



# **Girvan Harbour Dredge and Disposal Best Practicable Environmental Option Assessment**

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**Date:10/10/2018**

## Document Control

	Name	Title	Signature	Date
Author	[Redacted]			10/10/18
Reviewer				10/10/18
Authoriser				10/10/18

**Effective Date:** 10/10/18

Revision No:	Signature	Comments	Date
Draft 1	FH	For Client Review	23/9/18
1	FH	For Submission	10/10/18



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## 1 Introduction

This Best Practicable Environmental Option (BPEO) Report has been produced to support a three-year dredge and disposal marine licence application under the Marine Works (Scotland) Act 2010 for Girvan Harbour. The application has been submitted by the Port Authority, Ayrshire Roads Alliance (ARA). This report has been produced by Affric on behalf of the client's engineers Wallace Stone for submission in support of the application.

### 1.1 Reports Aims and Objectives

The purpose of this report is to identify and assess the available options for the disposal of dredged materials, to support the submission of a marine licence for dredge and disposal for Girvan Harbour.

The objectives are:

- To provide an overview of the required dredging works;
- Describe the proposed areas for which a dredging campaign is required, including estimated quantity of dredged material likely to be removed;
- Include a description of the BPEO methodology to be employed to complete the assessment; and
- To identify and assess options for disposal of dredged material to determine the BPEO for the disposal of dredge spoil.

## 2 Background

The ARA is the Port Authority (PA) for Girvan Harbour and as such are responsible for the management and maintenance of the port facilities. This role includes insuring that access to the port remains navigable for the variety of vessels transiting the area. The port is used by commercial fishing vessels, recreational fishing vessels, commercial craft and other recreational vessels, also stationed at the harbour is the Girvan Royal National Lifeboat Institution (RNLI) B Class Lifeboat.

Access to the channel and associated inner basin has become impeded through the decreased draft from sediment build up. Continued deposition attributed to fluvial action from the Water of Girvan River and associated longshore drift are the main contributing factors to the siltation of the channel and basin. Due to this continued deposition of sediments within the channel and harbour area there is the urgent requirement to dredge the area to ensure the continued safe operations within the harbour. Concerns have also been raised by the RNLI that without dredging of the channel the operational ability of the station will be jeopardised.

In addition, the first dredge needs to be completed by the 31<sup>st</sup> of May 2019. This is due to the site location being within 2km of designated bathing waters and the requirement for dredging campaigns to take place out with the Bathing Water Season (1 June to 15 September) (SEPA, 2016). Further dredge campaigns will be carried out between the 16<sup>th</sup> of September and the 31<sup>st</sup> of May.

## 2.1 Previous Dredges

Girvan Harbour has historically been dredged to ensure continued harbour operations and the safe navigation of the approach channel and inner basin. Previous dredging campaigns years and volumes are provided in Table 2.1. All dredge material has been disposed of to the Girvan spoil disposal site (MA025). The previous dredge licence 05335/15/0 expired on the 31<sup>st</sup> of May 2015, no dredging has been completed since then.

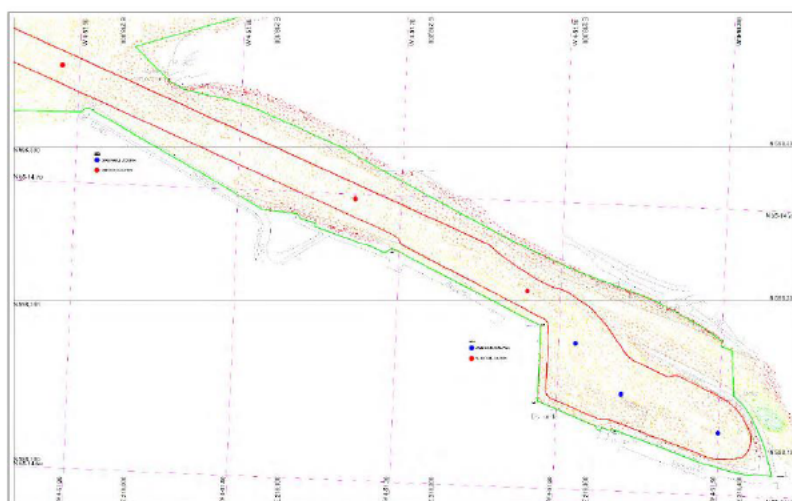
**Table 2.1: Historic Dredge Volume**

Year	Quantity Removed (m <sup>3</sup> )
1998/99	35,000
2000	12,500
2005	1,3300
2010	10,000
2013	4,300
2015	7,200

## 2.2 Description of Materials

The proposed dredge area is shown in Appendix 1. The area to be dredged includes the channel approach to the harbour entrance, the channel and the inner harbour basin. The channel dredge is proposed to take levels to 2.0m below chart datum, with the inner basin dredged to 1.5m below chart datum. The estimated volume of material to be extracted from this dredge is 15,000m<sup>3</sup> per year with a total of 45,000m<sup>3</sup> removed over the life of the dredge licence. It is assumed that the specific gravity will be around 2 and hence the mass of material to be removed is 30,000 tonnes per year with a total of 90,000 tonnes removed over the life of the dredge licence.

Sampling was conducted by Aspect Land & Hydrographic Ltd who through consultation with Marine Scotland identified the required number of samples for the dredge area. In line with licensing requirements 3 No. surface grabs were taken from the inner harbour basin due to the proposed dredge depth of less than 1m. The channel area has as proposed dredge depth of greater than 1m therefore there was the requirement to complete core sampling. It was agreed with Marine Scotland that 3 No. vibrocore samples would be taken within the channel. A map showing these locations is provided in Figure 2.1.



