Appendix 2.1 Best Practicable Environmental Options Assessment Report

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BEST PRACTICABLE ENVIRONMENTAL OPTIONS ASSESSMENT REPORT

St. Ola Pier Redevelopment

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Best Practicable Environmental Options Assessment Report
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1 GENERAL

1.1 Introduction

This document relates to the proposed redevelopment of St. Ola Pier within Scrabster Harbour, Caithness. The pier previously serviced the Orkney Ferry service which has since relocated to the Queen Elizabeth Pier. The location of the works can be seen below in Figure 1.

Significant portions of the existing St. Ola Pier have corroded heavily thus restricting the functionality and operational capacity of the pier. Due to the advanced level of pile deterioration, operational restrictions have been placed on quayside activities. Whilst the outer pier is in significantly better condition, the pier as a whole cannot be utilised to its full potential without remedial works/refurbishment.

The decision has been taken by Scrabster Harbour Trust (SHT) to refurbish the pier to reinstate the previous level of functionality, and to extend the capabilities of the pier to accommodate cruise vessels on the outer berth. In addition to redeveloping the existing St. Ola Pier, Scrabster Harbour Trust wish to dredge the outer basin between St. Ola and Queen Elizabeth Pier to a level of -9m Chart Datum (CD). The design of the outer pier walls will permit future dredging of -10m Chart Datum (CD) should any future vessels require this draught capability.

Dredging is also proposed on the inner berth to a level of -7.5m Chart Datum (CD). This additional dredge depth within each berth will allow for larger vessels to berth within Scrabster Harbour such as cruise vessels on the outer berth.

The capital dredging works will require the removal of approximately 164,500m^3 (including over-dredge and some contingency) on the outer berth between St. Ola Pier & Queen Elizabeth Pier. The capital dredging works on the inner berth between the Ice Quay and the St. Ola Pier will require the removal of approximately 7,400m^3 (including over-dredge and some contingency).

In line with the Marine (Scotland) Act 2010, a license must be sought for any dredging activities where disposal of material is proposed. This report is presented in support of an application for a dredging license.

This report identifies the potential land based and marine based disposal options for the dredged material and compared them in order to identify the best practical environmental option (BPEO).

An Environmental Impact Assessment Report (EIAR) have been produced for the St Ola Pier Redevelopment Project including the dredging works, as such the wider environmental issues associated with the project shall not be considered here.

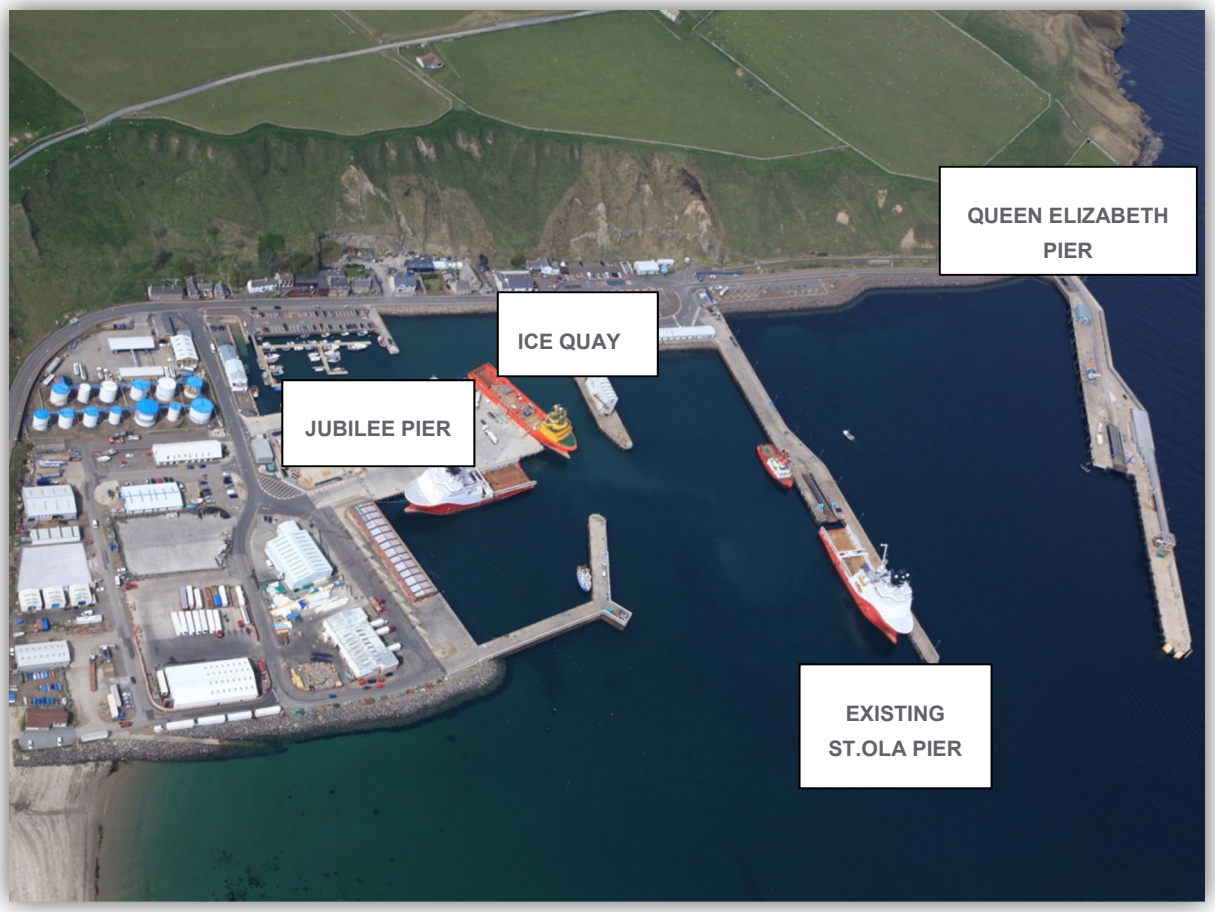

Figure 1 Location of Ola Pier (Source: SHT 2018)

1.2 Report Aims and Objectives

The main aim of this report is to assess the available disposal options for the dredged materials to support the submission of the marine license applications.

The key objectives of this report are to:

- Provide an overview of the requirement for dredging;
- Identify the location and estimated quantity of materials that are required to be dredged and provide a brief description of the methods likely to be involved to complete the works;
- Identify and assess the potential options for the disposal of dredged materials; and
- Provide recommendations with regards to the BPEO for the disposal.

1.3 Relevant Information

Land based & marine site investigations were undertaken in 2018 to specifically inform the redevelopment works including the dredging. The marine site investigation has been reviewed in relation to the anticipated nature of the dredge spoil.

1.4 Limitations

At present SHT are in the process of appointing a Principal Contractor for the works, who in turn will appoint a Dredging Contractor(s) under sub-contract to carry out the dredging works required as part of the redevelopment.

As the project is design & build in nature, the exact methodologies employed by the Principal Contractor, and Dredging Contractor(s) are not yet known.

Therefore for the basis of the EIA, license applications and this BPEO the techniques and production rates used are based on previous projects, technical expertise and where necessary assumptions are stated.

