Port Edgar Marina

Dredging Licence
Best Practical Environmental Option Report

December 2019

FAIRHURST

CONTROL SHEET

CLIENT: **Port Edgar Marina Ltd**

PROJECT TITLE: **Dredging Licence Application**

REPORT TITLE: **Best Practical Environmental Option Report**

PROJECT REFERENCE: **122592A**

DOCUMENT NUMBER: **122592A/WE/CP/06122019**

STATUS: **FINAL**

Issue & Approval Schedule	Issue 1	Name	Signature	Date
	Prepared by	Chris Paton	Signed copy held on file	09/12/2019
	Checked by	Rebecca Passmore	Signed copy held on file	09/12/2019
	Approved by	Rebecca Passmore	Signed copy held on file	09/12/2019

Revision Record	Rev.	Date	Status	Description	Signature	
	1				By	
					Check	
					Approve	
	2				By	
					Check	
					Approve	

This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System*

Contents

Appendices

1 Introduction

This report has been prepared to set out the Best Practicable Environmental Option (BPEO) in support of the marine licence application for dredging and disposal at sea of dredge arising within the boundary of Port Edgar Marina, the 'Site', as shown on the City of Edinburgh Council drawing, **Plan 2 -** all drawings referred to in this report are included in **Appendix A**.

The aim of the BPEO is to provide confidence following pre-disposal sampling, that the dredge arising is suitable for disposal within the confines of Port Edgar Marina; whilst the objectives are to:

- Describe dredge arising material.
- Interpret chemical and physical analysis of pre-disposal sampling and demonstrate consideration for disposal options as required by Marine Scotland guidance.
- Identify, minimise, manage and mitigate for potential environmental impacts.
- Demonstrate a consideration for, and a commitment to manage through a bio-security plan, invasive non-native species (INNS) within the Site.

The operator, Port Edgar Marina Ltd, are seeking to obtain a Capital Dredging Licence (CDL) to carry out plough dredging of the east and west sides of the old West Pier situated in the west side of the marina basin. This area was historically dredged and utilised as a naval port. However, as this area has not been dredged within the past seven years it is classed as a new site as regards capital dredging.

As a result of sedimentation, the operator currently undertakes regular (annual) maintenance plough dredging (**licence No. 06629/19/0**),for the area shown on drawing **122592/7003**,to maintain a sufficient depth for the continued operation of the port as an active marina. Anecdotal evidence suggests that construction activity relating to nearby bridge piers in recent years may have caused an additional volume of sediment to be deposited local to and within the confines of the marina.

The foreshore surrounding the West Pier within the Port Edgar Marina is a Site of Special Scientific Interest (SSSI) (SNH site code 8163, Firth of Forth), a Special Protection Area (SPA) (SNH site code 8499, Firth of Forth), and is in close proximity to a RAMSAR[1] site. These designations apply due to the area supporting a number of migratory overwintering, breeding and non-breeding bird populations. The designated sites are shown on drawing **WS/122592A/0003**, which also shows the proposed dredging area in relation to these designated areas as well as the pre-disposal sampling locations, and the location proposed for disposal of dredge arising. The proposed dredging, which may affect these sites, is to a maximum of 1.5 m (variable) depending on depth encountered. The dredging undertaken will remove silt some of which is both anoxic and is contaminated with hydrocarbons, likely to have built up over the preceding decades since the West Pier was last utilised. Post-dredging, mud and silt will remain exposed at low-tide and will continue to provide valuable habitat as regards the qualifying features of the designated sites.

[1]RAMSAR Convention on wetlands of international importance, Ramsar, Iran, 1971

2 Proposed Dredging

Potential options considered as regards dredging are listed and considered below:

- Do-nothing
- Dredging via excavator and hopper-barge
- Dredging via water injection
- Dredging via plough

Do-nothing: capital dredging is required so as to achieve sufficient water depth for the installation of pontoons and mooring of vessels. If dredging does not take place, the siting of pontoons with the intention of bringing the West Pier back into economic use at Port Edgar would not be considered viable. Do-nothing is therefore not considered.

Dredging via water injection: this method has been previously been undertaken within Port Edgar by water injection. This method proved to be ineffective due to insufficient tidal current within the marina to remove and redistribute the excavated sediment - this method was therefore discounted.

Dredging via excavator and hopper-barge: dredging has previously been carried out using this method within Port Edgar. However, this proved to be inefficient when considering the commercial cost-benefit to the marina operator - this method was therefore discounted.

Dredging via plough: plough dredging is in line with current practice which has been consented for use by Marine Scotland at the marina associated with aforementioned licences for capital dredging and ongoing maintenance dredging; and is considered to be the most suitable option to move material from the area surrounding the West Pier to the disposal point shown at the north east corner of the marina. A dredging method statement is included as (**Appendix B**).

It is proposed that an initial 20,000m^3 will be dredged over a period of 30 days. It is anticipated that annual maintenance dredging will be required for up to 10,000m^3.

The dredge arising to be removed is predominantly of estuarine fine-grained sediments including silts and clays, deposited within the inter-tidal zone of the Forth Estuary. The sediment has been tested in accordance with the guidelines set out in the Marine Scotland pre-disposal sampling guidance document.

As a pre-requisite to the CDL, pre-disposal sampling with Port Edgar Marina was carried out on 30th September 2019 and consisted of three cores to a depth of 1.5m CD. Cores were recovered using a Specialty Devices Incorporate (SDI) Vibrocore-4D system. Recovered cores were delivered to a United Kingdom Accreditation Service (UKAS) accredited laboratory, and were analysed against Marine Scotland's standard suite of pre-disposal sampling parameters.

A summary of materials recovered from within the core samples taken and interpreted by, Aspect Land & Hydrographic Surveys Ltd in their Report of Survey (**Appendix C**), is provided in **Table 1** below. Cores were recovered from the locations shown on drawings **122592A/WS/0002** and **122592A/WS/0003**. Full results from laboratory analysis on contaminants are provided in **Appendix D.**

Table 1 Core sample descriptions from Sampling carried out 30th September 2019

Sample	Material Description
Core 1	0.0 to 0.5 m Dark Brown/ Black Silt 0.5 to 1.0 m Anoxic Black Silt 1.0 to 1.5 m Black/ Brown Silt
Core 2	1.0 to 0.5 m Black/ Brown Silt 0.6 to 1.0 m Silt 1.0 to 1.5 m Firm Silt
Core 3	2.0 to 0.5 m Soft Dark Brown Silt 0.7 to 1.0 m Soft Brown Silt 1.0 to 1.15 m Soft Brown Silt 1.15 to 1.5 m Stiff Silt

3 Results

A summary of results for contaminants across each of the cores (1, 2 and 3) is compared with the AL (1) and AL (2) thresholds outlined in the, Marine Scotland Pre-disposal Sampling Guidance Verion-2 November 2017, in **Table 3** and **Table 4** below.

Table 2 Lab Results of Contaminants and Exceedances of AL 1 & AL2

Contaminant of concern	**AL 1 threshold** mg/kg dry weight (ppm)	**Lab Results** mg/kg dry weight (ppm)	**Exceedance of AL1** mg/kg dry weight (ppm)	**Percentage exceedance** (%)
Cadmium (Cd)	0.4	0.08	-	0
Chromium (Cr)	50	28.8	-	0
Copper (Cu)	30	18.7	-	0
Mercury (Hg)	0.25	0.42		0
Nickel (Ni)	30	15.5	-	0
Lead (Pb)	50	32.8	-	0
Zinc (Zn)	130	67.1	-	0
Benz(a)anthracene	0.1	0.171	0.071	71
Benzo(a)pyrene	0.1	0.193	0.093	93
Benzo(b)fluoranthene	0.1	0.228	0.128	128
Benzo(e)pyrene	0.1	0.177	0.077	77
Benzo(ghi)perylene	0.1	0.189	0.089	89
C1-naphthalenes	0.1	0.421	0.321	321
C1-phenanthrene	0.1	0.300	0.200	200
C2-naphthalenes	0.1	0.386	0.286	286
C3-naphthalenes	0.1	0.463	0.386	386
Chrysene	0.1	0.185	0.085	85
Diben(ah)anthracene	0.01	0.321	0.320	320
Fluoranthene	0.1	0.288	0.188	188
Indeno (1,2,3-cd) pyrene	0.1	0.160	0.060	60
Phenanthrene	0.1	0.204	0.104	104
Pyrene	0.1	0.359	0.259	259

Table 3 Contaminants Exceeding AL2

Contaminant of concern	**AL 2 threshold** mg/kg dry weight (ppm)	**Lab Results** mg/kg dry weight (ppm)	**Exceedance of AL1** mg/kg dry weight (ppm)	**Percentage exceedance** (%)
Cadmium (Cd)	4	0.08	-	-
Chromium (Cr)	370	28.8	-	-
Copper (Cu)	300	18.7	-	-
Mercury (Hg)	1.5	0.42	-	-
Nickel (Ni)	150	15.5	-	-
Lead (Pb)	400	32.8	-	-
Zinc (Zn)	600	67.1	-	-

4 Interpretation of results

When comparing results from the 2019 pre-disposal sampling, with results from the 2018 pre-disposal sampling reported in the 2018 BPEO report (**Appendix E**), fewer parameters exceeded the Marine Scotland thresholds. Whilst it is noted that the areas concerned with sampling undertaken during 2018 and 2019 were different, both areas are separated only by a short distance of approximately 150 m within the marina. It is considered likely that the distribution and concentration of contaminants in sediments within the marina is also likely to be affected by the tidal movements shifting sediments within the marina.

In total, 22 parameters were analysed. None of the metals recorded a value which exceeds the thresholds, compared with 2018 where each of the metals recorded a value in exceedance of the thresholds. Of the hydrocarbon parameters analysed, all recorded a value in exceedance of the thresholds. When compared against results from 2018, eight parameters recorded an increase, whilst seven recorded a decrease. Overall however, 13 out of the 22 parameters were shown to have improved when compared against samples analysed in 2018.

5 Environmental Impact

Consideration has been given to options as regards the disposal of dredge arising from the dredging activities. Options considered are listed below:

- Agricultural spreading
- Beach nourishment
- Construction industry
- Land reclamation, landfill and Incineration
- Sea disposal

Sampling undertaken has shown that the dredge arising is likely to contain contaminants in excess of Marine Scotland action levels. As such this means that dredge arising is likely to be unsuitable in respect of a number of the options outlined above. Considerations for each of the options have been outlined below:

Agricultural spreading: would require that the dredge material be pre-treated before it could be considered suitable for use, the contamination also presents a health and safety risk; combined with costs associated with transportation and handling of the material this option was not considered to be suitable.

Beach nourishment: due to the likely composition of dredge arising following pre-disposal sampling, the material was shown to consist almost entirely of fine silts and clays. This would make it unsuitable for such uses as the fine particle sizes are less stable and prone to accelerated rates of erosion.

Construction industry: uses for onshore construction including cement manufacture were considered; however, as the material has been classed as soft silty material it is not considered suitable for uses within the construction industry.

Land reclamation, landfill and incineration: given the likelihood of contamination within the dredge arising, costs associated with handling the anticipated volume of material, and the fine nature of particle sizes which makes the material unsuitable for engineering purposes, this option was also discounted.

Sea disposal: Bathymetric survey data, drawing **122592/7004**, indicates a significant change in depth immediately outwith the bounds of Port Edgar marina - this is the location of the main channel of the River Forth. The change in depth here and in particular the fast currents which flow within the main river channel which empties into the estuary, make a preferred location for disposal of plough dredging arising. This option was considered to represent the most appropriate option for dredging operations, taking account of the proximity of the disposal site resulting in minimal environmental impact, given the likely contaminated nature of the material, and the relatively short distance from where the material is required to be dredged from to where it is proposed to be deposited for redistribution.

It is considered that the material is largely similar in composition to that which has previously been plough dredged from within the marina and which is currently being disposed at the identified location at the entrance to the marina. As such, it is not considered likely that the disposal of further dredge arising at this location would result in an adverse environmental impact.

6 Consultation

Consultation feedback and advice received from SNH and Marine Scotland has been included as **Appendix F**.

7 Bio-security

A Bio-security Plan (**Appendix G**) in respect of the control and removal of invasive non-native species, specifically Japanese Wakame seaweed, was produced and written by APEM Ltd in October 2018. This plan has followed the 'simple approach' outlined by Scottish Natural Heritage (SNH) Biosecurity Planning Guidance. The operator is fully committed to the continued implementation of the plan which has been written cognisant of proposed dredging operations planned during the period between 1st January 2019 and 31st January 2022 on an annual of biannual basis.

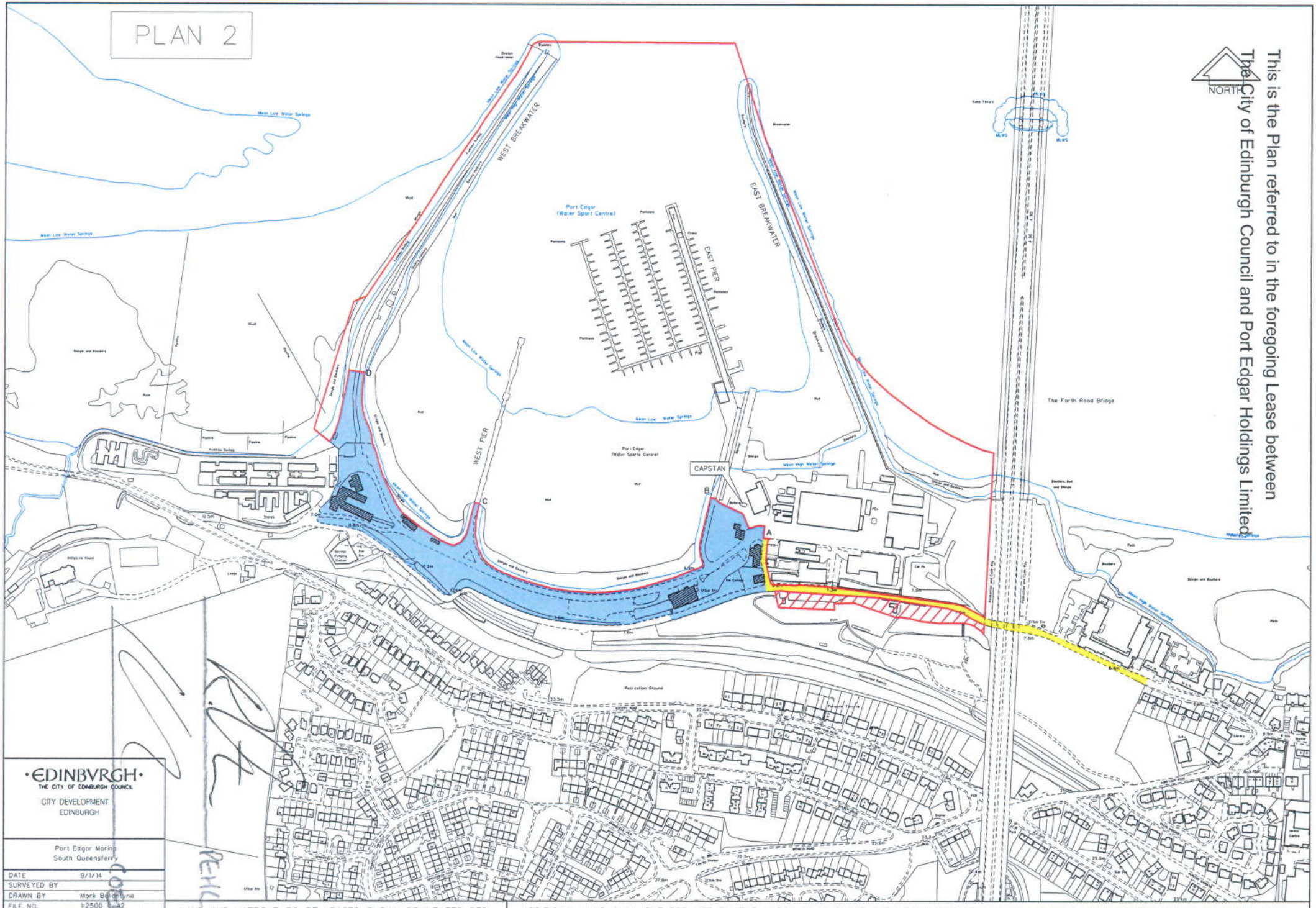
8 Conclusions

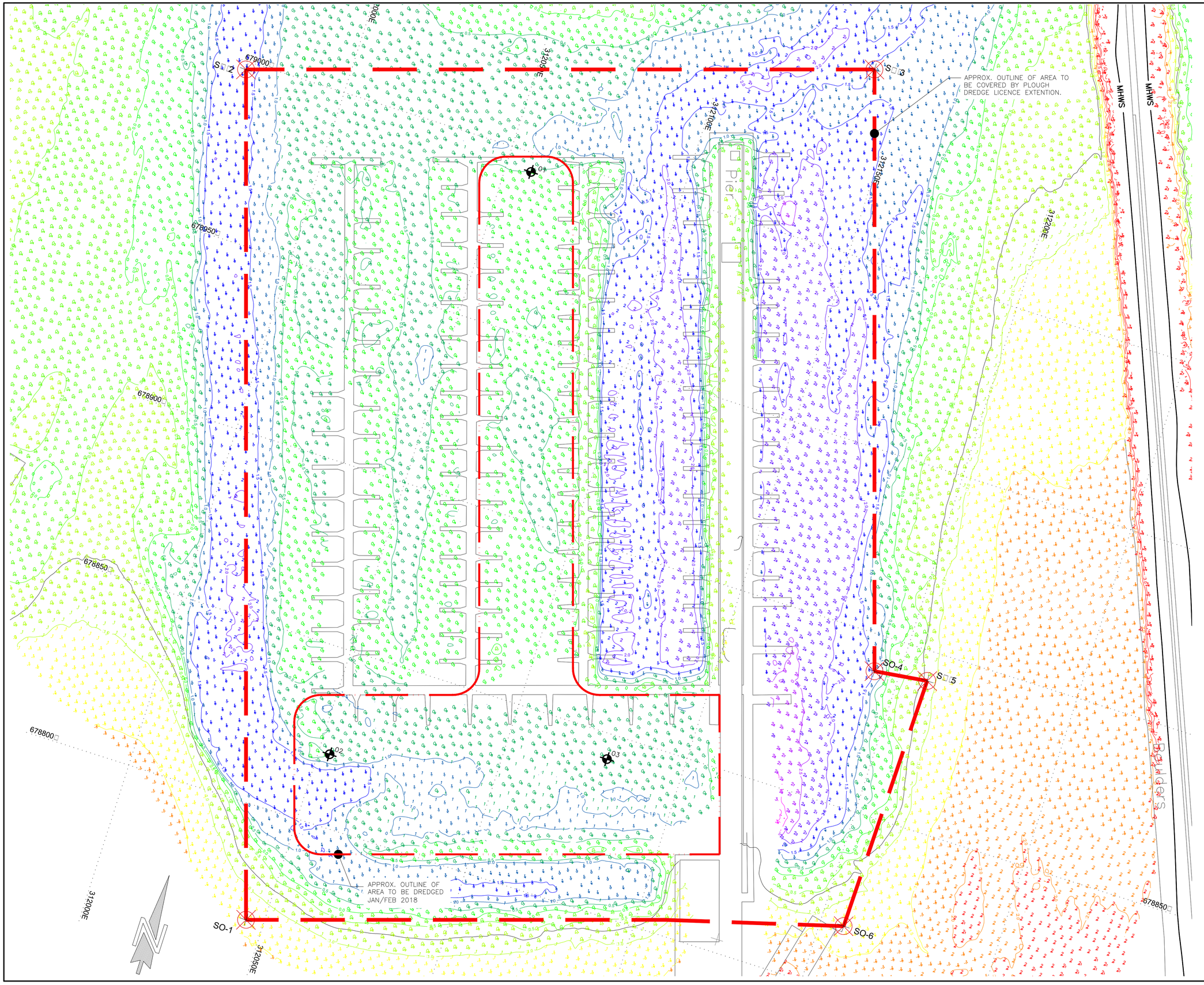
We note the following conclusions with cognisance given to environmental impact in relation to the dredging and disposal of dredge arising:

- Proposed dredging of the area surrounding the West Pier will enable this area, which was historically utilised by the Royal Navy, to be brought back into active use.
- Sampling and analysis of proposed dredge arising has shown that the material consists almost entirely of fine estuarine silts which have been deposited since the West Pier became inactive.
- Interpretation of the laboratory results has shown that, whilst pre-disposal sampling has indicated exceedances of some Marine Scotland AL thresholds; when these were compared with results from a nearby area sampled during 2018 there is an overall improvement.
- A number of dredging options were considered, based on past experience of their application within Port Edgar. Of the options plough dredging were considered to be the most appropriate and is in-line with current practice at the marina. It is also considered to represent the most appropriate option taking account of the proximity of the disposal site resulting in minimal environmental impact from to transportation.
- As the proposed dredge arising is being kept within the confines of Port Edgar Marina, there is likely to be a minimal impact from the transportation of dredge arising due to the proximity of the proposed disposal site which is already in use, as opposed to removal of dredge arising off-site.
- Post-dredging and the removal of silt, mud which provides valuable habitat as regards the qualifying features of the designated sites namely the Firth of Forth SPA and SSSI will remain exposed at low-tides.

Appendix A

Drawings


PLAN 2
This is the Plan referred to in the foregoing Lease between The City of Edinburgh Council and Port Edgar Holdings Limited
NORTH
WEST BREAKWATER
EAST BREAKWATER
EAST PIER
WEST PIER
Port Edgar (Water Sport Centre)
CAPSTAN
The Forth Road Bridge
Recreation Ground
Mean Low Water Springs
Mean High Water Springs
A
B
C
D
·EDINBVRGH·
THE CITY OF EDINBURGH COUNCIL
CITY DEVELOPMENT
EDINBURGH
Port Edgar Marina
South Queensferry
DATE 9/1/14
SURVEYED BY
DRAWN BY Mark Bellantyne
FILE NO. 1:2500 @ A2
NEG. NO. NT1177/A2/87 A
LAND AND HARBOUR TO BE LEASED SHOWN DELINEATED RED
ADDITIONAL LAND AVAILABLE FOR USE BY THE MARINA ON A SHORT TERM BASIS PENDING FUTURE POTENTIAL DEVELOPMENT SHOWN COLOURED BLUE



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION

DEMOLITION

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

LEGEND

EXTENT OF PROPOSED PLOUGH DREDGING

EXTENT OF PROPOSED DREDGING FEB 2018

02 LOCATION OF PROPOSED SAMPLES, REFER TO DRAWING No. 122592/7002.

SETTING OUT COORDINATES

POINT No.	EASTING (X)	NORTHING (Y)	LATITUDE	LONGITUDE
SO-1	312044.984	678768.404	55.993777 (55° 59' 37.60")	-3.411626 (-3° 24' 41.85")
SO-2	311971.564	678997.727	55.995829 (55° 59' 44.99")	-3.412871 (-3° 24' 46.34")
SO-3	312141.077	679051.999	55.996345 (55° 59' 46.84")	-3.410181 (-3° 24' 36.65")
SO-4	312193.034	678889.717	55.995100 (55° 59' 42.36")	-3.393268 (-3° 23' 35.77")
SO-5	312208.091	678891.649	55.994920 (55° 59' 41.71")	-3.409054 (-3° 24' 32.60")
SO-6	312206.716	678818.296	55.994256 (55° 59' 39.32")	-3.409046 (-3° 24' 32.57")

Rev.	Date	Description	Drwn.	Chkd.	Appd.
–	x	x	x	x	

FAIRHURST
225 Both Street
GLASGOW
G2 4GZ
Tel: 0141 204 8800
Fax: 0141 204 8801

Client: PORT EDGAR MARINA

Project Title: PORT EDGAR MARINA PLOUGH DREDGING

Drawing Title: PLOUGH DREDGING PRE-DREDGE SETTING OUT PLAN

Scale at A1:	Status:	
1:500	For Information	
Drawn: GB	Checked: CN	Approved:
Date: 25/01/18	Date: 25/01/18	Date:

Drawing No.: 122592/7003 Revision: –

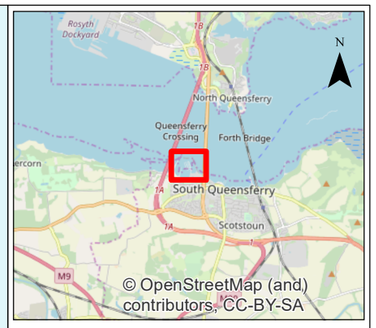
N

Queensferry Crossing

West Breakwater

West Pier

East Breakwater



Legend

- Location of Sediment Analysis
- Deposit Location
- Proposed Dredging Area
- Site of Special Scientific Interest
- Special Protection Area
- RAMSAR Site
- Mean High Water

SCALE: 1:2,500 @ A3

REV	SUIT	DATE	DESCRIPTION	BY	APP

FAIRHURST

Client

PORT EDGAR MARINA LTD

Project

PORT EDGAR MARINA
MARINE LICENCE APPLICATION FOR DREDGING AND SEA DISPOSAL

Drawing Title

PROPOSED DREDGING AREA, DISPOSAL LOCATION AND DESIGNATED AREAS

DESIGN:	DRAWN:	CHK:	APP:
CP	CP	RP	RP

DATE: 06/12/2019 | STATUS: FOR INFORMATION

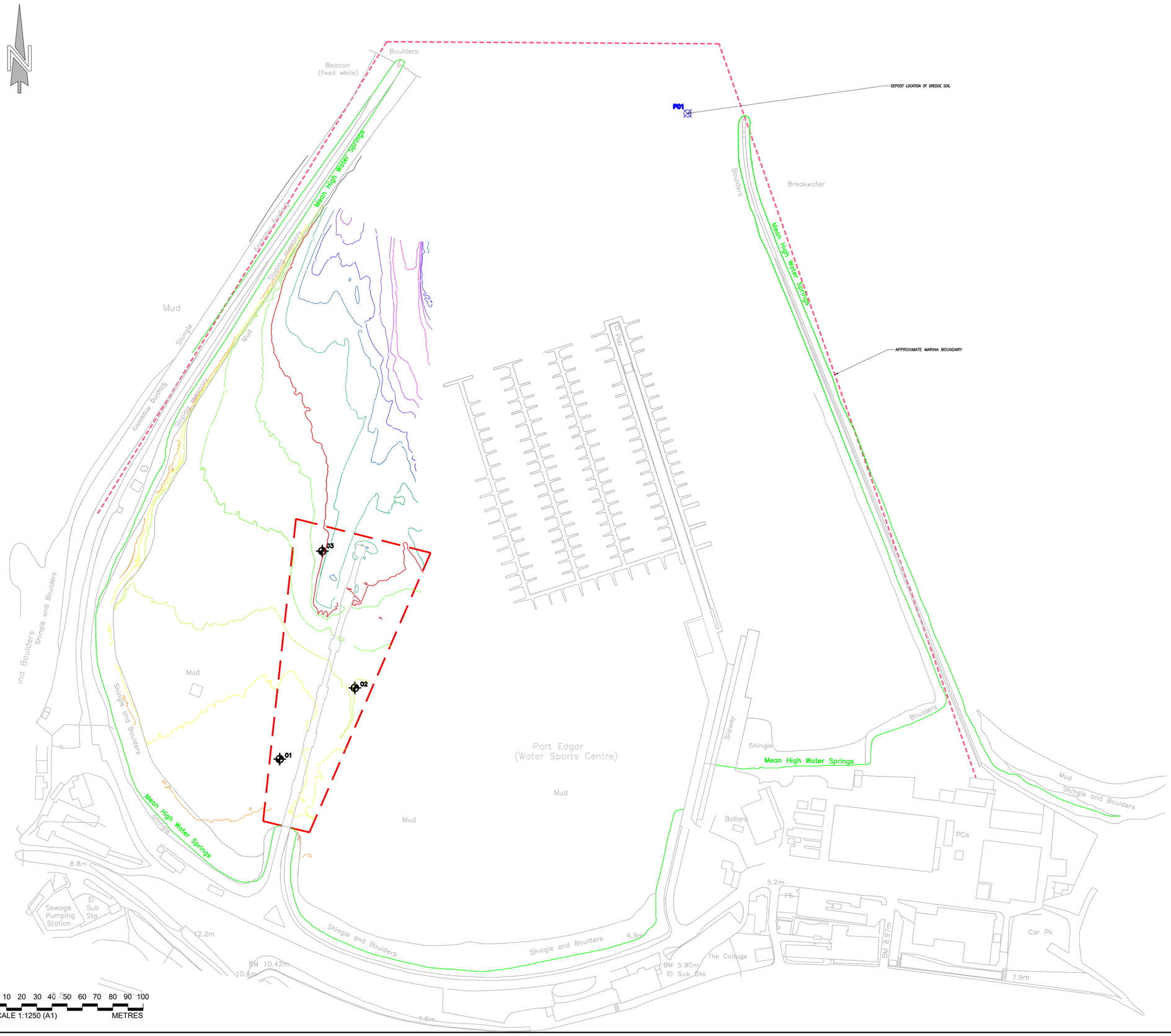
PROJ: 122592A

DWG: WS/122592A/0003

SHEET:	REVISION:	SUITABILITY:
1 OF 1	P01	S2

0 75 150 300 Meters

Document Path: X:\120000-124999\122592 - Port Edgar Breakwater Feasibility\13 Water\GIS\Port Edgar Dredging and Disposal Areas.mxd



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SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION

DEMOLITION

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IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

NOTES:
1. 3No. SAMLES TO BE TAKEN AT MARKED LOCATIONS.
2. SAMPLES TO BE TAKEN DOWN TO DEPTHS OF −1.0m C.D. UNO.
3. SAMPLES TO BE CORE SAMPLES IF DEPTH OF SEDIMENT > 1.0m
4. LAB TESTING AS PER MARINE SCOTLAND PRE−DREDGING SAMPLING GUIDANCE.
5. DREDGING WILL BE PLOUGH DREDGING TO A DEPTH OF −1.0m C.D. UNO.
6. THIS SKETCH IS BASED ON ASPECT BATHYMETRIC SURVEY COMPLETED IN MARCH 2017.