**Figure 2.1: Map showing sample locations within harbour and basin area blue dots denote surface grab sample points G1, G2, G3 right to left and red dots vibro core sample points VB1, VB2 and VB3 right to left (Aspect 2018).**

The 3 grab samples were taken from the surface and analysed by the Laboratory SOCOTEC who are accredited to ISO17025. The vibrocore locations produced differing core lengths due to the ability of the equipment to penetrate the sea bed. From these cores' separate samples were taken at intervals as set out below in Table 2.2 these samples were analysed by the same laboratory. The results of these analysis's have been summarised in this section the full sample results are available in the spreadsheet entitled Pre-disposal Sampling Results Form Girvan Harbour.

**Table 2.2: Vibrocore Core Lengths and Sample depth intervals.**

Sample location	Core length	Sample Depth (m)	Sample Depth (m)	Sample Depth (m)
VB1	0.39m	0.0-0.4m	Unable to penetrate further	Unable to penetrate further
VB2	0.77m	0.0 – 0.4m (VB2_1_1)	0.4-0.8m (VB2_1_2)	Unable to penetrate further
VB3	1.35	0.4 – 0.45m (VB3_1_1)	0.45 – 0.9m (VB3_1_2)	0.9-1.35m (VB3_1_3)

From the total amount of material sampled 62.5% were solids. The particle size and distribution (PSD) of the proposed dredged area has a composition of sand (68.6%) with silt (18.01%) and gravel (13.38%). PSD showed considerable variation with the channel area subject to fluvial



actions from running tide and river flow presenting mainly as gravel, whereas the Marina Area (inner basin) which is sheltered from main flow and turbulence there is an overburden of fine material.

All samples were tested for a suite of chemical parameters analysed against Action Levels (AL) as prescribed by Marine Scotland in the Pre-disposal Sampling Guidance (Marine Scotland, 2017). Both the seabed surface grabs and core samples indicated Chromium (Cr) above AL1 (Cr AL1 - 50 mg/kg), the 3 No. seabed surface grabs results showed Copper (Cu) above AL1 (Cu AL1 - 30 mg/kg). All samples showed the presence of Nickel (Ni) above AL1 (Ni AL1 - 30 mg/kg) with samples taken at location VB3 showing Ni concentration above Action Level 2 (Ni AL2 - 150 mg/kg) at core samples taken between 0.0 – 0.45m and 0.45 -0.9m. The final sample from this core returned below AL2 trigger at the 0.9 – 1.35m sample point. There was one occurrence of Zinc (Zn) at seabed surface sample site G3 above AL1 (Zn AL1 - 130 mg/kg) but below AL2 (Zn AL2 - 600 mg/kg). Table 2.3 shows the results for each sample taken as dry weight with Marine Scotland’s Action levels for each included. Table 2.4 presents the average sample result, note it is provides as a wet weight. All other parameters analysed from the samples returned results for trace metals and organotins below the prescribed Action levels.

**Table 2.3: Review of Action Level Exceedances**

Sample Point	Chromium (Cr) mg/kg (dry weight)	Copper (Cu) mg/kg (dry weight)	Nickel (Ni) mg/kg (dry weight)	Zinc (Zn) mg/kg (dry weight)
Marine Scotland AL1	50	30	30	130
Marine Scotland AL2	370	300	150	600
Sample Results				
G1	50.3	36.2	55.3	119.8
G2	55.2	38.2	59.7	125.6
G3	55.6	46.6	54.2	142.6
VB1_3_1	59.1	23.3	64.7	78.2
VB2_1_1	71	25.2	86.5	73.8
VB2_1_2	54.2	28.5	62.5	83.4
VB3_1_1	120.3	12.8	155.3	61.7
VB3_1_2	137.7	15.8	173.5	69.4
VB3_1_3	107.5	13.5	139.2	67.9
Average <sup>1</sup>	79.0	26.7	95.5	97.4

<sup>1</sup> Dry weight average for comparison with Dutch standards only, see Section 4.2.

**Table 2.4: Average mg/kg (wet weight) for Exceedances**

	<b>Chromium (Cr)</b> mg/kg (wet weight)	<b>Copper (Cu)</b> mg/kg (wet weight)	<b>Nickel (Ni)</b> mg/kg (wet weight)	<b>Zinc (Zn)</b> mg/kg (wet weight)
Average Across Dredge Area	23.5	12	27	39.6

As shown in Table 2.4 the average trace metal wet weight concentrations are below the prescribed Marine Scotland Action Levels (Marine Scotland, 2017). The material would be classed acceptable under the prescribed levels for disposal at sea in accordance with Marine Scotland’s Pre-Disposal Sampling Guidance (Marine Scotland, 2017). The singular area that has been identified as over AL2 is an isolated occurrence at the entrance of the harbour. It is not unusual to detect high spots of Cr and Ni in harbour areas, as nichrome alloy materials are regularly used in the marine sector due to its resistance to corrosion, and hence the source is likely to be from a vessel.

A range of Polyaromatic Hydrocarbons (PAH) have been identified that exceed AL1 at all the surface grab locations and one vibrocore sample (VB2) location at both depths sampled. These can be seen in detail in the Pre-disposal Sampling results Form Girvan Harbour. When these results are taken as an average across the dredge area 5 exceedances of above AL1 have been identified these are outlined in Table 2.5. Pyrene and Fluoranthene both have exceedances of more than double AL1, whereas the other three exceedances are minor ( $\leq 20\%$ ). All the PAH’s identified are produced by incomplete combustion processes and are present in coal tar and associated products which were historically utilised in the treatment of wood. Girvan Harbour has been a fishing harbour since the 1700 Century. Wood treatments from wooden vessels may explain the occurrence of PAH in the area.

