 samples tested recorded exceedances of RAL1.
- TBT: 0 of 11 samples tested recorded exceedances of RAL1.

6.2.2 Action Level 2

There are no recorded exceedances above RAL2.

6.2.3 ERL & PEL Review

Exceedances of the ERL and PEL (where one is available) is summarised in Table 6-1 Full summary tables are provided in Table B in Appendix C: Note any contaminant of concern with N/A indicates no corresponding ERL or PEL value currently available.

Table 6-1: Exceedances of ERL and PEL

Contaminant	No. of Exceedances (of all 11 samples)	
	ERL	PEL
Arsenic	-*	0
Cadmium	0	0
Chromium	9	0
Copper	11	0
Mercury	11	0
Nickel	-	-
Lead	11	1
Zinc	11	3
PAH (All Species Maximum)	11	9

Contaminant	No. of Exceedances (of all 11 samples)	
	ERL	PEL
PCBs	-	0

*Note: where a '-' is noted, no assessment criteria is available.

6.3 Averages

Review of the averaged data for all the data has been undertaken i.e. considering the material as a single volume for disposal to reflect the likely potential that the material is dredged as part of one exercise. 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:

Table 6-2: Exceedances of ERL and PEL – Average Concentrations

Contaminant	Do Average Concentrations exceed?	
	ERL	PEL
Arsenic	-	No
Cadmium	No	No
Chromium	Yes	No
Copper	Yes	No
Mercury	Yes	No
Nickel	-	-
Lead	Yes	No
Zinc	Yes	No
PAH (All Species Maximum)*	Yes	Yes
PCBs	N/A	No

*Note – where values are available for review.

6.4 Previous Sampling Campaign Data

A previous sampling campaigns and assessment was undertaken in 2020 and concluded the following:

6.4.1 Govan Dredge Site

The information can be summarised as follows:

- All 5 samples exceed RAL1 for one or more metal;
- All 5 samples record exceedances of RAL1 for various PAH species;
- All 5 samples record RAL1 exceedances for THC
- 3 of 5 samples record total PCBs above RAL1;

- The ERL is exceeded in all samples by various metals and PAHs where values are available for review;
- The PEL is exceeded for lead (1 sample), and zinc (1 sample). The PEL is exceeded for a number of PAHs with acenapthene and phenanthrene having the most exceedances in 4 samples.
- No samples recorded contaminants in exceedance of RAL 2 where one is available for review.

6.4.2 Averages

Average concentrations for samples collected in the 2020 sampling campaign concluded the following:

- Averaged concentrations for both sites exceeded RAL1 for all contaminants of concern with the exception of arsenic and TBT.
- Averaged concentrations of chromium, copper, lead, zinc, and various PAH species exceed the ERL;
- Acenaphthene, fluorene, anthracene, fluoranthene, pyrenen, benzo(a)anthracene, chrysene, benzo(a)pyrene and dibenz(a,h)anthracene recorded averages which were above the PEL;
- All samples recorded average concentrations below RAL2.

In summary, the findings of the 2023 sampling reflect results and conclusions of previous sampling campaigns within the River Clyde.

6.5 Chemical Assessment Conclusions

Multiple samples recorded exceedances of RAL1 for metals, PAHs and THC.

Up to 11 individual samples recorded exceedances of the ERL for various metals and PAH species. Up to 3 samples were recorded above the PEL for heavy metals, however, when the averaged data is considered in all of the material proposed to be disposed of, there are no exceedances of the PEL recorded for heavy metals. Concentrations of a number of PAHs within the sediment samples when considered on an average basis exceeded the PEL, it is noted that this is similar to the findings of the previous 2020 sampling campaign.

Review of the background contaminant levels at the disposal site has identified that there are contaminants of concern with individual sample exceedances of the adopted ERL and PELs for the key contaminants of concern (PAHs). There is no PEL currently available for Nickel but the average concentration of the proposed dredge material is 30.7 mg/kg compared to 35.3 mg/kg at Cloch Point, based on available data. Additionally, the average concentrations of lead, zinc and various 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.

6.6 Water Framework Directive Assessment

As outlined in the Water Framework Directive Assessment: estuarine and coastal waters guidance (Environment Agency, 2017), there are several key receptors which can be impacted upon including the following:

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

Each of these points are considered in Table 6-3 below.