LEGEND

EXTENT OF PROPOSED PLOUGH DREDGING

02 LOCATION OF PROPOSED SAMPLES.

PROPOSED SAMPLE LOCATIONS

Point	Easting	Northing	Latitude	Longitude
01	311894	678740	55.993498 (55° 59' 36.5928"N)	−3.4140370 (−3° 24' 50.5332"W)
02	311944	678787	55.993929 (55° 59' 38.1444"N)	−3.4132511 (−3° 24' 47.7036"W)
03	311926	678874	55.994707 (55° 59' 40.9452"N)	−3.4135681 (−3° 24' 48.8448"W)
P01	312157	679158	55.997300 (55° 59' 50.28"N)	−3.409959 (−3° 24' 35.85"W)

NOTE: POINT P01 DENOTES APPROXIMATE CO−ORDINATES OF DISPOSAL SITE

Rev.	Date	Description	Drwn.	Chkd.	Appd.

FAIRHURST
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Client:
PORT EDGAR MARINA

Project Title:
PORT EDGAR
PLOUGH DREDGING

Drawing Title:
PLOUGH DREDGING
PRE−DREDGE SAMPLING PLAN

Scale at A1:	Status:		
1:500	For Information		
Drawn:	Checked:	Approved:	
RM			
Date:	Date:	Date:	
24/07/19			

Drawing No.: 122592A/WS/0002 | Revision: P01

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SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION

DEMOLITION

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LEGEND

EXTENT OF PROPOSED PLOUGH DREDGING

EXTENT OF PROPOSED DREDGING FEB 2018

02 LOCATION OF PROPOSED SAMPLES.

PROPOSED SAMPLE LOCATIONS

Point	Easting	Northing	Latitude	Longitude
01	312057.280	678994.699	55.995818 (55° 59' 44.9447"N)	-3.411508 (3° 24' 41.4228"W)
02	312053.232	678820.249	55.994245 (55° 59' 39.2820"N)	-3.411515 (3° 24' 41.4540"W)
03	312128.457	678842.891	55.994466 (55° 59' 40.0776"N)	-3.410321 (3° 24' 37.1556"W)

Rev.	Date	Description	Drwn.	Chkd.	Appd.
A	31/01/18	SAMPLE LOCATIONS ADDED	GB	CN	

FAIRHURST

225 Bath Street
GLASGOW
G2 4GZ

Tel: 0141 204 8800
Fax: 0141 204 8801

Client:
PORT EDGAR MARINA

Project Title:
PORT EDGAR BREAKWATER FEASIBILITY
PLOUGH DREDGING

Drawing Title:
PLOUGH DREDGING
LOCATION OF DREDGE SPOIL DEPOSITS

Scale at A1:	Status:	
1:500	For Information	
Drawn: GB	Checked: CJN	Approved:
Date: 25/01/18	Date: 25/1/18	Date:

Drawing No.: 122592/7004 Revision: A

0 10 20 30 40 50 60 70 80 90 100
SCALE 1:1250 (A1) METRES

Appendix B

Dredging Method Statement

Dredging Method Statement

To allow operation within the west side of Port Edgar marina there is a requirement to dredge either side of the West Pier.

The total area for dredging is approximately one hectare and the proposed dredging will be to a depth of between 1 – 1.5 m (variable).

An initial volume of 20,000m^3 will be dredged, following which 10,000m^3 of maintenance dredging will be required annually to enable the continued use of the West Pier.

There is currently a maintenance plough dredging licence (**06629/19/0**) for a separate area within the marina which is dredged to enable operations to occur. Increased use of the marina has led to the requirement to utilize the West Pier to provide the additional capacity required.

The proposed method of dredging is plough dredging:

- Plough dredging operations will begin when there is adequate tide height for the vessels to operate taking into consideration the height of the vessels propellers above the plough to prevent materials being washed out of the plough.
- The ploughing chains will be set to suit the dredge depth required.
- Plough hoisting wires are pre-marked and calibrated to cope with varied water depth.
- Once there is adequate water depth at the south end of the West Pier the Forth Sentinel will commence ploughing operations.
- She will deploy her plough to the seabed allowing enough slack on the hosting wires to allow for final dredge depth.
- The vessel will work from North to south with the tide to achieve maximum working time.
- The material will be ploughed from the West Jetty location out to the 12m contour line outside the Marine where it will disperse.
- The process will be continued until the required dredge depth has been achieved.
- Dredge arising will be moved to the proposed disposal location at the entrance to the marina adjacent to the main channel of the Forth where tidal movements and fast currents will aid the redistribution of sediment.

This method described is in line with current licenced practice at Port Edgar marina.

Appendix C

Aspect Sampling Report

Aspect
Land+Hydrographic Surveys
CHARTERED SURVEYORS

TEL: 01294 313 399 • WEB: WWW.ASPECTSURVEYS.COM

VIBROCORE SURVEY & SEDIMENT ANALYSIS

PORT EDGAR MARINA, SOUTH QUEENSFERRY

JANUARY 2019

PROJECT REF: A7167

REV: 00

Client:

PORT EDGAR MARINA

Shore Road
South Queensferry
Midlothian
EH30 9SQ

Port Edgar Marina

ices Approved Development Partner

Achilles

QAS INTERNATIONAL ISO 9001:2008 REGISTERED FIRM

QAS INTERNATIONAL ISO 14001:2004 REGISTERED FIRM

QAS INTERNATIONAL BS OHSAS 18001:2007 REGISTERED FIRM

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LIST OF FIGURES

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DOCUMENT ISSUE RECORD

DATE	REVISON	COMPILED	CHECKED	NOTES
15/11/2019	00	JAH	CDT	FIRST ISSUE

1. INTRODUCTION

Aspect Land & Hydrographic Surveys Ltd (herein ALHS) were contracted by PORT EDGAR MARINA to carry out sediment sampling using vibrocores in order to licence a planned dredging campaign.

2. GEODESY & DATUM

The horizontal datum used throughout the data gathering phase of the survey was OSGB36 (OSTN15). Data has been rendered in OSGB36 Datum, British National Grid.

The vertical datum for all bathymetric data is Chart Datum which at Toft Pier is 1.24m below OD (Lerwick). OSTN15 defines OSGB36 National Grid in conjunction with the National GPS Network.

In this regard OSTN15 can be considered error free (not including any GPS positional errors). The agreement between OSTN15 and the old triangulation network stations (down to 3rd order) is 0.1m rms.

3. SCOPE OF WORKS

3 cores were to be recovered with the aim being to achieve a minimum core length of 1.5m.

The vibrocore sampling and testing procedures conformed to Marine Scotland Guidance notes http://www.gov.scot/Topics/marine/Licensing/marine/Applications/predredge

All analysis was completed by a laboratory accredited to the ISO17025 standard for marine sediment analysis, and also engages in inter-comparison analysis exercises such as QUASIMEME. The LOD and sensitivity requirements were met as per those set out in the CSEMP Green Book.

Vibrocore sampling was carried out in the areas depicted in Figure 1 below. Sampling was taken from the top, middle and bottom of each core recovered.

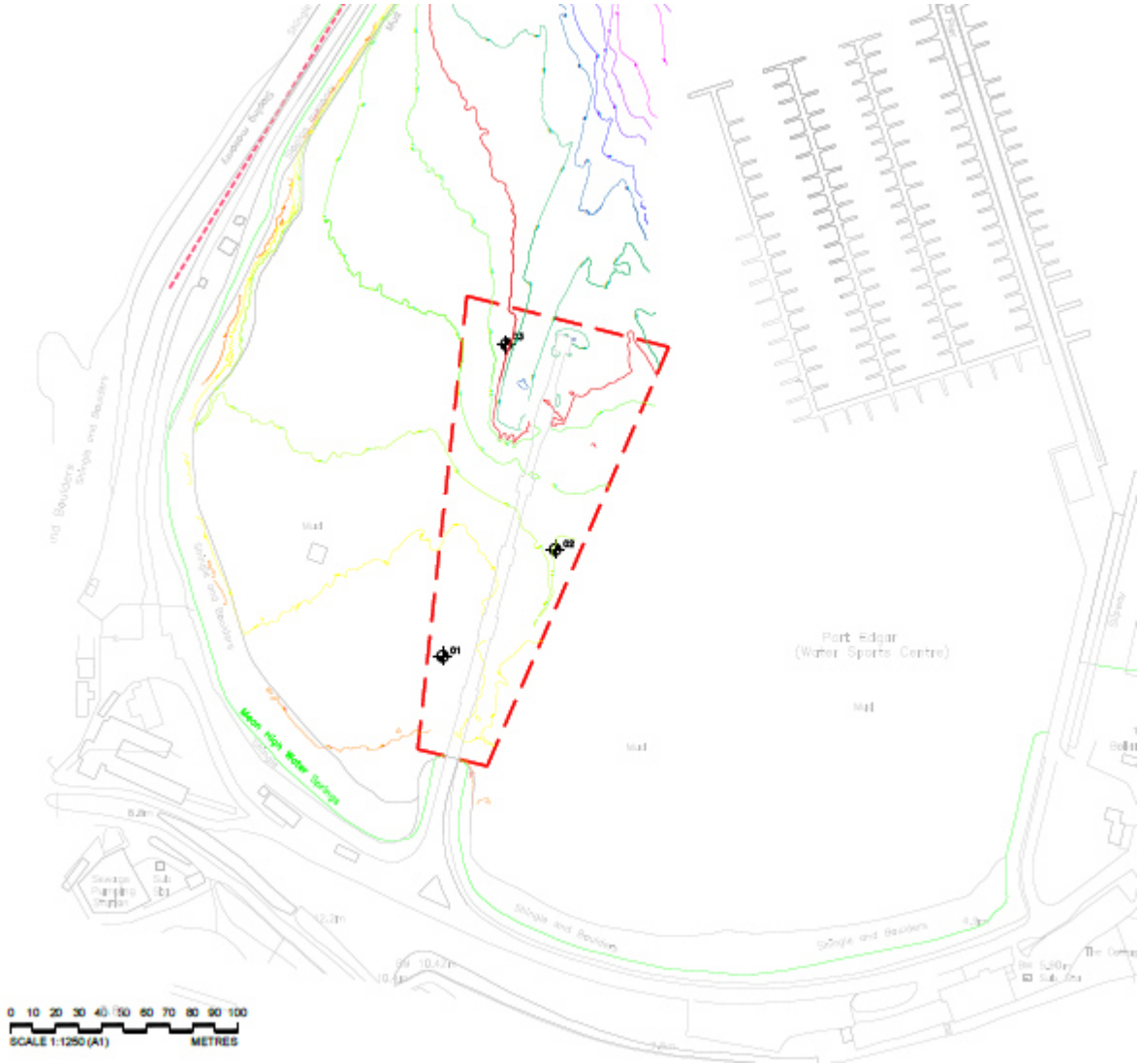


FIGURE 1 - PLANNED SAMPLE LOCATIONS AT PORT EDGAR MARINA

4. SEQUENCE OF EVENTS

Works were completed in the following order;

DATE	EVENT
30/09/2019	Mobilise Vibrocore Equipment to vessel at Port Edgar Marina
30/09/2019	Conduct Vibrocores
30/09/2019	Equipment demobilised
1/10/2019	Sub Samples taken and Frozen
2/10/2019	Frozen samples transmitted to Laboratory for analysis
12/11/2019	Sample analysis report received from SOCOTEC laboratory. Report generation and QA
15/11/2019	Report issued to client

TABLE 1 - SEQUENCE OF EVENTS

5. CONDUCT OF VIBROCORE SAMPLING

The vibrocore apparatus used was a lightweight SDI Vibrocore 4D system with 102mm aluminium extruded pipe being used to recover the core. The system does not rely on overall mass but the vibrational frequency of the equipment and liquefaction of surrounding sediments to enable effective penetration.

The portability and simplicity of this equipment facilitates rapid deployment at an alternate location should the previous location provide a poor return.

The aim was to collect 3 cores in total across the site, of at least 1.5m in length, from sample points indicated on Figure 1. Each sample core was split into sections and samples for analysis collected from the upper, middle and lower sections as a minimum.

Upper Section – 0.0 – 0.5m below seabed
Middle Section – 0.5-1.0m below seabed
Bottom Section – 1.0-1.5m below seabed

The vessel was manoeuvred to each of the locations in turn and secured fore and aft to avoid swinging during the sampling operation.

FIGURE 2 - VIBROCORE ON COMPLETION OF CORE

All vibrocore locations were sampled on 30th September 2019 at the following locations:

VIBROCORE POINT	SAMPLED EASTING	SAMPLED NORTHING	CORE LENGTH
Core 1	311897.56	678746.24	1.5
Core 2	311937.38	678808.78	1.5
Core 3	311932.11	678875.85	1.5

6. EQUIPMENT USED FOR SAMPLING

A Speciality Devices Incorporated D-4 vibrocorer was used for all samples. A 76mm diameter, 3m long core was fitted for all sample attempts and each core tube was constructed of aluminium.

The sediment was pushed out of the core tube and carefully sampled to prevent taking material that had come into contact with the tube wall.

FIGURE 3 - SDI D-4 VIBROCORER AND CORE BEING RECOVERED TO DECK OFSHORE SENSOR

7. SAMPLE ANALYSIS

The laboratory analysis was carried out by SOCOTEC in Burton on Trent. The intention was that all vibrocore samples would be sub sampled at 0.5m intervals at the top middle and bottom of the length of the core and each sub sample analysed for Particle Size, Heavy Metals, TOC, Specific Gravity, PAHs, TBT and DBT.

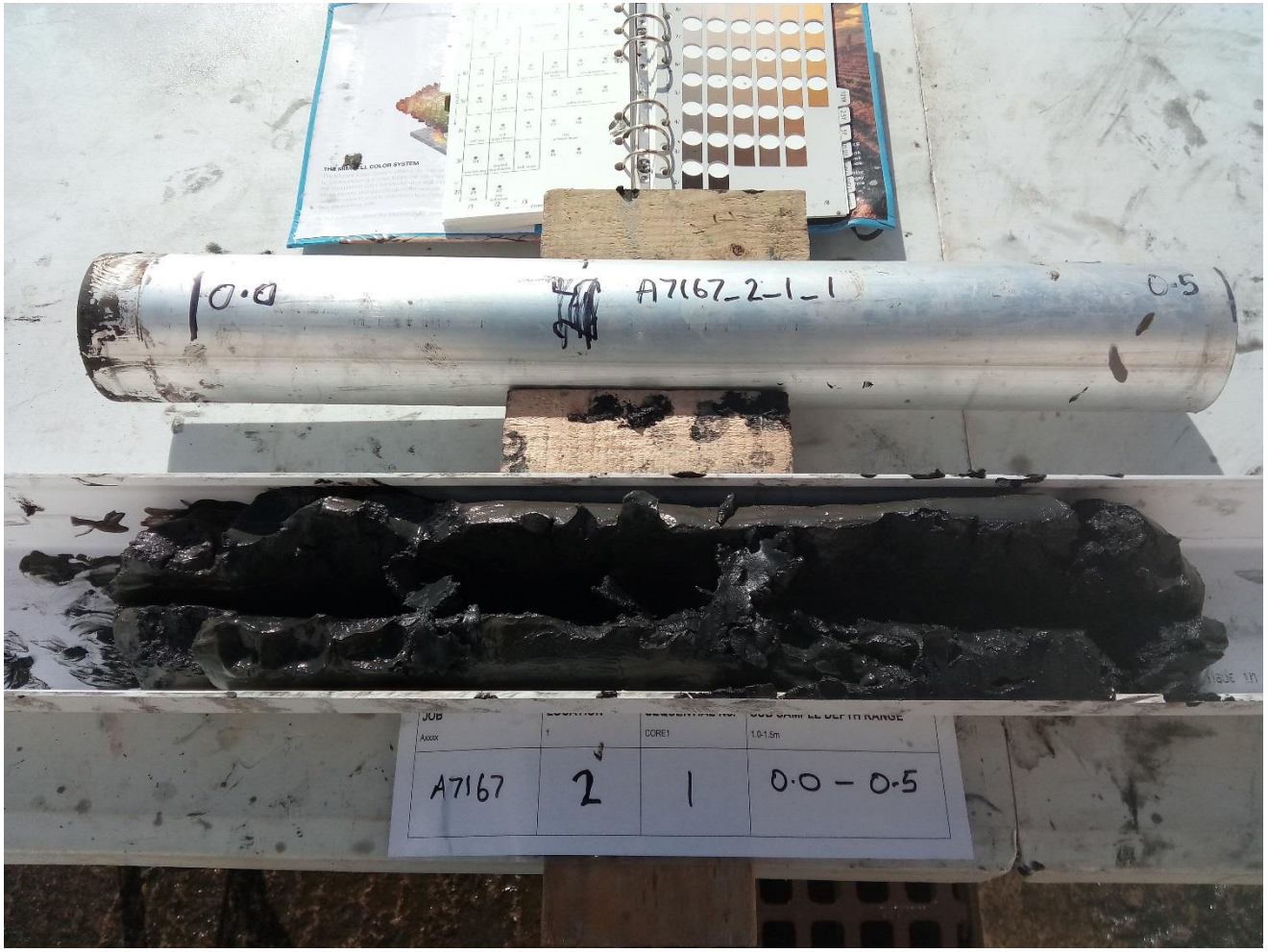
Soil / water	Test	Method (method code in bold)	Accreditation U=UKAS M=MCERTS	Method Reporting Limit, ppm unless stated otherwise
	Marine Scotland Suite (Table 2)			
	CRM &/Or In-House Reference Material to be run with each batch and data included in report			
sediment	Moisture content	Documented in-house method, oven drying @ 105°C, **PAHSED**		0.2%
sediment	**Sieving < 63 um** (samples for trace metals analysis should be sieved to <63 um) Selve size used to be noted on report	IHM		
sediment	**Metals Suite including low level Mercury at 0.01 mg/kg** *As(0.5), Cd(0.04), Cr(0.5),Cu(0.5), Pb(0.5), Hg(0.015), Ni(0.5), Zn(2)*	Documented in-house method using aqua regia extraction and ICPMS, **ICPMSS**	U (Hg UKAS accredited at 0.015mg/kg)	Detection Limits in brackets (mg/kg)
sediment	Low Level TBT & DBT	In house method: OGSNSED		1 ug/kg
sediment	PCBs, ICES 7 Congeners (PCB: 28, 52, 101, 118, 138, 153, 180)	Documented in-house method Triple Quad, **PCBMSSQ (marine sedS)**		0.1µg/kg
sediment	PAHs: 2 to 6 ring aromatics by GC-MS and/or + 16 USEPA (as required)	Documented in-house method using DTI specification by GC-MS, **PAHSED**	U (16 USEPA + Dibenzthiophene & Benzo(e)pyrene only)	0.001
sediment	Particle size distribution by wet and dry sieving to **BS 1377** and Laser Diffraction	Subcontracted to **Kenneth Pye Associates**		

FIGURE 4 - MARINE SCOTLAND SEDIMENT ANALYSIS SUITE & WAC ANALYSIS

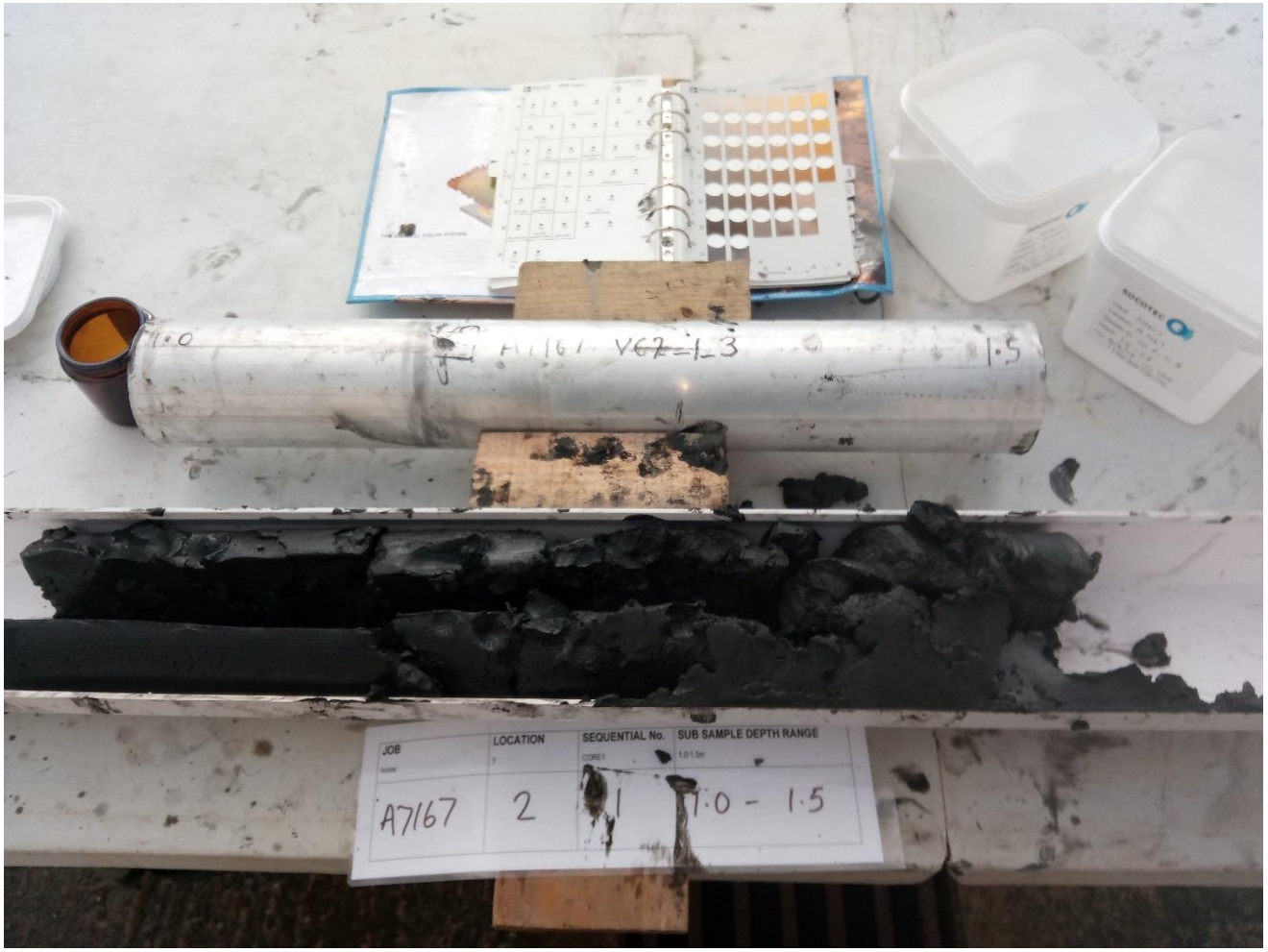
SAMPLE LOCATION	SAMPLE ACHIEVED	ANALYSIS ORDERED	FIELD ANALYSIS SEDIMENT DESCRIPTOR	LAB ANALYSIS SEDIMENT DESCRIPTOR
Core 1	1.5m	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	0.0 - 0.5m 10YR2/2 becoming 10YR2/1 @ 0.42m Dark Brown / Black Silt	**SILT**
				

Core 1	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	0.5-1.0 10YR2/1 Anoxic black SILT	**SILT**
				

Core 1	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	1.0-1.5 10yr2/1 BLACK/BROWN SILT	**SILT**
				

Core 2	1.5m	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	0.0-0.5 12YR2/1 BLACK / BROWN SILT	**SILT**
				

Core 2	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	0.5-1.0 12YR2/1 SILT	**SILT**
				

Core 2	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	1.0-1.5 12YR2/1 FIRM SILT	**SILT**
				

Core 3	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	0.0-0.5 10YR3/1 SOFT DARK BROWN SILT	**SILT**
				

Core 3	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	0.5-1.0 10YR3/2 SOFT BROWN SILT	**SILT**
				

Core 3	1.5	Sampled for PSD, TOC, Specific Gravity, PAHs, TBT and DBT, Heavy metals.	1.0-1.5 10YR3/2 SOFT BROWN SILT TO 1.15m STIFF THEREAFTER	**SILT**
				

The samples have been analysed against the Action Levels quoted by Marine Scotland and are presented in the standard Marine Scotland spreadsheet format: *A7167_Marine Scotland - Results Template MAR00427.xlsx* referenced in Appendix B of this document.

Details on the analysis of individual items are also provided in the accompanying laboratory records for each sample.

8. SURVEY VESSEL

FIGURE 5 - SURVEY VESSEL: OFFSHORE SENSOR

Offshore Sensor is a 22m aluminium hulled catamaran with a deck crane suitable for vibrocore operations.

9. SURVEY PERSONNEL

The following personnel were involved in the survey:

NAME	POSITION
Colin Thomson	QA and Reporting
Jason Hunter	Hydrographic Surveyor
Andrew McCormick	Survey Coxswain

All staff have marine survey experience, and adhered to Health & Safety instructions, including the wearing of life jackets at all times.