**Table 2.5 Review of Action Level Exceedances PAH**

	<b>Benz(a)anthracene</b>	<b>Diben(ah)anthracene</b>	<b>Flouranthene</b>	<b>Phenanthrene</b>	<b>Pyrene</b>
Marine Scotland AL1	0.1 mg/kg	0.01 mg/kg	0.1 mg/kg	0.1 mg/kg	0.1 mg/kg
Average Across Dredge Area	0.101 mg/kg wet weight	0.012 mg/kg wet weight	0.244 mg/kg wet weight	0.120 mg/kg wet weight	0.203 mg/kg wet weight

PAHs can be found within various foods including fish these are largely formed from the process of cooking at high temperatures such as charbroiling, grilling and frying, the Food Standards Agency concluded that PAHs were typically found in low levels in food and that consumers do not need to change their eating habits. (Public Health England, 2018).

Research as conducted by Environment Canada has identified interim sediment quality guideline (ISQG) and Probably Effect Levels (PEL) for a range of chemicals to protect aquatic life in the freshwater and marine environments. For pyrene the marine ISQG is set at 0.153mg/kg (dry weight) with the PEL at 1.398 mg/kg (dry weight) (CCME, 2002). Out of nine sample taken at Girven four were higher than the marine Pyrene ISQG on marine organisms,



one of which was above the PEL. The average dry weight for pyrene in the samples was 0.359mg/kg which is well below the PEL, hence no effects on marine life are predicted.

Fluoranthene as a PAH is metabolised in fish with possible tainting, it can however accumulate in Shellfish, (L Webster et al, 2010). A review of the proposed dredge area and the immediate areas adjacent to the proposed dredge, has not identified any active shellfish farms, or shellfish waters protected areas that could be of concern from the proposed operation (Marine Scotland, 2018). The marine ISQG for fluoranthene is 0.113mg/kg(dry weight) and the PEL is 1.494mg/kg (dry weight) in the marine environment (CCME, 2002). Of the nine Girvan samples taken five were above the ISQG but only one was above the PEL. The dry weight average for fluoranthene from the samples is 0.427mg/kg which is well below the PEL, hence no effects on marine life are predicted.

## 3 BPEO Method

### 3.1 Introduction.

In identifying the BPEO for this proposed dredge campaign the following methodology has been employed:

- Identification of options available for the disposal of material;
- Screening to eliminate unsuitable options;
- Assessment of remaining options; and
- Comparison of options and identification of the BPEO.

#### 3.1.1 *Option Identification*

Options for disposal of the material were identified, in addition to standard options considered (Do Nothing, Dispose to Sea and Dispose to Land) discussions with ARA were held to identify other potential options for reuse of the material in the area. The Marine Scotland's website was also reviewed to identify other projects that could have a material requirement.

#### 3.1.2 *Screening to Eliminate Unsuitable Options*

All options have been screened against a minimum criterion. These are the criteria for which each option must meet for the option to be considered. Any option which failed to meet one or more of the criteria were not taken forward to the detailed assessment of remaining options. This criterion is outlined below:

- Proposed option would allow dredge campaigns to be completed between the 16<sup>th</sup> of September and the 31<sup>st</sup> of May each year.
- The proposed option must be suitable for the characteristics of the dredge material;
- Technically viable option; and
- Allows for the continued operation of Girvan Harbour.

Not all options will facilitate the initial dredge being completed by the 31<sup>st</sup> of May 2019. However, they may be suitable for year two and three of the proposed dredge licence, therefore these options have not been screened out.

#### 3.1.3 *Attribute Identification and Scoring*

Attributes to be utilised in the assessment were identified, prior to the assessment of options.

Attributes were scored out of 5 with 1 being the worst performing and 5 being the best. Each score has been designated a colour to aid facilitate visual comparison. The Attributes are outlined in the Appendix 2.

Options meeting the minimum criteria were scored against each of the attributes (Appendix 3) and reasoning for this scoring provided (Appendix 4).

### **3.1.4 Comparison of Options and Identification of the BPEO**

Following the scoring of the options detailed comparison was undertaken to identify the BPEO.

## **4 Assessment of Options**

### **4.1 Identification of Options Available**

Several options were identified for the disposal of the dredged material, these include both terrestrial and marine based options. The options identified are outlined below and included in the options is a "do nothing" scenario:

- Do Nothing
- Disposal to Landfill
- Spreading on Agricultural Land
- Beach Nourishment
- Beneficial Reuse
- Disposal at Sea
- Plough Dredging

### **4.2 Screening of Options**

Options were initially screened against the minimum criterion as outlined in Section 3.1.2 this initial assessment has eliminated four of the options this is due to the options not meeting one or more of the screening criteria. The reasoning for each option that has been discounted as not viable for this proposed operation is outlined below.

#### **4.2.1 Do Nothing**

This option has been discounted as the cessation of dredging within the area would have a significant impact on the safe and continued use of the Harbour. Should the area become unnavigable due to reduced depth there would be a social and economic effect on Girvan due to the decline in commercial activities and tourism. Furthermore, there is the potential risk to the operational ability of the RNLI to continue launching from the harbour with significant effects on the emergency response capability in the area.

#### **4.2.2 Spreading on Agricultural Land**

This option has not been considered further due to the appropriateness of the material to be spread on agricultural land. The high saline content makes the material unsuitable for spreading onto agricultural land without significant further treatment. Salinity is a key environmental limiting factor for the productivity of plant growth many crops are salt sensitive therefore excess salinity is a threat to agriculture (Flowers, 2005).

The Marine Scotland AL are set with regard to marine sediments, and as such may not be appropriate for consideration of land uses of the material, as the pathways to receptors including humans are very different. Hence, the sample results were compared against the

Dutch Target and Intervention Values (the New Dutch List), (Ministerie van Volkshuisvesting, 2000) for soil, utilised for the assessment of contaminated land. The New Dutch List utilises dry weight values. A comparison of the metals average dry weight of the dredge samples (detailed in Table 2.2) against the New Dutch List identifies that only Nickel at 94.5mg/kg exceeds the target value of 35mg/kg, however it does not exceed the intervention value of 210mg/kg. With regard to PAH, the New Dutch List, combines 10 PAH's into one value (PAH(sum10)). The ten relevant PAH analysis results for the samples have been combined and averaged, the average PAH(sum10) for the Girven samples is 1.4m/kg. This is slightly above the target level for (PAH(sum10) of 1mg/kg but well below the intervention level of 40mg/kg.

