

FUGRO

**Weekly Progress Report
16 to 21 September 2017
Water Quality Monitoring
Nigg Bay, Aberdeen, UK**

Fugro Document No.: 179219_W3
28 September 2017

Draft

Prepared for: Dragados
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01	Draft				28 September 2017
Issue	Document Status	Prepared	Checked	Approved	Date

1. INTRODUCTION

Dragados UK have contracted Fugro to undertake water quality and under water noise monitoring during dredging operations at Nigg Bay, Aberdeen, as part of the Aberdeen Harbour Expansion Project (AHEP).

As outlined in the Dredging and Dredge Spoil Disposal Management and Monitoring Plan, Chapter 7 of the AHEP Construction Environmental Management Document (CEMD), the following weekly report documents the turbidity monitoring operations from 16 to 21 September 2017.

Dredging commenced on 5 September. Prior to this, Fugro conducted a baseline survey to establish reference conditions on site; this included the collection of turbidity measurements and water samples at eight sites, as per the CEMD. During dredging operations turbidity measurements and water samples continued to be taken at the same eight sites. A brief methodology for the baseline measurements and dredge monitoring is detailed in Section 2. Turbidity measurements were obtained using a Valeport CTD+ multiparameter probe and water samples were collected using a Niskin bottle. For each day of dredging operations, inferred suspended sediment concentration (SSC) was monitored to assess whether levels increased above the acceptable threshold. This threshold limit was set at 50 mg/l between background sampling sites (W6, W7, W8) and live dredging sites.

On 17 September dredging operations ceased prematurely due to failure of the dredging vessel.

Sediment sampling was undertaken on 19 September. A seabed grab sample was collected from six sites (including four at the disposal site) to allow a comparison of results over time. Sediment sampling methodology and results will be detailed in a separate report following analysis.

Fugro personnel demobilised on 21 September.

1.1 Sampling Locations

W1 to W8 refer to water quality monitoring sites. D1 to D4 refer to disposal site sediment sampling sites. G1 and G8 refer to additional sediment sampling sites.

Table 1.1: Summary of Water Quality Monitoring Locations

Location Name	Latitude [WGS84]	Longitude [WGS84]	Approximate Depth Below Chart Datum [m]
W1	57° 07' 49.57" N	002° 02' 22.74" W	14
W2	57° 08' 02.51" N	002° 02' 13.83" W	15
W3	57° 08' 15.45" N	002° 02' 05.81" W	22
W4	57° 09' 00.71" N	002° 02' 58.52" W	9
W5	57° 08' 43.17" N	002° 03' 34.46" W	7
W6	57° 08' 30.76" N	002° 04' 08.88" W	6
W7	57° 10' 05.37" N	002° 03' 58.14" W	9
W8	57° 06' 51.35" N	002° 02' 28.62" W	24