Annex A
Horizontal & Vertical Positioning System Precision

A7167

Differential GNSS Positioning Precision

	HORIZONTAL ACCURACY
dGPS	±0.5m + 1ppm RMS

Annex B
SOCOTEC Laboratory Analysis

A7167

- **A7167_Marine Scotland - Results Template MAR00427.xlsx**
- **A7167_MAR00427.xls**

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR00427**	
Issue Version	1	
Customer	Aspect Land & Hydrographic Surveys Ltd, Unit 1, Thornhouse Business Centre, Ballot Road, Irvine, Ayrshire, KA12 0HW	
Customer Reference	A1767	
Date Sampled	30-Sep-19	
Date Received	04-Oct-19	
Date Reported	11-Nov-19	
Condition of samples	Cold	Satisfactory

[Redacted]

Authorised by:	Marya Hubbard
Position:	Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	%	%	%	%	%	mg/m3
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SOCOTEC Doncaster*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	N/A
		Accreditation	UKAS	UKAS	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture @ 120°C**	**Total Solids**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**	**Particle Density**
A7167_VC1_1_1	MAR00427.001	Sediment	55.1	44.9	0.0	9.5	90.5	2.59
A7167_VC1_1_2	MAR00427.002	Sediment	51.6	48.4	0.0	8.8	91.2	2.58
A7167_VC1_1_3	MAR00427.003	Sediment	50.7	49.3	0.0	8.0	92.0	2.61
A7167_VC2_1_1	MAR00427.004	Sediment	53.2	46.8	0.0	9.9	90.1	2.57
A7167_VC2_1_2	MAR00427.005	Sediment	51.1	48.9	0.0	8.8	91.2	2.57
A7167_VC2_1_3	MAR00427.006	Sediment	52.4	47.6	0.0	8.0	92.0	2.58
A7167_VC3_1_1	MAR00427.007	Sediment	56.6	43.4	0.0	10.3	89.7	2.56
A7167_VC3_1_2	MAR00427.008	Sediment	56.0	44.0	0.0	9.1	90.9	2.57
A7167_VC3_1_3	MAR00427.009	Sediment	51.3	48.7	0.0	9.6	90.4	2.57
		Reference Material (% Recovery)	N/A	N/A	N/A	N/A	N/A	N/A
		QC Blank	N/A	N/A	N/A	N/A	N/A	N/A

* See Report Notes
NAIIS - No Asbestos Identified In Sample
CH - Chrysotile

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	N/A	% M/M
		Method No	SUB_02*	SOCOTEC Env Chem*
		Limit of Detection	N/A	0.02
		Accreditation	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Asbestos**	**TOC**
A7167_VC1_1_1	MAR00427.001	Sediment	NAIIS	4.06
A7167_VC1_1_2	MAR00427.002	Sediment	NAIIS	4.41
A7167_VC1_1_3	MAR00427.003	Sediment	NAIIS	4.88
A7167_VC2_1_1	MAR00427.004	Sediment	NAIIS	4.15
A7167_VC2_1_2	MAR00427.005	Sediment	NAIIS	4.44
A7167_VC2_1_3	MAR00427.006	Sediment	CH	5.12
A7167_VC3_1_1	MAR00427.007	Sediment	CH	4.02
A7167_VC3_1_2	MAR00427.008	Sediment	NAIIS	3.97
A7167_VC3_1_3	MAR00427.009	Sediment	NAIIS	4.33
		Reference Material (% Recovery)	N/A	100
		QC Blank	N/A	<0.02

* See Report Notes
NAIIS - No Asbestos Identified In Sample
CH - Chrysotile

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	mg/Kg (Dry Weight)							
		Method No	SOCOTEC Env Chem*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	N	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
A7167_VC1_1_1	MAR00427.001	Sediment	14.5	0.19	46.8	32.5	0.79	31.7	66.1	130
A7167_VC1_1_2	MAR00427.002	Sediment	14.0	0.16	60.4	38.9	0.93	30.5	69.4	132
A7167_VC1_1_3	MAR00427.003	Sediment	16.6	0.21	68.1	46.0	1.12	32.4	77.4	153
A7167_VC2_1_1	MAR00427.004	Sediment	15.0	0.18	57.0	39.2	1.03	29.8	73.8	136
A7167_VC2_1_2	MAR00427.005	Sediment	14.9	0.15	56.3	39.1	0.77	27.9	60.2	134
A7167_VC2_1_3	MAR00427.006	Sediment	16.6	0.19	73.5	46.5	0.99	33.0	73.6	157
A7167_VC3_1_1	MAR00427.007	Sediment	17.4	0.18	50.3	34.5	0.70	33.7	61.4	131
A7167_VC3_1_2	MAR00427.008	Sediment	16.7	0.14	53.5	32.4	0.62	32.5	54.8	120
A7167_VC3_1_3	MAR00427.009	Sediment	16.3	0.14	59.2	33.1	0.70	31.8	62.1	133
Certified Reference Material SETOC 774 (% Recovery)			95	94	93	103	91	95	92	100
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
A7167_VC1_1_1	MAR00427.001	Sediment	<5	5.34
A7167_VC1_1_2	MAR00427.002	Sediment	<5	8.78
A7167_VC1_1_3	MAR00427.003	Sediment	14.6	12.0
A7167_VC2_1_1	MAR00427.004	Sediment	<5	<5
A7167_VC2_1_2	MAR00427.005	Sediment	<5	<5
A7167_VC2_1_3	MAR00427.006	Sediment	13.6	12.0
A7167_VC3_1_1	MAR00427.007	Sediment	<5	<5
A7167_VC3_1_2	MAR00427.008	Sediment	<5	<5
A7167_VC3_1_3	MAR00427.009	Sediment	<5	13.0
Certified Reference Material BCR-646 (% Recovery)			84	73
QC Blank			<1	<1

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
A7167_VC1_1_1	MAR00427.001	Sediment	37.5	43.2	159	311	365	406
A7167_VC1_1_2	MAR00427.002	Sediment	45.6	82.4	203	330	369	442
A7167_VC1_1_3	MAR00427.003	Sediment	61.8	65.9	252	418	458	535
A7167_VC2_1_1	MAR00427.004	Sediment	57.5	79.6	210	403	466	530
A7167_VC2_1_2	MAR00427.005	Sediment	57.0	71.2	243	391	458	562
A7167_VC2_1_3	MAR00427.006	Sediment	69.8	119.0	281	412	437	535
A7167_VC3_1_1	MAR00427.007	Sediment	49.1	43.6	178	325	382	430
A7167_VC3_1_2	MAR00427.008	Sediment	57.3	47.4	185	321	375	429
A7167_VC3_1_3	MAR00427.009	Sediment	46.2	54.2	206	363	393	489
Certified Reference Material CRM180013 1941b (% Recovery)			74	103	70	70	63	89
		QC Blank	<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BEP**	**BENZGHIP**	**BKF**	**C1N**	**C1PHEN**	**C2N**
A7167_VC1_1_1	MAR00427.001	Sediment	327	354	202	695	505	646
A7167_VC1_1_2	MAR00427.002	Sediment	348	367	187	823	623	750
A7167_VC1_1_3	MAR00427.003	Sediment	417	426	219	1030	684	944
A7167_VC2_1_1	MAR00427.004	Sediment	413	424	220	907	663	882
A7167_VC2_1_2	MAR00427.005	Sediment	418	441	209	970	692	867
A7167_VC2_1_3	MAR00427.006	Sediment	414	433	189	1090	769	1020
A7167_VC3_1_1	MAR00427.007	Sediment	345	369	162	739	552	660
A7167_VC3_1_2	MAR00427.008	Sediment	342	385	181	908	601	798
A7167_VC3_1_3	MAR00427.009	Sediment	368	427	167	884	652	818
Certified Reference Material CRM180013 1941b (% Recovery)			89	69	105	82	83	110
		QC Blank	<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	N	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**C3N**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**	**INDPYR**
A7167_VC1_1_1	MAR00427.001	Sediment	643	320	55.9	519	90.4	302
A7167_VC1_1_2	MAR00427.002	Sediment	902	353	64.4	547	119	320
A7167_VC1_1_3	MAR00427.003	Sediment	1160	457	78.7	698	159	372
A7167_VC2_1_1	MAR00427.004	Sediment	1070	435	76.0	657	148	337
A7167_VC2_1_2	MAR00427.005	Sediment	1080	438	68.7	702	143	385
A7167_VC2_1_3	MAR00427.006	Sediment	1370	447	72.3	714	188	370
A7167_VC3_1_1	MAR00427.007	Sediment	791	351	66.1	544	104	290
A7167_VC3_1_2	MAR00427.008	Sediment	871	345	67.5	551	114	330
A7167_VC3_1_3	MAR00427.009	Sediment	968	383	65.7	579	125	350
Certified Reference Material CRM180013 1941b (% Recovery)			133	90	108	81	59	76
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	N	UKAS	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**NAPTH**	**PERYLENE**	**PHENANT**	**PYRENE**	**THC**
A7167_VC1_1_1	MAR00427.001	Sediment	239	196	342	629	452000
A7167_VC1_1_2	MAR00427.002	Sediment	273	258	389	732	500000
A7167_VC1_1_3	MAR00427.003	Sediment	377	327	485	872	667000
A7167_VC2_1_1	MAR00427.004	Sediment	299	326	440	818	574000
A7167_VC2_1_2	MAR00427.005	Sediment	333	332	469	863	614000
A7167_VC2_1_3	MAR00427.006	Sediment	358	347	528	914	683000
A7167_VC3_1_1	MAR00427.007	Sediment	255	219	393	651	536000
A7167_VC3_1_2	MAR00427.008	Sediment	301	231	428	674	500000
A7167_VC3_1_3	MAR00427.009	Sediment	303	285	424	711	631000
Certified Reference Material CRM180013 1941b (% Recovery)			66	59	82	73	103~
		QC Blank	<1	<1	<1	<1	<100

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**
A7167_VC1_1_1	MAR00427.001	Sediment	1.10	0.87	0.91	1.02	1.43	1.34
A7167_VC1_1_2	MAR00427.002	Sediment	1.76	1.07	1.17	1.34	1.58	1.78
A7167_VC1_1_3	MAR00427.003	Sediment	1.55	1.14	1.44	1.40	1.75	2.13
A7167_VC2_1_1	MAR00427.004	Sediment	1.15	0.99	1.20	1.28	1.63	1.82
A7167_VC2_1_2	MAR00427.005	Sediment	1.22	1.04	1.27	1.30	1.56	1.79
A7167_VC2_1_3	MAR00427.006	Sediment	1.49	1.39	1.58	1.42	1.67	2.04
A7167_VC3_1_1	MAR00427.007	Sediment	0.94	0.86	1.06	1.17	1.46	1.51
A7167_VC3_1_2	MAR00427.008	Sediment	0.90	0.83	0.82	1.04	1.10	1.28
A7167_VC3_1_3	MAR00427.009	Sediment	1.23	1.06	1.19	1.11	1.63	1.72
Certified Reference Material SRM 1941b (% Recovery)			67	78	77	85	116	82
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB18**	**PCB105**	**PCB110**	**PCB128**	**PCB141**	**PCB149**
A7167_VC1_1_1	MAR00427.001	Sediment	0.91	0.39	0.99	0.17	0.17	0.99
A7167_VC1_1_2	MAR00427.002	Sediment	1.21	0.48	1.30	0.25	0.11	1.38
A7167_VC1_1_3	MAR00427.003	Sediment	1.03	0.50	1.53	0.24	0.15	1.89
A7167_VC2_1_1	MAR00427.004	Sediment	0.86	0.33	1.26	0.23	0.20	1.44
A7167_VC2_1_2	MAR00427.005	Sediment	0.87	0.46	1.28	0.28	0.16	1.42
A7167_VC2_1_3	MAR00427.006	Sediment	1.20	0.49	1.47	0.27	0.17	1.63
A7167_VC3_1_1	MAR00427.007	Sediment	0.76	0.37	1.02	0.26	0.23	1.03
A7167_VC3_1_2	MAR00427.008	Sediment	0.78	0.37	0.81	0.17	0.13	0.79
A7167_VC3_1_3	MAR00427.009	Sediment	1.02	0.45	1.16	0.23	0.19	1.17
Certified Reference Material SRM 1941b (% Recovery)			74	80	91	87	95~	72
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB151**	**PCB156**	**PCB158**	**PCB170**	**PCB180**	**PCB183**
A7167_VC1_1_1	MAR00427.001	Sediment	0.24	0.15	0.21	0.46	0.99	0.22
A7167_VC1_1_2	MAR00427.002	Sediment	0.24	0.12	0.19	0.41	1.05	0.29
A7167_VC1_1_3	MAR00427.003	Sediment	0.29	0.20	0.25	0.51	1.26	0.41
A7167_VC2_1_1	MAR00427.004	Sediment	0.29	0.18	0.18	0.39	1.00	0.33
A7167_VC2_1_2	MAR00427.005	Sediment	0.19	0.19	0.20	0.40	1.03	0.28
A7167_VC2_1_3	MAR00427.006	Sediment	0.27	0.17	0.24	0.48	1.21	0.36
A7167_VC3_1_1	MAR00427.007	Sediment	0.24	0.17	0.21	0.37	0.91	0.23
A7167_VC3_1_2	MAR00427.008	Sediment	0.18	0.08	0.10	0.29	0.82	0.16
A7167_VC3_1_3	MAR00427.009	Sediment	0.21	0.16	0.23	0.40	1.02	0.23
Certified Reference Material SRM 1941b (% Recovery)			103~	70	97	82	78	55
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB187**	**PCB194**	**PCB31**	**PCB44**	**PCB47**	**PCB49**
A7167_VC1_1_1	MAR00427.001	Sediment	0.56	0.29	1.55	0.64	0.22	0.70
A7167_VC1_1_2	MAR00427.002	Sediment	0.81	0.24	2.38	0.90	1.12	1.03
A7167_VC1_1_3	MAR00427.003	Sediment	0.96	0.32	1.99	0.79	1.46	1.08
A7167_VC2_1_1	MAR00427.004	Sediment	0.68	0.23	1.65	0.76	0.84	0.84
A7167_VC2_1_2	MAR00427.005	Sediment	0.63	0.24	1.69	0.81	1.07	0.90
A7167_VC2_1_3	MAR00427.006	Sediment	0.79	0.31	2.10	0.99	1.43	1.17
A7167_VC3_1_1	MAR00427.007	Sediment	0.48	0.20	1.37	0.63	0.51	0.61
A7167_VC3_1_2	MAR00427.008	Sediment	0.43	0.18	1.29	0.58	0.16	0.60
A7167_VC3_1_3	MAR00427.009	Sediment	0.60	0.20	1.66	0.95	0.23	0.81
Certified Reference Material SRM 1941b (% Recovery)			76	62	92	77	93	89
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB66**	**AHCH**	**BHCH**	**GHCH**	**DIELDRIN**	**HCB**
A7167_VC1_1_1	MAR00427.001	Sediment	1.00	<0.1	<0.1	0.15	0.43	3.73
A7167_VC1_1_2	MAR00427.002	Sediment	1.54	<0.1	<0.1	0.11	0.60	5.74
A7167_VC1_1_3	MAR00427.003	Sediment	1.62	<0.1	<0.1	0.17	0.93	8.07
A7167_VC2_1_1	MAR00427.004	Sediment	1.24	<0.1	<0.1	0.11	0.80	4.90
A7167_VC2_1_2	MAR00427.005	Sediment	1.31	<0.1	<0.1	0.14	0.69	5.98
A7167_VC2_1_3	MAR00427.006	Sediment	1.60	<0.1	<0.1	0.14	0.85	7.84
A7167_VC3_1_1	MAR00427.007	Sediment	0.91	<0.1	<0.1	<0.1	0.52	3.29
A7167_VC3_1_2	MAR00427.008	Sediment	0.91	<0.1	<0.1	<0.1	0.43	3.63
A7167_VC3_1_3	MAR00427.009	Sediment	1.19	<0.1	<0.1	0.10	0.64	3.85
Certified Reference Material SRM 1941b (% Recovery)			80	92~	112~	97~	102~	114
QC Blank			<0.08	<0.1	<0.1	<0.1	<0.1	<0.1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**DDE**	**DDT**	**DDD**
A7167_VC1_1_1	MAR00427.001	Sediment	1.07	0.12	2.27
A7167_VC1_1_2	MAR00427.002	Sediment	1.25	<0.1	2.79
A7167_VC1_1_3	MAR00427.003	Sediment	1.39	0.24	3.69
A7167_VC2_1_1	MAR00427.004	Sediment	1.28	0.13	2.97
A7167_VC2_1_2	MAR00427.005	Sediment	1.20	0.14	2.79
A7167_VC2_1_3	MAR00427.006	Sediment	1.37	<0.1	3.52
A7167_VC3_1_1	MAR00427.007	Sediment	1.02	0.11	2.19
A7167_VC3_1_2	MAR00427.008	Sediment	0.94	<0.1	2.12
A7167_VC3_1_3	MAR00427.009	Sediment	1.10	0.11	2.84
Certified Reference Material SRM 1941b (% Recovery)			82	88~	80~
QC Blank			<0.1	<0.1	<0.1

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR00427.001-009	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SOCOTEC Doncaster*	MAR00427.001-009	Analysis was conducted by an internal SOCOTEC laboratory.
SUB_01*	MAR00427.001-009	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR00427.001-009	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR00427.001-009	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR00427.001-009	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

Method	Sample and Fraction Size	Method Summary
Total Solids	Wet Sediment	Calculation (100%-Moisture Content).Moisture content determined by drying a portion of the sample at 105°C to constant weight.
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.
Total Organic Carbon (TOC)	Wet Sediment	Carbonate removal and sulphurous acid/combustion at 800°C/NDIR.
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Organochlorine Pesticides (OCPs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Diben[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDE	p,p'-Dichorodiphenyldicloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDT	p,p'-Dichorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene		
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

Annex C
Standard Disclaimer

A7167

1. All client-supplied data is taken on trust as being accurate and correct, and the subcontractor cannot be held responsible for the quality and accuracy of that data set.

2. Geophysical interpretation of bathymetry and sonar is based on an informed opinion of the supplied data, and is subject to inherent errors out with the control of the interpretational hydrographer or geophysicist, which include but are not limited to GPS positioning errors, navigation busts, data quality, assumed speed velocity sediment profiles in the absence of Geotechnical data, sub bottom profile pulse width, and induced scaling errors therein associated with seismic signature. Seabed geomorphology and sub-seabed geology should be further investigated by visual or intrusive methods.

3. The limits of this survey are defined by the data set; out with the survey limits are not covered at any level by the subcontractor.

4. The data is accurate at the time of data acquisition, the subcontractor cannot be held responsible for environmental changes, and the client by accepting this report accepts that the environment of the seabed is subject to continuous change, that items of debris, hard contacts etc. may move, appear, be relocated or removed, thickness of surficial sediment change out with the knowledge of the subcontractor and they will not be held responsible for such actions at any level.

Appendix D

SOCOTEC Laboratory Analysis

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR00427**	
Issue Version	1	
Customer	Aspect Land & Hydrographic Surveys Ltd, Unit 1, Thornhouse Business Centre, Ballot Road, Irvine, Ayrshire, KA12 0HW	
Customer Reference	A1767	
Date Sampled	30-Sep-19	
Date Received	04-Oct-19	
Date Reported	11-Nov-19	
Condition of samples	Cold	Satisfactory

[Redacted]

Authorised by:	Marya Hubbard
Position:	Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	%	%	%	%	%	mg/m3
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SOCOTEC Doncaster*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	N/A
		Accreditation	UKAS	UKAS	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture @ 120°C**	**Total Solids**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**	**Particle Density**
A7167_VC1_1_1	MAR00427.001	Sediment	55.1	44.9	0.0	9.5	90.5	2.59
A7167_VC1_1_2	MAR00427.002	Sediment	51.6	48.4	0.0	8.8	91.2	2.58
A7167_VC1_1_3	MAR00427.003	Sediment	50.7	49.3	0.0	8.0	92.0	2.61
A7167_VC2_1_1	MAR00427.004	Sediment	53.2	46.8	0.0	9.9	90.1	2.57
A7167_VC2_1_2	MAR00427.005	Sediment	51.1	48.9	0.0	8.8	91.2	2.57
A7167_VC2_1_3	MAR00427.006	Sediment	52.4	47.6	0.0	8.0	92.0	2.58
A7167_VC3_1_1	MAR00427.007	Sediment	56.6	43.4	0.0	10.3	89.7	2.56
A7167_VC3_1_2	MAR00427.008	Sediment	56.0	44.0	0.0	9.1	90.9	2.57
A7167_VC3_1_3	MAR00427.009	Sediment	51.3	48.7	0.0	9.6	90.4	2.57
		Reference Material (% Recovery)	N/A	N/A	N/A	N/A	N/A	N/A
		QC Blank	N/A	N/A	N/A	N/A	N/A	N/A

* See Report Notes
NAIIS - No Asbestos Identified In Sample
CH - Chrysotile

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	N/A	% M/M
		Method No	SUB_02*	SOCOTEC Env Chem*
		Limit of Detection	N/A	0.02
		Accreditation	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Asbestos**	**TOC**
A7167_VC1_1_1	MAR00427.001	Sediment	NAIIS	4.06
A7167_VC1_1_2	MAR00427.002	Sediment	NAIIS	4.41
A7167_VC1_1_3	MAR00427.003	Sediment	NAIIS	4.88
A7167_VC2_1_1	MAR00427.004	Sediment	NAIIS	4.15
A7167_VC2_1_2	MAR00427.005	Sediment	NAIIS	4.44
A7167_VC2_1_3	MAR00427.006	Sediment	CH	5.12
A7167_VC3_1_1	MAR00427.007	Sediment	CH	4.02
A7167_VC3_1_2	MAR00427.008	Sediment	NAIIS	3.97
A7167_VC3_1_3	MAR00427.009	Sediment	NAIIS	4.33
		Reference Material (% Recovery)	N/A	100
		QC Blank	N/A	<0.02

* See Report Notes
NAIIS - No Asbestos Identified In Sample
CH - Chrysotile

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	mg/Kg (Dry Weight)							
		Method No	SOCOTEC Env Chem*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	N	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
A7167_VC1_1_1	MAR00427.001	Sediment	14.5	0.19	46.8	32.5	0.79	31.7	66.1	130
A7167_VC1_1_2	MAR00427.002	Sediment	14.0	0.16	60.4	38.9	0.93	30.5	69.4	132
A7167_VC1_1_3	MAR00427.003	Sediment	16.6	0.21	68.1	46.0	1.12	32.4	77.4	153
A7167_VC2_1_1	MAR00427.004	Sediment	15.0	0.18	57.0	39.2	1.03	29.8	73.8	136
A7167_VC2_1_2	MAR00427.005	Sediment	14.9	0.15	56.3	39.1	0.77	27.9	60.2	134
A7167_VC2_1_3	MAR00427.006	Sediment	16.6	0.19	73.5	46.5	0.99	33.0	73.6	157
A7167_VC3_1_1	MAR00427.007	Sediment	17.4	0.18	50.3	34.5	0.70	33.7	61.4	131
A7167_VC3_1_2	MAR00427.008	Sediment	16.7	0.14	53.5	32.4	0.62	32.5	54.8	120
A7167_VC3_1_3	MAR00427.009	Sediment	16.3	0.14	59.2	33.1	0.70	31.8	62.1	133
Certified Reference Material SETOC 774 (% Recovery)			95	94	93	103	91	95	92	100
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
A7167_VC1_1_1	MAR00427.001	Sediment	<5	5.34
A7167_VC1_1_2	MAR00427.002	Sediment	<5	8.78
A7167_VC1_1_3	MAR00427.003	Sediment	14.6	12.0
A7167_VC2_1_1	MAR00427.004	Sediment	<5	<5
A7167_VC2_1_2	MAR00427.005	Sediment	<5	<5
A7167_VC2_1_3	MAR00427.006	Sediment	13.6	12.0
A7167_VC3_1_1	MAR00427.007	Sediment	<5	<5
A7167_VC3_1_2	MAR00427.008	Sediment	<5	<5
A7167_VC3_1_3	MAR00427.009	Sediment	<5	13.0
Certified Reference Material BCR-646 (% Recovery)			84	73
QC Blank			<1	<1

***** See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
A7167_VC1_1_1	MAR00427.001	Sediment	37.5	43.2	159	311	365	406
A7167_VC1_1_2	MAR00427.002	Sediment	45.6	82.4	203	330	369	442
A7167_VC1_1_3	MAR00427.003	Sediment	61.8	65.9	252	418	458	535
A7167_VC2_1_1	MAR00427.004	Sediment	57.5	79.6	210	403	466	530
A7167_VC2_1_2	MAR00427.005	Sediment	57.0	71.2	243	391	458	562
A7167_VC2_1_3	MAR00427.006	Sediment	69.8	119.0	281	412	437	535
A7167_VC3_1_1	MAR00427.007	Sediment	49.1	43.6	178	325	382	430
A7167_VC3_1_2	MAR00427.008	Sediment	57.3	47.4	185	321	375	429
A7167_VC3_1_3	MAR00427.009	Sediment	46.2	54.2	206	363	393	489
Certified Reference Material CRM180013 1941b (% Recovery)			74	103	70	70	63	89
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BEP**	**BENZGHIP**	**BKF**	**C1N**	**C1PHEN**	**C2N**
A7167_VC1_1_1	MAR00427.001	Sediment	327	354	202	695	505	646
A7167_VC1_1_2	MAR00427.002	Sediment	348	367	187	823	623	750
A7167_VC1_1_3	MAR00427.003	Sediment	417	426	219	1030	684	944
A7167_VC2_1_1	MAR00427.004	Sediment	413	424	220	907	663	882
A7167_VC2_1_2	MAR00427.005	Sediment	418	441	209	970	692	867
A7167_VC2_1_3	MAR00427.006	Sediment	414	433	189	1090	769	1020
A7167_VC3_1_1	MAR00427.007	Sediment	345	369	162	739	552	660
A7167_VC3_1_2	MAR00427.008	Sediment	342	385	181	908	601	798
A7167_VC3_1_3	MAR00427.009	Sediment	368	427	167	884	652	818
Certified Reference Material CRM180013 1941b (% Recovery)			89	69	105	82	83	110
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	N	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**C3N**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**	**INDPYR**
A7167_VC1_1_1	MAR00427.001	Sediment	643	320	55.9	519	90.4	302
A7167_VC1_1_2	MAR00427.002	Sediment	902	353	64.4	547	119	320
A7167_VC1_1_3	MAR00427.003	Sediment	1160	457	78.7	698	159	372
A7167_VC2_1_1	MAR00427.004	Sediment	1070	435	76.0	657	148	337
A7167_VC2_1_2	MAR00427.005	Sediment	1080	438	68.7	702	143	385
A7167_VC2_1_3	MAR00427.006	Sediment	1370	447	72.3	714	188	370
A7167_VC3_1_1	MAR00427.007	Sediment	791	351	66.1	544	104	290
A7167_VC3_1_2	MAR00427.008	Sediment	871	345	67.5	551	114	330
A7167_VC3_1_3	MAR00427.009	Sediment	968	383	65.7	579	125	350
Certified Reference Material CRM180013 1941b (% Recovery)			133	90	108	81	59	76
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	N	UKAS	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**NAPTH**	**PERYLENE**	**PHENANT**	**PYRENE**	**THC**
A7167_VC1_1_1	MAR00427.001	Sediment	239	196	342	629	452000
A7167_VC1_1_2	MAR00427.002	Sediment	273	258	389	732	500000
A7167_VC1_1_3	MAR00427.003	Sediment	377	327	485	872	667000
A7167_VC2_1_1	MAR00427.004	Sediment	299	326	440	818	574000
A7167_VC2_1_2	MAR00427.005	Sediment	333	332	469	863	614000
A7167_VC2_1_3	MAR00427.006	Sediment	358	347	528	914	683000
A7167_VC3_1_1	MAR00427.007	Sediment	255	219	393	651	536000
A7167_VC3_1_2	MAR00427.008	Sediment	301	231	428	674	500000
A7167_VC3_1_3	MAR00427.009	Sediment	303	285	424	711	631000
Certified Reference Material CRM180013 1941b (% Recovery)			66	59	82	73	103~
		QC Blank	<1	<1	<1	<1	<100