2 BACKGROUND INTRODUCTION

Scrabster is located on the north coast of Caithness and has a grid reference centre point of ND10437 70310. Scrabster is situated 1.5 miles northwest of Thurso, the largest town in Caithness, provides a ferry link to Orkney and is ideally located for access to the North Sea and Atlantic Ocean.

The proposed redevelopment is driven by the need to ensure the ongoing structural integrity of the existing pier. Due to the advanced level of pile deterioration, restrictions have been applied to quayside activities on the inner pier. Whilst the outer pier is in significantly better condition, the pier as a whole cannot be utilised to its full potential without remedial works/refurbishment.

Whilst ensuring the ongoing structure integrity of the existing pier, the opportunity has been taken to provide additional berthage for use by oil and gas supply vessels and cruise ships. In addition to providing additional berthage, dredging is required to allow for adequate draught for the larger vessels on both the inner and outer berths.

It is estimated that dredging will remove approximately 164,500m^3 (considering over-dredge and some contingency) of material between the outer berth between St. Ola Pier & Queen Elizabeth Pier. The dredging works on the inner berth between the Ice Quay and the St. Ola Pier will require the removal of approximately 7,400m^3 (considering over-dredge and some contingency). The dredging of both areas will be completed in one dredge campaign. The redevelopment will require in the region of 110,000m^3 of fill material and as such there is an opportunity for reuse should the material prove to be suitable.

Given the nature of the design & build contract the exact methodology for dredging is at this stage unknown. As a large degree of fill is required within the proposed new pier and reclamation it is possible that the Principal Contractor may wish to reuse this material within the new structures. In this scenario the dredging will likely be completed at a relatively slow rate using a backhoe dredger working on a barge, with the material recovered and then placed within the structures. Given that there is a greater volume of material generated by the dredging than is required for the works disposal options also need to be considered. It is also worth considering that it may not prove economical for the Principal Contractor to have such a long dredge campaign and they may choose to undertake a quicker dredging operation using a trailing suction hopper dredger, dumping the majority of the dredge spoil at sea. The programming of the dredging works will be determined by the Principal Contractor and would be subject to the contractor's programme of works, weather condition and any other restrictions that may be in place relating to harbour operations.

2.1 Description of Materials

An intrusive marine ground investigation was carried out by Fugro GeoServices Limited (Fugro) between October and November 2018. The ground investigation include 16 overwater boreholes with sampling and field testing, geotechnical and contamination laboratory testing. During the survey environmental samples were obtained from the top, middle and bottom of the strata and areas that were anticipated to require to be dredged.

The site work comprised the following:

- 5 cable percussion boreholes (BH05 to BH08 and BH11), to depths of 5.00 m below seabed level (BSL) and 7.50 m BSL;
- 11 combined cable percussion and rotary cored boreholes (BH01 to BH04, BH09, BH20 to BH23, BH24a and BH30) to depths between 7.65 m BSL and 26.00 m BSL;
- Standard penetration tests;
- Geotechnical logging, subsampling and core photography;
- Position surveying.

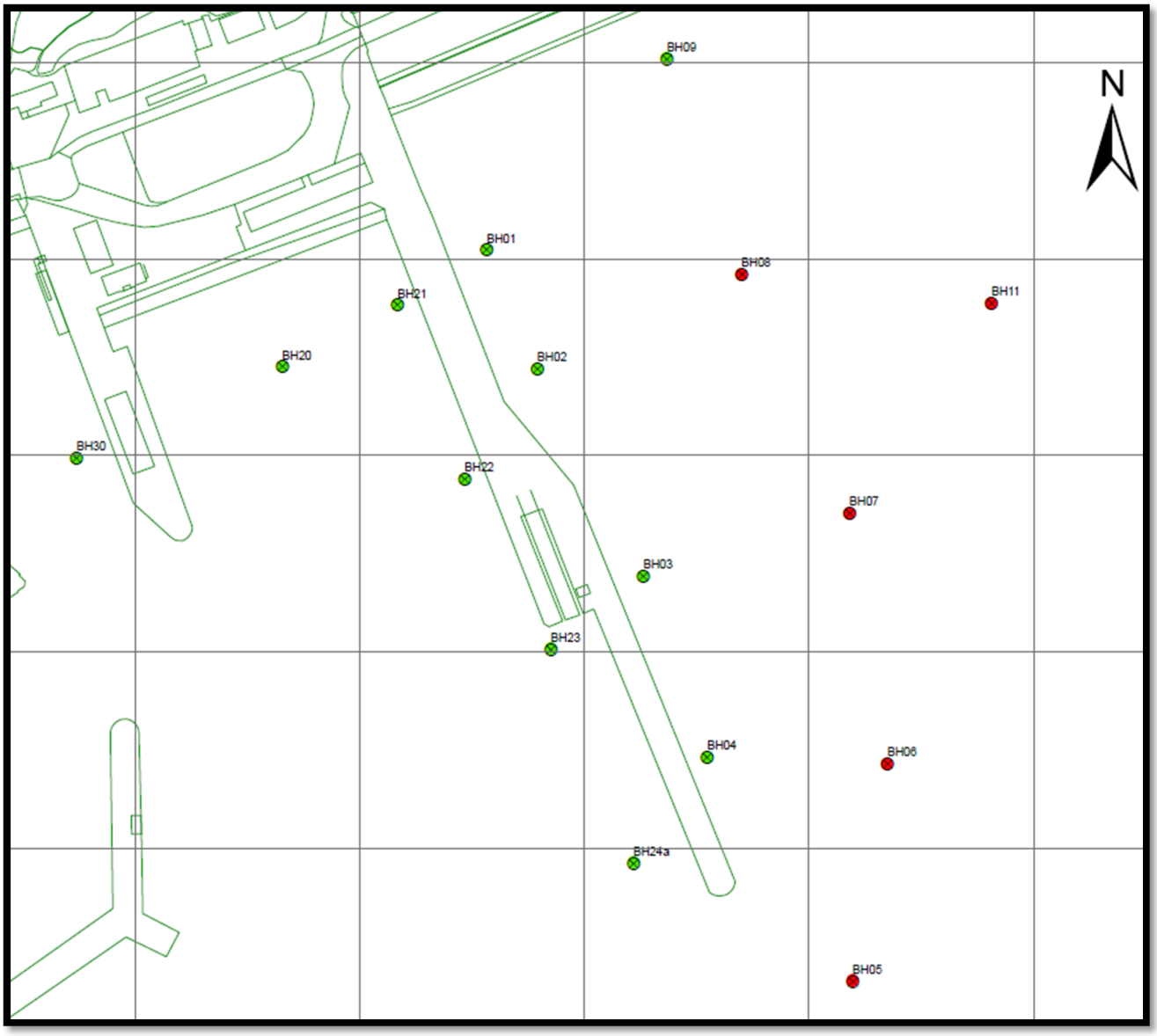

Figure 2 Borehole Location Plan

Data from the sediment samples completed as part of a recent Ground Investigation is presented within the Marine License Application for Dredging and Sea Disposal form and the Pre-Disposal Sampling Results Form. 26 No. samples were obtained from the boreholes in the upper strata during the marine ground investigation. The testing was conducted by Concept Life Sciences on behalf of Fugro as part of the Ground Investigation. The particle size distribution indicates the sediment generally consists of gravelly silty sands.