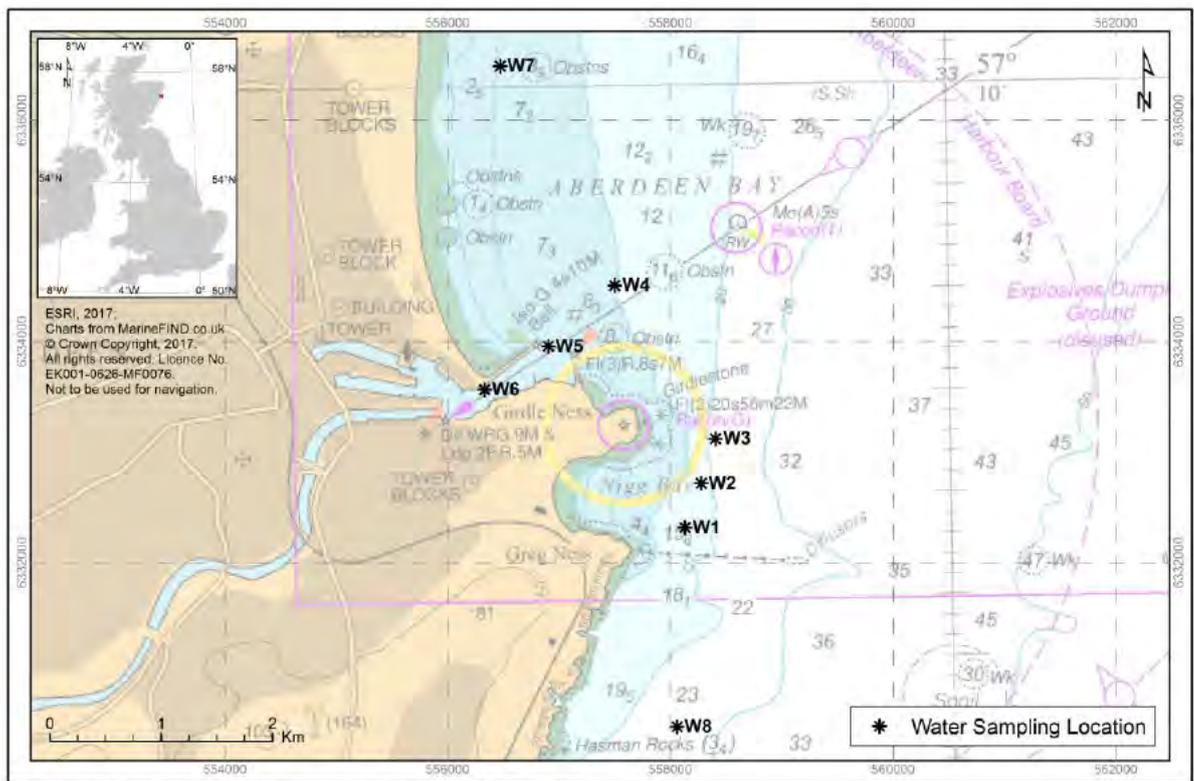


Figure 1.1: Location map of water quality monitoring sites

Table 1.2: Summary of Sediment Sampling Locations

Location Name	Latitude [WGS84]	Longitude [WGS84]	Approximate Depth Below Chart Datum [m]
D1	57° 07' 07" N	002° 00' 15" W	35 m to 50 m
D2	57° 07' 07" N	001° 59' 45" W	35 m to 50 m
D3	57° 06' 52" N	002° 00' 15" W	35 m to 50 m
D4	57° 06' 52" N	001° 59' 45" W	35 m to 50 m
G1	57° 07' 57" N	002° 02' 56" W	-
G8	57° 07' 56" N	002° 02' 53" W	-