For full analyte name see method summaries

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As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**
A7167_VC1_1_1	MAR00427.001	Sediment	1.10	0.87	0.91	1.02	1.43	1.34
A7167_VC1_1_2	MAR00427.002	Sediment	1.76	1.07	1.17	1.34	1.58	1.78
A7167_VC1_1_3	MAR00427.003	Sediment	1.55	1.14	1.44	1.40	1.75	2.13
A7167_VC2_1_1	MAR00427.004	Sediment	1.15	0.99	1.20	1.28	1.63	1.82
A7167_VC2_1_2	MAR00427.005	Sediment	1.22	1.04	1.27	1.30	1.56	1.79
A7167_VC2_1_3	MAR00427.006	Sediment	1.49	1.39	1.58	1.42	1.67	2.04
A7167_VC3_1_1	MAR00427.007	Sediment	0.94	0.86	1.06	1.17	1.46	1.51
A7167_VC3_1_2	MAR00427.008	Sediment	0.90	0.83	0.82	1.04	1.10	1.28
A7167_VC3_1_3	MAR00427.009	Sediment	1.23	1.06	1.19	1.11	1.63	1.72
Certified Reference Material SRM 1941b (% Recovery)			67	78	77	85	116	82
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB18**	**PCB105**	**PCB110**	**PCB128**	**PCB141**	**PCB149**
A7167_VC1_1_1	MAR00427.001	Sediment	0.91	0.39	0.99	0.17	0.17	0.99
A7167_VC1_1_2	MAR00427.002	Sediment	1.21	0.48	1.30	0.25	0.11	1.38
A7167_VC1_1_3	MAR00427.003	Sediment	1.03	0.50	1.53	0.24	0.15	1.89
A7167_VC2_1_1	MAR00427.004	Sediment	0.86	0.33	1.26	0.23	0.20	1.44
A7167_VC2_1_2	MAR00427.005	Sediment	0.87	0.46	1.28	0.28	0.16	1.42
A7167_VC2_1_3	MAR00427.006	Sediment	1.20	0.49	1.47	0.27	0.17	1.63
A7167_VC3_1_1	MAR00427.007	Sediment	0.76	0.37	1.02	0.26	0.23	1.03
A7167_VC3_1_2	MAR00427.008	Sediment	0.78	0.37	0.81	0.17	0.13	0.79
A7167_VC3_1_3	MAR00427.009	Sediment	1.02	0.45	1.16	0.23	0.19	1.17
Certified Reference Material SRM 1941b (% Recovery)			74	80	91	87	95~	72
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB151**	**PCB156**	**PCB158**	**PCB170**	**PCB180**	**PCB183**
A7167_VC1_1_1	MAR00427.001	Sediment	0.24	0.15	0.21	0.46	0.99	0.22
A7167_VC1_1_2	MAR00427.002	Sediment	0.24	0.12	0.19	0.41	1.05	0.29
A7167_VC1_1_3	MAR00427.003	Sediment	0.29	0.20	0.25	0.51	1.26	0.41
A7167_VC2_1_1	MAR00427.004	Sediment	0.29	0.18	0.18	0.39	1.00	0.33
A7167_VC2_1_2	MAR00427.005	Sediment	0.19	0.19	0.20	0.40	1.03	0.28
A7167_VC2_1_3	MAR00427.006	Sediment	0.27	0.17	0.24	0.48	1.21	0.36
A7167_VC3_1_1	MAR00427.007	Sediment	0.24	0.17	0.21	0.37	0.91	0.23
A7167_VC3_1_2	MAR00427.008	Sediment	0.18	0.08	0.10	0.29	0.82	0.16
A7167_VC3_1_3	MAR00427.009	Sediment	0.21	0.16	0.23	0.40	1.02	0.23
Certified Reference Material SRM 1941b (% Recovery)			103~	70	97	82	78	55
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

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Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB187**	**PCB194**	**PCB31**	**PCB44**	**PCB47**	**PCB49**
A7167_VC1_1_1	MAR00427.001	Sediment	0.56	0.29	1.55	0.64	0.22	0.70
A7167_VC1_1_2	MAR00427.002	Sediment	0.81	0.24	2.38	0.90	1.12	1.03
A7167_VC1_1_3	MAR00427.003	Sediment	0.96	0.32	1.99	0.79	1.46	1.08
A7167_VC2_1_1	MAR00427.004	Sediment	0.68	0.23	1.65	0.76	0.84	0.84
A7167_VC2_1_2	MAR00427.005	Sediment	0.63	0.24	1.69	0.81	1.07	0.90
A7167_VC2_1_3	MAR00427.006	Sediment	0.79	0.31	2.10	0.99	1.43	1.17
A7167_VC3_1_1	MAR00427.007	Sediment	0.48	0.20	1.37	0.63	0.51	0.61
A7167_VC3_1_2	MAR00427.008	Sediment	0.43	0.18	1.29	0.58	0.16	0.60
A7167_VC3_1_3	MAR00427.009	Sediment	0.60	0.20	1.66	0.95	0.23	0.81
Certified Reference Material SRM 1941b (% Recovery)			76	62	92	77	93	89
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB66**	**AHCH**	**BHCH**	**GHCH**	**DIELDRIN**	**HCB**
A7167_VC1_1_1	MAR00427.001	Sediment	1.00	<0.1	<0.1	0.15	0.43	3.73
A7167_VC1_1_2	MAR00427.002	Sediment	1.54	<0.1	<0.1	0.11	0.60	5.74
A7167_VC1_1_3	MAR00427.003	Sediment	1.62	<0.1	<0.1	0.17	0.93	8.07
A7167_VC2_1_1	MAR00427.004	Sediment	1.24	<0.1	<0.1	0.11	0.80	4.90
A7167_VC2_1_2	MAR00427.005	Sediment	1.31	<0.1	<0.1	0.14	0.69	5.98
A7167_VC2_1_3	MAR00427.006	Sediment	1.60	<0.1	<0.1	0.14	0.85	7.84
A7167_VC3_1_1	MAR00427.007	Sediment	0.91	<0.1	<0.1	<0.1	0.52	3.29
A7167_VC3_1_2	MAR00427.008	Sediment	0.91	<0.1	<0.1	<0.1	0.43	3.63
A7167_VC3_1_3	MAR00427.009	Sediment	1.19	<0.1	<0.1	0.10	0.64	3.85
Certified Reference Material SRM 1941b (% Recovery)			80	92~	112~	97~	102~	114
QC Blank			<0.08	<0.1	<0.1	<0.1	<0.1	<0.1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.1	0.1	0.1
		Date Analysed	03/03/2018	03/03/2018	03/03/2018
		Accreditation	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**DDE**	**DDT**	**DDD**
A7167_VC1_1_1	MAR00427.001	Sediment	1.07	0.12	2.27
A7167_VC1_1_2	MAR00427.002	Sediment	1.25	<0.1	2.79
A7167_VC1_1_3	MAR00427.003	Sediment	1.39	0.24	3.69
A7167_VC2_1_1	MAR00427.004	Sediment	1.28	0.13	2.97
A7167_VC2_1_2	MAR00427.005	Sediment	1.20	0.14	2.79
A7167_VC2_1_3	MAR00427.006	Sediment	1.37	<0.1	3.52
A7167_VC3_1_1	MAR00427.007	Sediment	1.02	0.11	2.19
A7167_VC3_1_2	MAR00427.008	Sediment	0.94	<0.1	2.12
A7167_VC3_1_3	MAR00427.009	Sediment	1.10	0.11	2.84
Certified Reference Material SRM 1941b (% Recovery)			82	88~	80~
QC Blank			<0.1	<0.1	<0.1

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00427
Issue Version 1
Customer Reference A1767

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR00427.001-009	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SOCOTEC Doncaster*	MAR00427.001-009	Analysis was conducted by an internal SOCOTEC laboratory.
SUB_01*	MAR00427.001-009	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR00427.001-009	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR00427.001-009	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR00427.001-009	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR00427
Issue Version	1
Customer Reference	A1767

Method	Sample and Fraction Size	Method Summary
Total Solids	Wet Sediment	Calculation (100%-Moisture Content).Moisture content determined by drying a portion of the sample at 105°C to constant weight.
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.
Total Organic Carbon (TOC)	Wet Sediment	Carbonate removal and sulphurous acid/combustion at 800°C/NDIR.
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Organochlorine Pesticides (OCPs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Diben[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDE	p,p'-Dichorodiphenyldicloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDT	p,p'-Dichorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene		
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

Appendix E

2018 Best Practical Environmental Option Report

Port Edgar Marina

Dredging Licence
BPEO Report

May 2018

FAIRHURST

CONTROL SHEET

CLIENT: **Port Edgar Marina**

PROJECT TITLE: **Dredging Licence Application**

REPORT TITLE: **BPEO Report**

PROJECT REFERENCE: **122592A**

DOCUMENT NUMBER: **122592A/R001/REV 01**

Issue & Approval Schedule	ISSUE 1	Name	Signature	Date
	Prepared by	Claire Nicolson Catherine McCutcheon		08/02/18
	Checked by	Grant Scholes		09/02/18
	Approved by	Colin Clark		12/02/18

Revision Record	Rev.	Date	Status	Description	Signature	
	1	03/05/18	Final	Amended to incorporate Marine Scotland Comments	By	
					Checked	
					Approved	
	2				By	
					Checked	
					Approved	

This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System*

Contents

1 Introduction

1.1 Background to application

The report has been prepared to set out the Best Practice Environmental Option (BPEO) for the treatment of dredge arisings as a result of the need to carry out maintenance dredging within the boundary of Port Edgar Marina. The dredging is required to maintain a suitable dredge depth for operation of the marina.

Port Edgar Marina currently have a licence in place to allow plough dredging within the marina boundaries up to a volume of 2000m^3 less any volume dredged under previous licences.

Port Edgar Marina undertakes regular (annual) dredging as a result of sedimentation within the confines of the protected area, which has increased as a result of the construction of nearby bridge piers in recent years.

The current dredging licence is valid until July 2018; the operator is seeking to obtain an extension of time and volume. Due to the previous test samples having been obtained and reviewed over three years ago, this BPEO has been prepared to review the current sample test results. It is not intended to amend the method of dredging which has been reviewed and reported on in the previous BPEO which supported the current dredging licence application (Port Edgar Marina, Best Practicable Environmental Option Assessment: Sea Disposal of Solid Materials, Black & Veatch, Revised Feb 2015, see Appendix E). It is considered that plough dredging remains the most suitable option, due to the relative proximity of the disposal site which results in minimal impact due to adverse effects of transportation.

1.2 Source of Materials

The material to be relocated via plough dredging is from the area surrounding the pontoons within the marina. Drawing 122592/7004 in Appendix A shows the area to be dredged, and the location to which the sediment will be moved.

1.3 Description of Materials

1.3.1 Volume of Material

The licence application covers a period of three years, up to 10,000 wet tonnes. The volume of dredging to be carried out per year may vary, depending on the amount of sedimentation which occurs.

1.3.2 Nature of Material

The material to be removed is predominantly soft silty material.

The sediment has been tested in accordance with the guidelines set out in the Marine Scotland pre-disposal sampling guidance document.

A summary of the results of the sampling is provided in table 1 below, with the full results contained in Appendix B. Drawing 122592/7004 in Appendix A shows the locations at which the samples were obtained.

Photographs of each grab sample are contained within Appendix C.

Table 1: Grab Sample Descriptions

Sample	Material Description
Grab 1	Soft brown silt with a colour change at around 10mm below surface to a grey/brown colour. No noticeable odour and no anthropogenic inputs noted.
Grab 2	Soft brown silt with a colour change at around 20mm below surface to a grey/brown colour. No noticeable odour and no anthropogenic inputs noted.
Grab 3	Soft brown silt with a colour change at around 5mm below surface to a grey/brown colour. No noticeable odour and no anthropogenic inputs noted.

1.4 Test Results

The test results suggest that a number of trace metals and organotins, and PAHs fall between the suggested Marine Scotland action level 1 and 2 thresholds.

Samples with contaminants identified between action levels 1 and 2 may incur constraints such as restriction on disposal at sea, monitoring of dredge material and disposal site or treatment / mitigation measures.

Those contaminants which are greater than the Marine Scotland action level 1 are displayed for each sample in tables 2 - 4 below:

Table 2: Grab Sample 1 Contaminants Exceeding AL1.

Sample : Grab 1				
Contaminant of concern	**AL1 threshold** mg/kg dry weight (ppm)	**Result** mg/kg dry weight (ppm)	**Exceedance of AL1** mg/kg dry weight (ppm)	**Percentage exceedance** (%)
Cadmium (Cd)	0.4	0.46	0.06	15
Chromium (Cr)	50	64.2	14.2	28
Copper (Cu)	30	206.9	176.9	590
Mercury (Hg)	0.25	0.73	0.48	192
Nickel (Ni)	30	33.2	3.2	11
Lead (Pb)	50	70.1	20.1	40
Zinc (Zn)	130	222.7	92.7	71
Benz(a)anthracene	0.1	0.1084	0.084	8
Benzo(a)pyrene	0.1	0.1104	0.0104	10
Benzo(b)fluoranthene	0.1	0.1322	0.0322	32
Benzo(e)pyrene	0.1	0.1137	0.0137	14
Benzo(ghi)perylene	0.1	0.1153	0.0153	15
C1-naphthalenes	0.1	0.5715	0.4715	472
C1-phenanthrene	0.1	0.4949	0.3949	395
C2-naphthalenes	0.1	0.6198	0.5198	520
C3-naphthalenes	0.1	0.6294	0.5249	529
Chrysene	0.1	1.2758	1.1758	1176
Diben(ah)anthracene	0.01	0.8094	0.7994	7994
Fluoranthene	0.1	0.1833	0.0833	83
Indeno (1,2,3-cd) pyrene	0.1	0.1051	0.0051	5
Phenanthrene	0.1	0.1345	0.0345	35
Pyrene	0.1	0.2202	0.1202	120

Table 3: Grab Sample 2 Contaminants Exceeding AL1.

Sample : Grab 2				
Contaminant of concern	**AL1 threshold** mg/kg dry weight (ppm)	**Result** mg/kg dry weight (ppm)	**Exceedance of AL1** mg/kg dry weight (ppm)	**Percentage exceedance** (%)
Chromium (Cr)	50	61.7	11.7	23
Copper (Cu)	30	53	23	77
Mercury (Hg)	0.25	0.75	0.5	200
Nickel (Ni)	30	32.3	2.3	8
Lead (Pb)	50	60.6	10.6	21
Zinc (Zn)	130	142.1	12.1	9
Benz(a)anthracene	0.1	0.1168	0.0168	17
Benzo(a)pyrene	0.1	0.1117	0.0117	12
Benzo(b)fluoranthene	0.1	0.1486	0.0486	49
Benzo(e)pyrene	0.1	0.109	0.09	9
Benzo(ghi)perylene	0.1	0.1199	0.0199	20
C1-naphthalenes	0.1	0.5945	0.4945	495
C1-phenanthrene	0.1	0.5339	0.4339	434
C2-naphthalenes	0.1	0.6325	0.5825	533
C3-naphthalenes	0.1	0.6741	0.5741	574
Chrysene	0.1	1.3868	1.2868	1287
Diben(ah)anthracene	0.01	0.9664	0.9564	9464
Fluoranthene	0.1	0.1995	0.0995	100
Indeno (1,2,3-cd) pyrene	0.1	0.1133	0.0133	13
Phenanthrene	0.1	0.1409	0.0409	41
Pyrene	0.1	0.2395	0.1395	140

Table 4: Grab Sample 3 Contaminants Exceeding AL1.

Sample : Grab 3				
Contaminant of concern	**AL1 threshold** mg/kg dry weight (ppm)	**Result** mg/kg dry weight (ppm)	**Exceedance of AL1** mg/kg dry weight (ppm)	**Percentage exceedance** (%)
Chromium (Cr)	50	57.6	7.6	15
Copper (Cu)	30	39.4	9.4	31
Mercury (Hg)	0.25	0.73	0.48	192
Nickel (Ni)	30	30.2	0.2	0.7
Lead (Pb)	50	55.4	5.4	11
Benz(a)anthracene	0.1	0.1282	0.0282	28
Benzo(a)pyrene	0.1	0.1324	0.0324	32
Benzo(b)fluoranthene	0.1	0.1671	0.0671	67
Benzo(e)pyrene	0.1	0.1201	0.0201	20
Benzo(ghi)perylene	0.1	0.126	0.026	26
C1-naphthalenes	0.1	0.6303	0.5303	530
C1-phenanthrene	0.1	0.566	0.466	466
C2-naphthalenes	0.1	0.6869	0.5869	587
C3-naphthalenes	0.1	0.659	0.559	56
Chrysene	0.1	1.5731	1.4731	1473
Diben(ah)anthracene	0.01	1.0004	0.9904	990
Fluoranthene	0.1	0.2202	0.1202	120
Indeno (1,2,3-cd) pyrene	0.1	0.1122	0.0122	12
Phenanthrene	0.1	0.1523	0.0523	52
Pyrene	0.1	0.2574	0.1574	157

In accordance with Marine Scotland Pre-disposal Sampling Guidance (version 2), Figure 1 step (5), suitability of these samples for disposal will have to be determined ultimately by Marine Scotland through expert judgement based on evaluation of evidence including historical information, disposal site characteristics and physical characteristics of the material. Historical testing records for samples taken in 2013 are compared against 2017 chemical testing results, comparison of these results and those that exceed AL1 (highlighted in blue) are provided in table 5.

Table 5: 2013 & 2017 Comparison of Contaminants Exceeding AL1.

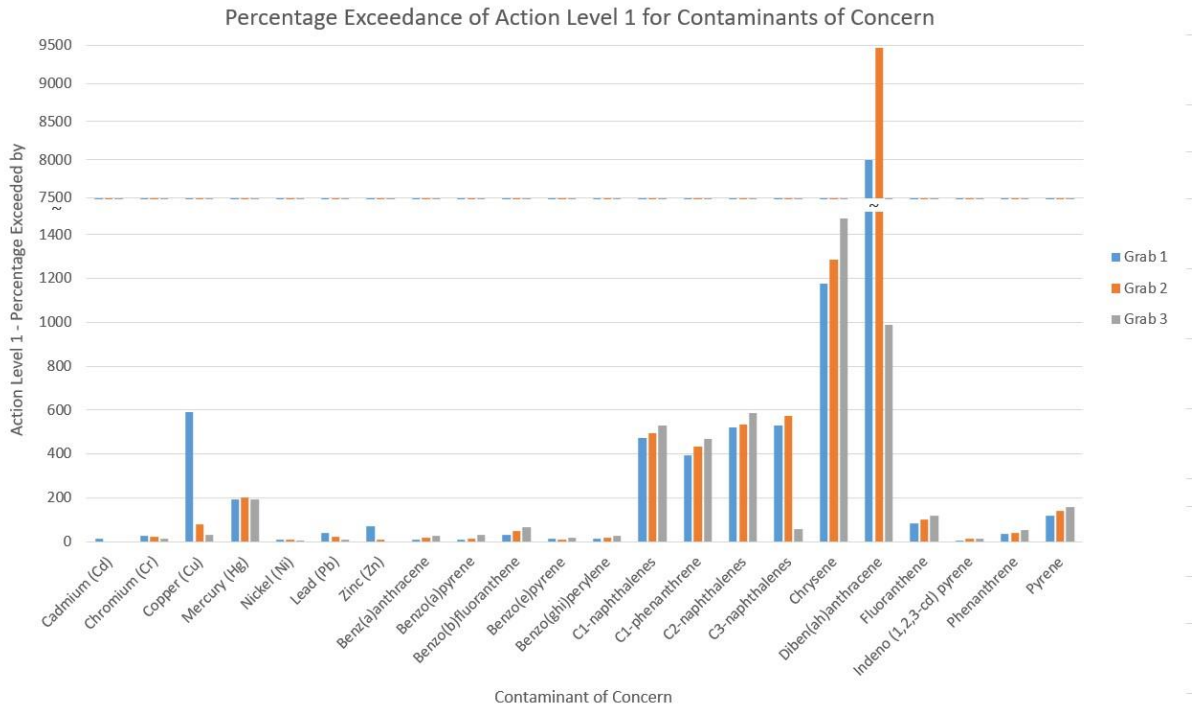
Contaminant of concern	**2013 Results** (3 samples) mg/kg dry weight (ppm)		**2017 Results** (3 samples) mg/kg dry weight (ppm)		AL1 threshold mg/kg dry weight (ppm)
	Minimum	Maximum	Minimum	Maximum	
Cadmium (Cd)	0.13	0.19	-	0.46	0.4
Chromium (Cr)	66.7	76.4	57.6	64.2	50
Copper (Cu)	34.0	41.5	39.4	206.9	30
Mercury (Hg)	0.63	0.67	0.73	0.75	0.25
Nickel (Ni)	34	37.1	30.2	33.2	30
Lead (Pb)	62.2	67.4	55.4	70.1	50
Zinc (Zn)	123	147	142.1	222.7	130
Benz(a)anthracene	0.0857	0.141	0.1084	0.1282	0.1
Benzo(a)pyrene	0.0682	0.122	0.1104	0.1324	0.1
Benzo(b)fluoranthene	0.132	0.177	0.1322	0.1671	0.1
Benzo(e)pyrene	-	-	0.109	0.1201	0.1
Benzo(ghi)perylene	0.0491	0.0911	0.126	0.1199	0.1
C1-naphthalenes	-	-	0.5715	0.6303	0.1
C1-phenanthrene	-	-	0.566	0.5339	0.1
C2-naphthalenes	-	-	0.6198	0.6869	0.1
C3-naphthalenes	-	-	0.659	0.6741	0.1
Chrysene	0.143	0.176	1.2758	1.5731	0.1
Dibenzo(ah)anthracene	0.0088	0.026	0.8094	1.0004	0.01
Fluoranthene	0.151	0.285	0.1833	0.2202	0.1
Indeno (1,2,3-cd) pyrene	0.0425	0.0935	0.1051	0.1133	0.1
Phenanthrene	0.114	0.164	0.1345	0.1523	0.1
Pyrene	0.216	0.319	0.2202	0.2574	0.1

Note: samples highlighted in blue are above AL(1) but below AL(2)

The most proximal of the three samples to the proposed disposal area is Grab 1. The disposal area lies approximately 210m from the boundary of the dredge area as seen on drawing 122592/7004.

With respect to the contaminants of concern, 75% of those above AL(1) in 2017 were also above AL(1) in 2013, indicating that few 'new' contaminants have been introduced into the environment. Graph 1, below, shows that the exceedances seen in the three 2017 samples follow similar exceedance trends, suggesting that there is unlikely to be a large variation in contamination levels elsewhere in the site, including within the proposed disposal area.

Graph 1: Percentage Exceedance of AL1 for Contaminants of Concern



As the dredge material in question is not to be moved out of the site of origin, but moved to a nearby location within the site, the possible risk of cross contamination could be considered low, however, as previously mentioned, suitability of this material for disposal in the proposed area will ultimately be determined by Marine Scotland.

1.5 Details of Previous Dredging Operations

Port Edgar Marina has held dredging licences as follows in table 6:

Table 6: Port Edgar Marina Dredging Licences

Licence Ref	Dates Valid	Allowable Quantity	Description
05048/14/0	10/2/14 – 9/2/15	24,000m3	Capital dredging – sea disposal
05048/15/0	18/2/15 – 28/2/15	23,000m3 sea disposal 1,000m3 plough	Revision to above
05577/15/0	14/7/15 – 13/7/18	2,000m3	3 year plough dredging licence
05577/17/0	14/7/15 – 13/7/18	2,000m3 (less any arisings from above licence)	Revision to above
05577/17/1	31/1/17 – 13/7/18	2,000m3 (less any arisings from above licence)	Revision to above
05577/17/2	1/2/17 – 13/7/18	2,000m3 (less any arisings from above licence)	Revision to above

A programme of capital dredging was carried out in 2015 and thereafter maintenance dredging has been carried out annually to ensure operability of the marina.

2 Options for Relocation of Dredge Spoil

The material to be dredged from the vicinity of the marina berths will not be removed off site; plough dredging will be carried out to move the material from the high spots at the marina to an area at the north east corner of the area for which Port Edgar Marina is responsible. This is in line with current practice in place at the marina, following a previous exercise being undertaken to look at the options

for dredging, and is considered to represent the most appropriate option for the continuation of dredging operations, taking account of the proximity of the disposal site resulting in minimal environmental impact due to transportation.

Drawing 122592/7003 in Appendix A shows the layout of the pontoons and the area which requires maintenance dredging to be carried out. The area to which the dredge arisings will be removed is shown on drawing 122592/7004 in relation to the dredge area, with the dredge spoil being relocated approximately 210m from the boundary of the dredge area.

3 Removal of Invasive Species

An invasive species of seaweed, Japanese Wakame, was noted to be present in the marina. Subsequent investigations by Marine Scotland noted that while the seaweed does not seem to have spread to nearby areas, it would be prudent for the seaweed to be removed. Port Edgar Marina has been in discussion with Marine Scotland's Marine Planning department in order to resolve this issue.

A letter issued by Marine Scotland's Planning and Policy department on 27th November 2017 confirms that the meeting was undertaken and that means of removal of the seaweed were agreed (letter contain in Appendix D). The seaweed has now been removed; therefore there is no outstanding issue relating to the presence of this invasive species.

In line with current good practice, regular inspections will be carried out in order to identify any invasive species as soon as is reasonably possible and minimise the risk of further spread of non-native species, alongside a cleaning regime and the development of a biosecurity plan which is to be followed in the event that non-native species are discovered. This biosecurity plan will be developed and managed in line with the guidance published by SNH within the document "Marine Biosecurity Planning – Guidance for producing site and operation-based plans for preventing the introduction of non-native species" (Payne, R.D., Cook, E.J. and Macleod, A. (2014)), and as directed by SEPA https://www.nature.scot/sites/default/files/2017-06/A1294630.pdf.

A monthly inspection around the waterline of the pontoons, moorings, and piles will be carried out, while annually an underwater inspection will be undertaken. Annual cleaning of marine fouling will be undertaken, taking cognisance of the safe collection and disposal of arisings to minimise the risk of a spread of non-native species. In addition to the actions which can be taken by Port Edgar Marina operators, visiting vessel owners will be encouraged to adhere to the SEPA good practice biosecurity measures as described in their "Check Clean Dry" campaign.

4 Special Protection Area

The foreshore at Port Edgar is part of a designated Special Protection area (SNH site code 8499, Firth of Forth), due to the area supporting a number of overwintering bird populations and some migrating species.

The dredge area however covers an area of the marina basin which is outwith the SPA boundary and does not include the foreshore; therefore it is considered that plough dredging will have minimal effect on the habitat and feeding grounds of these birds. The timing of plough dredging will be determined to minimise the overall impact.

5 Discussion and Conclusions

5.1 Disposal

The material to be dredged will be disposed of within the boundaries of Port Edgar Marina, as depicted on drawing 122952/7004.

5.2 Environmental Impact

Samples collected within the proposed dredge area have been compared to the previous set of tests from 2013, which has shown limited variation in the characteristics of contaminants within the material. In accordance with MS Pre-disposal sampling guidance v2, fig 1 step 5, the final decision for disposal of the material rests with Marine Scotland. However, we note that there is likely to be limited environmental impact in relation to the disposal of the dredge material as it is being kept within the confines of the marina limits. Therefore there are limited issues related to the environmental impact of transportation, which will be minimal due to the proximity of the disposal site under the plough dredging regime compared to taking the arisings offsite.

5.3 Conclusion

This BPEO report has been prepared to support the application being made to undertake plough dredging within Port Edgar marina, with the dredge arisings being moved to an area immediately adjacent to the marina breakwater on the north east boundary of the marina.