The salinity issues, plus the fact that the dredge spoil is likely to be above the target values for PAH(sum10) and is significantly above the Nickel target levels, make the option unsuitable due to the characteristics of the dredge material.

#### **4.2.3 Beach Nourishment**

This option has been discounted as there have been no recipients identified requiring nourishment operations within the required timescale for works. Material suitability is a further consideration with regards this option as material designated for beach nourishment is required to be of the same/similar PSD as the recipient beach. In addition the concerns with regard to the PAH(sum10) and Nickel levels being above target levels for soils, may also make the material unsuitable for this use in areas above Mean High Water Springs (MHWS).

#### **4.2.4 Plough Dredging**

This option was considered as an immediate solution to allow for continued operation of the RNLI station and acceptable to be undertaken during bathing seasons. However, this option has not been taken further as this method would mean an increased burden to other areas of the harbour with the possibility of making these areas unnavigable due to material deposition decreasing depth. Hence, it does not meet the minimum criterion for the continued operation of Girvan Harbour.

### **4.3 Assessment of Remaining Options**

Following the screening process the following options have been selected to take forward for further analysis:

- Disposal to landfill
- Beneficial Reuse
- Disposal at Sea

Each of these options have been further analysed for their suitability to receive the dredged material based on the attributes identified in Appendix 2. Further information to understand the process for each of the options has also been included. The options scoring is provided in Appendix 3 with the reasoning for attribute scoring provided in Appendix 4. Where referred to scores are provided in brackets below.

#### **4.3.1 Disposal to Landfill**

Disposing of dredged material to landfill can take up valuable space within a landfill when space with the UK landfill network is at a premium. With disposal to landfill there are logistical steps that will need to be completed before removal to these sites. Dredged material will need landing, dewatering, storage and transport to a disposal site.



Three potential landfill sites have been identified as being within a reasonable distance for the disposal of the dredged materials each of these have been assessed and details have been provided in Table 4.1. Each of these options have been scored in Appendix 3. Straid Farm Ltd Landfill is the closest landfill to Girvan Harbour as such it scores slightly better (3) than the other two landfills under the distance attribute (2).

**Table 4.1 Landfill Information**

Landfill Site	Distance from Girvan and Approx travel distance and time	Operator	Local Authority Area	Description	Estimated % Dredged material as a Percentage of Annual Landfill Capacity
Straid Farm Landfill site, Lendalfoot, Girvan	6.6 Miles 12 Minutes Approx	Straid Farm Ltd	South Ayrshire	Permitted to accept Non-Hazardous Waste until June 2020 Annual Capacity 110,000 Tonnes	27%
Tarbolton Moss Landfill site, South Ayrshire	28.2 Miles 47 Minutes Approx	Tarbolton Landfill Limited	South Ayrshire	Permitted to accept Non-Hazardous Waste until December 2021 Annual Capacity 147,000 tonnes.	20%
Barr Environ, Garlaff L/F, Skares Rd, Cumnock	33.5 Miles 54 Minutes	Barr Environment Ltd	East Ayrshire	Permitted to accept Non-Hazardous Waste Until May 2025 Annual Capacity 250,000 Tonnes	12%

Material would need to be acceptable for the proposed landfill. Consideration would need to be made for effects on drainage and the chemical composition of the material leaching into the surrounding environment. The high salinity of the material has the potential to react with existing materials/chemicals within the landfill. Ultimately the responsibility for accepting the waste material will be with the landfill operator.

The drying, transport and disposal of the dredged material to landfill would be subject to Waste Management Licensing controls regulated by the Scottish Environment Protection Agency (SEPA).

The Scottish Government launched a Zero Waste Plan for Scotland in 2010 with a vision for a zero-waste society. The plan has a target to recycle 70% of material and a maximum of 5% to landfill by 2025 for all Scotland's waste (Scottish Government, 2010). The disposal of dredged material into existing landfill sites therefore does not align with the Scottish Government Policy where the onus is on reducing the amount of material being sent to a landfill site.

Further considerations with the removal of material to landfill sites by HGV's will need to be assessed. On the assumption that an HGV could hold 20 tons of material this would require 1,500 round trips. Connected with the use of HGV's is the short-term potential of decreased air quality within urban areas and increases in noise and vibration effects. Table 4.2 below shows the expected emissions associated with disposing to each site. Information sourced from the UK Government Greenhouse gas reporting: conversion factors 2018 (BEIS, 2018). The environmental effects associated with transport are directly related to the distance from site. As distance has been scored as an individual attribute, including transport into the environmental effects score would be double counting, therefore it hasn't been included.

**Table 4.2 Showing Kg CO<sub>2</sub>e (kilogram Carbon Dioxide Equivalent) for Disposal to Each Site**

Site & Distance	1 Full Outward Journey kg CO <sub>2</sub> e	1 Empty Return Journey kg CO <sub>2</sub> e	1 Round Trip kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e for Disposal of 30,000 Tonnes of waste
Straid Farm Landfill site, Lendalfoot, Girvan 6.6 miles	0.30943 x 6.6 = 2.04224	0.25017 x 6.6 = 1.65112	3.7	5,550
Tarbolton Moss Landfill site, South Ayrshire 28.2 miles	0.30943 x 28.2 = 8.72593	0.25017 x 28.2 = 7.05479	15.8	23,700
Barr Environ, Garlaff L/F, Skares Rd, Cumnock 33.5 miles	0.30943 x 33.5 = 10.36590	0.25017 x 33.5 = 8.38070	18.7	28,050

As previously mentioned the landfill options would require dredged material to be dried before the transportation to landfill. This process would put pressures on Girvan Harbour to set aside space to process the material and source equipment to complete the process. This has the potential to interfere with legitimate users of the Harbour area which could have consequential effects on the income of local commercial activities within the area, hence impacts on harbour operations score is 2. Possible environmental effects such as visual effects and impacts on local water quality, depending of the effluent disposal route lead to an environmental effect score of 3.