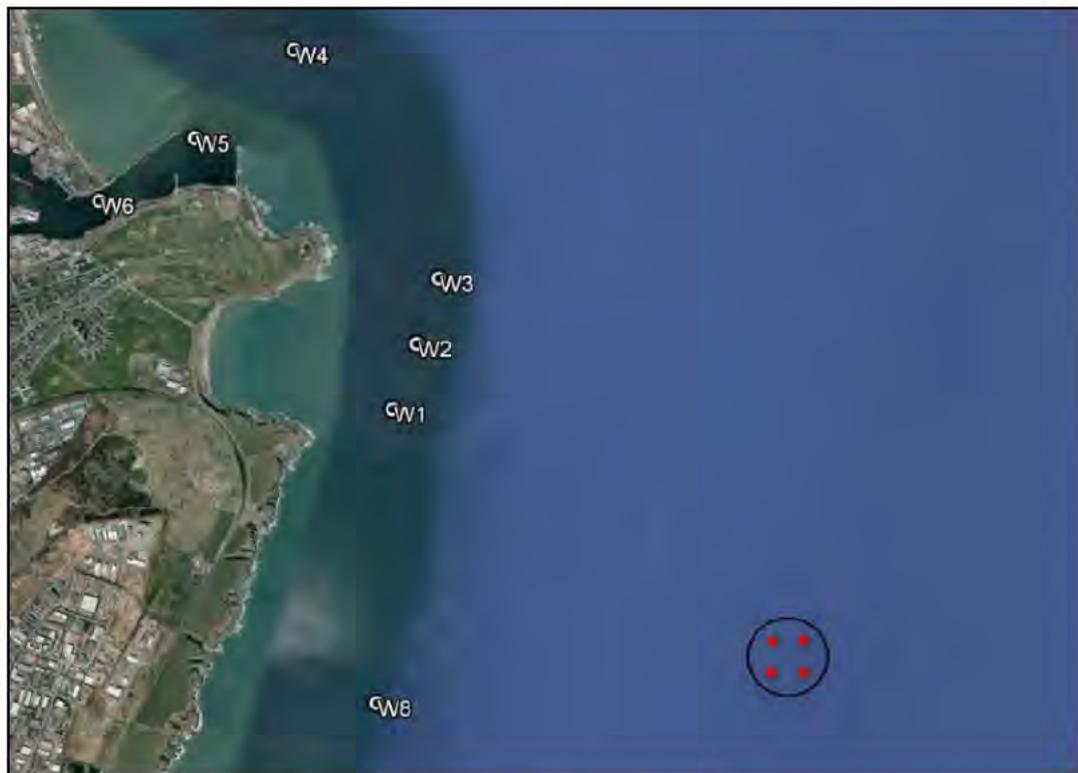


Figure 1.2: Location map of disposal site sediment sampling sites

2. METHODOLOGY

2.1 Dredge Monitoring

During dredge operations SSC data were calculated using an average turbidity value from 10 minutes of profiling data collected from the turbidity sensor, at each site. This value was converted to a SSC value by applying the site-specific turbidity-SSC relationship coefficient. The turbidity measurements used in the averaging calculation were derived from all values obtained where pressure was greater than or equal to 1 dbar over the course of the 10 minute sample.

For this study a maximum of 50 mg/l increase in SSC is considered acceptable, when compared to background sampling sites (W6, W7 and W8).

3. OPERATIONS SUMMARY: 16 TO 21 SEPTEMBER

Table 3.1: Operations Summary

Vessel	16 September	Ocean Predator
	19 September	Marilyn M
Personnel	16 to 21 September	[Redacted]
Dredge status	16 September	Dredge monitoring; Trailing Suction Hopper Dredger (TSHD)
	17 September onward	Dredge monitoring ceased
Equipment	Valeport CTD +	Turbidity sensor
	Niskin bottle	Water sampler
	Sediment grab	Van Veen grab

3.1 Dredge Monitoring

Monitoring during dredging operations commenced on 5 September 2017. A summary of the monitoring results from 16 September is provided in Table 3.2 with full records provided in Appendix A.

Table 3.2: Dredge Monitoring: 16 September 2017

Date	Personnel	Coefficient used	Location	SSC [mg/l]	SSC cf. Reference [mg/l]
16/09/2017	[Redacted]	$Y=0.8035x + 27.481$	W8	29.738	Reference
			W1	39.327	9.589
			W3	30.321	0.583
			W2	32.718	2.980
			W7	40.898	11.160
			W4	33.922	4.184
			W5	52.284	22.546
W6	55.269	25.531			
Notes: SSC = Suspended sediment concentration SSC cf. Reference = SSC compared to reference sample					

3.2 Meteorological / Wave Data

Currently unavailable, awaiting further information from Dragados.

3.3 Comments / Remarks

On 16 September, nine samples were obtained and analysed.



A. APPENDIX A

Date	Time (GMT)	Location	Sample Depth	Site Depth [m]	Turbidity [FTU]	SSC [mg/l]
16/09/2017	08:14	W8	Bottom	27	2.695	20
Saturday	08:23	W8	Middle		3.080	22
	08:30	W8	Top		2.582	14
	09:26	W3	Bottom	28	3.492	37
	09:33	W3	Middle		3.587	14
	09:37	W3	Top		2.853	30
	11:51	W4	Bottom	13	12.946	22
	11:56	W4	Middle		6.277	7
	12:00	W4	Top		4.770	62
Notes: SSC = Suspended sediment concentration FTU = Formazin turbidity units						

FUGRO

**Weekly Progress Report
9 to 15 September 2017
Water Quality Monitoring
Nigg Bay, Aberdeen, UK**

Fugro Document No.: 179219_W2
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1. INTRODUCTION

Dragados UK have contracted Fugro to undertake water quality and under water noise monitoring during dredging operations at Nigg Bay, Aberdeen, as part of the Aberdeen Harbour Expansion Project (AHEP).

As outlined in the Dredging and Dredge Spoil Disposal Management and Monitoring Plan, Chapter 7 of the AHEP Construction Environmental Management Document (CEMD), the following weekly report documents the baseline survey and turbidity monitoring operations from 9 to 15 September 2017.