Appendix A

Drawings

Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION

DEMOLITION

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

LEGEND

EXTENT OF PROPOSED PLOUGH DREDGING

EXTENT OF PROPOSED DREDGING FEB 2018

02 LOCATION OF PROPOSED SAMPLES. REFER TO DRAWING No. 122592/7002.

SETTING OUT COORDINATES				
POINT No.	EASTING (X)	NORTHING (Y)	LATITUDE	LONGITUDE
SO-1	312045	678768	55.993777 (55° 59' 37.60")	-3.411626 (-3° 24' 41.85")
SO-2	311972	678998	55.995829 (55° 59' 44.99")	-3.412871 (-3° 24' 46.34")
SO-3	312141	679052	55.996345 (55° 59' 46.84")	-3.410181 (-3° 24' 36.65")
SO-4	312193	678890	55.994900 (55° 59' 41.64")	-3.409294 (-3° 24' 33.46")
SO-5	312208	678892	55.994920 (55° 59' 41.71")	-3.409054 (-3° 24' 32.60")
SO-6	312207	678818	55.994256 (55° 59' 39.32")	-3.409046 (-3° 24' 32.57")

Rev.	Date	Description	Drwn.	Chkd.	Appd.
A	02/10/18	SETTING OUT POINT SO-4 (LAT/LONG) AMENDED.	GB	NM	CN

FAIRHURST
225 Both Street
GLASGOW
G2 4GZ
Tel: 0141 204 8800
Fax: 0141 204 8801

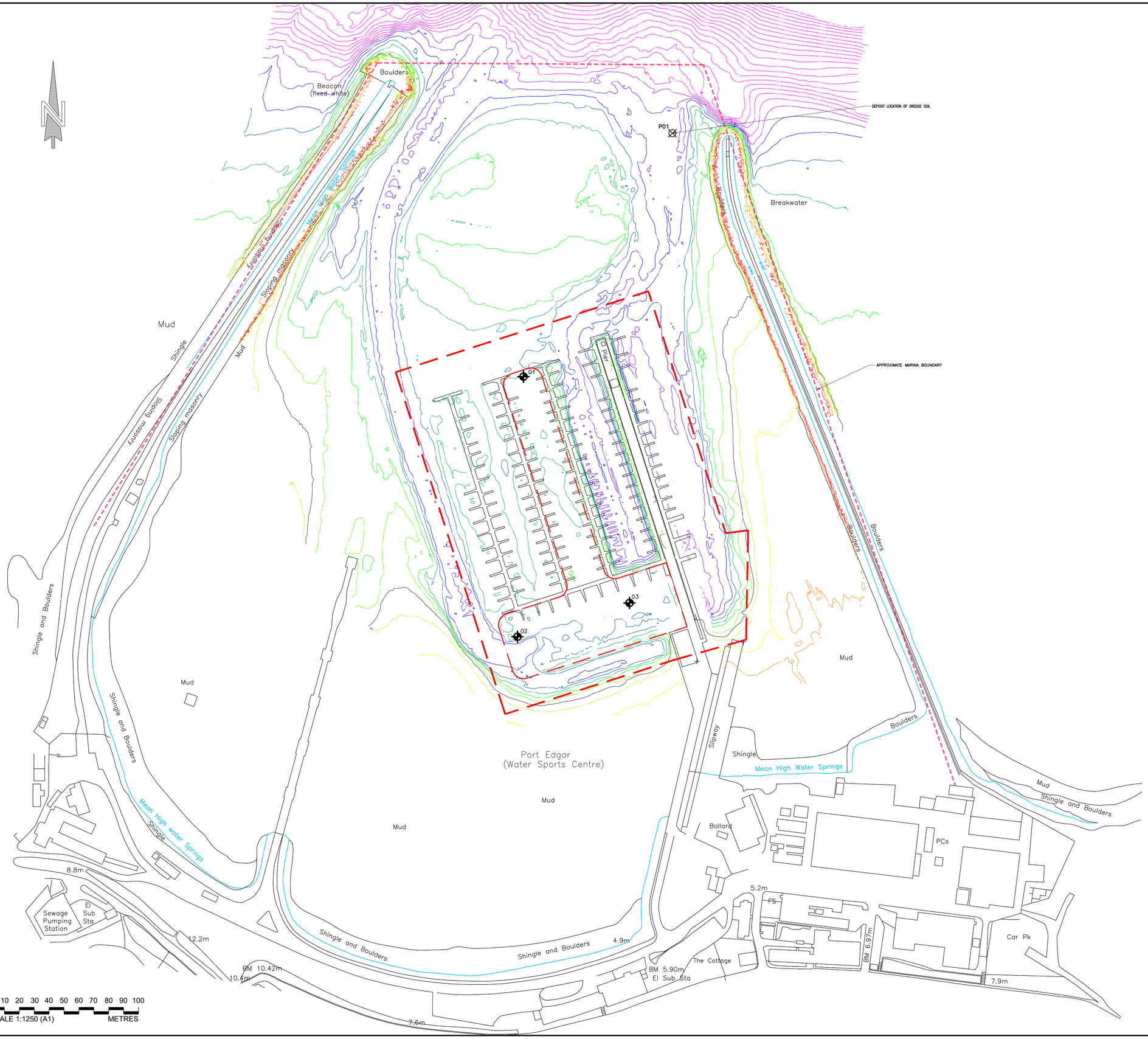
Client: PORT EDGAR MARINA

Project Title: PORT EDGAR BREAKWATER FEASIBILITY PLOUGH DREDGING

Drawing Title: PLOUGH DREDGING PRE-DREDGE SETTING OUT PLAN

Scale at A1:	Status:	
1:200	For Information	
Drawn: GB	Checked: CN	Approved:
Date: 25/01/18	Date: 25/01/18	Date:

Drawing No.: 122592/7003 Revision: A



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION

DEMOLITION

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

LEGEND

EXTENT OF PROPOSED PLOUGH DREDGING

EXTENT OF PROPOSED DREDGING FEB 2018

02 LOCATION OF PROPOSED SAMPLES.

PROPOSED SAMPLE LOCATIONS

Point	Easting	Northing	Latitude	Longitude
01	312057	678995	55.995818 (55° 59' 44.9447"N)	-3.411508 (-3° 24' 41.4228"W)
02	312053	678820	55.994245 (55° 59' 39.2820"N)	-3.411515 (-3° 24' 41.4540"W)
03	312128	678843	55.994466 (55° 59' 40.0776"N)	-3.410321 (-3° 24' 37.1556"W)
P01	312157	679158	55.997300 (55° 59' 50.28"N)	-3.409959 (-3° 24' 35.85"W)

NOTE: POINT P01 DENOTES APPROXIMATE CO-ORDINATES OF DISPOSAL SITE

Rev.	Date	Description	Drwn.	Chkd.	Appd.
B	26/02/18	POINT P01 ADDED, CO-ORDINATES TABLE REVISED.	GB	CN	
A	31/01/18	SAMPLE LOCATIONS ADDED	GB	CN	

FAIRHURST
225 Bath Street
GLASGOW
G2 4GZ
Tel: 0141 204 8800
Fax: 0141 204 8801

Client:
PORT EDGAR MARINA

Project Title:
PORT EDGAR BREAKWATER FEASIBILITY
PLOUGH DREDGING

Drawing Title:
PLOUGH DREDGING
LOCATION OF DREDGE SPOIL DEPOSITS

Scale at A1:	Status:	
1:500	For Information	
Drawn: GB	Checked: CJN	Approved:
Date: 25/01/18	Date: 25/1/18	Date:

Drawing No.: 122592/7004 Revision: B

Appendix B

Sample Test Results

Pre-disposal Sampling Results Form

Version 2 - June 2017

This form should be used to submit the results from your pre-disposal sampling plan.
Full information must be provided in all relevant sheets of this workbook. The blue cells in each worksheet indicate where information can be entered.
Where information cannot be provided, or where there are more than 30 samples required, please contact the Marine Scotland - Licensing Operations Team (MS-LOT) using the contact details below.

Once you have completed this form, send it (including any reference number for the dredging and sea disposal marine licence application in the subject header of your email) to the following email address:
ms.marinelicensing@gov.scot

If you have any questions in relation to this form contact MS-LOT:

Marine Scotland - Licensing Operations Team
Marine Laboratory
375 Victoria Road
Aberdeen, AB11 9DB

01224 295579
ms.marinelicensing@gov.scot

Applicant Information

Applicant:	Port Edgar Marina
Description of dredging:	Plough dredging
Total amount to be dredged (wet tonnes)	10,000 over 3 years

Sample Details & Physical Properties

Explanatory Notes:
An example of a 'Dredge area' is: 'Dock A, Harbour X'
Provide description of the dredge area and the latitude and longitude co-oridnates (WGS84) for each sample location. Co-ordinates taken from GPS equipment should be set to WGS84.
Note for sample depth that the seabed is 0 metres.
Gravel is defined as >2mm, **Sand** is defined as >63um<2mm, **Silt** is deinfed as <63um).

Sample information:

Sample ID	Dredge area	Latitude	Longitude	Type of sample	Sample depth (m)	Total solids (%)	Gravel (%)	Sand (%)	Silt (%)	TOC (%)	Specific gravity	Asbestos
1	Port Edgar Marina	° . 'N	° . 'W	Grab	1							
2	Port Edgar Marina	° . 'N	° . 'W	Grab	1							
3	Port Edgar Marina	° . 'N	° . 'W	Grab	1							
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
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		° . 'N	° . 'W									
		° . 'N	° . 'W									

Trace Metals & Organotins

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Dibutyltin (DBT)	Tributyltin (TBT)
				mg/kg dry weight									
1	Port Edgar Marina	Grab	1	16.9	0.46	64.2	206.9	0.73	33.2	70.1	222.7	<1	<1
2	Port Edgar Marina	Grab	1	17.8	0.21	61.7	53	0.75	32.3	60.6	142.1	<1	<1
3	Port Edgar Marina	Grab	1	16.6	0.15	57.6	39.4	0.73	30.2	55.4	124.4	<1	<1
0	0	0	0										
0	0	0	0										
0	0	0	0										
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0	0	0	0										
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Polyaromatic Hydrocarbons (PAH)

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Definitions:

ACENAPTH	Acenaphthene
ACENAPHY	Acenaphthylene
ANTHRACN	Anthracene
BAA	Benz(a)anthracene
BAP	Benzo(a)pyrene
BBF	Benzo(b)fluoranthene
BEP	Benzo(e)pyrene
BENZGHIP	Benzo(ghi)perylene
BKF	Benzo(K)fluoranthene
C1N	C1-naphthalenes
C1PHEN	C1-phenanthrene
C2N	C2-naphthalenes
C3N	C3-naphthalenes
CHRYSENE	Chrysene
DBENZAH	Diben(ah)anthracene
FLUORANT	Fluoranthene
FLUORENE	Fluorene
INDPYR	Indeno(1,2,3-cd)pyrene
NAPTH	Naphthalene
PERYLENE	Perylene
PHENANT	Phenanthrene
PYRENE	Pyrene
THC	Total Hydrocarbon Content

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	µg/kg																										
				ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF	BEP	BENZGHIP	BKF	C1N	C1PHEN	C2N	C3N	CHRYSENE	DBENZAH	FLUORANT	FLUORENE	INDPYR	NAPTH	PERYLENE	PHENANT	PYRENE	THC
1	Port Edgar Marina	Grab	1	16.6	19.9	58.6	108.4	110.4	132.2	113.7	115.3	64	571.5	494.9	619.8	629.4	1275.8	809.4	183.3	36.5	105.1	80.2	75.1	134.5	220.2	
2	Port Edgar Marina	Grab	1	17.4	20.3	61.7	116.8	111.7	148.6	109	119.9	59.8	594.5	533.9	632.5	674.1	1386.8	966.4	199.5	37.7	113.3	82.7	72.7	140.9	239.5	
3	Port Edgar Marina	Grab	1	17.7	20.8	65.5	128.2	132.4	167.1	120.1	126	61	603.3	566	686.9	659	1573.1	1000.4	220.2	39.1	112.2	85.2	79.7	152.3	257.4	
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Organohalogens

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.
ICES7 is the sum of PCB 28,52,101,138,153,180 and 118.

Definitions:

AHCH	alpha-Hexachlorcyclohexane
BHCH	beta-Hexachlorcyclohexane
GHCH	gamma-Hexachlorcyclohexane
DIELDRIN	Dieldrin
HCB	Hexachlorobenzene
PPDDE	p,p'-Dichorodiphenyldicloroethylene
PPDDT	p,p'-Dichorodiphenyltrichloroethane
PPTDE	p,p'-Dichorodiphenyldicloroethane

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB18	PCB105	PCB110	PCB128	PCB141	PCB149	PCB151	PCB156	PCB158	PCB170	PCB180	PCB183	PCB187	PCB194	PCB31	PCB44	PCB47	PCB49	PCB66	ICES7
				µg/kg																									
1	Port Edgar Marina	Grab	1	1.0331	0.8929	1.0861	0.8094	1.784	1.1947											0.9557									
2	Port Edgar Marina	Grab	1	1.0272	0.7465	1.012	0.8435	2.0043	1.176											0.9022									
3	Port Edgar Marina	Grab	1	0.8485	0.7446	0.9869	0.767	1.8443	1.2285											0.971									
0	0	0	0																										
0	0	0	0																										
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AHCH	BHCH	GHCH	DIELDRIN	HCB	DDE	DDT	TDE	BDE100	BDE138	BDE153	BDE154	BDE17	BDE183	BDE209	BDE28	BDE47	BDE66	BDE85	BDE99

PR Details

Total amount to be dredged (wet tonnes)	10000

Explanatory Notes:
The values entered for each determinand should be an average wet weight concentration from all the samples representing the material to be disposed to sea. They should be entered in the units stated in the Unit of measurement column in the table below.
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Average for the total dredge area:

Sample ID	Unit of measurement	
Total Solids	%	
Gravel	%	
Sand	%	
Silt	%	100
Arsenic (As)	mg/kg	
Cadmium (Cd)		
Chromium (Cr)		
Copper (Cu)		
Mercury (Hg)		
Nickel (Ni)		
Lead (Pb)		
Zinc (Zn)		
Dibutyltin (DBT)		
Tributyltin (TBT)		
Acenapth		
Acenapthylene		
Anthracn		
BAA		
BAP		
BBF		
BEP		
Benzghip		
BKF		
C1N		
C1PHEN		
C2N		
C3N		
Chrysene		
Debenzah		
Flurant		
Fluorene		
Indypr		
napth		
perylene		

phenant		
pyrene		
THC		
PCB28		
PCB52		
PCB101		
PCB118		
PCB138		
PCB153		
PCB18		
PCB105		
PCB110		
PCB128		
PCB141		
PCB149	µg/kg	
PCB151		
PCB156		
PCB158		
PCB170		
PCB180		
PCB183		
PCB187		
PCB194		
PCB31		
PCB44		
PCB47		
PCB49		
PCB66		
ICES7		
AHCH		
BHCH		
GHCH		
DIELDRIN		
HCB		
DDE		
DDT		
TDE		
BDE100		
BDE138		
BDE153		
BDE154		
BDE17		
BDE183		
BDE209		
BDE28		
BDE47		
BDE66		
BDE85		
BDE99		

Comments:

Laboratory Details

Explanatory Notes:
Please complete a separate worksheet for each laboratory (e.g. complete 'Laboartory_1' worksheet for 1 laboratory and complete 'Laboartory_2' worksheet for a second laboratory). If there are more than 3 laboratories then please contact MS-LOT.

Laboratory 1 Details:

Laboratory name:	Socotec
Year:	2018

LabRefMat	**Q1**	Does the laboratory carrying out the analyses undertake the analysis of blank samples and laboratory reference materials with each batch of samples of waste and other material dumped in the maritime area that is analysed by that laboratory?	Yes
CompAnal	**Q2**	Does the laboratory carrying out the analyses undertake periodic comparative analysis of laboratory reference materials and certified reference materials?	Yes
QAQC	**Q3**	Does the laboratory carrying out the analyses undertake the compilation of quality control charts based upon the data resulting from the analyses of the laboratory reference materials and certified reference materials, and the use of those quality control charts to monitor analytical performance in relation to all samples of dumped wastes or other materials?	Yes
InterlabCaleb	**Q4**	Does the laboratory carrying out the analyses undertake periodic participation in interlaboratory comparison exercises, including, where possible, international comparison exercises?	Yes
InternatCaleb	**Q5**	Does the laboratory carrying out the analyses undertake periodic participation in national and, where possible, international laboratory proficiency schemes?	Yes
SpikedSamples	**Q6**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory analyse samples of substances which are provided by the organisers of the scheme?	Yes
BlindSamples	**Q7**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory confirm that the composition of those samples is not disclosed in advance?	Yes
Ranking	**Q8**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory confirm that the results of the scheme for each participating laboratory are made available to all participating laboratories?	Yes
FracAnal	**Q9**	Enter the size fraction that is analysed i.e. Whole or less than 63µm etc.	<63um(metals)
GranMeth	**Q10**	PSA method	NMBAQC
OCMeth	**Q11**	Organic Carbon method	carbonate removal and sulfurous acid/combustion at 800°C/NDIR,
MetExtrType	**Q12**	Method of extraction used for metal analysis	Aquaregia
MethOfDetMetals	**Q13**	Method of detection used for metal analysis	ICP-MS
PAHExtrType	**Q14**	Method of extraction used for poly aromatic hydrocarbon analysis	Methanol/DCM solvent extraction with silica clean up and copper clean up stages
MethOfDetPAH	**Q15**	Method of detection used for poly aromatic hydrocarbons analysis	GCMS
OHExtrType	**Q16**	Method of extraction used for organohalogens inc PCBs, pesticides, flame retardants etc analysis	Ultrasonic acetone/hexane solvent extraction
MethOfDetOH	**Q17**	Method of detection used for organohalogens inc PCBs, pesticides, flame retardants etc analysis	GCMSMS
OTExtrType	**Q18**	Method of extraction used for organotin analysis	derivatisation and solvent extraction
MethOfDetOT	**Q19**	Method of detection used for organotin analysis	GCMS

		LOD/LOQ	Precision (%)	Recovery (%)
mg/kg	Hg	0.015	4.2	97.3
	As	0.5	2.7	98.04
	Cd	0.04	3.6	95.18
	Cu	0.5	2.9	92.61
	Pb	0.5	3	101.34
	Zn	2	2.6	94.86
	Cr	0.5	3.1	87.97
	Ni	0.5	3.6	96.26
	TBT	0.001	12.62	100.65
	DBT			
µg/kg	PCB28	0.1	12.56	95.55
	PCB31			
	PCB44			
	PCB47			
	PCB49			
	PCB52	0.1	6.999	104.3
	PCB66			
	PCB101	0.1	8.43	100.2
	PCB105			
	PCB110			
	PCB118	0.1	14.61	105.4
	PCB128			
	PCB138+163	0.1	12.93	96.65
	PCB141			
	PCB149			
	PCB151			
	PCB153	0.1	7.41	106.6
	PCB156			
	PCB158			
	PCB170			
	PCB180	0.1	9.85	105.05
	PCB183			
	PCB187			
	PCB194			
	DDE			
	DDT			
	DDD			
	Dieldrin			
	Lindane			
	HCB			
	BDE17			
	BDE28			
	BDE47			
	BDE66			
	BDE85			
	BDE99			
	BDE100			
	BDE138			
	BDE153			
	BDE154			
	BDE183			
	BDE209			
	ACENAPTH	1	6.68	105.98
	ACENAPHY	1	7.74	103.16
	ANTHRACN	1	4.95	103.44
	BAA	1	9.8	94.12
	BAP	1	9.07	92.16
	BBF	1	8.44	88.66
	BENZGHIP	1	13.46	92.72
	BEP	1	7.9	98.54
	BKF	1	8.9	100.46
	C1N	1	8.27	108.8
	C1PHEN	1	N/A	N/A
	C2N	1	N/A	N/A
	C3N	1	N/A	N/A
	CHRYSENE	1	7.87	99.32
	DBENZAH	1	19.23	87.66
	FLUORENE	1	5.25	106.26
	FLUORANT	1	4.36	102.24
	INDPYR	1	17.1	80.94
	NAPTH	1	3.02	100.7
	PERYLENE	1	N/A	N/A
	PHENANT	1	5.41	109.44
	PYRENE	1	4.29	101.22
	THC			

Customer Fairhurst
Site Marine Scotland Pre-Dredge Sediment Testing
Report No S181671

Consignment No S71274
Date Logged 19-Dec-2017

Report Due 11-Jan-2018

ID Number	Description	MethodID	CustServ	ICPMSS											OGSNSED	PAHSED		PCBMSSQ	SubC061	TPHSED
		Sampled	Report C	Copper (MS) Sediment	Arsenic (MS) Sediments	Cadmium (MS) Sediments	Chromium (MS) Sediments	Cobalt (MS) Sediments	Lead (MS) Sediments	Manganese (MS) Sediments	Mercury (MS) Low Level Sediments	Nickel (MS) Sediments	Zinc (MS) Sediments	Tributyl Tin (Sediments)	Moisture @ 105C	PAH by MS Dti	PCB- 7 Congeners (Marine Sediments)	^Particle Size Analysis (Sediment)	TPH GCFID (Si)+Sats
	UKAS Accredited			Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No
CL/1787802	Grab 01	13/12/17	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
CL/1787803	Grab 02	13/12/17	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
CL/1787804	Grab 03	13/12/17	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
CL/1787805	CRM		R												R	R	R		
CL/1787814	QC Blank		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
CL/1787815	Reference Material (% Recovery)		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

	Method Codes	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS
	Detection Limit	0.5	0.04	0.5	0.5	0.5	0.5	0.5	0.01	0.5
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID Number	Description	**Arsenic (MS) Sediments**	**Cadmium (MS) Sediments**	**Chromium (MS) Sediments**	**Cobalt (MS) Sediments**	**Copper (MS) Sediment**	**Lead (MS) Sediments**	**Manganese (MS) Sediments**	**Mercury (MS) Low Level Sediments**	**Nickel (MS) Sediments**
S1787802	Grab 01	16.9	0.46	64.2	14.4	206.9	70.1	626.4	0.73	33.2
S1787803	Grab 02	17.8	0.21	61.7	12.5	53	60.6	737.2	0.75	32.3
S1787804	Grab 03	16.6	0.15	57.6	11.7	39.4	55.4	620.5	0.73	30.2
S1787814	QC Blank	<0.5	<0.04	<0.5	<0.5	<0.5	<0.5	<0.5	<0.015	<0.5
S1787815	Reference Material (% Recovery)	103	92	94	101	92	95	100	101	93

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

ICPMSS	OGSNSED
2	1
mg/kg	ug Sn/kg
Zinc (MS) Sediments	**Tributyl Tin (Sediments)**
222.7	<1
142.1	<1
124.4	<1
<2	<1
106	86

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Sample ID	Client ID	Moisture (%)
CL/1787802	Grab 01	61.2
CL/1787803	Grab 02	62.4
CL/1787804	Grab 03	61.8

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Polyaromatic Hydrocarbon Concentrations (ng/g dry weight basis) UKAS accredited?: Yes

		Sample ID :	CL1787814	CL1787815	CL1787802	CL1787803	CL1787804	CL1787805
		Station :	QC Blank	ce Material (% R	Grab 01	Grab 02	Grab 03	1941b
PAH Fraction	***# PAH***	***Mass***						
Naphthalene *	1	128	<1	117.4	206.7	219.8	223.1	39.3
C1 Naphthalenes *	2	142	<1	114.1	571.5	594.5	603.3	21.1
C2 Naphthalenes *		156	<1	N.D	619.8	632.5	686.9	15.0
C3 Naphthalenes *		170	<1	N.D	629.4	674.1	659.0	11.6
C4 Naphthalenes *		184	<1	N.D	441.2	377.3	402.4	7.8
Sum Naphthalenes *			0	116	2469	2498	2575	95
Phenanthrene / Anthracene	2	178	<1	110.7	497.8	539.0	570.0	33.6
C1 178 *		192	<1	N.D	494.9	533.9	556.0	21.0
C2 178 *		206	<1	N.D	454.8	469.8	506.7	16.4
C3 178 *		220	<1	N.D	419.8	460.9	456.7	12.7
Sum 178 *			0	111	1867.3	2003.7	2089.4	83.7
Dibenzothiophene		184	<1	112	31.8	34.5	39.2	2.9
C1 Dibenzothiophenes *		198	<1	N.D	88.1	93.0	101.6	4.8
C2 Dibenzothiophenes *		212	<1	N.D	136.3	146.2	152.3	5.6
C3 Dibenzothiophenes *		226	<1	N.D	116.1	110.6	160.9	4.2
Sum Dibenzothiophenes *			0	112	372.3	384.3	454.0	17.5
Fluoranthene / pyrene	2	202	<1	109	1039.9	1167.6	1250.2	70.7
C1 202 *		216	<1	N.D	577.8	624.3	665.3	17.3
C2 202 *		230	<1	N.D	505.4	546.0	581.7	13.3
C3 202 *		244	<1	N.D	309.6	329.1	318.3	6.5
Sum 202 *			0	109	2432.7	2667.0	2815.5	107.8
Benzoanthracene / Chrysene	2	228	<1	110	595.8	663.2	710.2	43.7
C1 228 *		242	<1	N.D	408.7	431.5	467.0	18.4
C2 228 *		256	<1	N.D	271.4	292.1	396.0	10.1
Sum 228 *			0	110	1275.8	1386.8	1573.1	72.2
Benzofluoranthenes / benzopyrenes	4	252	<1	102	1083.4	1141.4	1258.1	83.5
C1 252 *		266	<1	N.D	515.6	564.9	587.7	22.6
C2 252 *		280	<1	N.D	304.0	308.1	349.6	14.6
Sum 252 *			0	102	1903.1	2014.5	2195.4	120.7
Dibenzoanthracene / Indenopyrene / Benzoperylene	3	276	<1	106	615.6	675.2	678.6	39.9
C1 276 *		290	<1	N.D	146.5	238.7	258.6	9.2
C2 276 *		304	<1	N.D	47.3	52.5	63.1	3.1
Sum 276 *			0	106	809.4	966.4	1000.4	52.2
Sum of all fractions *			0	109	11129.3	11920.9	12702.5	548.8
Sum of NPD fraction *			0	113	4708.2	4886.2	5118.1	196.0
NPD / 4-6 ring PAH ratio *			#DIV/0!	0.26	0.73	0.69	0.67	0.56

N.D = Not Determined as these compounds are not in the reference material spike.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.
* Denotes not UKAS accredited

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Polyaromatic Hydrocarbon Concentrations (ng/g dry weight basis) UKAS accredited?: Yes

EPA 16 PAHs Compounds marked with a * are reported not UKAS.