2.2 Suitability for Disposal at Sea

The sediments were also analysed for a suite of chemical parameters and screened against Marine Scotland Revised Action Levels (AL) 1 and 2 in order to identify any contamination which may be present. A number of samples within the dredge areas indicated levels above the lower chemical action level (AL1) for Copper, Nickel & Chromium. A summary of the results above AL1 can be seen in Table 1, it is highlighted that whilst each of the levels are marginally above AL1, they are well below AL2.

It is also noted that BH30 (highlighted in Table 1) has been completed to inform the possible routing of a fuel line from Jubilee Quay onto the Ice Pier, this area is not specified for dredging.

For the purposes of the BPEO the material is considered not to be contaminated.

Contaminant	Sample ID	Sample depth (m)	Sample concentration (mg/kg)	cAL1 (mg/kg)	cAL2 (mg/kg)
Copper	BH23	0.5-1.0	37	30	300
Nickel	BH20	0.5-1.0	41	30	150
	BH30	0.1-0.5	34	30	150
	BH30	0.6-1.15	37	30	150
Chromium	BH20	0.0-0.5	60	50	370
	BH20	0.5-1.0	95	50	370

Table 1 Lab analysis results for relevant cAL exceedances

2.2.1 Previous Dredge Campaigns

During the construction of the Jubilee Pier in 2012, 197,970m^3 of dredging was completed as part of the works. All of the dredge spoil generated from the dredging campaign was disposed of at the Scrabster Extension Disposal Site, which is located approx. 5km from Scrabster Harbour. The location of the dumpsite relative to St. Ola Pier is shown in Figure 3.

Figure 3 Location of Scrabster Spoil Ground

2.3 Suitability of Material for Reuse

In order to understand if reuse of dredge material is possible, the suitability of the material must be reviewed.

The effects of placing the dredged material within the proposed reclamation will need to be considered in the context of a number of elements:

- Impact on Suspended Sediments
- Risk to Water Quality
- Risk to Biodiversity
- WAC Testing (Waste Acceptance Criteria) of Material.

Further assessment on the suitability of the material for reuse from an engineering perspective have also been discussed in Section 2.3.5.

2.3.1 Impact on Suspended Sediments

The impact on the sedimentation within the harbour has been assessed within the Environmental Impact Assessment (EIA). A worst case assessment of all material being dumped at sea was completed within the Coastal Processes Chapter of the EIAR. The assessment of the plumes generated during dumping at sea of the total volume of dredge material illustrated no significant impact on the suspended sediment concentrations (SSC) around the harbour. A small increase in the SSC was shown during the dredging and disposal operations, with 25mg/l shown at the mouth of the Thurso River above background.

The proposed reclamation will require the placement of a volume of material considerably less on the seabed (approx. 45,000m^3) than the proposed dredge (172,000m^3 assessed within EIA). As such, it follows that the impact on the suspended sediment concentrations within the harbour would be similarly insignificant, and would be less widespread given the lesser volume of material.

Full details of the assessment completed as part of the Environmental Impact Assessment are included within EIAR Chapter 09 – Coastal Processes.

2.3.2 Potential Risk to Water Quality

The potential risk to water quality has been reviewed in the context of the materials being disposed of at sea, it has been considered that dumping the material at sea will have essentially the same impact as placing the material within the proposed reclamation. It is noted that both reuse and dumping at sea may be likely outcomes as the volume of material to be provided for the works is less than the proposed dredge volume.

As noted in Section 2.2, 6 samples tested indicated levels above the Revised Action Levels as stipulated by Marine Scotland. One sample (BH23), tested above cAL1 for Copper, 3 samples tested above cAL1 for Nickel (BH20, and two samples within BH30), and 2 samples tested above cAL1 for Chromium (both BH20). Whilst 6 samples, were marginally above cAL1, it is worth noting that these samples are confined to 3 boreholes on the inner basin and as such are not widespread. Furthermore, BH30 was completed to inform the potential fuel route, and as such no dredging is proposed for this area.

It is noted, that whilst these were higher than Action Level 1, there were significantly below Action Level 2.

It will be at the discretion of Marine Scotland, as to whether the material can be disposed of at sea. In the case that Marine Scotland allow for disposal of the material at sea it would be expected that the material could therefore also be reused within the works.

Full details of the assessment completed as part of the Environmental Impact Assessment are included within EIAR Chapter 10 – Water Quality.

2.3.3 Risk to Biodiversity

The impact of reusing the dredge spoil within the proposed reclamation has been reviewed in relation to the effects on the habitats, fish and shellfish and marine mammals.

2.3.3.1 Surveys and Sampling

Site specific surveys were completed to ascertain the sediment physical and chemical properties, and the characteristic benthic communities of Scrabster Harbour and the Thurso Bay area. The first survey was undertaken on 15 May 2018 to collect sediment samples to determine the physical and chemical properties of sediments within Scrabster Harbour dredging footprint to assess the suitability of sediments for repurposing within the proposed redevelopment of the pier and for disposal within the licensed marine disposal site. A total of nine grab samples were collected by divers from the dredge footprint, three samples on the western side of St. Ola's Pier and six samples on the eastern side. The location of the grab samples has been shown in Figure 4. Samples were analysed for organotins, metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and particle size analysis (PSA).

The second survey was undertaken on 7 February 2019 to determine and describe the benthic communities found within Thurso Bay and Scrabster Harbour, in waters between 5 m and 30 m that could be potentially impacted by the redevelopment. A total of 10 sediment samples were collected for the benthic survey, three of which were collected from within the proposed dredge footprint and seven from Thurso Bay.

It is noted, further chemical analysis was completed as part of the 2018 marine site investigation as noted within Section 2.2 & 2.3.2.