Table 6-3: Receptor Risk Assessment

Key Receptor[1]	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 area proposed to be dredged have previously been subjected to routine maintenance dredging. The dredge sites are within the Inner and Outer Clyde Estuary which is classified as a Heavily Modified Water Body (HWMB) of Moderate Status/Potential[2]. The disposal site is located within the Firth of Clyde Inner - Dunoon and Wemyss Bay area which is Classified as Good and is not considered to be heavily Modified. The classification of this water body takes into account the presence of the disposal site, so no further assessment is considered to be required.
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	No	The inner and outer Clyde Estuary and Firth of Clyde Inner - Dunoon and Wemyss Bay are all classified as Good Potential/Status or pass for Coastal and Transitional Waters for fish. The outer Clyde Estuary has been classified as High Potential Status for macro invertebrates. There was no classification for the inner estuary. Clyde Inner - Dunoon and Wemyss Bay are all classified as Good Potential/Status or pass for Coastal waters for macro invertebrates. Proposed material to be deposited as part of dredging campaign(s) similar in nature with material previously deposited. No further assessment considered necessary.

[1] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters
[2] https://map.environment.gov.scot/sewebmap/

Key Receptor[1]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	The inner and outer Clyde Estuary and Firth of Clyde Inner - Dunoon and Wemyss Bay are all classified as Good Potential/Status or pass for Coastal and Transitional Waters for fish. Proposed material to be deposited as part of dredging campaign(s) similar in nature with material previously deposited. No further assessment considered necessary. It is noted that under periods of exceptionally hot and dry weather the potential for oxygen related issues to arise i.e. oxygen depletion and it is proposed that dredging works will be avoided as far as practicable during such times.
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	The inner Clyde Estuary is classified as Bad potential/status or fail for “specific pollutants”. The outer estuary and Firth of Clyde Inner - Dunoon and Wemyss Bay are classified as Good potential/status or pass for “specific pollutants”. No classification is provided for the inner Clyde Estuary for status for “priority pollutants”. The Outer estuary and Firth of Clyde Inner - Dunoon and Wemyss Bay both are both classified as Good Potential/Status or pass for Coastal and Transitional Waters. Contaminants are noted to exceed CEFAS RAL1 within sediment samples. It is noted that sediments with comparable contaminant levels have been deposited at Cloch Point historically, chemical status has not been affected. Potential effects are considered to be both local and temporary. Further consideration of potential effects is discussed in section 6.7 for completeness. It is noted that no samples exceed RAL2.

Key Receptor[1]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
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	No	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 Lunderston Bay. The dredge and disposal sites are not designated as shellfish water. The closest Shellfish Waters Protected Areas are located at Kyles of Bute and Loch Striven over 20km to the south and west; and Loch Long located approximately 20km north of the disposal site. The locations of dredging activity area are within close proximity to (but not within) the Inner Clyde SPA and River Clyde Ramsar site. The minimum distance between any of the dredge areas and the designated SPA/Ramsar is approximately 40m. 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. However, given the close proximity of the works to the Ramsar/SPA, Scottish Natural Heritage (SNH) now NatureScot were previously consulted. Dredging works undertaken between mid-March and mid-September would have ‘no likely significant effect’ as birds would be absent. If dredging is to occur in the winter months, then SNH stated that a Habitat Regulations Appraisal will be required. The SNH response is included in Appendix D.

6.7 Potential Risk to Water Quality and Protected Areas

6.7.1 Water Quality

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

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

SEPA classified the coastal water body Firth of Clyde Inner - Dunoon and Wemyss in the area of the disposal ground as “good” for both specific and priority pollutants in 2018[3]. The dredge areas are all on the Inner and Outer Clyde estuary, which has an estuarine classification of “moderate ecological potential” (SEPA, 2018). No further information was available relating to the reason for the moderate status.

Although there are contaminants of concern above the RAL1 within the sediment for disposal, it is considered that these levels will not contribute to an overall degradation of water quality in proximity to the disposal site. While any effects are considered to be both localised and temporary, the potential for dilution in the Firth of Clyde (Firth of Clyde Inner - Dunoon and Wemyss) is considerable when comparing the size of disposal site in relation to the wider Firth of Clyde.