Dredging commenced on 5 September. Prior to this, Fugro conducted a baseline survey to establish reference conditions on site; this included the collection of turbidity measurements and water samples at eight sites, as per the CEMD. During dredging operations turbidity measurements and water samples continued to be taken at the same eight sites. A brief methodology for the baseline measurements and dredge monitoring is detailed in Section 2. Turbidity measurements were obtained using a Valeport CTD+ multiparameter probe and water samples were collected using a Niskin bottle. For each day of dredging operations, inferred suspended sediment concentration (SSC) was monitored to assess whether levels increased above the acceptable threshold. This threshold limit was set at 50 mg/l between background sampling sites (W6, W7, W8) and live dredging sites.

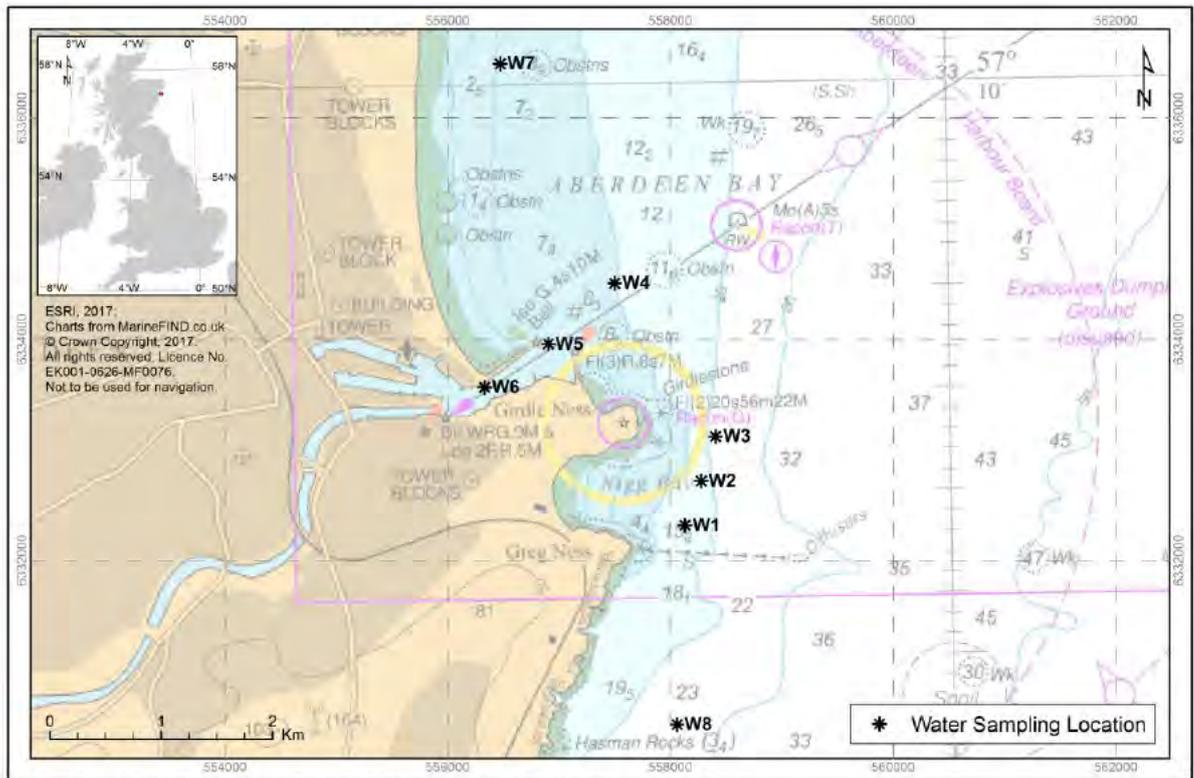
In addition, disposal site sediment sampling will be undertaken. A seabed grab sample is to be collected from four sites at the disposal site to allow a comparison of results over time.

1.1 Sampling Locations

W1 to W8 refer to water quality monitoring sites. D1 to D4 refer to disposal site sediment sampling sites.