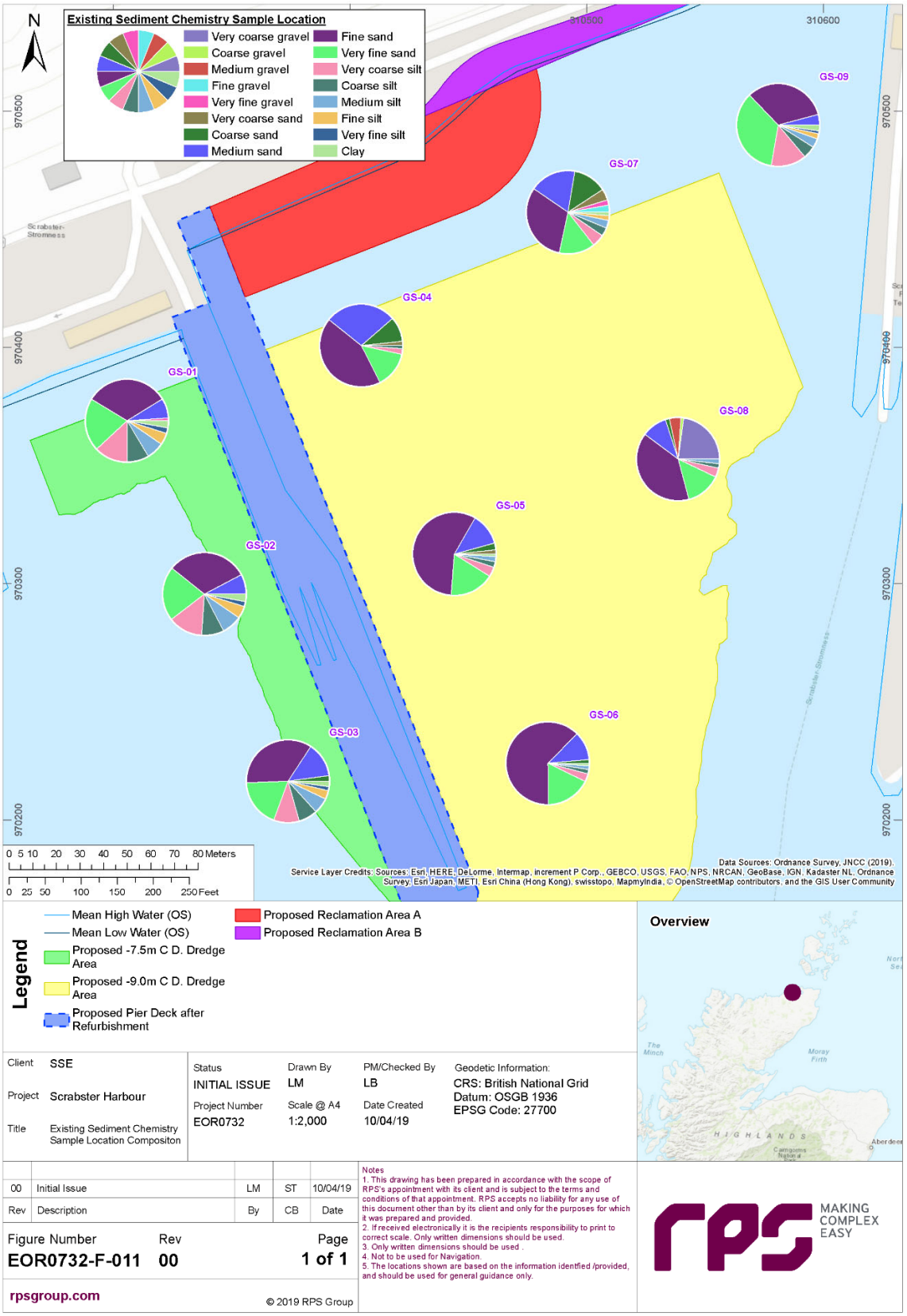

Figure 4 Grab Sample Locations (Taken May 2018)

2.3.3.2 Chemical Sampling Results

The results of the chemical analysis in relation to marine biodiversity have been compared to environmental quality standard thresholds, where relevant, including Cefas Action Level 1 (AL1), Cefas Action Level 2 (AL2), Canadian3 Threshold Effect Levels (TEL) and Probable Effect Levels (PEL).

Heavy Metals

All metal concentrations were below adopted thresholds except for sites 1–3 Metal concentrations which were elevated above AL1 and Canadian TEL threshold for metals arsenic, copper and nickel, all located the dredge footprint to the west of St. Ola Pier, shown on Figure 4.

Organotins

Dibutyltin (DBT) and tributyltin (TBT) concentrations determined from all samples were found to be below adopted environmental quality standard thresholds levels for sediments.

Polychlorinated Biphenyls (PCB)

PCB concentrations determined from all samples were found to be below AL1. AL1 is below the Canadian TEL and PEL thresholds.

Polycyclic Aromatic Hydrocarbons (PAH)

PAH concentrations were found to exceed the Canadian TEL for sites 4, 5,7 and 8 and CEFAS AL1 for all other sites, locations shown on Figure 4.

Overview

Cefas AL2 and Canadian TEL thresholds were not reached and broadly the area has low levels of contamination.

2.3.3.3 Outcome of Assessment

The assessment on marine biodiversity has been conservatively based upon the full dredge volume being disposed of at sea. As discussed previously, it is believed that this will have essentially the same impact as placement of the dredge spoil on the seabed within the proposed reclamation.

The impact of increases to suspended sediment concentrations and potential contaminant release (arising from dredging and disposal at sea) has been considered specifically in relation to habitats, fish ecology and marine mammals. This has considered the effects of disposal as based on the assessment of SSCs arising from dredging & disposal, and also the levels of contamination identified from the sampling discussed in 2.3.3.2. A summary of the significance of the effects for each of these receptors has been outlined below.

Receptor	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
Benthic Ecology	Low (Adverse)	Low	Negligible or Minor (Adverse)
Fish Ecology	Minor (Adverse)	Low – High (varies depending on species)	Negligible – Minor (Adverse)
Marine Mammals	Negligible	Low	Minor (Adverse)

Table 2 Summary of Significance of Effects on for Marine Biodiversity

Full details of the assessment completed as part of the Environmental Impact Assessment are included within EIAR Chapter 11 – Marine Biodiversity.

2.3.4 WAC Testing of Dredge Material

Chemical analysis of twenty sediment samples for a range of potential contaminants followed by assessment of the analytical results using the HazWasteOnline WM3 Waste Classification tool was undertaken on dredged sediments from St Ola Pier. Where sufficient data was not available we have made assumptions based on the information supplied to us and using our professional judgement.

The HazWasteOnline WM3 Waste Classification tool indicated that ten samples constituted Non-Hazardous waste and ten samples constituted Potentially Hazardous waste due to the concentration of TPH within these samples.

TPH analysis was completed on thirteen of the twenty samples. Three of the samples recorded TPH concentrations below the method detection limit (1 mg/kg) while ten samples recorded concentrations ranging from 2 to 21 mg/kg and are potentially hazardous with hazardous property HP3 (Flammable). Certain determinands, in particular petroleum hydrocarbons, are classified as potentially hazardous within the HazWasteOnline tool due to this hazardous property. However it is our opinion that as these are dredged sediments with high moisture content, they will not be flammable as a result of the contamination and as such the 'Flammable' properties have been forced to Non-hazardous within the assessment.

The analysis suite is incomplete at the following locations which leaves gaps in the analysis:

- BH01 (0.0-1.0m)
- BH02 (4.5-5.5m)
- BH08 (4.5-5.0m)
- BH21 (1.5-2.0m)
- BH22 (3.0-3.5m)

In conclusion, twenty samples were assessed using the HazWasteOnline WM3 Waste Classification tool which indicated that ten samples were Non-Hazardous and ten samples were deemed provisionally Potentially Hazardous due to their TPH concentrations. However as explained above, the 10 provisionally Potentially Hazardous samples are considered to be Non-hazardous due to their moisture content as dredged sediments. Therefore in summary, based on the chemical parameters that were analysed, the twenty samples are considered Non-Hazardous waste.

The Non-Hazardous nature of the material as described by the WAC testing has indicated that the material would be suitable for reuse within the proposed reclamation.

2.3.5 Engineering Suitability

From an engineering view point the material appears to be suitable for reuse. The particle size distribution tests completed as part of the marine site investigation lab testing has shown the dredged material to be a fine to medium sand with some gravel and a small amount of silt, typically of about 8% less than 0.063 mm diameter.

The typical grading of the dredge material as utilised within the Coastal Processes has been included below.