When the sediment results are reviewed as an average to assess the sediment mass as a single unit for disposal there are marginal exceedances for chromium, copper, mercury, lead and zinc, and PAHs. All averaged results were recorded below both the PEL and RAL2 for heavy metals however PAHs were recorded exceeding PELs.

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 (e.g. 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 local and temporary event and has been factored into the selection and location of the agreed disposal ground. Finally, the material sampled in the most recent campaign is similar in chemical nature to material previously deposited under licence. The average proportion of the three key size components in the samples is 0.93% gravel, 41.5% sand and 57.6% silt for the entire dredge site.

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 water quality classification for chemical status of the waterbody which accommodates the disposal grounds as “good”).

[3] https://map.environment.gov.scot/sewebmap/

The previous sediment quality report and BPEOs compiled by EnviroCentre in 2020, identified elevated metals and PAHs exceeding AL1 for sediment within the Govan dredge site indicating similar chemical quality findings to the samples collected the most recent sampling exercise. Water quality does not appear to have been impacted as a result of previous maintenance dredge exercise.

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 change in status of the waterbodies in question at both the dredge and disposal sites.

7 BPEO CONCLUSIONS AND RECOMMENDATIONS

Review of available information for the remainder of the analytes representing Govan Dredge Area has highlighted that although several contaminants of concern exceed RAL1 in sediment samples, assessment of key receptors identified from the Water Framework Directive assessment for estuarine and coastal waters concluded that there is a low risk of the sediments impacting upon the overall ecological or chemical status. Additionally, the contaminants of concern levels recorded in the sediment are not considered likely to have a significant adverse impact on the sediment quality already located within the disposal grounds and are at similar levels previously deposited at Cloch Point.

Overall, based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment for these samples, the recommendation for sea disposal is considered to be the BPEO for the maintenance dredge arisings.

REFERENCES

Environment Agency (2017). Water Framework Directive assessment: estuarine and coastal waters. https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

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

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

APPENDICES

A FIGURES


BAE Govan
Actual Sample Locations
Legend
Dredge Area
Sample Locations
River Clyde
River Clyde
GB1A
GB2A
VC2B
VC3A
VC1B
Google Earth
Image Landsat / Copernicus
100 m
N

B SAMPLE LOGS

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Scotstoun and Govan Sediment Samples 2023, Glasgow	**Location ID**
	Project No.	178900	**VC1B**
	Client	Arch Henderson	

SEDIMENT CORE LOG

Date/Time:	20/12/2023 11:30	**Latitude/Longitude:**	55° 52.051343, -4° 19.443235
Dredge Area:	Govan	**Sampled/logged by:**	AK/MMF
Method:	Vibrocore	**Core Length (m):**	2.0

Remarks:

0.0 – 0.5m
Very soft dark grey/brown silt with rare leaf litter.

0.8 - 1.3m
Stiff dark grey sandy silt with rare rootlets.

1.5 – 2.0m
Dark grey/brown silty sand with rare rootlets and a singular angular piece of gravel.

Biota: None noted.

Odours: None noted

Anthropogenic Inputs: None noted.

Notes: Position moved north from VC1A due to no access from positioning of silt curtain.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Scotstoun and Govan Sediment Samples 2023, Glasgow	**Location ID**
	Project No.	178900	**VC2B**
	Client	Arch Henderson	

SEDIMENT CORE LOG

Date/Time:	20/12/2023 10:15	**Latitude/Longitude:**	55° 52.064518 -4° 19.507826
Dredge Area:	Govan	**Sampled/logged by:**	AK/MMF
Method:	Vibrocore	**Core Length (m):**	2.0

Remarks:

0.0 – 0.15 (Grab)
Dark grey /brown sandy very soft silt with many H_2S blooms.

0.6 – 1.1m
Dark grey/brown semi-soft silt with frequent rootlets.

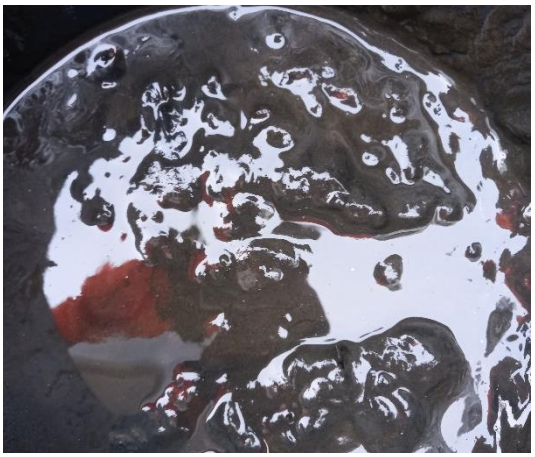
1.3 – 2.0m
Dark grey/black semi-soft silt with frequent rootlets.