	Sample ID :	CL1787814	CL1787815	CL1787802	CL1787803	CL1787804	CL1787805
	Station :	QC Blank	ce Material (% R	Grab 01	Grab 02	Grab 03	1941b
PAH	***Mass***						
Naphthalene *	128	<1	117.4	80.2	82.7	85.2	39.3
Acenaphthylene	152	<1	116.9	19.9	20.3	20.8	3.7
Acenaphthene	154	<1	119.7	16.6	17.4	17.7	2.7
Fluorene	166	<1	116.0	36.5	37.7	39.1	3.9
Phenanthrene	178	<1	113.9	134.5	140.9	152.3	24.5
Dibenzothiophene	184	<1	112.2	12.3	13.0	15.0	2.9
Anthracene	178	<1	107.5	58.6	61.7	65.5	9.0
Fluoranthene	202	<1	109.6	183.3	199.5	220.2	39.8
Pyrene	202	<1	108.0	220.2	239.5	257.4	30.9
Benzo[a]anthracene	228	<1	107.6	108.4	116.8	128.2	17.7
Chrysene	228	<1	111.7	122.8	132.6	143.1	26.0
Benzo[b]fluoranthene	252	<1	96.4	132.2	148.6	167.1	31.4
Benzo[k]fluoranthene	252	<1	95.3	64.0	59.8	61.0	14.7
Benzo[e]pyrene	252	<1	110.9	113.7	109.0	120.1	21.5
Benzo[a]pyrene	252	<1	105.6	110.4	111.7	132.4	15.9
Perylene *	252	<1	113.8	75.1	72.7	79.7	16.9
Indeno[123,cd]pyrene	276	<1	104.0	105.1	113.3	112.2	20.8
Dibenzo[a,h]anthracene	278	<1	105.5	18.5	20.6	21.1	4.2
Benzo[ghi]perylene	276	<1	107.6	115.3	119.9	126.0	14.9

As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

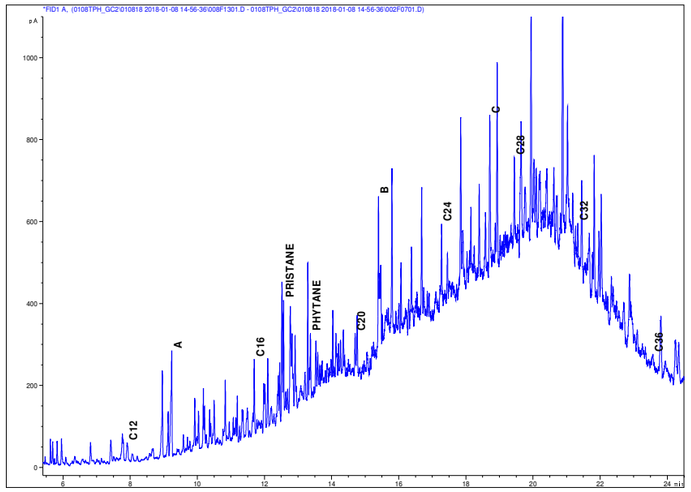
n-alkanes (ng/g) **UKAS accredited?: No** As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Sample ID :	CL1878814	CL1878815	CL1787802	CL1787803	CL1787804
Station :	QC Blank	nce Material (% Re	Grab 01	Grab 02	Grab 03
Alkane					
nC10	<1	102.9	142.5	128.7	125.3
nC11	<1	<0.04	127.2	187.0	141.2
nC12	<1	109.1	162.5	274.4	239.0
nC13	<1	<0.04	512.2	605.4	572.5
nC14	<1	101.4	225.8	289.3	250.7
nC15	<1	<0.04	247.7	297.5	263.7
nC16	<1	97.3	247.7	359.2	375.9
nC17	<1	<0.04	683.3	722.7	797.6
pristane	<1	<0.04	517.1	564.7	510.8
nC18	<1	119.0	558.7	632.3	613.6
phytane	<1	<0.04	305.9	373.9	360.1
nC19	<1	<0.04	240.0	243.3	235.0
nC20	<1	105.5	134.5	178.3	147.5
nC21	<1	<0.04	232.4	712.0	293.2
nC22	<1	108.2	236.3	239.8	230.1
nC23	<1	<0.04	509.7	552.8	484.6
nC24	<1	110.4	252.0	420.6	273.5
nC25	<1	<0.04	733.8	832.7	684.0
nC26	<1	107.3	353.9	376.7	299.4
nC27	<1	<0.04	805.2	844.6	723.0
nC28	<1	109.1	331.5	364.0	301.0
nC29	<1	<0.04	1,171.6	1,119.9	1,093.5
nC30	<1	108.9	314.0	393.2	373.7
nC31	<1	<0.04	1,416.4	1,449.3	1,347.2
nC32	<1	112.3	151.6	130.8	101.5
nC33	<1	<0.04	615.8	833.0	604.9
nC34	<1	112.0	165.9	122.7	76.6
nC35	<1	1.4	60.6	325.0	129.8
nC36	<1	119.8	59.5	134.8	59.6
nC37	<1	3.1	226.6	244.1	171.8
Total Oil (ug/kg)	30.7	0.0	651,764.6	689,173.8	293,685.9
Total n alkanes (ng/g)	0	1,528	10,919	13,014	11,009
Carbon Preference Index	#DIV/0!	0.00	2.27	2.22	2.18
Pristane	<1	<0.04	517	565	511
Phytane	<1	<0.04	306	374	360
Pristane / phytane ratio			1.7	1.5	1.4

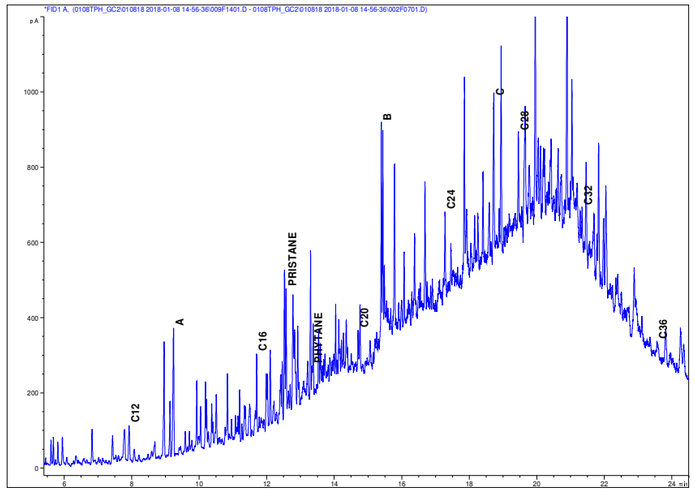
Note: sample data are NOT blank corrected

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

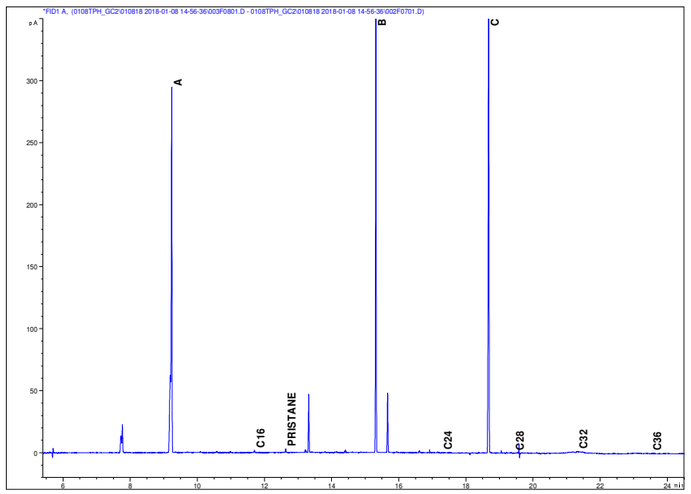
CL/1787802	Grab 01	CL1787802.WMF
CL/1787803	Grab 02	CL1787803.WMF
CL/1787804	Grab 03	CL1787804.WMF
CL/1787814	QC Blank	CL1787814.WMF
CL/1787815	Reference Material (% Recovery)	CL1787815.WMF



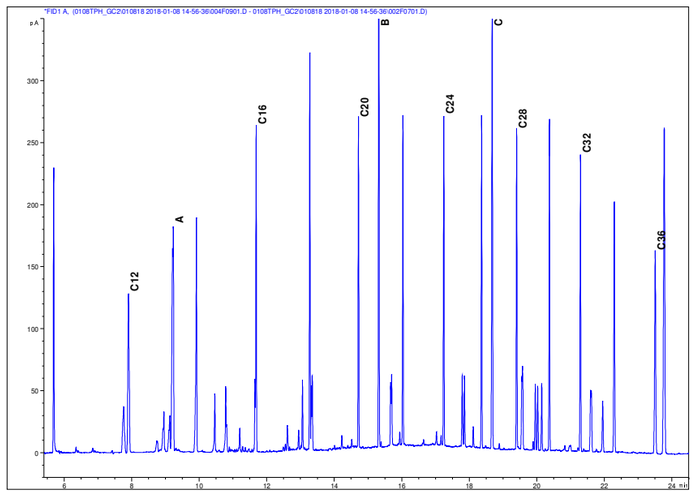
Sample ID: CL/1787802
Station: Grab 01



Sample ID: CL/1787803
Station: Grab 02

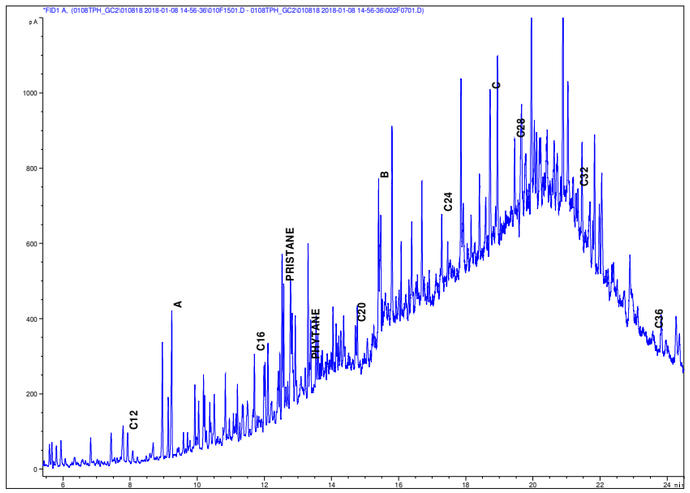


Sample ID: CL/1787814
Station: QC Blank



Sample ID: CL/1787815
Station: Reference Material (% Recovery)

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted



Sample ID: CL/1787804
Station: Grab 03

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Polychlorinated Biphenyls (congeners)

Customer and Site Details: Fairhurst: Marine Scotland Pre-Dredge Sediment Testing
Job Number: S18_1671
QC Batch Number: 180001
Directory: 181217PCB.TQ1
Method: Ultrasonic

Matrix: Soil
Date Booked in: 19-Dec-17
Date Extracted: 02-Jan-18
Date Analysed: 08-Jan-18

Compounds marked * are not UKAS or MCerts accredited

		Concentration, (µg/kg)						
Sample ID	**Customer ID**	**PCB28***	**PCB52***	**PCB101***	**PCB118***	**PCB153***	**PCB138***	**PCB180***
CL1787802	Grab 01	1.03	0.89	1.09	0.81	1.19	1.78	0.96
CL1787803	Grab 02	1.03	0.75	1.01	0.84	1.18	2.00	0.90
CL1787804	Grab 03	0.85	0.74	0.99	0.77	1.23	1.84	0.97
CL1787805	CRM	2.03	4.10	4.17	2.31	3.41	4.39	2.22
CL1787814	QC Blank	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
CL1787815	Reference Material (% Recovery)	77	108	100	94	99	107	100

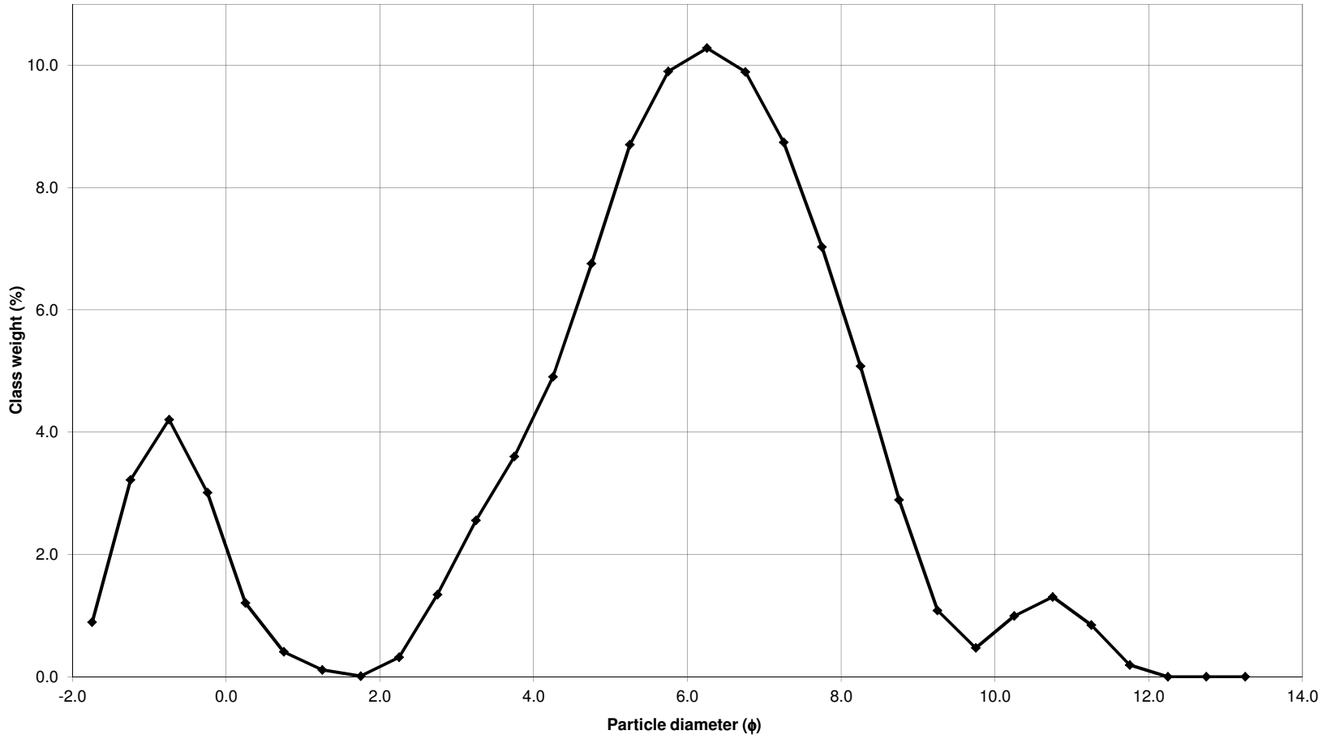
KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Aperture (microns)	S1787802	S1787803	S1787804
4000.000	0.000	0.000	0.000
2800.000	0.212	0.139	0.918
2000.000	0.690	0.492	3.128
1400.000	0.947	0.719	4.330
1000.000	0.718	0.614	2.925
707.000	0.460	0.556	1.209
500.000	0.677	0.656	0.407
354.000	0.904	0.746	0.113
250.000	0.543	0.728	0.011
177.000	0.470	1.099	0.317
125.000	1.259	1.841	1.350
88.400	2.502	2.843	2.559
62.500	3.900	4.244	3.606
44.200	5.454	5.844	4.905
31.200	7.423	7.587	6.793
22.100	9.408	9.154	8.663
15.600	10.915	10.333	9.954
11.000	11.568	10.812	10.368
7.810	11.119	10.372	9.781
5.520	10.038	9.452	8.756
3.910	7.960	7.628	6.997
2.760	5.681	5.551	5.106
1.950	3.076	3.136	2.903
1.380	0.980	1.184	1.083
0.977	0.323	0.519	0.471
0.691	0.937	1.034	0.993
0.488	1.181	1.404	1.311
0.345	0.601	0.991	0.849
0.244	0.054	0.322	0.194
0.173	0.000	0.000	0.000
0.122	0.000	0.000	0.000
0.086	0.000	0.000	0.000
	0.000	0.000	0.000

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Station	Client Sample Description	Treatment	Textural Group Classification	Folk and Ward Description	Folk and Ward Sorting	Mean µm	Mean phi	Sorting Coefficient	Skewness	Kurtosis	Major Sediment Fractions		
											% Gravel	% Sand	% Mud
S1787802	Grab 01	Sediment	Sandy Mud	Medium Silt	Poorly Sorted	14.901	6.068	1.947	-0.151	1.210	0.90%	12.38%	86.72%
S1787803	Grab 02	Sediment	Sandy Mud	Medium Silt	Very Poorly Sorted	15.251	6.035	2.007	-0.094	1.138	0.63%	14.05%	85.32%
S1787804	Grab 03	Sediment	Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	19.807	5.658	2.627	-0.286	1.450	4.05%	16.83%	79.13%

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted



KEY:
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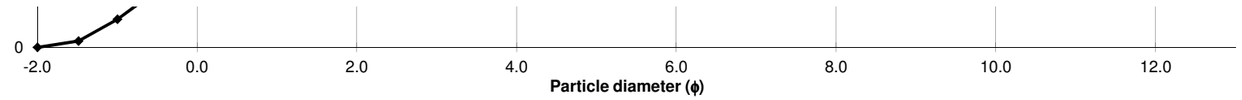
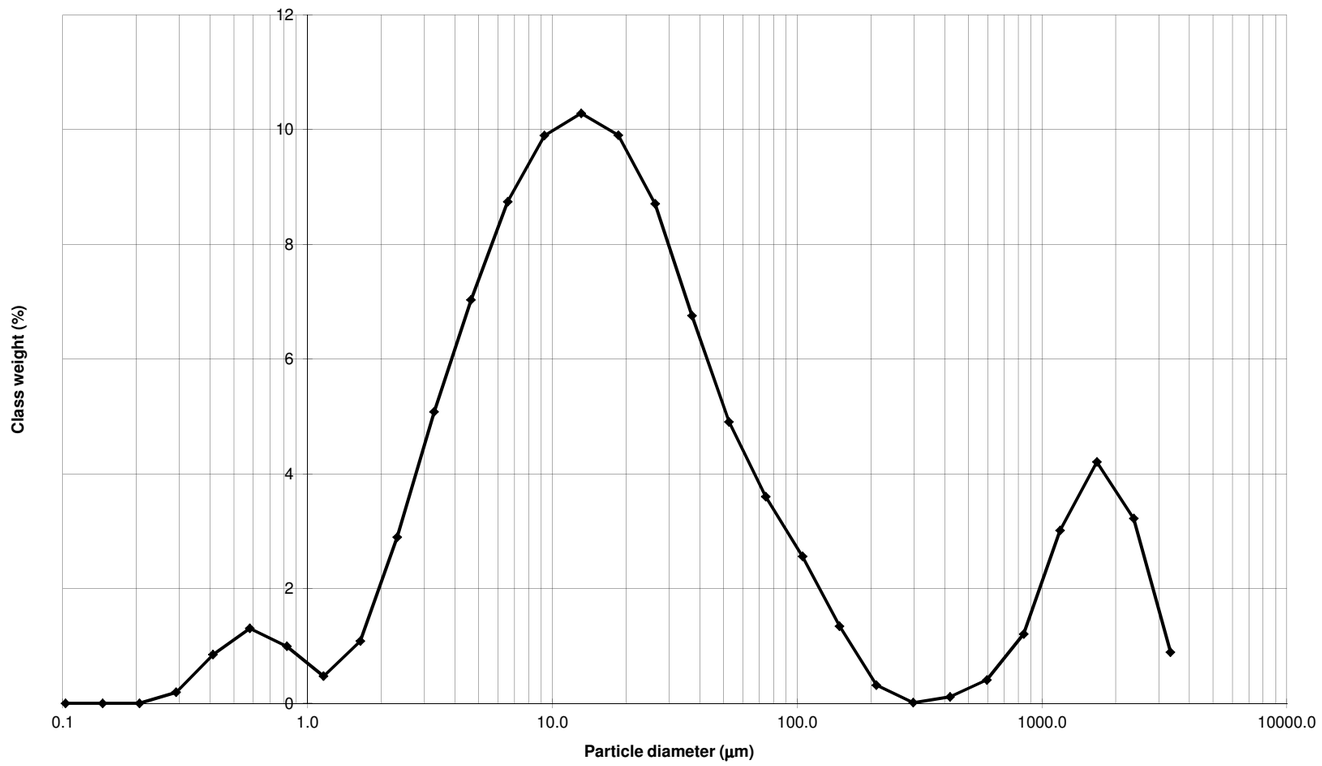
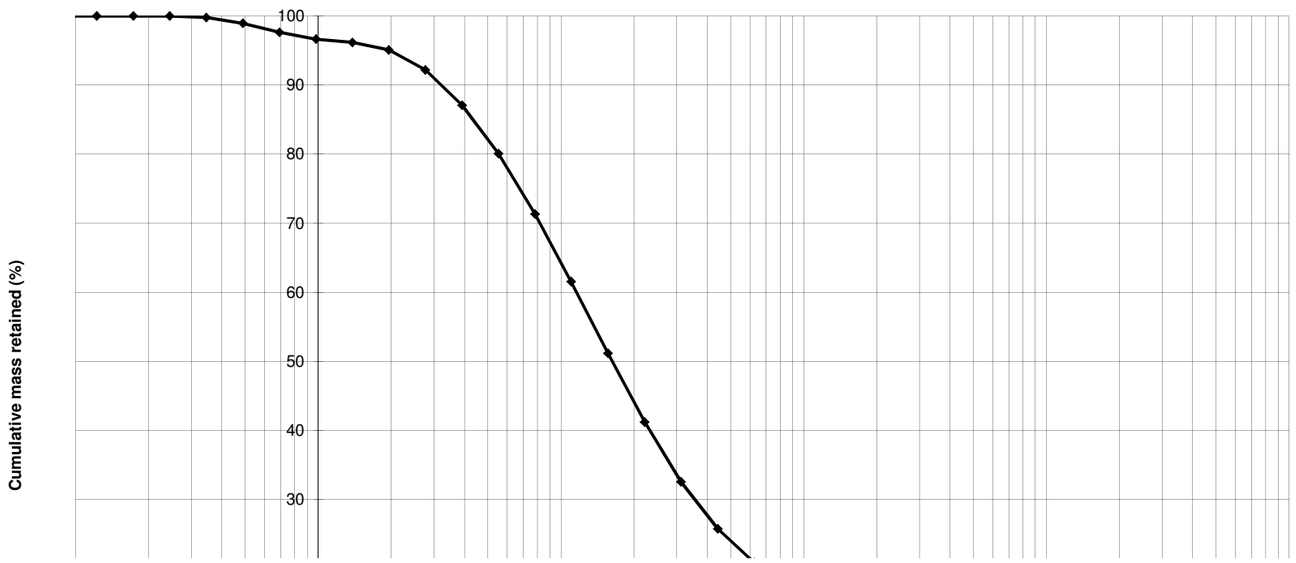
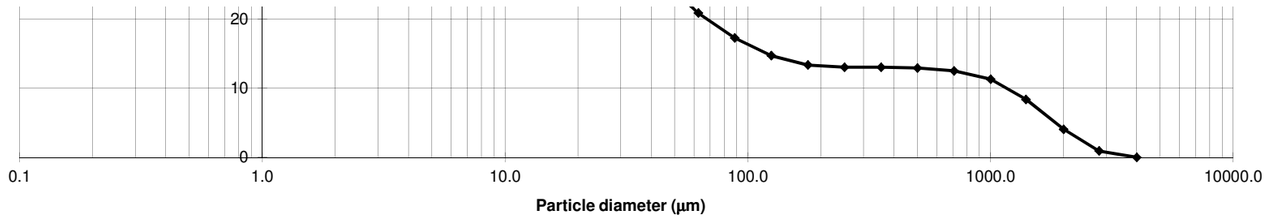
DO Dependent Option
C Completed
^ Subcontracted







KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted



KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Report Number : EFS/181671

Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
PAHSED	CL1787802 to CL1787804	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (Naphthalene) . These circumstances should be taken into consideration when utilising the data.
PAHSED	CL1787802 to CL1787804	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Sample Descriptions

Client : Fairhurst
Site : Marine Scotland Pre-Dredge Sediment Testing
Report Number : S18_1671

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1787802	Grab 01	MARINE SEDIMENTS
CL/1787803	Grab 02	MARINE SEDIMENTS
CL/1787804	Grab 03	MARINE SEDIMENTS
CL/1787805	CRM	QUALITY CONTROL SAMPLE
CL/1787814	QC Blank	QUALITY CONTROL SAMPLE
CL/1787815	Reference Material (% Recovery)	QUALITY CONTROL SAMPLE

KEY:
R Required
DO Dependent Option
C Completed
^ Subcontracted

Appendix C

Photographs

Grab 1: Soft brown silt

Grab 2: Soft brown silt

Grab 3: Soft brown silt

Appendix D

Marine Scotland Correspondence

marinescotland

Scottish Government
Riaghaltas na h-Alba
gov.scot

T: +44 (0)131 244 1540
E: Lorna.King@gov.scot

Fraser Sturgeon
Port Edgar Marina
Shore Road
South Queensferry
EH30 9SQ

27 November 2017

Dear Fraser,

***Undaria pinnatifida* (Japanese Wakame) found at Port Edgar Marina**

Thank you for meeting myself and David Pratt at Port Edgar on the November 01 to discuss the removal of Japanese Wakame from the marina in order to help control and contain it. In order to determine the spread of wakame, Marine Scotland and Scottish Natural Heritage have surveyed a number of locations along the Firth of Forth where access was possible. No wakame was found leading to the conclusion there is still merit in seeking to control it at Port Edgar.

We discussed methods for its removal and agreed that there were a number of actions the marina could undertake to help contain it. These include

- the removal of wakame as part of the marina's regular programme of removing biofouling from the pontoons but that the method is adapted to catch dislodged material and dispose of it on land rather than release it into the marine area

- opportunistic cleaning when possible of areas otherwise difficult to access as part of the regular cleaning programme, such as cross supports of the floating pontoons and the barrage

You have since confirmed to us via telephone that the biofouling has been removed.

You made us aware of an application for a licence to dredge the marina that your agents would be submitting to Marine Scotland Licensing Operations Team. MSLOT have confirmed to us that this has been received. Presence of an invasive non-native species and the risk of spread that accompanies a marine activity is one which is considered as part of routine licensing considerations. Unless a species has been eradicated there may still be a risk of spread from specific activities, and this will be factored into the consideration of licence applications. Should MSLOT require information in relation to wakame or the actions we have recommended, we will of course liaise with them as necessary.

An outstanding action on us has been to provide advice in relation to the disposal of the biofouling which you have removed. I have received confirmation from SEPA that it can be disposed of as organic waste, meaning that it can be sent to landfill or used as composting. Should you wish to satisfy yourself of this your local SEPA area office can be contacted. I have included a link to authorised landfill sites in the email which accompanies this letter. I have also attached a list of organic waste processors. This information has been sourced from a third party and I have not contacted the companies directly. It does not confer a recommendation to use these companies and other operators may be available.

I am of course happy to discuss the wakame and its removal/ disposal further if this would be helpful to you.

Yours sincerely,

Lorna King

Marine Policy Officer
Marine planning and policy
Marine Scotland

Appendix E

2015 BPEO

PORT EDGAR MARINA LTD

PORT EDGAR MARINA, BEST PRACTICABLE ENVIRONMENTAL OPTION ASSESSMENT: SEA DISPOSAL OF SOLID MATERIALS

Version 2

November 2013

Revised February 2015

BLACK & VEATCH
Building a world of difference.®

BEST PRACTICABLE ENVIRONMENTAL OPTION ASSESSMENT: SEA DISPOSAL OF SOLID MATERIALS

CONTENTS

Details of document preparation and issue:

Version no.	Prepared by	Reviewed by	Authorised for issue	Issue date	Issue status
1	Darleen Chamles	Richard Hein	Richard Hein	29/11/2013	Final
2	Norman Cox	Norman Cox	Norman Cox	02/02/2015	Plough Dredging added

B&V project no. 121937 Client's reference no.

BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF SOLID MATERIALS

1. INTRODUCTION

1.1 Background to application

This report is the Best Practicable Environmental Option (BPEO) for the Application for Dredging and Deposit of Solid Waste in the Territorial Sea and UK Controlled Waters Adjacent to Scotland, relating to dredging works required at Port Edgar, Edinburgh, Scotland.

This report is part of the requirement for the application for the sea disposal of solid materials at sea. Part 4, Section 27(2) of the Marine (Scotland) Act 2010 states that the Licensing Authority has an obligation to consider the availability of practical alternatives when considering applications involving disposal of material at sea.

This report will outline the available alternative options that have been considered, and the reasons that have led to depositing the materials at sea.