Table 1.1: Summary of Water Quality Monitoring Locations

Location Name	Latitude [WGS84]	Longitude [WGS84]	Approximate Depth Below Chart Datum [m]
W1	57° 07' 49.57" N	002° 02' 22.74" W	14
W2	57° 08' 02.51" N	002° 02' 13.83" W	15
W3	57° 08' 15.45" N	002° 02' 05.81" W	22
W4	57° 09' 00.71" N	002° 02' 58.52" W	9
W5	57° 08' 43.17" N	002° 03' 34.46" W	7
W6	57° 08' 30.76" N	002° 04' 08.88" W	6
W7	57° 10' 05.37" N	002° 03' 58.14" W	9
W8	57° 06' 51.35" N	002° 02' 28.62" W	24



Map Document: (V:\C179209_NiggBay_WaterSampling3_Plots1_SurveyArray\179209_WaterSamplingLocationsOverview.mxd)
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Figure 1.1: Location map of water quality monitoring sites

Table 1.2: Summary of Disposal Site Sediment Sampling Locations

Location Name	Latitude [WGS84]	Longitude [WGS84]	Approximate Depth Below Chart Datum [m]
D1	57° 07' 07" N	002° 00' 15" W	35 m to 50 m
D2	57° 07' 07" N	001° 59' 45" W	35 m to 50 m
D3	57° 06' 52" N	002° 00' 15" W	35 m to 50 m
D4	57° 06' 52" N	001° 59' 45" W	35 m to 50 m

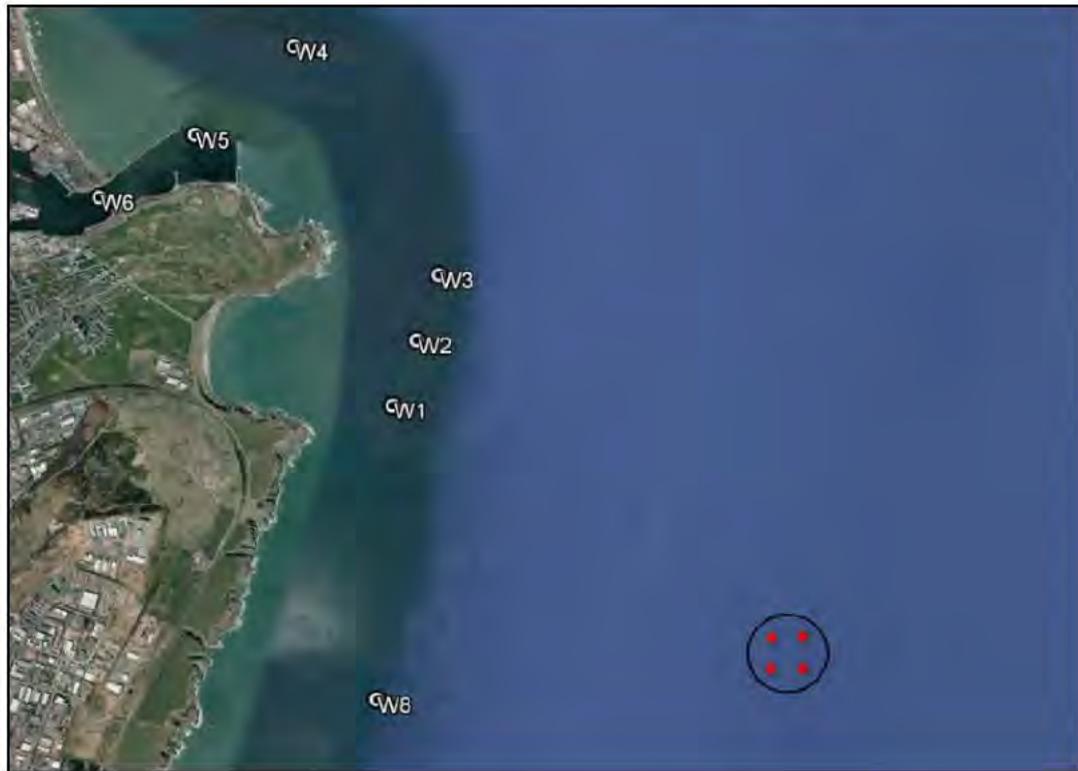


Figure 1.2: Location map of disposal site sediment sampling sites

2. METHODOLOGY

2.1 Dredge Monitoring

During dredge operations SSC data were calculated using an average turbidity value from 10 minutes of profiling data collected from the turbidity sensor, at each site. This value was converted to a SSC value by applying the site-specific turbidity-SSC relationship coefficient. The turbidity measurements used in the averaging calculation were derived from all values obtained where pressure was greater than or equal to 1 dbar over the course of the 10 minute sample.

For this study a maximum of 50 mg/l increase in SSC is considered acceptable, when compared to background sampling sites (W6, W7 and W8).