Biota: None noted.

Odours: Strong decaying odour.

Anthropogenic Inputs: None noted.

Notes: Position moved north from VC2A due to no access from positioning of silt curtain.



envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Scotstoun and Govan Sediment Samples 2023, Glasgow	**Location ID**
	Project No.	178900	**VC3Aa**
	Client	Arch Henderson	

SEDIMENT CORE LOG

Date/Time:	19/12/2023 09:45	**Latitude/Longitude:**	55° 52.056801 -4° 19.474853
Dredge Area:	Govan	**Sampled/logged by:**	AK/MMF
Method:	Vibrocore	**Core Length (m):**	2.4

Remarks:

0.0 – 0.5m
Very dark grey/brown slightly clayey silt.

1.0 – 1.5m
Dark grey/brown slightly sandy silt with frequent roots.

1.9 - 2.4m
Dark grey/brown silty sand with frequent rootlets (at depths between 1.9 - 2.2m)

Biota: None noted.

Odours: Strong decaying odour.

Anthropogenic Inputs: None noted.

Notes: Position moved north from VC3A due to no access from positioning of silt curtain.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Scotstoun and Govan Sediment Samples 2023, Glasgow	**Location ID**
	Project No.	178900	**GB1A**
	Client	Arch Henderson	

GRAB SAMPLE LOG

Date/Time	19/12/2023 08:30	**Latitude**	55° 52.745619
Dredge Area	Govan	**Longitude**	-4° 21.876641
Method	0.045m^2 Van Veen Grab Sampler	**Sampled/logged by**	MMF/AK

Remarks: Very soft dark grey/brown SILT with rare leaf litter and many H_2S blooms.

Biota: None noted.

Odours: Very strong H_2S odour.

Anthropogenic Inputs: None noted.

Notes: -

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Scotstoun and Govan Sediment Samples 2023, Glasgow	**Location ID**
	Project No.	178900	**GB2A**
	Client	Arch Henderson	

GRAB SAMPLE LOG

Date/Time	19/12/2024 09:30	**Latitude**	55° 52.08165
Dredge Area	Govan	**Longitude**	-4° 19.451143
Method	0.045m^2 Van Veen Grab Sampler	**Sampled/logged by**	MMF/AK

Remarks: Very soft grey/black silt.

Biota: None noted.

Odours: Strong decaying odour.

Anthropogenic Inputs: None noted.