1.2 Source of materials

The source of the material that is being considered for disposal at sea is the dredged material from Port Edgar Marina. The site location is shown on Drawing 121937-DL-002 in Appendix A. The dredging areas (the shaded areas) where the materials will be sourced are shown in Drawing 121937-DL-005 in the same appendix.

A sketch has been added to Appendix A showing a small area adjacent to an existing slipway that it is proposed to dredge using a plough in February 2015.

1.3 Description of materials

1.3.1 Volume of materials

The volume of dredged materials to be disposed in the sea is approximately 20,000m^3 to 25,000m^3, of which approximately 1,000m^3 will be from the plough dredging of the slipway.

1.3.2 Nature of Materials

The material for disposal at sea consists mostly of soft silty material. The results from sample analysis of the material are shown in Appendix A.

The sediment has been tested for PCBs, PAHs and heavy metals. The results are provided in the Analytical Report, and Sediment Sampling Results Summary enclosed with the licence application.

Some of the results suggest a risk to public health, and any options for disposal of the material that could result in an increase in this risk will therefore not be considered.

The material from the area to be plough dredged has been deposited within the past five years having been regularly plough dredged by the previous owners of the marina (Edinburgh Leisure) at a time when plough dredging did not require licensing.

1.4 Details of previous, related operations

Anecdotal evidence exists to suggest that some dredging was carried out either in the late 1980's or early 1990s, but it has not been possible to confirm this.

Since that time only plough dredging (within the limits of the marina) has been carried out to level the channel beds and remove high spots, but this process provides only a short term measure and is not sufficient to maintain the required navigational depths in the long term.

2. INITIAL OPTIONS FOR RELOCATION/REMOVAL OF MATERIALS

A long list of eight options was considered for the relocation or removal of the material.

The options considered are:

- Spreading on agricultural land, or for soil conditioning of reclaimed land
- Beach nourishment
- Onshore construction
- Concrete manufacture
- Reclamation
- Sacrificial landfill
- Land incineration and subsequent disposal of residue
- Sea disposal

Each of the above options was considered first in broad terms to determine what options should be short listed for more detailed consideration. The options were examined using the criteria of strategic, environmental and cost consideration. Table 2.1 discusses the criteria in relation to the eight options for the disposal of the material.

Table 1.1: Criteria for the Assessed Options for the Disposal of the Dredged Material

Option	Criteria	Positive	Negative
Spreading on agricultural Land, or for soil conditioning of reclaimed land	**Strategic**		Identification of sites for agricultural use would be required, but timing of the work makes it unlikely that a suitable site could be found. Similar issue with use in reclaimed land. Land reclamation sites unlikely to be within reasonable transport distances. Agricultural use would require pretreatment to remove salt, followed by dewatering.
	Environmental		Contamination in the disposal material presents a risk to the health and safety of the public. There is a risk of PCB and PAH entering the food chain if used for spreading on agricultural land. PCB and PAH could also spread via skin contact.
	Cost		High cost due to rehandling and transportation.
Beach nourishment	**Strategic**		The disposal material is classified as soft silty material. Smaller grains are less stable as beach nourishment material because it is prone to accelerated erosion. The material is therefore unsuitable for use in beach recharge. Thus this option is eliminated from further consideration.
	Environmental		The materials to be disposed is contaminated (PCB and PAH) and it is highly unlikely that it would be acceptable as beach recharge material.
	Cost		High cost due to rehandling (transhipment to vessels capable of placing recharge material)
Onshore construction	**Strategic**		The material is classified as soft silty material and is unlikely to be suitable for construction.
	Environmental		The materials to be disposed is contaminated (PAH and PCB) and would pose a health risk if used in construction.
	Cost		High cost due to rehandling and transportation.

Option	Criteria	Positive	Negative
Concrete manufacture	**Strategic**		The material is classified as soft silty material and is not suitable for concrete manufacture.
	Environmental		The materials to be disposed is contaminated (PAH and PCB) and could post a health risk if used in construction.
	Cost		High cost due to rehandling and transportation.
Reclamation	**Strategic**		The material is classified as soft silty material and is unlikely to be suitable for reclamation. Engineering properties are unsuitable without post placement treatment (dewatering and soil stabilisation)
	Environmental		The materials to be disposed is contaminated (PCB and PAH). PCB and PAH can spread via skin contact.
	Cost		
Sacrificial landfill	**Strategic**	A facility has been identified. Avondale Hazardous Landfill Site only 17 km away from Port Edgar.	
	Environmental		The number of round trips need to be made by the truck to transport the material to the landfill is in the region of 1,000, with significant associated environmental impact. There is a potential risk of air pollution from the vehicles, as well as the risk of spillage from the trucks transporting the material. Noise and increased traffic would be other concerns. High energy cost.
	Cost		High transportation and labour costs due to the number of trips needed to be made by the truck to and from the Port to the landfill.

Option	Criteria	Positive	Negative
Land incineration and subsequent disposal of residue	**Strategic**	There are facilities in the UK suitable for incineration of PCBs.	The facilities are limited to three sites only. None of these sites are in Scotland. The closest site would be Pontypool, 630 km from Port Edgar.
	Environmental	This method would disposed of the PCB and PAH, eliminating any risk in the future of contamination and pollution from the residue.	The number of round trips need to be made by the truck to transport the material to the incinerator is in the region of 1,000, with a 1,260km round trip. Shipment by sea would require considerable rehandling.
	Cost		PCB and PAH needs to be combusted under extreme and carefully controlled conditions. Improper combustion of PCB would lead the formation of other toxins and incomplete destruction of PCB. Such specific conditions mean that it is extremely expensive to destroy PCB in a huge scale. High energy, transportation and labour costs due to the number of trips needed to be made by the truck to and from the port to the incinerator location.
Sea Disposal (1)	**Strategic**	A site location (Oxcars Spoil Ground) has been identified for sea disposal less than 10km east of Port Edgar.	
	Environmental	Material originates from the sediment load of the Firth of Forth. The material is considered suitable for disposal at sea because the amount of PCB, PAH, TBT and other Heavy Metals adheres to the Cefas guideline for Environmental Action Levels (EALs) for the disposal of dredge material.	Some of the contaminants are slightly higher than the EAL1 levels, although they are still well below the EAL2 levels.
	Cost	The costs and the number of trips required to transport the materials to the disposal site is affordable as no double handling is needed as the materials are loaded from the dredger to the split hopper barge, which would dispose it at sea.	

Sea Disposal (2)	**Strategic**	Plough dredging of the slipway and marina fairways has been undertaken regularly over the past 10 years with the material being dragged into the main channel of the Forth with no observed adverse effect.	
	Environmental	Material originates from the sediment load of the Firth of Forth.	Some of the contaminants are slightly higher than the EAL1 levels, although they are still well below the EAL2 levels.
	Cost	The costs and the number of trips required to transport the materials to the disposal site is affordable as no double handling is needed. The material is dragged directly to the disposal area without leaving the seabed.	

The materials to be disposed are contaminated with a number of compounds. Several options for the disposal of the dredged material, which could potentially cause direct effects to public health and safety, have been eliminated from further consideration. All of these options are also likely to be prohibitively expensive due to the requirement for rehandling of the material and transportation costs.

The options that have been eliminated from further consideration at this stage are:

- Spreading on agricultural Land, or for soil conditioning of reclaimed land
- Beach nourishment
- Onshore construction
- Concrete manufacture
- Reclamation

The remaining options take forward for further (more detailed) consideration are:

- Sacrificial landfill
- Land incineration and subsequent disposal of residue
- Sea disposal

3. SHORTLISTED OPTIONS FOR RELOCATION/REMOVAL OF MATERIALS

The shortlisted options were examined based on the strategic, environmental and cost consideration. This chapter would further evaluate the shortlisted options.

3.1 Sacrificial Landfill

a) Strategic Considerations

A facility has been identified suitable for the disposal of the dredged material, near to Port Edgar, which is the Avondale Hazardous Landfill. Figure 3.1 shows the location of the facility and the possible routes to transport the material from the port to the landfill.

Figure 3.1: Location of the Facility and Possible Transport Routes

The address of the facility is:

Avondale Environmental Limited
Avondale Quarry
Polmont
Falkirk
Stirlingshire FK2 0YG

There are two possible routes identified to transport the material from Port Edgar to Avondale Hazardous Landfill. The first route is via land all the way from Port Edgar to the landfill, which is identified via the blue line on Figure 3.1. The distance of this route is approximately 24.5km. The second route is via transporting the waste from Port Edgar to Grangemouth Dock by sea, and then transporting it to the landfill by land. The distance between Grangemouth Dock and Port Edgar is 18km and the distance by land from Grangemouth Dock to the landfill is 7.3km.

b) Environmental Consideration

The total number of round trips needed to transport the material from Port Edgar or Grangeworth dock is in the region of 1,000, assuming that the truck would be carrying approximately 20$m^3$of waste per trip.

This poses a risk of pollution to the environment from the vehicle emissions and further contamination to the environment as the risk of spillage is high and unlikely to be accepted by the local population.

There is a very high risk of spillage of material when transporting by land, as each of the vehicle would need to carefully transport this contaminated spoil without spillage, using routes that are frequently used by the public, along a number of parks and residential areas. This would not be a viable option, as the risk of spillage is high and the local resident are unlikely to accept such a high number of trucks carrying contaminated materials passing through their residential area.

Some form of stilling basin would also be required to allow the sediment to settle out of the water column before transportation. Frequent rehandling of the material would increase the risk of spillage and contamination.

c) Cost considerations

The transportation cost would be very high, as this involves 1,000 round trips to and from the port or dock to the landfill. Labour costs would also increase as more supervisors would be needed at the dock or port during the loading of the contaminated dredge material to supervise and make sure that the material is securely loaded on the truck to the landfill all the time.

3.2 Land Incineration and subsequent disposal of residue

a) Strategic Considerations

Three facilities have been identified in the UK suitable for the disposal of the dredged material. These incinerators have the facilities for incineration of PCBs and equipment. None of these sites are in Scotland. The incinerators are Cleanaway Ltd and two run by Shanks Chemical Services Ltd. The three sites are:

Cleanaway Ltd
Bridges Road
Ellesmere Port
South Wirral
Merseyside
L65 4EQ

Shanks Chemical Services Ltd
Pontyvelin Industrial Estate
Panteg
Pontypool
NP4 5DQ

Shanks Chemical Services Ltd
Charleston Road
Hardley
Hythe
SO45 3NX

Figure 3.2 shows the locations of the facilities, and the routes and distances to transport the material from the port to each of the facilities. Figure 3.2 shows that the nearest Incinerator from Port Edgar is Shanks (Facility 1) and the furthest would be Shanks (Facility 2).

Figure 1.2: Location of the Incinerators and Distance from Port Edgar

b) Environmental Consideration

The total number of trips needed to transport the material from Port Edgar or Grangeworth dock is approximately 1,000, assuming that the truck would be carrying

approximately 20m^3 of wastes per trip. The minimum distance each truck would need to travel to transport the waste per round trip is 1,260km.

This would post a risk of pollution to the environment from the emissions of the vehicles transporting the material.

There is also a very high risk of spillage of material when transporting by land, as each of the vehicle would need to carefully transport this contaminated spoil, sharing routes with the public going through residential and public areas before the trucks could get on the motorway. This would not be a viable option, as the risk of spillage is high and the local resident are unlikely to accept such a high number of trucks carrying contaminated materials passing through their residential area.

Some form of stilling basin would also be required to allow the sediment to settle out of the water column before transportation. Frequent rehandling of the material would increase the risk of spillage and contamination.

c) Cost considerations

The transportation cost would be very high, as this involves 1,000 round trips to and from the port to the incinerator. Labour costs would also increase as supervisors would need to be at the port during the loading of the contaminated dredge material to supervise and make sure that the material is securely loaded on the truck to the landfill all the time.

The cost to destroy PCB at a huge scale is extremely costly. This is because PCB and PAH needs to be combusted under extreme and carefully controlled conditions. Improper combustion of PCB would lead the formation of other toxins and incomplete destruction of PCB. Such specific conditions mean that it is extremely expensive to destroy PCB in a huge scale.

Costs from both transportation and the disposal of the material itself would deem it too costly for this option to be viable

3.3 Sea Disposal

a) Strategic Considerations

A site that has been identified as the nearest acceptable site for sea disposal is the Oxcars Spoil Ground which is less than 10km east of Port Edgar. Early consultation with Marine Scotland suggests that the material should be suitable for disposal at sea. A copy of the correspondence with Marine Scotland is included in Appendix B.

Figure 3.3 shows the location of the Oxcars Spoilground and the distance from Port Edgar.

Figure 3.3: Location of the Oxcars Spoilground and the Distance from Port Edgar

b) Environmental Consideration

The amount of round trips needed to transport the material from Port Edgar to the Oxcars spoilground is approximately 80, assuming that the barge would be carrying approximately 300m^3 of material per trip. The distance each barge would need to travel to transport the waste per round trip is less than 20km.

This would reduce double handling as the dredged material would be securely loaded on a barge and brought to Oxcars for direct disposal.

Early consultation with Marine Scotland suggests that the material should be suitable for disposal at sea. A copy of the correspondence with Marine Scotland is included in Appendix B.

c) Cost considerations

The transportation cost would be affordable as the material would only need to be transported less than10km away from the site with only around 80 round trips. This would also eliminate double handling, as the dredged material would be loaded onto split hopper barges.

d) Plough Dredging

Plough dredging will be used to move recently deposited material to a deepwater location in the Forth, adjacent to the marina. It is anticipated that the locally based vessel "Forth Boxer" will be able to complete the ploughing operation of approximately 1,000m^3 in four days. It is a cost effective way of returning to the estuary environment sediment that has been recently deposited by tidal action in the marina. The fine material will be weakened by the ploughing operation and is expected to be resuspended when deposited by the plough and spread by tidal action. The quantity is small in relation to the natural suspended sediment load of the estuary.

4. CONCLUSION

4.1 Summary of the Assessment

Eight options to dispose the waste material based on strategic, environmental and cost consideration, shows that several options could have direct potential effects on public health and safety due to the contaminants found in the material. These options were spreading on agricultural land, or for soil conditioning of reclaimed land, beach nourishment, onshore construction, concrete manufacture and reclamation. These options were eliminated from further consideration as the negative implications to public health are too high.

Hence three other options were then discussed in more detail before coming to a conclusion on why the disposal method at sea was the most favourable. These options were sacrificial landfill, land incineration and sea disposal.

In terms of Strategic consideration, there are suitable facilities for all the remaining options. However, in terms of transportation, handling, and acceptability to the public, both landfill and incineration are considered unacceptable.

In terms of Environmental consideration, the potential benefits of incineration are considered to be wiped out by energy costs and transportation impacts. Both sacrificial landfill and the incineration facility would need 1,000 round trips from the port to the disposal facilities, with the distance being as short as 7.3km for the sacrificial landfill and 630km for the incineration facility. There is a real risk of air pollution, traffic disruption, and local residents disapproving this option as the routes to the disposal sites would pass along public and residential areas. However, the sea disposal site (Oxcars) would only need 80 round trips for a distance of less than 10km. This would greatly reduce the potential for air pollution, traffic disruption and the need to go through roads near public areas.

In terms of costs, the sea disposal is the most favourable as this option would provide low energy, transportation and labour costs. This is because it reduces the amount of double handling as the dredged material that has been loaded on the barge could be brought to site immediately to be disposed of.

4.2 BPEO: Sea Disposal

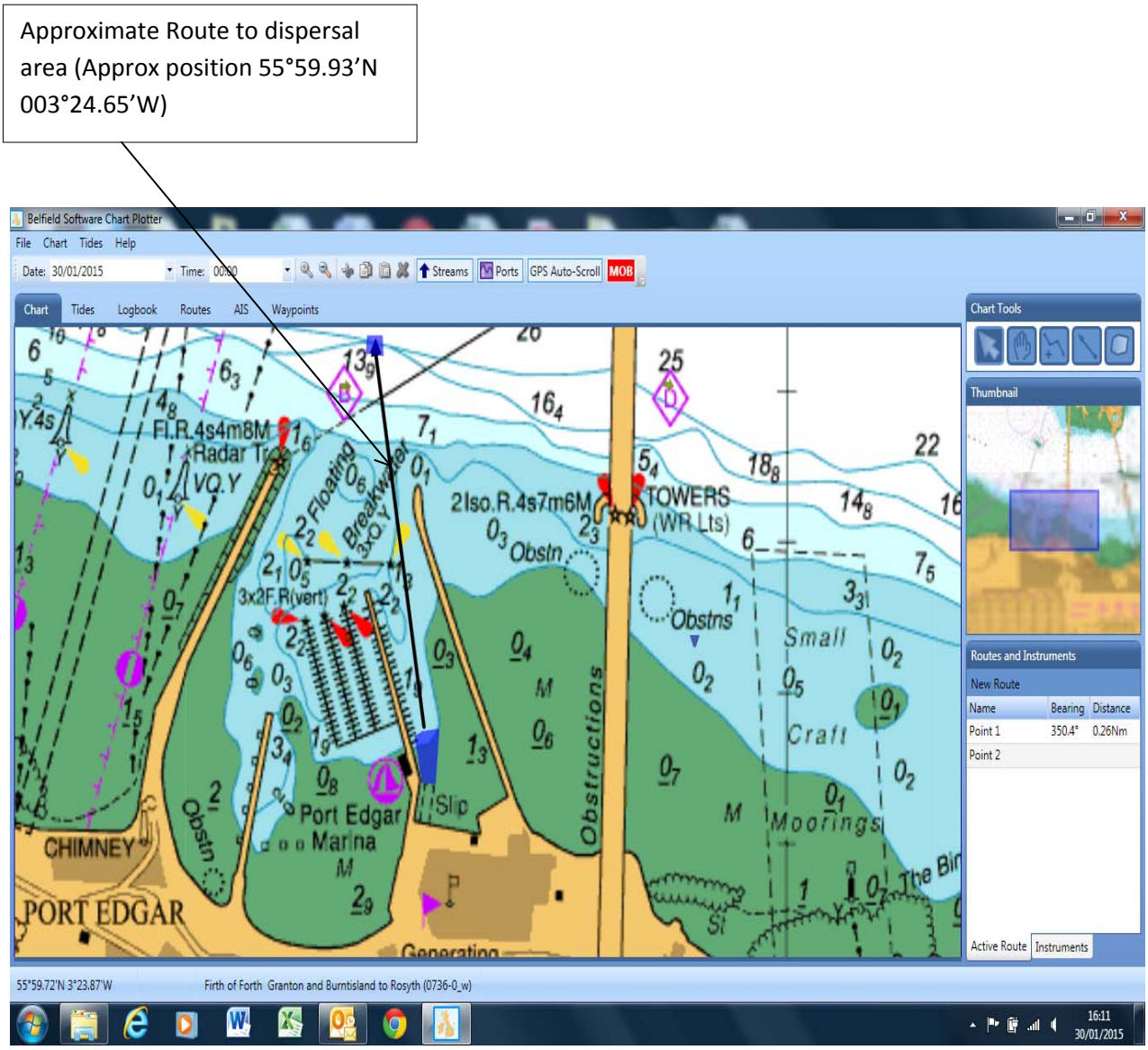
Disposal at sea is the Best Practicable Environmental Option. It is strategically and financially viable, and poses the lowest risk in terms of environmental impact. Whilst capital dredging should be taken to the licensed disposal ground, dredging by ploughing techniques to the deep channel immediately beyond the marina is the BPEO for small maintenance dredging campaigns.

APPENDICES

APPENDIX A: DRAWING 121937-DL-002, LOCATION PLAN

DRAWING 121937-DL-005-A, DREDGING AREAS

SKETCH PLAN OF PLOUGH DREDGING PROPOSAL



Co-ordinates of Dredge Box
55°59.639N 003°24.559W
55°59.663N 003°24.569W
55°59.666N 003°24.549W
55°59.639N 003°24.545W

.

APPENDIX B: CORRESPONDENCE WITH MARINE SCOTLAND

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Appendix F

Consultation

Chris Paton

From: Fiona.Munro2@gov.scot
Sent: 11 September 2019 15:03
To: Rebecca Martin
Subject: RE: 122592: Port Edgar - Notice of Intention to Carry Out an Exempted Activity
Attachments: ATT00001.txt

Dear Rebecca,

We have approved the plans for pre-dredge sampling in Port Edgar. The samples (3) will need to be core samples as you are dredging between 1m-1.5m cd and tested for the top, middle and bottom of the core sample. Also, please note all of these samples should be retained for the duration of the dredge campaign in case further analysis is required at any point.

If you have any further questions please get in touch.

Kind regards,
Fiona Munro

Marine Licensing Casework Manager
Marine Scotland - Marine Planning & Policy

Scottish Government | Marine Laboratory | 375 Victoria Road | Aberdeen | AB11 9DB

General Queries: +44 (0)300 244 5046
Email: MS.MarineLicensing@gov.scot
Website: http://www.gov.scot/Topics/marine/Licensing/marine

From: Rebecca Martin <rebecca.martin@fairhurst.co.uk>
Sent: 11 September 2019 13:59
To: Munro F (Fiona) (MARLAB) <Fiona.Munro2@gov.scot>
Subject: RE: 122592: Port Edgar - Notice of Intention to Carry Out an Exempted Activity

Hi Fiona,

The depth will be 1m – 1.5m below chart datum and the volume will be 10,000m3 annually.

Thanks
Becca

Rebecca Martin MSc
Graduate Environmental Consultant

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Glasgow, G2 4GZ
Tel: 0141 204 8800
Website: www.fairhurst.co.uk

From: Fiona.Munro2@gov.scot [mailto:Fiona.Munro2@gov.scot]
Sent: 11 September 2019 13:52
To: Rebecca Martin
Subject: RE: 122592: Port Edgar - Notice of Intention to Carry Out an Exempted Activity

Dear Ms. Martin,

Thank you for the notice of intention to carry out an exempted activity for pre-dredge sampling in Port Edgar. Could you please confirm the planned dredge volume and depth?

Kind regards,
Fiona Munro

Marine Licensing Casework Manager
Marine Scotland - Marine Planning & Policy

Scottish Government | Marine Laboratory | 375 Victoria Road | Aberdeen | AB11 9DB

General Queries: +44 (0)300 244 5046
Email: MS.MarineLicensing@gov.scot
Website: http://www.gov.scot/Topics/marine/Licensing/marine

From: Rebecca Martin <rebecca.martin@fairhurst.co.uk>
Sent: 10 September 2019 13:52
To: MS Marine Licensing <MS.MarineLicensing@gov.scot>
Subject: 122592: Port Edgar - Notice of Intention to Carry Out an Exempted Activity

Good afternoon,

Attached is a notice of intention to carry out an exempted activity, this is for taking three samples within Port Edgar for pre-dredge sampling. Also attached is the pre-dredge sampling plan and correspondence from SNH confirming they have no concerns with the sampling proposal.

Kind Regards
Becca

Rebecca Martin MSc
Graduate Environmental Consultant

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Chris Paton

From: Malcolm Fraser <Malcolm.Fraser@nature.scot>
Sent: 19 August 2019 08:34
To: Rebecca Martin
Subject: RE: Port Edgar Pre-Dredge Sampling Confirmation

Rebecca –

Thank you for contacting us regarding the proposed pre-dredge sampling at Port Edgar.

I note the outline method statement that you have provided in your email below, alongside the sample point locations in the attached PDF. It is clear from this that the sampling activity represents one additional boat active for a brief period, in an already busy marina, during higher tidal state. I confirm that the effects of this activity upon the SSSI/ SPA/ Ramsar site will be minimal and do not require any further assessment. In Natura terms this activity will not generate 'likely significant effects' upon the SPA.

Please use this email as confirmation to Marine Scotland that we have no issues to raise with the sampling proposal.

Please contact SNH at the appropriate time regarding the subsequent proposal to carry out a capital dredge – as on a first reading this looks like it will lead to a loss of SPA habitat.

All the best.

--
Malcolm Fraser | Operations Officer - Forth
Scottish Natural Heritage | Silvan House | 3rd Floor East | 231 Corstorphine Road | Edinburgh | EH12 7AT | t: 0131 316 2629
Dualchas Nàdair na h-Alba | Taigh Silvan | 3mh Làr an Ear | 231 Rathad Chros Thoirphin | Dùn Èideann | EH12 7AT
nature.scot – Connecting People and Nature in Scotland – @nature_scot

---

From: Rebecca Martin <rebecca.martin@fairhurst.co.uk>
Sent: 06 August 2019 09:30
To: FORTH <FORTH@nature.scot>
Subject: Port Edgar Pre-Dredge Sampling Confirmation

Good morning,

I am writing on behalf of a client who is applying for a capital dredging marine licence within Port Edgar. The location of the proposed dredging site (see attached drawing attached drawing 122592A/WS/0002) is within the Firth of Forth SSSI, SPA and is close to a RAMSAR site.

As part of the process we are required to carry out pre-dredge sampling under a 'Notice of intention to carry out an exempted activity', and within this we require written confirmation from SNH that the proposed sampling will not have a likely significant effect on the SSSI, SPA or RAMSAR. Is this something that can be provided at this stage?

We are planning on taking three samples, using a locations seen on the attached drawing 122592A/WS/0002, within the proposed dredging area.

Below is the method statement on how the sampling is carried out;

- The site is accessed at high tide using a small displacement work boat (6 meter boat powered by an air cooled diesel engine)
- The grab used is a small scale stainless steel bucket grab.

- The boat is positioned using a handheld GPS over the pre-determined site for sampling.
- The grab is lowered to the sea bed by hand over the side of the boat using a length of rope.
- Once the grab is on the sea bed it is activated so the two sides can come together to collect the sample.
- The grab is recovered onto the boat where the samples is removed and placed into the collection pots.
- The grab is cleaned over the side of the boat to avoid contamination at the next site.
- The process is completed at each site as required.

Within the main marine licence application we will be consulting with SNH regarding the dredging and also consulting with a marine ecologist to ensure there is no significant effect on the protected areas.

If there is any more information required please contact me.

If there is someone more specific I should contact can you please let me know.

Kind regards
Becca

Rebecca Martin MSc
Graduate Environmental Consultant

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Appendix G

Bio-security Plan (APEM, 2018)

Port Edgar Marina Biosecurity Plan

Fairhurst

APEM Ref P000002984

October 2018

Ashley Cordingley, Dr Natalie Hold and Dr Marc Hubble

Client:	**Fairhurst**
Address:	**225 Bath Street**
	Glasgow, G2 4GZ
Project reference:	**P2984**
Date of issue:	**October 2018**

Project Director:	**Dr Marc Hubble**
Project Manager:	**Dr Natalie Hold**

APEM Ltd
Riverview
A17 Embankment Business Park
Heaton Mersey
Stockport
SK4 3GN

Tel: 0161 442 8938
Fax: 0161 432 6083

Registered in England No. 02530851

"This is a draft document and should not be cited"

Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
01	17/09/2018	All	All	Document creation	MH
02	28/09/2018	All	All	Internal review	**DH**
03	10/09/2018	All	All	Client review	**MH**

Contents

1. Project background

Out of over 90 marine non-native species (NNS) in the UK and Ireland (Payne *et al*. 2014) 23 are established in Scotland (Nall 2015), with their spread primarily due to shipping (ballast water, biofouling of hulls) and imported consignments of cultured species (Nall *et al.* 2016; Cook *et al.* 2016). Recently, the NNS, *Undaria pinnatifida* (Japanese wakame) has been found in Port Edgar Marina but further surveys of locations along the Firth of Forth found no other occurrences of wakame and therefore Marine Scotland conclude that there is merit in seeking to control the NNS at Port Edgar. Whilst the non-native seaweed has been removed from the hard structures in the marina, full eradication of marine NNS is difficult and a precautionary approach should be adopted so that control and containment measures are considered for all activities and sites (Scottish Government 2012)[1], including prevention of new introductions of other NNS. As such, the Scottish Government requires a Biosecurity Plan to risk assess the routine dredging operations at the marina to avoid further spread of existing NNS or introduction of new NNS as part of its precautionary approach to biosecurity.