% Of	Grain Size
Sample	mm
6	1.500
3	0.630
7	0.250
36	0.180
28	0.120
12	0.072
4	0.050
4	0.030

Table 3 Grading of Dredge Sediment

2.3.6 Conclusions

The risk to the various receptors appears to be low in relation to suspended sediments and potential contamination release caused by placement of the dredge spoil within the proposed reclamation.

In addition, the material appears to be suitable for repurposing in a reclamation from an engineering perspective.

3 BPEO METHOD

3.1 Introduction

In order to identify the BPEO, the following method has been employed.

- Identification of options available;
- Assessment of these options based on the criteria detailed below; and
- Comparison of the advantages and disadvantages of the options.

3.2 Identification of Options Available

As several of the options share common logistical steps to disposal all options have been divided in to land based disposal or marine based reuse / disposal categories (See Section 4).

3.3 Screening

A screening process has been carried out to remove options which are technically unfeasible from the assessment process. Where options have been screened out a reason is provided.

3.4 Assessment of Options – Criteria

3.4.1 Practical Considerations

3.4.1.1 Established Practice

Consideration regarding the techniques and technologies proposed. Is this an established method for disposal of dredge material. If so, the performance of the option can be assessed, and any potential obstacles anticipated.

3.4.1.2 Operational Aspects

Consideration if the method is operationally and technically feasible for implementation at Scrabster Harbour. This includes information on handling, spatial considerations, transport etc.

3.4.1.3 Availability of Sites / Facilities

Determination if the facilities and / or sites required for the reuse or disposal of material are available in the vicinity of Scrabster Harbour.

3.4.1.4 Legislative Implications

Determining if any licenses / permissions are required in accordance with the relevant legislation and potential management control required.

3.4.1.5 Extent of Control

Determining whether SHT will have control over each stage of the operation from dredging to disposal as required by the Environmental Protection (Duty of Care) Regulations 1991.

3.4.1.6 Third Party Considerations

A summary of the outcome of any consultations will relevant authorities or agencies. Assessing the public opinion on the works based on relevant information available and previous consultations.

3.4.2 Environmental Considerations

- Safety Considerations – Identifying any potential sources of hazard and the probability of risk to the public, site users or workers.
- Public Health Implications – Identifying any risks to public health based on predicted contaminant pathways and receptors.
- Pollution / Contamination and Waste Implications – Assessing if there is potential for contamination / pollution exceedances above Marine Scotland Action Levels.
- Interference with Other Activities – Other potential disruptions including but not limited to activities including interference with traffic and users of the site and associated access roads.
- Amenity / Aesthetic Implications – Determining if there is likely to be any adverse impact on amenities in the area. Assessing if there is likely to be a visual impact as a result of reuse /disposal of the dredged materials.

3.4.3 Cost Considerations

It should be noted that cost estimates are based on typical industry rates, previous projects and / or professional judgement and no consultation has been carried out to determine specific costs for this site detailed in this document.

4 AVAILABLE OPTIONS FOR DREDGE MATERIAL

4.1 Introduction

There are three main options for management of the sand/gravel/clay arisings from the dredging of Scrabster Harbour.

4.1.1 Do Nothing – Prevention

The main approach to avoiding the generation of waste would be to avoid undertaking any dredging with the harbour at Scrabster. The principle driver in dredging the outer basin within the harbour is to facilitate larger vessels which would be proposed to berth on the upgraded pier, particularly cruise vessels and offshore supply vessels which will berth at the proposed redeveloped pier structure. The existing St. Ola Pier structure has reached the end of its serviceable life. Given that major maintenance works would be needed to simply reinstate the original capacity of the pier, it was decided to upgrade the structure with a view to accommodating larger vessels. If the dredging were not completed these vessels would not be able to navigate safely within the basin, reducing the potential for Scrabster to attract further business from the cruise and oil & gas sectors. Dredging is therefore seen as essential for the proposed redevelopment of the St.Ola Pier.

Whilst it is not possible to provide the operational requirements without dredging at Scrabster Harbour, in outlining the requirements for the dredge basin the dredge area has been defined to provide the required functionality with the least possible dredge volume. The requirements have been optimised to allow for the safe and efficient navigation of vessels up to 64,000t (Gross Tonnage), and of 8.2m draft.

Measures to prevent, and where not possible, reduce the volume of waste generated by the project dredging have been explored. The proposed dredge area provides the minimum dredge requirement to allow for the vessels proposed to navigate and berth safely within Scrabster Harbour.

4.1.2 Reuse

Given that dredging has been identified as an essential part of the redevelopment of the St Ola Pier, potential options for reusing the dredge arisings have been identified.

Potential reuse options identified are:

- Beach nourishment/coastal reclamation;
- Spreading on agricultural land;
- Aggregate production
- Reuse within the redeveloped pier and new reclamation

4.1.3 Disposal

Disposal options for the dredge arisings have also been considered and are identified as follows:

- Disposal to landfill
- Sea disposal.

As several of the options share common logistical steps to reuse/disposal, all options have been divided into land based reuse/disposal or marine based reuse/disposal categories.

4.2 Land Based Reuse/Disposal Options

The dredge materials which are deemed suitable for use within the works by the Principal Contractor should be placed directly within the land reclamation or stored on land until placement within the reclamation is possible.

If the dredge materials are unsuitable for reuse and the materials are to be reused elsewhere or disposed of on land there are a number of stages involved in conveying the materials to the site / facility for disposal. These involve landing, storage, dewatering, loading, and transporting the material and are further detailed below.

1. Landing the Dredged Material

The material must be transferred to an onshore facility. Methods available include using an excavator, pumped discharge or grab. It is assumed that the material would be landed using an excavator to a site near Scrabster Harbour.

2. Dewatering of the Dredged Material

If the dredged material is to be disposed of on land, dewatering of materials (to approximately 10% water content depending on the water content requirements to transfer and place the final material) is necessary in order to transport the material and / or create a material which is suitable for land based disposal. The methods used for dewatering dredge materials include the construction of settling lagoons and / or the use of a mobile centrifuge or hydro cyclone systems. Due to space constraints it is assumed that centrifuge or hydro cyclone system would be utilised to dewater the material.

3. Storage of Dredged Material

When the dredged material has been landed and dewatered it will require a storage facility prior to transport for final disposal. Assuming a weight of 2 tonnes per $1m^3$ of dredge spoil, a space would be required to store approximately 172,000 m^3 of material. Based on a 5m high storage mound, an area of approximately 185m x 185m (34,225m^2) would be required. It is highly unlikely that this size of area would be available within Scrabster Harbour to store the entirety of the material.

Such a storage area would also require an extended area around it to maintain safe working in the area and avoid issues with any adjacent works, roads etc due to slippage of materials. Dust mitigation and management would also require consideration within the method statement for the storage of the dredged material.

4. Loading

To transport the material to disposal sites or facilities, construction of a loading facility adjacent to the storage and dewatering area is necessary. Hard standing areas would be necessary to allow HGVs to receive material loaded by mechanical excavators.

5. Transport

It would be necessary to use sealed HGVs for the transport of material due to the potential for spillage nuisance. The time and cost of this transport is dependent on the location of the reuse / disposal site and is detailed further in Section 5.