Notes: -

C DATA SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

Source	AL1	AL2	BAC CSEMP	ERL CSEMP	PEL Canada	GB1A 0.0-0.15	GB2A 0.0-0.15	VC1B 0.0-0.5	VC1B 0.8-1.3	VC1B 1.5-2.0	VC2B 0-0.15	VC2B 0.6-1.1	VC2B 1.3-1.8	VC3A 0.0-0.5	VC3A 1.0-1.5	VC3A 1.9-2.4	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Arsenic	20	70	25		41.6	8.5	8.6	12.8	11.7	16.6	10.9	7.6	9.8	9.5	12.2	11.4	10.87	0	0	0	N/A	0
Cadmium	0.4	4	0.31	1.2	4.2	0.74	0.84	0.92	0.82	0.51	0.94	0.67	0.56	0.8	0.79	0.7	0.75	11	0	11	0	0
Chromium	50	370	81	81	160	108	115	134	123	77.6	136	83.5	78.7	111	116	105	107.98	11	0	9	9	0
Copper	30	300	27	34	108	53.2	57.4	62.7	66.2	36.1	70.9	44.2	40.5	55.1	52.1	46.1	53.14	11	0	11	11	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.24	0.26	0.34	0.28	0.32	0.29	0.2	0.34	0.26	0.31	0.33	0.29	9	0	11	11	0
Nickel	30	150	36	-	-	30	36.4	30.1	27.7	22.4	42	33.7	24.4	32.6	33.9	24.8	30.73	7	0	2	N/A	N/A
Lead	50	400	38	47	112	85.4	96.5	107	98.2	62.6	113	91.2	71.4	99.2	96.8	85.7	91.55	11	0	11	11	1
Zinc	130	600	122	150	271	238	286	268	278	154	325	216	181	263	251	216	243.27	11	0	11	11	3
Napthalene	0.1		0.08	0.16	0.391	0.117	0.193	0.343	0.406	0.466	0.197	0.208	0.177	0.27	0.308	0.373	0.28	11	N/A	11	10	2
Acenaphthylene	0.1		-	-	0.128	0.0642	0.0764	0.116	0.0805	0.119	0.0859	0.055	0.0349	0.123	0.133	0.111	0.09	5	N/A	N/A	N/A	1
Acenaphthene	0.1		-	-	0.0889	0.0936	0.15	0.231	0.264	0.321	0.134	0.186	0.112	0.208	0.235	0.294	0.20	10	N/A	N/A	N/A	11
Fluorene	0.1		-	-	0.144	0.116	0.171	0.282	0.422	0.295	0.164	0.2	0.121	0.263	0.269	0.33	0.24	11	N/A	N/A	N/A	9
Phenanthrene	0.1		0.032	0.24	0.544	0.53	0.732	0.946	1.51	1.22	0.643	0.667	0.483	0.798	1.07	1.24	0.89	11	N/A	11	11	9
Anthracene	0.1		0.05	0.085	0.245	0.195	0.267	0.415	0.408	0.38	0.234	0.241	0.142	0.332	0.36	0.42	0.31	11	N/A	11	11	7
Fluoranthene	0.1		0.039	0.6	1.494	1.34	1.4	1.77	1.95	1.47	1.37	1.01	0.64	1.74	1.47	1.63	1.44	11	N/A	11	11	4
Pyrene	0.1		0.024	0.665	1.398	1.23	1.34	1.94	2	1.74	1.3	0.975	0.847	1.69	2.08	2.05	1.56	11	N/A	11	11	6
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.657	0.707	0.939	0.972	0.787	0.713	0.53	0.341	0.912	1.01	0.844	0.76	11	N/A	11	11	8
Chrysene	0.1		0.02	0.384	0.846	0.72	0.826	0.984	1.15	0.847	0.794	0.562	0.395	0.967	0.98	0.913	0.83	11	N/A	11	11	6
Benzo(b)fluoranthene	0.1		-	-	-	0.715	0.911	1.28	1.17	1.07	0.927	0.589	0.443	1.23	1.07	1.08	0.95	11	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.75	0.789	1.09	0.88	0.877	0.75	0.515	0.328	0.988	0.891	0.874	0.79	11	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.813	0.949	1.36	1.15	1.12	0.962	0.659	0.414	1.26	1.15	1.14	1.00	11	N/A	11	11	9
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.622	0.75	1.07	0.848	0.784	0.811	0.522	0.301	1.06	0.749	0.78	0.75	11	N/A	11	11	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.635	0.787	1.08	1.05	0.945	0.815	0.559	0.382	1.09	0.833	0.942	0.83	11	N/A	11	11	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.126	0.156	0.223	0.196	0.187	0.168	0.114	0.0711	0.227	0.167	0.173	0.16	11	N/A	N/A	N/A	8
TPH	100		-	-	-	1620	2030	2130	1720	1160	2290	1110	666	2380	957	1300	1578.45	11	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.03103	0.02475	0.05706	0.06101	0.02363	0.02503	0.01982	0.02961	0.03153	0.0358	0.03609	0.0341	10	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.005	0.005	0.0219	0.0307	0.005	0.005	0.0103	0.0285	0.005	0.0188	0.01	0.0132	0	0	N/A	N/A	N/A

Note: Underlined Values are < LOD. Values highlighted red are equal to or greater than AL1.
PEL Data Source: http://ceqg-rcqe.ccme.ca/en/index.html#void