As mentioned ARA would be required to purchase / rent the required equipment to dewater the dredged material and construct a suitable area for storage of said material during this process. There are further costs then associated with the loading and haulage of this material to the designated landfill site. The material will also be subject to landfill tax at £88.95 per tonne of material. (Based on the estimated dredge amount of 30,000 tonnes this would equate to £2,668,500 in tax). A score of 1 has been given for cost for all landfill disposals, however the cost of disposals to Tarbolton and Barr Environment Landfills will be more than Straid Farm, due to the additional transportation costs.

The preferred landfill site would be Straid Farm Ltd, as it is closest to the harbour scoring 3 on distance, giving rise to the lowest transport related environmental and cost implications.

### 4.3.2 Beneficial Reuse of Material

The dredge material has been identified as potentially suitable in PSD and chemical<sup>2</sup> composition for use as marine infill material. The reuse of material is near the top of the waste hierarchy and is therefore, consistent with the Scottish government's policy of Zero Waste Scotland by 2025 and scores highly in the options assessment with a 5.

In order to identify potential projects suitable to receive the dredged material. A review was undertaken on projects currently in the Pre-Application and Application and Determination phases with the Marine Scotland Licencing Operations Team, these are outlined below in Table 4.3. Further to reviewing Marine Scotland's information, a review of the local area was undertaken to identify any local projects not yet in the legislative process. A potential coastal protection project has been identified at the South Ayrshire Girvan Municipal Golf course, located approximately 0.5 km north of Girvan Harbour, this is discussed further below.

**Table 4.3 Marine Scotland's Current Construction, Cable and National Renewables, Infrastructure Plan Projects (Marine Scotland, 2018)**

Potential Recipient Projects	Current Status
<b>Pre-Application</b>	
Rosyth International Container Terminal	Unclear if and when application will be submitted. Unlikely to have a requirement for material.
Sound of Mull Artificial Reed Trust	No requirement for material.
Ardersier Port, Nairn	This project includes a large dredge, and hence has no material requirement.
Millport Coastal Flood Protection Scheme	No requirement for material.
Hunterston Marine Construction Yard	No requirement for material.
Lochmaddy Ferry Terminal Development	Material not required until late 2019.
Uig Ferry Terminal Development	No requirement for material.
Tarbert Ferry Terminal Development	Material not required until late 2019.
Stornoway Port Authority – Deep Water Port, Arnish	Project has a large dredge and therefore unlikely to require additional material.
Granton Harbour Marina Development	No requirement for material.
Kilfinichen Pier Development	No requirement for material.
St Ola Pier Redevelopment, Scrabster	Excess material is likely to be produced from this project.
Helensburgh Waterfront Development	No requirement for material.
Pentland Ferries – Extension to St Margaret's Hope Marshalling Area	No requirement for material identified in pre-application phase.

<sup>2</sup> On the assumption that the proposed receiver is not within an Active shellfish site or within Shellfish waters protected area.



Potential Recipient Projects	Current Status
<b>Application and Determination</b>	
Port of Cromarty Firth: Phase 4 Development, Invergordon Service Base	Requires material from late summer 2019.
Clyde Waterfront Renfrew Riverside	No material requirement.
Scottish Woodlands- Installation to temporary floating pier	No material requirement.
North Ayrshire Coastal Protection & Footpath, Fairlie	No material requirement.
Lerwick Port Authority – Gremista Reclamation Extension Proposal	No material requirement.

The review of the projects both in Pre-application phase and Application and Determination phase identified no suitable recipient projects for the dredged material within the appropriate timescale of an initial first winter dredge campaign 2018/2019. Three projects were identified which could be suitable recipients during the second and third years of the dredge licence as identified below:

- Lochmaddy Ferry Terminal Development (material required from late 2019);
- Tarbert Ferry Terminal Development (material required from late 2019); and
- Port of Cromarty Firth: Phase 4 Development, Invergordon Service Base (Requires material from late summer 2019).

The storage of dredge material is not practicable due to the volumes involved and associated space requirements, coupled with the management of the water associated with the dredged material. Hence beneficial reuse options are not available for the 2018/19 dredge campaign, which gives a score of 1 on timescales.

For dredge materials to be reused by another project, the material needs to meet the engineering specification for the planned use. High silt levels give rise to settlement issues, which can cause issues for load bearing land reclamation works, such as the harbour projects identified above. The average PSD results show that some of the material in the channel has very low silt content ~2% and as such has the potential to be suitable for many engineering uses. However, the grab samples from the harbour area have silt levels of between 32.6% and 47.7% which is less likely to be acceptable for engineered fill material. Hence not all the material may be suitable for reuse (3).

Other projects will only utilise the material if it is cost effective to do so, and it can be delivered when required, hence the costs associated with Crown Estate Scotland fees and delivering the material need to be less than those associated with gaining the material from other sources. The cost is directly related to the distance between the dredge area and the receiving project, together with the number of trips required. Due to the limited water depths at Girvan, vessel sizes are limited. Therefore, it is assumed that the maximum vessel size which can be accommodated at Girvan will have a capacity for approximately 750m<sup>3</sup> of dredge material. Given the estimated annual dredging volume of 15,000m<sup>3</sup>, there would be a need for 20 trips per year to deliver the material to a receiving site.