Within this approach there are two types of biosecurity plans: 'Site' and 'Operations'.

- A site biosecurity plan covers the long-term, on-going activities at a single location such as a marina (e.g. routine anti-fouling or routine dredging activities).
- The operation biosecurity plan is for a particular activity or set of activities which are time-limited (e.g. construction of a new jetty or one-off dredging activities) (Payne *et al.* 2014). Site biosecurity plans are likely to be in place for a longer period of time and suited to periodic monitoring and review.

There are three levels of biosecurity plan, two of which are described in detail in the Scottish Natural Heritage guidance (Payne *et al.* 2014); a simple approach and a more in-depth approach (using a simplified Hazard Analysis and Critical Control Point (HACCP) technique). The third approach is a full HACCP technique and is not included in the guidelines. The simple approach for this project would list the activities which make up the dredging operation that may carry a risk of introducing or spreading NNS and control measures are proposed for each activity. Following liaison with Marine Scotland in September 2018 the simple approach was deemed suitable to accompany the dredge license application at Port Edgar Marina, with the primary aim of the Biosecurity Plan being to identify best practice for the control of spread of wakame.

[1] Scottish Government non-native species code of practice: https://www.gov.scot/Publications/2012/08/7367

2. Methodology

The preparation of the Port Edgar Biosecurity Plan following the simple approach outlined by Scottish Natural Heritage Biosecurity Planning Guidance (Payne *et al.* 2014) involves the following aspects:

- Defining the dredging operations to be undertaken – frequency, size of operation, location, methods etc.
- Site description – description of physical site components (e.g. permanent hard structures) and environmental description (water flow, salinity etc.) and how these affect the risk of new NNS introductions and the spread of NNS.
- Review of current status of NNS in the marina.
- Review of proposed dredging activities (e.g. arrival, activity, disposal, leaving site).
- Assigning a risk level for each activity (High, Medium, Low).
- Proposing biosecurity control measures for the medium and high risk tasks associated with the dredging activity along with instructions for staff and contractors.
- Proposing contingency plan e.g. rapid response and containment measures if monitoring detects high risk incidents or new NNS.

3. Marine Biosecurity Plan

3.1 Introduction

This operation biosecurity plan has been prepared to assess the biosecurity risks associated with routine dredging operations within Port Edgar Marina.

3.1.1 Description of operation

The scope of the dredging operation is defined in the dredging Marine Licence Application submitted to Marine Scotland as:

“Port Edgar Marina undertakes regular (annual) dredging as a result of sedimentation within the confines of the protected area, which has increased as a result of the construction of nearby bridge piers in recent years. The material to be dredged from the vicinity of the marina berths will not be removed off site; plough dredging will be carried out to move the material from the high spots at the marina to an area at the north east corner of the area for which Port Edgar Marina is responsible”

.

3.1.2 Site Description

Location

Port Edgar is situated on the southern shore of the Firth of Forth on the east coast of Scotland, between the Queensferry Crossing Bridge and the new Forth Road Bridge (please refer to Figure 1). The Firth of Forth is a busy industrial estuary with large commercial dockyards at Rosyth and Leith, which are located approximately XXX km from Port Edgar (both receive substantial shipping traffic from Europe and around the world). Furthermore, the oil refinery at Grangemouth receives boat traffic from around the world. The Firth of Forth is fed by the River Forth and flows into the North Sea along the coasts of Fife and East Lothian. The estuary is considered to be well-mixed to partially mixed, depending on the river flow and tidal range (Webb & Metcalfe 1987). The salinity varies from 18-31[2] at the surface to 26-32 at the bottom in the wider estuary (Webb & Metcalfe 1987). Salinity intrusion into the Forth estuary is highly dependent on river flow and tidal range (Webb & Metcalfe 1987). The Firth of Forth has a moderate but variable current speed of between 2.5 and 4.5 knots at peak flow depending on location (Admiralty Chart 734).

Port Edgar Marina

The marina at Port Edgar consists of three main structural components (the outer breakwaters, floating pontoons and the piers) and each should be considered separately (see Figure 1). Each structural component is subjected to similar environmental conditions, however, the habitats associated with them and the physical characteristics of the structures are different. Therefore, each of the three structures will have different risk factors and control measures associated with them specific to their physical characteristics.

Outer breakwaters

The outer breakwater sections are the oldest part of the marina and a remnant of the original naval base. The breakwaters are solid structures extending from the seabed to above the surface and are approximately 450 metres (m) long on each side of the marina with a further 150 m stretch at the front of the marina. The breakwaters are constructed from caissons and rubble and provide a large subtidal and intertidal area with high levels of structural complexity. The structural complexity created by the outer breakwater provides large areas of habitat suitable for colonisation by marine organisms.

[2] Salinity values determined by conductivity measurement are calculated as a ratio of measured conductivity to standard KCl conductivity. Since Salinity is a ratio, the value is actually dimensionless (no units)

Floating pontoons

The floating pontoons are the newest addition to the harbour and consist of seven floating arms, comprising of 3 x 150 m, 2 x 200 m and 2 x100 m sections, supporting 300 floating berths. The floating platforms have various designs and provide large areas of subtidal habitat that can be colonised by marine organisms.[3]

Piers

The two piers are also remnants of the original naval base. The piers comprise one 230 m and one 350 m section supported by numerous piles. The piles create a large subtidal and intertidal area with high habitat complexity, capable of supporting diverse intertidal and subtidal communities.

Dredge site

The proposed dredging operation will take place within the marina, between the pontoons and piers within the confines of the breakwaters Figure 1. The actual dredged extent will likely be a smaller section within the dredge area outlined in Figure 1 which will be informed by depth conditions at the site and the needs of the marina berth holders. The seabed within the marina is predominantly soft sediment and described as SS.SMu.CSaMu 'Circalittoral sandy mud' under the EUNIS classification system (EmodNET)[4]. The mud habitats are not considered to provide suitable substrate for colonisation by the NNS currently found in Port Edgar Marina (see Section 3.2.4). However, debris and other hard substrata amongst the mud could provide potential settlement habitats and a precautionary approach requires the assumption that NNS could be present in the sediment.

3.1.3 Plan period

Proposed dredging operations are planned between 1st January 2019 and 31st January 2022 on an annual or biannual (twice yearly) basis. It is anticipated that the dredger (provided by Briggs Marine) will be able to carry out the required volume of dredging within approximately ten – twelve days.

3.1.4 Biosecurity Manager

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[3] Port Edgar Marina: https://www.portedgarmarina.co.uk/
[4] EmodNET: http://www.emodnet-seabedhabitats.eu/

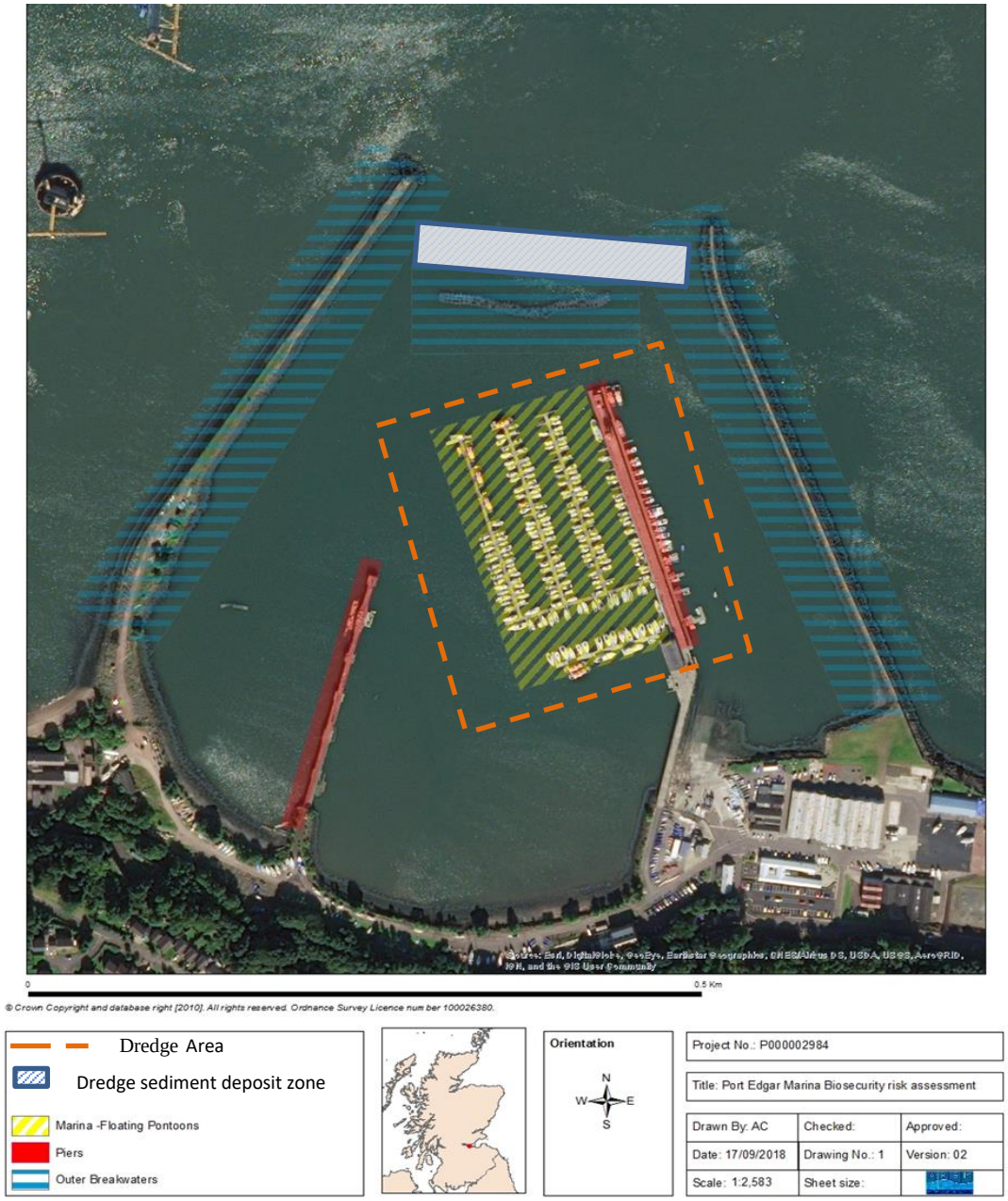

Figure 1 Plan view of Port Edgar indicating the location of the outer breakwaters, marina, piers and dredge area.

3.2 Information related to the environmental conditions affecting biosecurity

3.2.1 Salinity, temperature, tidal flow

Port Edgar can be considered a fully marine site, with a salinity regime capable of supporting fully marine species. The effects of any freshwater inputs are not evident within Port Edgar, which has a salinity of between 31 and 33 (Catarino *et al*. 2018). In addition, the temperature range within Port Edgar is favourable for most European-habituated NNS with an annual variation of between 15.7 °C in the summer and 5.6 °C in the winter (Catarino *et al.* 2018). The tidal flow within the marina is also minimal, making larval retention times high but possible dispersal potential is low. Due to the fully marine environment, favourable temperature and tidal conditions the marina is categorised as high risk for the colonisation of NNS according to the Scottish Natural Heritage Non-Native Species guidelines (Payne *et al*. 2014).

3.2.2 Submerged structures

Port Edgar has a variety of different submerged structures without anti-fouling coating, that are submerged for longer than 6 months at a time and that can only be cleaned *in situ*. Therefore these submerged structures all present a high-risk under the Scottish Natural Heritage Non-Native Species guidelines (Payne *et al*. 2014).

Breakwaters

The breakwaters present the greatest risk to biosecurity, because of their age, structural complexity, lack of antifouling measures and limited cleaning / eradication potential. As such, they provide a large area of colonisable habitat suitable for most NNS present in Scottish waters.

Floating pontoons

The pontoons provide a submerged hard-structure for NNS settlement and are in close proximity to recreational boating traffic (which is a primary transportation vector for NNS). However, the pontoons can be cleaned *in situ* and can be removed and treated further if necessary. The marina carries out biannual scraping and removal of seaweed using a method approved by Marine Scotland for containment of the NNS seaweed Japanese wakame. During this removal the wakame is gathered into a large net on a pole prior to scraping, the weed is then scraped off into the net, removed from the water, dried on the breakwater and disposed of in landfill or used for composting. The pontoons are therefore considered low risk due to the ongoing biosecurity management routine already in place.

Piers

The piers present a high risk settlement structure, because of their age, structural complexity, lack of antifouling measures and limited cleaning / eradication potential. Furthermore, the piers are in close proximity to high risk areas of NNS transportation such as recreational boating and the fuel berth.

3.2.3 Dredge site

The dredging site (Figure 1) can be considered low risk in terms the spread of NNS that are already present due to the dominance of sandy mud substrate which is not favourable for the NNS recorded at the site (see Section 3.2.4), particularly wakame.

3.2.4 Non-native species at Port Edgar

There are currently 23 known non-native species (NNS) in Scotland (Nall *et al*. 2015). Their distribution is uneven and available data are mainly restricted to that obtained from marinas (Nall *et al*. 2015). Currently three non-native species have previously been recorded within Port Edgar (Table 1). Two species (Green fingers seaweed *Codium fragile* subsp. *tomentosoides* and the Japanese skeleton shrimp *Caprella mutica*) were recorded in Port Edgar in 2006 during a survey of the ten largest marinas in Scotland to determine the presence of the seven marine non-native species highlighted in the Marine Aliens programme[5] (Ashton *et al.* 2006). The Japanese brown kelp known as wakame *Undaria pinnatifida* was not found in 2006 but has subsequently been identified on the floating pontoons in Port Edgar with containment measures introduced in collaboration with Marine Scotland. These consist of twice annual removal of biofouling seaweed from the floating pontoons as described above. Wakame has not been found to be growing on the piers.

Although only three NNS have been reported in Port Edgar, many other NNS are widespread and common across the UK. The Scottish Government advocates a precautionary approach with the Marine Biosecurity Planning document (Payne *et al*. 2014) recommending that biosecurity plans and measures assume the presence of potential NNS as well as those recorded, and that operations should be planned and biosecurity measures identified accordingly. This approach has been followed for the biosecurity assessment for the dredging operations at Port Edgar Marina.

[5] (http://www.marlin.ac.uk/marine_aliens/)

Table 1: Non-native species recorded within Port Edgar (as recorded in Ashton *et al*. 2006 and by Port Edgar Marina and Marine Scotland).

Species	Description	Habitat and ecology
Undaria pinnatifida	Japanese wakame, a brown kelp which can out compete native species[6].	A fouling species which attaches to hard substrate and is often found on man-made structures such as floating marina pontoons. Reproduction occurs in late spring or early summer[5].
Codium. fragile subsp. tomentosoides	Green sea-fingers, a spongy green seaweed which can displace native seaweeds, considered invasive by Scottish Natural Heritage[7]	Occurs on rock and coralline algae in pools and on open rock, often found on man-made structures[5]. Reproduction likely occurs towards the end of the summer / beginning of autumn[5].
Caprella mutica	Japanese skelton shrimp, which is considered invasive by Scottish Natural Heritage[5]	Often found on biogenic reefs and in areas of human activity on natural and artificial substrate such as hydroids, mooring ropes and buoys[5]. Fully benthic lifecycle with limited dispersal potential although can disperse along coasts on drifting algae[5].

4. Dredge activities which have a significant risk of introducing or spreading non-native species

The dredge operation has been broken down into three main activities: vessel arrival, dredging and vessel departure. Within each of these activities the biosecurity risks for each task have been identified and the risk assessed using the Marine Biosecurity Planning guidelines (Payne *et al*. 2014), to aid expert judgement. As a precautionary approach the overall activity risk was categorised at the highest risk level of any of the component tasks. Internal quality control for the risk categorisation consisted of review of the risk table by a senior marine taxonomist with expertise in non-native species.

[6] GB Non Native Secretariat species factsheets (http://www.nonnativespecies.org/home/index.cfm).
[7]https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/marine-non-native-species

Table 2 Risk assessment of introduction and spread of NNS during dredge operations. Risk categories were assigned using guidelines in Payne *et al.* (2014), additional scientific literature and expert judgement.

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium /Low)
Arrival of dredge vessel.	Introduction of new NNS.	The vessel will be provided by Briggs Marine which are located locally in the Forth of Firth (north shore). Movements for commercial purposes will be unknown but will likely consist of regular movements between different ports along the east coast of Scotland.	Medium	Medium
		The vessel "Forth Sentinel" has a running speed of 9.5 knots and is therefore not considered slow moving.	Low	
		The biofouling removal regime is unknown at present.	Medium	
Dredging	Spreading on NNS via fragmentation or dispersal of NNS into the water column from hard structures due to physical disturbance or propwash	The dredge vessel will be operated by a very experienced company (Briggs Marine) minimising the risk of contact with hard structures.	Low	High
		The floating pontoons will be removed from the piers and rafted together providing opportunity for fragmentation, especially wakame which has been found on the pontoons.	High	
		Propwash from the dredge vessel could fragment NNS from hard structures.	Low	
	Dispersal of NNS from dredged sediment	The sandy-mud sediment that is to be dredged is not a favourable habitat of any of the NNS known to be present in Port Edgar, however using the precautionary approach it is assumed that some soft sediment NNS may be present. Hard debris such as shells and rocks can provide substrate for wakame and green sea fingers[1].	Medium	Medium

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium/ Low)	Overall activity risk (High/Medium /Low)
Departure of vessel.	Spread of NNS from Port Edgar Marina on the hull of the dredge vessel.	The dredge vessel is expected to be present for approximately ten - twelve days in January or February each year and it is expected that the planktonic dispersal phase of most NNS will occur outside this timeframe. For example wakame releases zoospores in late spring or early summer[1], after the anticipated dredging. Japanese skeleton shrimp spend their entire lifecycle on substrate and lack a free swimming planktonic stage, dispersal can occur on drifting algae[1]. Green sea fingers are thought to have reproduction peaks in late summer / early autumn[2].	Low	Low

[1]GB non-native species secretariat: http://www.nonnativespecies.org/factsheet/index.cfm.

[2]Watanabe *et al.* (2009)

5 Biosecurity Control Measures

5.1 Existing measure

Port Edgar already adopts best practice biosecurity measures for the removal of wakame under an agreement with Marine Scotland. Pontoons are regularly checked by Port Edgar Marina for biofouling and cleaned twice annually to remove wakame and other bio-fouling organisms as described above.

5.2 Additional proposed measures

Additional biosecurity control measures have been identified for the specific medium and high risk activities indicated in Table 3. Consideration has also been given to using any movement of the floating pontoons to scrape wakame and other fouling biota from areas of the hard structure that would otherwise be inaccessible. Whilst it is not anticipated that access will be changed, any opportunities observed during operation will be taken. The control measures in Table 3 will be listed in a biosecurity log and the date when each control measure is carried out will be recorded in the log. This process will allow the identification of any breaches in control measures. If such a breach occurs it will be recorded in the biosecurity log and the contingency plan triggered.

Table 3 Biosecurity control measures proposed for Port Edgar dredging activity

Activity and biosecurity risk	Risk	Control measure	Where	When
Arrival of dredger - introduction of new NNS.	Dredge vessel is a commercial vessel with regular movement between unknown ports, biofouling removal regime is unknown.	Briggs Marine is a large respected marine services company and their boats are used by the Environment Agency who require stringent biosecurity measures and carry out inspections regularly.	NA	Ongoing
		Request anti-fouling treatment and bio-fouling removal record from Briggs Marine. If biofouling removal does not occur at intervals appropriate for the type of antifoul applied then refuse entry until bio-foul is removed.	Port Edgar Marina	Prior to dredge activity
		Use the rapid visual inspection scheme (see Table 5) on vessel arrival. If vessel is ranked at level 3 or higher the vessel should be refused entry.	Port Edgar Marina	On vessel arrival
Dredging - Fragmentation and dispersal of NNS.	Fragmentation of NNS especially wakame when floating pontoons are moved and rafted together.	Port Edgar Marina already carries out twice annual removal of bio-foul, including wakame from the floating pontoons. This procedure will be carried out no earlier than six weeks prior to the dredging activities.	Floating pontoons, Port Edgar Marina	Within 6 weeks prior to dredging
	Dispersal of NNS from dredged sediment.	All dredged material will be disposed of inside the marina breakwater to avoid any NNS being transported outside of the marina.	Port Edgar Marina	During dredge activities
		Any larger rock dredged and spotted by the dredge workers will be inspected for NNS including wakame, which will be removed and disposed of in landfill or composting.	Port Edgar Marina	During dredge activities
All	All	Training will be given to key staff at Port Edgar in the identification of NNS (e.g. see Firth of Clyde Forum Marine Invasive Non-Native Species Identification Guide[1]) and using the visual inspection scheme (Table 5). These references should be printed off and placed in the biosecurity plan folder along with this plan.	Port Edgar Marina	Prior to dredge activity

6. Contingency Plan

In the event of any of any control measures being breached or the detection of a new NNS all necessary steps should be made to control the spread and dispersal of the NNS. Contingency plans for specific scenarios are provided in Table 4.

Table 4 Port Edgar Contingency Plan

Issue	Action	Responsibility	Equipment
Fragmentation or dispersal of NNS into the water column.	Remove debris from the water column and dispose to landfill. Use the same procedures in place for routine cleaning.	Port Edgar should instruct dredge operatives to inform management of any observed fragmentation.	Hand nets
Dredge vessel is ranked at class 3 or above in the visual inspection (see Table 5).	The vessel is not allowed entry to port Edgar. Remove from water at home port, clean and antifoul. Inspect surrounding berths.	Port Edgar staff to carry out visual inspection prior to entry. Port Edgar Marina to refuse entry if required.	Laminated copy of visual inspection table to be available in marina office.
Debris with NNS are dredged off the seabed.	Remove from water and allow to air dry or dispose to landfill.	Port Edgar	NA
New non-native species found.	Inform Marine Scotland. Follow Marine Scotland and SNH instructions.	Port Edgar	Copy of Marine Scotland contact available in marina office.

7. Site surveillance and reporting procedure

The Marine Biosecurity Planning guidelines (Payne *et al*. 2014) require the use of a biosecurity logbook to record training, surveillance, control measures carried out and any other activities or concern regarding the biosecurity of the operation. The pontoons will be routinely scraped of bio-foul which will occur twice a year with one scraping occurring within six weeks prior to the dredging operation. This should be recorded in the biosecurity logbook. In addition, a visual inspection of the hard structures (using the visual inspection method in Table 5) within the marina should take place at Port Edgar prior to any dredging operation. This is to determine the presence and extent of any biofouling (specifically NNS), so that any adjustment can be made to procedure or biosecurity action plans.

Surveillance and biosecurity procedures should be assessed annually to ensure they are still relevant and up to date. In addition, procedure should be revised if any significant changes occur to the structure of the marina or if new NNS are recorded.

Following the guidance given by the Scottish Government under the Marine Scotland Act, any new NNS or a significant increase of existing NNS should be reported to Marine Scotland and Scottish Natural Heritage. The Marine Scotland contact for reporting invasive non-native species is the Scottish Environment and Rural Services telephone number: 08452 30 20 50 and email: info@sears.scotland.gov.uk

The GB Non-native Species Secretariat should also be informed so they can update species distribution and abundance databases for NNS.Relevant details are located on their website:

http://www.nonnativespecies.org

Table 5 Biofouling visual assessment (Payne *et al.* 2014)

Rank	Description	Visual estimate of biofouling cover
0	No visible fouling. Hull entirely clean, no biofilm on visible submerged parts of the hull.	Nil
1	Slime fouling only. Submerged hull areas partially or entirely covered in biofilm, but the absence of any plants or animals.	Nil
2	Light fouling. Hull covered in biofilm and one to two very small patches of one type of plant or animal.	1–5 % of visible submerged surfaces
3	Considerable fouling. Presence of biofilm, and fouling still patchy, but clearly visible and comprised of either one or more types of plant and/or animal.	6–15 % of visible submerged surfaces
4	Extensive fouling. Presence of biofilm and abundant fouling assemblages consisting of more than one type of plant or animal.	16–40 % of visible submerged surfaces
5	Very heavy fouling. Many different types of plant and / or animal covering most of visible hull surfaces.	41–100 % of visible submerged surfaces

8 Key sources of Advice

- GB NNSS Website
  - Biosecurity in the field (including biosecurity for boat users, submerged structures and event biosecurity support pack) http://www.nonnativespecies.org/index.cfm?pageid=174
- RYA
  - www.rya.org.uk/go/alienspecies
- The Green Blue
  - Antifoul and Invasive Species
  - http://thegreenblue.org.uk/Boat-Users/Antifoul-and-Invasive-Species
  - The Green Guide to Boat Washdown
  - http://thegreenblue.org.uk/Leaflets-and-Resources/Resources-for-Clubs-Training-Centres-and-Marinas
- Cefas Biosecurity Measures Guidance
  - Shellfish biosecurity measures plan
  - http://www.defra.gov.uk/aahm/files/Book-Shellfish-BMP.pdf
  - Finfish biosecurity measures plan
  - https://www.gov.uk/prevent-fish-or-shellfish-diseases#prevent-the-spread-of-disease-in-fish-and-shellfish
- Invasive Species Ireland
  - Aquaculture Code of Good Practice http://invasivespeciesireland.com/cops/aquaculture/
  - Marina Operators Code of Good Practice http://invasivespeciesireland.com/cops/marina-operators/
  - Water Users Code of Good Practice http://invasivespeciesireland.com/cops/water-users/
- Firth of Clyde Biosecurity Plan
  - Invasive non-native species – A biosecurity plan for the Firth of Clyde http://clydeforum.com/index.php/projects/invasive-species
- IMO Guidelines For The Control And Management Of Ships' Biofouling To Minimize The Transfer Of Invasive Aquatic Species
  - http://www.imo.org/blast/blastDataHelper.asp?data_id=30766&filename=207(62).pdf
- IMO Guidance For Minimizing The Transfer Of Invasive Aquatic Species As Biofouling (Hull Fouling) For Recreational Craft
  - http://www.imo.org/en/OurWork/Environment/Biofouling/Documents/MEPC.1-Circ.792.pdf

9 Annex: Glossary

Biofouling: Biological growth which develops on manmade structures in the aquatic environment.

Biosecurity: Taking action in order to minimise the introduction or spread of invasive non-native species or disease.

Biosecurity Plan: A written document which details site / operation activities and actions that will be undertaken to minimise the introduction or spread of a specified threat (i.e. invasive non-native species).

Control Measures: Refers to actions which are undertaken in order to prevent the introduction or spread of an invasive non-native species.

Establishment: Refers to the process of a non-native species in a new location successfully producing viable offspring with the likelihood of continued survival.

EUNIS: The European Nature Information System (EUNIS) habitat classification is a pan-European system, which was developed between 1996 and 2001 by the European Environment Agency (EEA) in collaboration with experts from throughout Europe. It covers all types of natural and artificial habitats, both aquatic and terrestrial.

Introduction: Refers to the movement by human means, indirect or direct, of a species outside its natural range. This movement can be within a country or between countries.

Native Species: Also known as indigenous species, means a species occurring within its natural range (past or present) and dispersal potential, i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or intervention by humans.

Non-Native Species: Non-native species (also known as alien, non-indigenous, foreign or exotic) means a species or subspecies occurring outside its native range i.e. the range it occupies naturally without the intervention of human activity. This includes any part of the species that might survive and subsequently reproduce.

Prop Wash: An aviation and nautical term used to define a mass of air or water pushed aft or fore by the propeller of an aircraft or propeller-driven watercraft. This term is synonymous with any water disturbance created by a vessel's propulsion systems.

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