4.2.1 Beach Nourishment

Beach nourishment involves the deposit of the dredged material on a beach. Considered as a land based reuse option, this process would involve all the steps detailed above as well as possible desalination. This option specifically requires material of a similar colour and composition to the receiving beach.

4.2.2 Spreading on Agricultural Land

Certain agricultural wastes qualify for an exemption from waste management licensing for treatment to land. Disposal of marine spoil to agricultural land is likely to involve the additional step of desalinisation. This would require space for lagoons and construction of a suitable treatment facility to allow leaching of salt back into Scrabster Harbour.

4.2.3 Disposal to Landfill

Dispose of dewatered material to landfill.

4.3 Marine Based Reuse/Disposal Options

4.3.1 Reuse within Redevelopment

Reusing the dredge spoil within the redevelopment would involve placing the dredged material directly onto the reclamation area or within the new pier structure.

4.3.2 Sea Disposal

Disposal of the dredged material to sea involves the transport of material to a licensed marine disposal site by vessel.

5 SCREENING

Options have been assessed with regards the technical feasibility for this given project to identify whether or not they should be taken forward for detailed assessment.

Option	Is it Technically Feasible?	Remarks
Land Based	**Questionable**	**All land based solutions will require space near the development site to allow them to be implemented. Potential space constraints will make all land based options difficult to implement.**
Beach Nourishment	Questionable	Whilst there are no SACs or MPAs within Scrabster Harbour, consideration has been given to the designated bathing waters of Thurso Bay. The dredge material has been classified as gravelly silty sands, and as such it is expected that these are more cohesive (and potentially more poorly oxygenated) potentially hosting slightly different ecological communities than those characterising the coastal habitats outside the harbour. Additionally, the cost of transporting the material to another area will attract a cost which makes this an unattractive option.
Spreading on Land	No	The use of a natural low-cost material for enhancing the growing qualities of agricultural land at first sight appears to be attractive. However, the material has the following properties: - There is a high concentration of chlorine present from the sea salts encompassing the silt particles. Chlorine is a horticultural poison. This will be present whether dry or wet silt is used. There are costs involved in the transport and application of the material to fields. There is a lack of suitable sites capable of accepting the dredged material. Given these factors this option should be discounted.
Disposal to Landfill	Yes	Various land disposal sites have been identified. This operation will be given further consideration in Section 6 of the assessment and is considered to be a potentially viable disposal option.
Marine Based	**Likely**	**Both marine based solutions appear to be viable.**
Reuse with Redevelopment	Likely	Information on particle size distribution obtained during the Ground Investigation works indicated that the material is likely to be suitable for reuse in the works either in the pier or the new reclamation. However, it will be the responsibility of the Principal Contractor to determine whether or not the material is suitable to meet the design life requirements of each structure.
Sea Disposal	Yes	There is a disposal site in close proximity to Scrabster Harbour, the Scrabster Extension Spoil Ground which is approx. 5 km from Scrabster Harbour. Option taken forward for detailed assessment in Section 6.

Table 4 Options Screening

6 OPTIONS ASSESSMENT

6.1 Introduction

In this section the potential land based reuse and disposal, and marine based disposal options are described and the constraints for each option are outlined. For both land and marine based disposal there are several stages from dredging to the ultimate destination of the material. These are described in Section 4. The potential disposal options are then assessed against criteria detailed in Section 3.4 and the advantages/disadvantages of each are discussed.

6.2 Land Based Disposal

6.2.1 Disposal to Landfill: Practical & Legislative Considerations

6.2.1.1 Established Practice

Dredged material is sometimes disposed of at landfill. However, these are normally small volumes as larger amounts of material use valuable landfill space.

6.2.1.2 Operational Aspects

This option presents logistical difficulties with regard to landing, dewatering, storage and transport of the dredged material, however the material sampled during the Ground Investigations was generally deemed chemically suitable for disposal at landfill.

A mobile dewatering unit such as a centrifuge would be required to dewater sediment.

6.2.1.3 Availability of Sites / Facilities

Following the waste classification of soil results, the material is potentially hazardous with HP3 (Flammable) due to TPH concentrations. However, as the material is dredged sediment (wet), it is not considered to be flammable as a result of this contamination and can therefore be classed as Non-hazardous for disposal.

There is one SEPA authorised operational Non-hazardous landfill site within 30minutes travelling time of Scrabster Harbour at Seater. Three more sites are within four hours travel (Granish, Nether Dallachy, Duisky) and an additional four landfill sites within five hours travelling time. These sites are shown in Figure 4.