Return delivery trips to the Lochmaddy (190 nautical miles north) and Tarbert (210 Nautical Miles north) sites, would take in the region of 32 to 35 hours, assuming a 12kt transit speed. However, this does not include off-loading time, which could be up to 12 hours. Therefore, reuse of the material at these sites would require additional vessel time (compared to sea disposal at Girvan) of between 880-940 hours per annual campaign. This estimate takes no account of weather delays, which are likely to be frequent, due to works being carried out through the autumn and winter months. Hence, it is highly unlikely to be commercially attractive compared to onshore material sources or offshore bulk deliveries.

The Invergordon Service Base has been identified as a possible site for material to be used as infill, however, it is not anticipated that material will be required until late summer of 2019. The site is significantly further by sea from Girvan than Tarbert or Lochmaddy, making this option impractical and not economically attractive as a preferred option.

The option scored highly on alignment to policy (5) and environmental effects (4) due to the reuse of material, although there is carbon cost of the material transport. Depending on the dredging vessels utilised there could be a need for a long reach excavator to be utilised to empty materials from barges, which can pose technical challenges for the construction work, so, a Technical Feasibility score of 3 is given.

If tugs and barges are to be used, dredge works would need to be delayed while deliveries were being made, even with multiple sets of tugs and barges being utilised there is likely to be an extended dredging period, which will have a negative impact upon harbour operations (3).

The South Ayrshire Girvan Municipal Golf course has been subjected to coastal erosion events, suffering damage. The option to reuse the dredged spoil as a coastal protection product would be consistent with Scottish government's policy of a Zero Waste Scotland by 2025. However, there are no plans for this project to be undertaken within the next five years. Therefore, this option is currently unsuitable for disposal of the material due to timeframes required for the dredge. However, should this situation change, the option should be re-addressed for possible use in years two and three of the dredge licence.

### **4.3.3 Disposal at Sea**

There are numerous open dredge disposal sites in Scottish Waters for deposition of dredged material, the closest of which is Girvan. The disposal of dredged material from the channel and inner basin at Girvan is an established process with dredging campaigns dating back to 1998 using the disposal site Girvan (MA025). There have been no issues associated with the use of this site, and due to the close proximity and associated efficiencies with regard to transit, it will score higher than other sites on assessment. Hence only this Girvan MA025 has been considered.

Disposal of material is low in the waste hierarchy and as such doesn't align with the Zero Waste policy (2). Dredge disposal is standard practice and as such Technically Feasibility scores 5. The option scores a 4 in all other assessment categories.

## **4.4 Comparison of Options**

As detailed in Appendix 4, the landfill options score 3 or less against all attributes and as such are not preferred. Disposal at Sea scores 36 out of 45, the highest scoring option, scores well

4 or higher on all but one category. A score of 2 for policy is assigned as disposing of material is not in alignment with the Scottish Governments Zero Waste Policies.

Beneficial Reuse which scored 26 out of 45 has much better alignment to policy than Disposal at Sea, as the materials would be reused. The main draw backs to the Beneficial Reuse option are associated with timeframes due to the availability of sites to receive the dredged material for the first campaign and the distance to the available sites which makes the options economically unattractive. Although this option theoretically provides a good use for material it is not considered the preferred option due to the practicalities of implementation.

## 5 Conclusion

Following assessment of the available options as discussed throughout this document, the Best Practicable Environmental Option for disposal of dredged material is for the Disposal at Sea to the Girvan (MA025) Sea Disposal Site. This option is the only option which fits with the urgent timeline associated with the first dredge of winter 2018/2019.

It is however recognised that if a suitable project for the reuse of material were available in the immediate vicinity of Girven, then the Beneficial Reuse option may become practical and cost neutral. Hence if a local project that could utilise the material, gains consent during the timeframes of the dredge licence, then the material will be offered to the developer for reuse.