Summary Table B

River Clyde 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	10.9	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.8	**Yes**	No	**Yes**	No	No
Chromium	50	370	81	81	160	108.0	**Yes**	No	**Yes**	**Yes**	No
Copper	30	300	27	34	108	53.1	**Yes**	No	**Yes**	**Yes**	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.3	**Yes**	No	**Yes**	**Yes**	No
Nickel	30	150	36	-	-	30.7	**Yes**	No	No	N/A	N/A
Lead	50	400	38	47	112	91.5	**Yes**	No	**Yes**	**Yes**	No
Zinc	130	600	122	150	271	243.3	**Yes**	No	**Yes**	**Yes**	No
					-						
Napthalene	0.1	-	0.08	0.16	0.319	0.28	**Yes**	N/A	**Yes**	**Yes**	No
Acenaphthylene	0.1	-	-	-	0.128	0.09	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.20	**Yes**	N/A	N/A	N/A	**Yes**
Fluorene	0.1	-	-	-	0.144	0.24	**Yes**	N/A	N/A	N/A	**Yes**
Phenanthrene	0.1	-	0.032	0.24	0.544	0.89	**Yes**	N/A	**Yes**	**Yes**	**Yes**
Anthracene	0.1	-	0.05	0.085	0.245	0.31	**Yes**	N/A	**Yes**	**Yes**	**Yes**
Fluoranthene	0.1	-	0.039	0.6	1.494	1.44	**Yes**	N/A	**Yes**	**Yes**	No
Pyrene	0.1	-	0.024	0.665	1.398	1.56	**Yes**	N/A	**Yes**	**Yes**	**Yes**
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.76	**Yes**	N/A	**Yes**	**Yes**	**Yes**
Chrysene	0.1	-	0.02	0.384	0.846	0.83	**Yes**	N/A	**Yes**	**Yes**	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.95	**Yes**	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.79	**Yes**	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	1.00	**Yes**	N/A	**Yes**	**Yes**	**Yes**
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.75	**Yes**	N/A	**Yes**	**Yes**	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.83	**Yes**	N/A	**Yes**	**Yes**	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.16	**Yes**	N/A	N/A	N/A	**Yes**
TPH	100	-	-	-	-	1578.45	**Yes**	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.034	**Yes**	No	N/A	N/A	No
TBT	0.1	0.5	-	-	-	0.0132	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

D HISTORIC SNH INFORMATION

Campbell Stewart

From: Dave Lang <Dave.Lang@nature.scot>
Sent: 10 December 2019 14:05
To: Fraser Russell
Cc: Campbell Stewart
Subject: RE: Clyde Maintenance Dredge Revisions

Hi Fraser,

As you may very well be aware, prior to the advent of Marine Licensing in 2010 SNH were required to regulate maintenance and capital dredging of the Clyde in that part of the channel that passed through the SPA.

Originally, our view was that dredging should be undertaken in the 'summer' months of April to August when the protected birds were not present as this meant that there was no requirement to undertake the potentially tricky process of establishing what impact dredging has on them in order to demonstrate on the basis of "no reasonable scientific doubt" (as required by the legislation).

This, ultimately, was not deemed to be a workable restriction by the Port Authority, as they often could not guarantee in advance when dredging equipment would become available to them.

Consequently, we were ultimately unable to avoid the whole process of Habitats Regs Appraisal and appropriate assessment.

Happily, with the help of sedimentation modelling carried out by the FRS Marine Lab, SNH were able to conclude that dredging OF THE SORT THEN BEING DISCUSSED would not impact on the protected birds, regardless of where it was undertaken in the Clyde. The main reason we were able to reach this conclusion in a manner that met the legislative tests was because it had been clearly demonstrated to us that the dredging equipment proposed for use in all of the projects for which Clydeport (as they were then) were seeking consent did not give rise to levels of noise or vibration that were in excess of those from normal shipping in the Clyde – to which we had confirmed that the birds were generally habituated.

So given all that I would say –

If all of your dredging for this project can be scheduled for the 'summer' months of – at the most generous – mid-March to mid-September, then the birds we are concerned about will likely be absent and there will be no issues. There will be 'no likely significant effect' and Marine Scotland need give the issue no further thought. (I presume that Marine Scotland will be the regulators for this project – with ourselves as statutory consultees?)

If that is not possible, and you would rather have the freedom to also dredge in winter, then Marine Scotland will need to perform and HRA. But if it can be demonstrated in some way that all of the equipment you refer to is either similar or better (in terms of noise and vibration levels) to that used by Clydeport for their capital and maintenance dredging prior to 2010, then that HRA should conclude that there will be no adverse effects on the birds and everything should still be fine.

I hope that the above helps in developing these proposals.

Yours,

Dave Lang
SNH Operations Officer
Strathclyde & Ayrshire