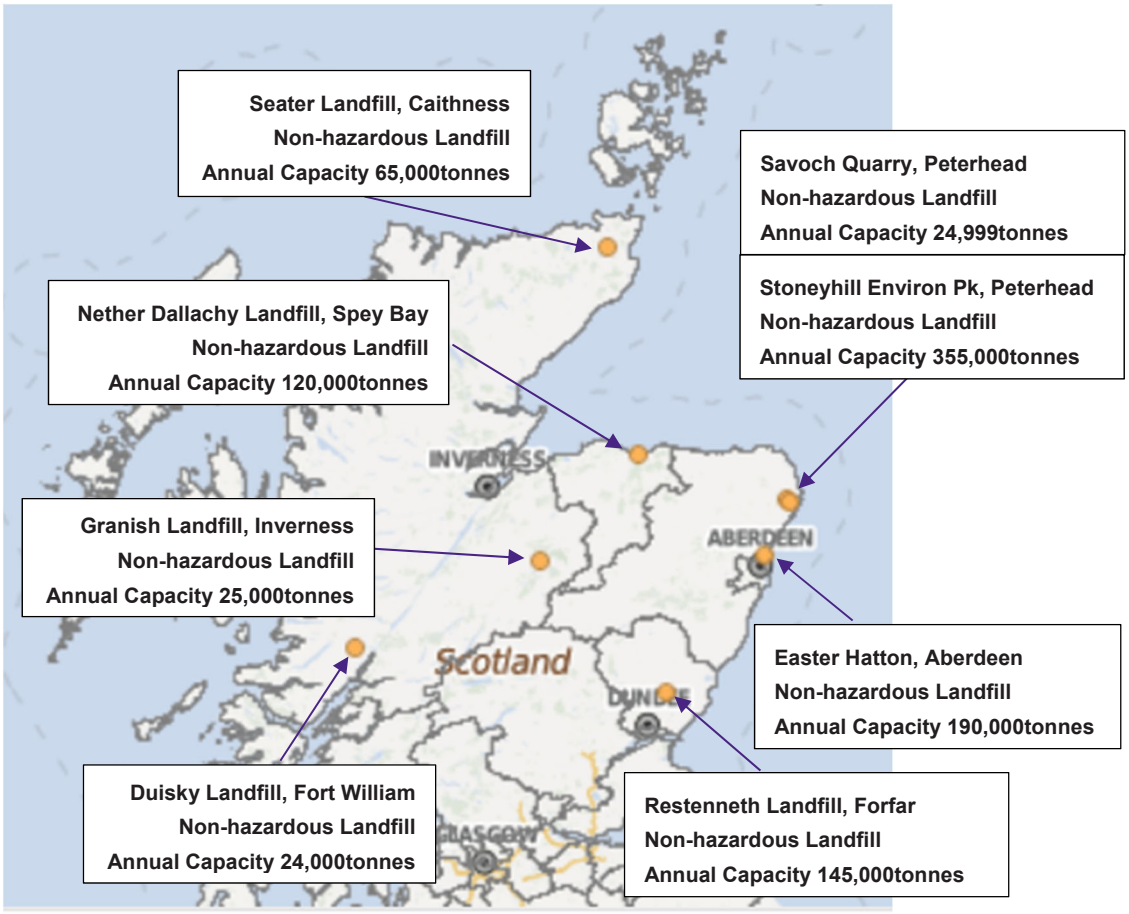

Figure 5 Landfill Sites near Scrabster Harbour

Ideally the total volume of material would be sent to one landfill site, however due to the total volume anticipated this would be more than the annual capacity of the nearest landfills. Thus, additional time and vehicles would be required to split the volume across several sites or to transport it a larger distance therefore increasing costs. Additionally, the Nether Dallachy landfill site is nearing overall capacity with only 84,000 tonnes currently available in total meaning it may not be able to receive much if any material. Based on an estimated total weight of approximately 344,000 tonnes of material, some of the material will require transport for 5 hours to landfill sites.

6.2.1.4 Legislative Implications

The material would be classified as controlled waste for the purposes of transport, storage, and disposal. The Waste Management Regulations 1994 require a waste management license for disposal. Section 34(7) of the Environmental Protection Act 1990 and Section 1 of the Control of Pollution Act 1974 will apply and it is likely compliance is possible.

6.2.1.5 Extent of Control

SHT would not have direct control over the transport of the material, however they would carry out audits to demonstrate 'Duty of Care'. Additionally, it would be necessary to agree a final contract with the landfill site operator for the disposal of the waste.

6.2.1.6 Third Party Considerations

The National Waste Strategy for Scotland 1999 (Reference 5) prefers a reduction in the quantity of waste sent to landfill and therefore there may be objections from the Scottish Environment Protection Agency (SEPA) as waste regulators regarding the loss of landfill capacity to dredge material.

6.2.2 Disposal to Landfill: Environmental Considerations

6.2.2.1 Safety Considerations

Road safety risks associated with the transport of dredged materials have the potential to increase particularly if HGV's are travelling through settlements.

Whilst there would be a number of HGVs involved with the removal of the material to landfill, the EIA traffic assessment has shown that general construction vehicle movements will be greater than those required to remove the dredge spoil to landfill by road. And as such the impact of the removal of the dredge material by land will be no greater than the construction associated vehicle movements.

However, it is acknowledged that there will be safety considerations associated with the removal of the dredge spoil by land.

Full details of the assessment completed as part of the Environmental Impact Assessment are included within EIAR Chapter 05 – Traffic and Transportation.

6.2.2.2 Public Health Implications

Air Quality

If HGVs are used to transport the materials through settlements there may be a limited, short term decrease in air quality due to exhaust fumes.

The effects of the construction activities have been explored and analysed within the Project EIA and EIAR.

The conclusions drawn from EIA stated that whilst there would be a short term decrease in the air quality due to increased vehicle activity associated with the construction works, the overall effects were negligible. However, it is still acknowledged that there will be some short term effects associated with increased vehicle activity.

Full details of the assessment completed as part of the Environmental Impact Assessment are included within EIAR Chapter 06 – Air Quality and Climate.

Noise and Vibration

Similarly, the use of HGVs to transport dredge spoil away from the site will lead to a short term increases in noise and vibration levels.

This has also been investigated as part of the EIA which concluded that noise impacts from increased traffic resulting from the proposed redevelopment would be negligible. However, it is still acknowledged that there will be some short term effects.

Full details of the assessment completed as part of the Environmental Impact Assessment are included within EIAR Chapter 07 – Noise and Vibration.

6.2.2.3 Pollution / Contamination and Waste Implications

The landfill site operator is responsible for accepting waste. The Ground Investigation indicated the material consists mainly of gravelly silty sands which is potentially problematic as it could interfere with drainage and leaching from the landfill site. Potentially hazardous levels of contaminants were present in many of the samples during the Ground Investigation. This contamination was classified as HP3 (Flammable) due to the Total Petroleum Hydrocarbon concentrations. However, as the samples are dredged sediment and therefore wet, they will not be flammable as a result of the contamination and the 'Flammable' properties are forced to Non-hazardous. Therefore, the material was generally deemed to be suitable for disposal at a non-hazardous waste landfill from a contamination perspective.

6.2.2.4 Interference With Other Activities

If this option was accepted it would result in a reduced space availability at the Scrabster Harbour which could impact existing and future operations due to reduced space, and loss of revenue.

6.2.2.5 Amenity / Aesthetic Implications

There is potential for a visual impact during the material treatment operations, and a limited impact on amenities through the noise, and vibration of the HGV transport to the landfill.

6.2.3 Disposal to Landfill: Cost Considerations

Cost estimates have been based on typical industry values, and previous experience. The number of tippers required for disposal and time for disposal has assumed transport to Seater landfill, which is the nearest of the suitable landfill sites. It has been assumed that each tipper will be able to make 9 round trips per day, allowing for the proposed 11 hour working day. Given the volume of material for disposal is much greater than the annual capacity of this site it is likely that other landfill sites will also be required and tippers will be limited to one or two round trips per day. The actual cost could therefore be significantly higher than estimated depending on the available sites.

For the purposes of the cost estimate it has been assumed that space would be available within the harbour estate to land the dredge spoil, in reality this may not be the case.

Process	Details	Approx. Cost
Bringing material to shore	Vessel hire, equipment to pump to shore	£250,000
Dewatering of dredge spoil	Dewatering machine to allow for material to be transported to landfill	£125,000
Transport to landfill	Hire of 12 nr tippers, 3 nr excavators plus required staff for 150 days	£500,000
Disposal at landfill	Landfill tax at £2.80/t plus an approximated gate fee of £10/t	£4,400,000
TOTAL		**£5,275,000**

Table 5 Cost Estimate to Dispose of Dredge to Landfill

6.3 Marine Based Disposal

6.3.1 Disposal at Sea: Practical & Legislative Considerations

6.3.1.1 Established Practice

Disposal of dredge spoil to sea is established practice.

The proposed dumpsite for the works, the Scrabster Extension Spoil Ground was the areas used for disposal during previous dredge campaigns at Scrabster Harbour.

6.3.1.2 Operational Aspects

The disposal to sea will have to consider the movements of the Northlink Ferry and other vessel movements in completing trips to and from the proposed dumpsite.

6.3.1.3 Availability of Sites/Facilities

The Scrabster Extension Spoil Ground proposed for the dredge spoil is approx. 5km from Scrabster Harbour and is the dumpsite which was used during previous dredge campaigns.

6.3.1.4 Legislative Implications

Under the provisions of Marine Scotland, a dredging license is required. This requires the acceptance of the BPEO by the statutory consultees.

Plume modelling completed as part of the Environmental Impact Assessment (EIA) confirmed that the disposal of the dredge material at the proposed dumpsite had minimal detrimental effect on the coastal processes within the harbour.