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## 7 Glossary

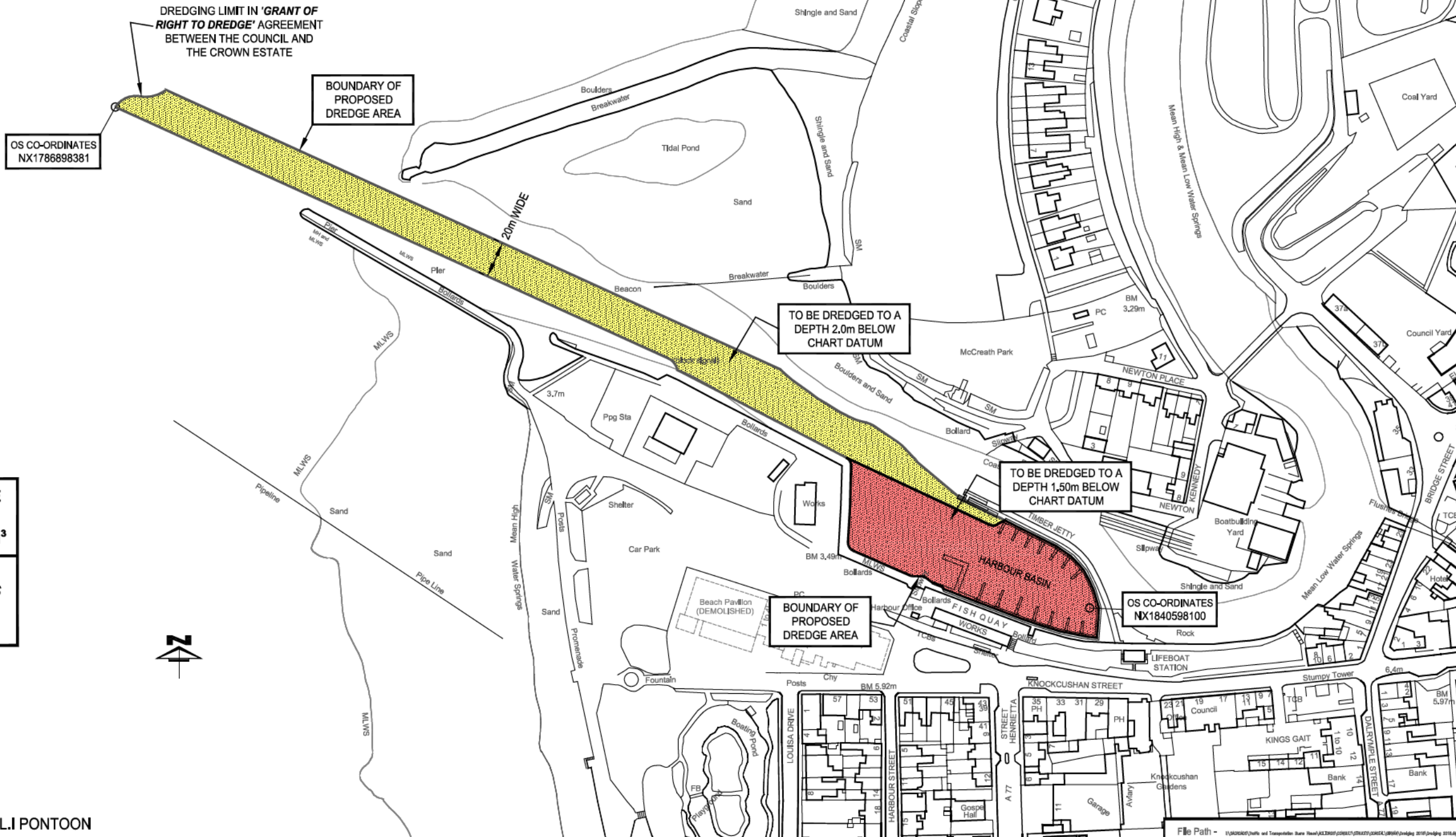
Acronym	Definition
AL	Action Levels
ARA	Ayrshire Roads Alliance
BPEO	Best Practicable Environmental Option
EIA	Environmental Impact Assessment
ISQG	Interim Sediment Quality Guideline
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
PAH	Polycyclic Aromatic Hydrocarbons
PEL	Probable Effect Level
PSD	Particle Size and Distribution
RNLI	Royal National Lifeboat Institution
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage

## **Appendix 1 – Proposed Dredge Area**



**NOTES**

1. DRG. No. 17CB20/200/001 - PROPOSED DREDGE AREA  
 DRG. No. 17CB20/200/002 - DETAILS OF PONTOONS WITHIN HARBOUR BASIN  
 DRG. No. 17CB20/200/003 - LOCATION OF SPOIL GROUND FOR DREDGE MATERIAL DISPOSAL  
 DRG. No. 17CB20/200/004 - LOCATION PLAN
2. DREDGING WORKS SHALL BE CARRIED OUT AS DESCRIBED IN THE SPECIFICATION AND IN ACCORDANCE WITH BS 6349-5: 1991 - MARINE STRUCTURES - Part 5: CODE OF PRACTICE FOR DREDGING AND LAND RECLAMATION.
3. THE ENGINEER SHALL ARRANGE FOR INDEPENDENT PRE-DREDGE AND POST-DREDGE SURVEYS TO BE CARRIED OUT IMMEDIATELY BEFORE AND AFTER THE DREDGING OPERATION. THE COST OF THESE PRE-DREDGE AND POST DREDGE SURVEYS WILL BE MET BY THE EMPLOYER.



**APPROX. VOLUME OF MATERIAL TO BE REMOVED BY DREDGING TO 1.50m OR 2.0m BELOW CHART DATUM = 11,000m<sup>3</sup>**

ACTUAL VOLUME TO BE DETERMINED BY PRE-DREDGE AND POST-DREDGE SURVEYS CARRIED OUT IMMEDIATELY BEFORE AND AFTER DREDGING OPERATION

00 - ORIGINAL  
 01 - DREDGE AREA AMENDED TO INCLUDE R.N.L.I PONTOON

**Ayrshire Roads Alliance**  
 A partnership between East Ayrshire Council and South Ayrshire Council

Head of Roads - Ayrshire Roads Alliance  
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ODS : 420 x 297 (A3)

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Traced by	
Checked by	
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Approved by	

Drg. Status	
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**GIRVAN HARBOUR  
 DREDGING 2017/2018  
 PROPOSED DREDGE AREA**

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Rev.	00 01

## Appendix 2 – Assessment Attributes

Attribute	Description	1	2	3	4	5
<b>Alignment with Policy</b>	How complex are the regulator requirements and what risks are posed.	In direct conflict with policy.	Does not fully align with policy.	No policy implications.	In the spirit of policy.	Positively implements policy.
<b>Cost</b>	Financial Cost of the Option	>£2Million	£1M to £2M	£500,000 to £999,000	£100,000 to £499,000	<£100,000
<b>Timescale</b>	Will the timeframe for the option impact on the continued operations of the harbour, will the option impact on the dredging timeline?	Risk dredge couldn't be started before the 2019 bathing season.	High risk dredge couldn't be completed before the start of the 2019 bathing season.	Risk dredge couldn't be completed before the start of the 2019 bathing season.	Allows dredge to be comfortably completed prior to the 2019 bathing season.	Allows dredge to be completed promptly.
<b>Material Suitability</b>	Is the chemical makeup and PSD of material suitable for the option selected?	Not all of the material is acceptable.	Requires significant mitigation to be made suitable.	Acceptable with mitigation.	Acceptable material for option.	Ideal material for option.
<b>Distance</b>	Impact location has on logistics for material movements.	Beyond 40 miles	10-40 miles	6-10 miles	1-5 miles	Within 1 mile
<b>Technically Feasibility</b>	Is the option within the capabilities of the PA to carry out?	Technology not proven.	Complex requirements, but proven technology.	Simple proven technology available.	Practicable with basic management.	Standard practice
<b>Environmental Effects</b>	Potential environmental effects associated with implementing the option.	Very Significant	Significant	Minimal	Trivial	None
<b>Impacts on Harbour Operations</b>	Level of interfere with normal harbour operations.	Very Significant	Significant	Minimal	Trivial	None
<b>Legislative Complexity</b>	How complex are the regulator requirements and what risks are posed.	Significant risk additional permits, licences or consents will not be granted.	Requires significant additional permits, licences or consents.	Requires additional permits, licences or consents.	Minor management required to comply with legislation	Complies with all relevant legislation.