6.3.1.5 Extent of Control

The proposed disposal site falls partially within the Scrabster Harbour Limit, and as such SHT have control over passage to and from the site.

6.3.1.6 Third Party Considerations

The Scrabster Spoil Ground is a licenced disposal ground, and given that the dredge material has shown relatively low levels of contamination it is unlikely that there will be objections to disposal.

6.3.2 Disposal at Sea: Environmental Considerations

6.3.2.1 Safety

Given that the disposal operations are proposed for at sea there is minimal risk to public safety.

6.3.2.2 Public Health

Given that the disposal operations are proposed for at sea there is minimal risk to public health.

6.3.2.3 Interference with Other Activities

The dredging works will be completed as part of the construction activity associated with the St. Ola Pier Redevelopment and as such there will already be some level of disturbance to ordinary harbour operations.

SHT anticipate some level of disruption and can take appropriate action to minimise the impact on the harbour operations.

6.3.2.4 Amenity / Aesthetic Implications

There are unlikely to be any adverse visual impacts because of the dredging operation due to the location of the Scrabster disposal ground. The vessel will be visible from shore, however currently many vessels enter and exit the harbour daily therefore one additional vessel is unlikely to have significant adverse visual impact.

6.3.3 Disposal at Sea: Cost Considerations

Cost considerations for disposal at sea include for the hire of a split hopper barge, fuel, and staff costs.

Process	Details	Approx. Cost
Mobilisation/Demobilisation of TSHD, split hopper barges, and surveys		£200,000
Transportation of dredge spoil from outer berth to disposal site	Vessel hire, labour, etc	£1,000,000
Transportation of dredge spoil from outer berth to disposal site	Vessel hire, labour, etc	£45,00
TOTAL		**£1,245,000**

Table 6 Cost Estimate to Dispose of Dredge Spoil at Sea

7 COMPARISON OF OPTIONS

7.1 Reuse within Redevelopment

It is proposed that as much of the dredge spoil should be reused within the redevelopment as possible (if economically viable). However, in the case that all the dredge spoil is reused there will be an excess, which is anticipated as approx. 50,000-60,000m^3. As part of the consultation process, Scottish Environment Protection Agency (SEPA) have been contacted in relation to the redevelopment. SEPA inquired about the possibility of the dredge spoil being reused at the Dounreay site, which is in close proximity to Scrabster.

Scrabtser Harbour Trust sought to explore this option with a view to understanding if this would be feasible within the constraints of the project. SHT engaged in dialogue with Dounreay in May 2019.

Given that the project programme is of significant importance to the successful delivery of the project, liaison with Dounreay has suggested that the reuse at this site would not fit the time scales proposed for the project.

Additionally, whilst reuse at another site is an attractive option, this would require a significant area within the harbour to store the material and dewater prior to transport offsite. Scrabster Harbour Trust have indicated that such an area would not be readily available within the Harbour Estate particularly during construction, and trying to accommodate this additional area would significantly restrict harbour operations. Transport of the material to another site would attract considerable cost, in terms of transport to Dounreay by a number of HGVs, this additional cost would not be catered for within the proposed project budget. Furthermore, significant time and labour would be required to dewater and transport a significant volume of material offsite making the option more unattractive.

Given the reasoning outlined above, reuse of the material at another site, such as Dounreay has been deemed an unsuitable option.

Reusing as much dredge spoil as possible within the works will reduce the level of disposal required in addition to reducing the volume of imported fill required for the works.

7.2 Disposal to Landfill

Disposal to landfill is an unattractive option from a number of viewpoints. Although this is an established practice, the National Waste Strategy for Scotland (1999) favours a reduction in the amount of waste disposed of to landfill therefore there is potential for objections from waste regulators. Additionally, from correspondence received during the consultation process SEPA have stated their ambition to improve environmental performance by encouraging the reuse of waste where possible rather than disposal.

It is not entirely known at this stage if space would be available within Scrabster Harbour to allow for the landing of the dredge material. This would have a significant impact on harbour operations and is undesirable from a practicality aspect. There are also considerations relating to the effects on public health and safety arising from the volume of traffic associated with transporting such large volumes of material.

The cost associated with disposing the entirety of the dredge spoil to landfill is exorbitant and would make the project unaffordable rendering this option unsuitable.

7.3 Disposal to Sea

The disposal of the dredge spoil to sea is a relatively attractive option based on a number of considerations.

Disposal at sea offers a lower cost disposal option in comparison disposal to landfill. Additionally, as the dumpsite lies partially within the extents of Scrabster Harbour, SHT will have greater control over the disposal process.

Plume modelling completed as part of the EIAR has shown that the disposal of dredge material will have little effect on the coastal processes.

There are minimal risks posed to the public in regard to health and safety. Whilst some interruption to harbour operations would be expected, the dredging will take place during the construction phase and as such SHT will have anticipated and mitigated disruption as far as possible.

As discussed in Section 7.1, in the case that all the spoil can be reused in the works there will be some excess which will require disposal. Dumping at sea would be a cost effective option for disposal in this case where partial reuse and disposal was required.

8 CONCLUSION

On the basis of the waste hierarchy, the reuse of materials as part of the St. Ola Pier Redevelopment would be considered the Best Practicable Environmental Option for the dredge spoil. The assessment of the suitability of the material for reuse in Section 2.3 largely suggests the dredge material should be able to be reused within the proposed reclamation. However, given that there is a greater volume of material generated by the dredging than is required for the works disposal options also need to be considered. Additionally, given the nature of the contract and that the Principal Contractor has yet to be appointed, the proposed dredge methodology has yet to be confirmed. The choice of dredging methodology will tie in with the Contractor's proposed works and will likely be driven by the most economically advantageous option.

Taking this into consideration the BPEO for the dredge material is considered to be:

- Reuse material within the works as far as possible & disposal of surplus.

On assessing the various options for disposal, it is considered that the Best Practicable Environmental Option for disposal is sea disposal to the Scrabster Dump Site. Land based disposal options impose many additional special, time and cost constraints in comparison with sea-based disposal options and are therefore not considered a viable option for the disposal of the material especially given the storage area restrictions at Scrabster Harbour.

Whilst reusing the material at another site would be a potential option for the surplus material, it presents a number of difficulties from a practicality point of view. Prior to reuse, any material will require the same treatment as material being disposed of on land, i.e. storage on land and dewatering. Scrabster Harbour have indicated that there is limited availability for storage within the Harbour Estate and trying to accommodate this additional area would significantly restrict harbour operations. Additionally, there will be both time and cost constraints associated with transport offsite and landing and dewatering the material. The costs associated with the transport offsite of this material would be significant, and beyond what may be possible within the project budget. There are further complications in regard to finding a site in close proximity with volume capabilities matching those of the project, and also ensuring the project timescale aligns with the timing of the requirement for material. Based on this reasoning this options has been discounted.

Disposal of the material to the Scrabster site is recommended as it will allow the SHT to maintain control over most aspects of the operation and it is unlikely to pose significant risks to public health and safety. Cost estimates are expected to be significantly lower for this method of disposal and no additional space will be required at the harbour. Additionally, plume modelling completed as part of the Environmental Impact Assessment indicated that dumping at sea would have little effect on the coastal processes within the harbour.