## Appendix 3 – Option Scoring

Attribute	Straid Farm Ltd Landfill	Tarbolton Landfill Ltd	Barr Environment Ltd Landfill	BENEFICIAL REUSE	Disposal at Sea MA025 Girvan
	LANDFILL DISPOSAL				SEA DISPOSAL
Alignment with Policy	1	1	1	5	2
Cost	1	1	1	2	4
Timescale	3	3	3	1	5
Material Suitability	3	3	3	3	4
Distance	3	2	2	1	4
Technically Feasibility	3	3	3	3	5
Environmental Effects	3	3	3	4	4
Impacts on Harbour Operations	2	2	2	3	4
Legislative Complexity	3	3	3	4	4
<b>Total</b>	<b>22</b>	<b>21</b>	<b>21</b>	<b>26</b>	<b>36</b>

## Appendix 4 – Scoring Reasoning

Attribute	Straid Farm Ltd Landfill	Tarbolton Landfill Ltd	Barr Environment Ltd Landfill	BENEFICIAL REUSE	Disposal at Sea MA025 Girvan
	LANDFILL DISPOSAL				SEA DISPOSAL SITES
Alignment with Policy	Disposal to land fill doesn't align with the Scottish Governments Zero Waste Policy, it would also take up valuable landfill space.			Reuse of material is near the top of the waste hierarchy, hence this the option is compliant with government policy for a waste free Scotland by 2025.	Disposal to Sea is low on the waste hierarchy and as such does not align to policy.
Cost	Costs associated with the drying of the dredged material include the hiring of equipment to dry material, store material infrastructure, costs associated with the transport of material to designated site. Landfill tax at £88.95 with an estimate of 22,000 tonnes equates to £1,956,900.			Costs associated with transport of material to potential sites is significant.	Estimated a lower cost than other options / dredger would complete the disposal operation no further costs associated with the works.
Timescale	Due to the processing requirements, this will take time to arrange and get the equipment set up, the drying process itself will take time and limited storage could mean that dredging cannot be carried out as fast as normal. Hence there is a risk that the dredge cannot be completed prior to the start of the bathing season 2019.			No sites have been identified as being able to receive material from the initial proposed urgent winter dredge of 2018/2019.	It should be practical to implement this option in the winter of 2018/19, as disposal can be completed quickly during dredging.



Attribute	Straid Farm Ltd Landfill	Tarbolton Landfill Ltd	Barr Environment Ltd Landfill	BENEFICIAL REUSE	Disposal at Sea MA025 Girvan
	LANDFILL DISPOSAL				SEA DISPOSAL SITES
Material Suitability	Material has been assessed as Acceptable with Mitigation - as dewatering will be required.			THE PSD of the channel material makes it potential suitable for reuse, the harbour dredge material may not be suitable for all uses.	Material is acceptable for the option of sea disposal under the Pre-Disposal Guidance issued by Marine Scotland.
Geographical location to site	Site is within 6.6 miles of harbour works - distance is therefore tolerable, Approx 12 minutes from harbour by road.	Site is 28.2 miles from harbour approx 47minute drive from site. This is a significant distance and time when considered the number of trips that could be required to complete removal of material.	Site is 33.5 miles from harbour approx 54 minute drive. This is a significant distance and time when considered then number of trips that could be required to complete removal.	Proposed sites are greater than 40 miles from the harbour and would therefore have major transport issues. Impacting cost and timing of dredge.	Site is less than 2 miles from the Harbour therefore distance to steam is minimal.
Technically Feasibility	The drying of material is relatively simple; however, it will need to be appropriately managed in terms of throughput due to space restrictions.			Considerations will need to be made with regard to the vessels used for this operation and how material would be removed from it for reuse.	The disposal to sea is an established and well-practiced methodology.

Attribute	Straid Farm Ltd Landfill	Tarbolton Landfill Ltd	Barr Environment Ltd Landfill	BENEFICIAL REUSE	Disposal at Sea MA025 Girvan
	LANDFILL DISPOSAL				SEA DISPOSAL SITES
Environmental Effects	There is the potential for environmental consequences with the inclusion of material into the landfill - though it is uncertain if this would be above standard environmental concerns associated with landfills. There is the further impact from associated transport and greenhouse gasses emitted from the use of HGVs to complete delivery of material.			The delivery of wet material would have minimal environmental effects, there would be a carbon cost associated with delivery.	The disposal to sea at an existing disposal site will have minimal environmental effects, temporary effects on water quality may occur.
Impacts on Harbour Operations	Space requirements to process materials ready for landfill, would significantly interfere with other harbour activities.			The delivery time for material, would extend the dredge timescales affecting operations at the harbour.	Dredging works are required in the main access to the harbour and the harbour itself. Hence harbour operations will need to be managed around the dredging works.
Legislative Complexity	Disposal to landfill is in line with current legislation, appropriate waste licenses would be required, these should not be overly complex.			Licence requirements are being progressed for Lochmaddy and Tarbert though will not be in place by winter 2018/2019. Invergordon licence is determined though unable to accept material until summer 2019. Disposal at these sites would be permitted under their marine licences.	Disposal to sea would be permitted under the dredging marine licence.