3. OPERATIONS SUMMARY: 9 TO 15 SEPTEMBER

Table 3.1: Operations Summary

Vessel	9 to 15 September	Ocean Predator
Personnel	9 to 15 September	[Redacted]
Dredge status	9 to 15 September	Dredge monitoring; Trailing Suction Hopper Dredger (TSHD)
Equipment	Valeport CTD +	Turbidity sensor
	Niskin bottle	Water sampler

3.1 Dredge Monitoring

Monitoring during dredging operations commenced on 5 September 2017. A summary of the monitoring results from 9 to 15 September is provided in Table 3.2 with full records provided in Appendix A.

Table 3.2: Dredge Monitoring: 9 to 15 September 2017

Date	Personnel	Coefficient used	Location	SSC [mg/l]	SSC cf. Reference [mg/l]
09/09/2017	[Redacted]	$Y=0.1527x + 29.976$	W8	30.698	Reference
			W1	31.100	0.402
			W3	30.891	0.193
			W2	30.854	0.156
			W7	31.425	0.727
			W4	30.667	-0.031
			W5	31.315	0.617
			W6	30.715	0.017
10/09/2017	[Redacted]	$Y=0.1527x + 29.976$	W8	30.628	Reference
			W1	31.608	0.980
			W2	30.993	0.365
			W3	30.916	0.288
			W7	30.684	0.056
			W4	30.632	0.004
			W5	30.603	-0.025
			W6	30.521	-0.107
11/09/2017	[Redacted]	$Y=0.1527x + 29.976$	W8	31.079	Reference
			W1	31.407	0.328
			W2	31.142	0.063
			W3	31.103	0.024
			W7	32.861	1.782
			W4	32.904	1.825
			W5	32.861	1.782
			W6	32.904	1.825
12/09/2017	[Redacted]	$Y=0.8035x + 27.481$	W8	30.612	Reference
			W1	35.783	5.171
			W2	32.502	1.890
			W3	33.548	2.936
			W7	33.430	2.818
			W4	37.095	6.483
			W1	32.399	1.787



Date	Personnel	Coefficient used	Location	SSC [mg/l]	SSC cf. Reference [mg/l]
			W2	33.686	3.074
			W3	32.685	2.073
			W5	34.705	4.093
			W6	34.599	3.987
13/09/2017	██████████	Y=0.8035x + 27.481	W8	29.799	Reference
			W1	31.266	1.467
			W2	30.072	0.273
			W3	30.386	0.587
			W7	35.245	5.446
			W4	32.355	2.556
			W5	33.814	4.015
			W6	33.482	3.683
14/09/2017	██████████	Y=0.8035x + 27.481	W8	30.266	Reference
			W1	31.407	1.141
			W2	30.499	0.233
			W3	29.767	-0.499
			W7	34.706	4.440
			W1	29.841	-0.425
			W2	30.249	-0.017
			W3	30.054	-0.212
			W4	36.506	6.240
			W5	45.158	14.892
15/09/2017	██████████	Y=0.8035x + 27.481	W8	29.799	Reference
			W7	40.079	10.280
			W4	35.267	5.468
			W3	31.905	2.106
			W2	34.750	4.951
			W1	33.720	3.921
			W6	37.201	7.402
			W5	40.583	10.784
Notes: SSC = Suspended sediment concentration SSC cf. Reference = SSC compared to reference sample					

3.2 Meteorological / Wave Data

Currently unavailable, awaiting further information from Dragados.

3.3 Comments / Remarks

Between 9 and 15 September, 111 samples were obtained and analysed. A greater variation in SSC was recorded by sampling within the dredge plume behind the dredger; this helped to develop a more robust relationship between FTU and SSC. Consequently, the sampling regime was reduced from eight to three sites from 12 September onward.

The next report will cover the period 16 to 21 September.



A. APPENDIX A

Date	Time (GMT)	Location	Sample Depth	Site Depth [m]	Turbidity [FTU]	SSC [mg/l]
09/09/2017	08:48	D1	Bottom	40	3.206	50
Saturday	08:52	D1	Middle		1.944	33
	08:54	D1	Top		1.911	41
	09:08	W8	Bottom	28	6.480	73
	09:12	W8	Middle		3.790	34
	09:18	W8	Top		2.569	6
	09:38	W1	Bottom	24	8.980	36
	09:44	W1	Middle		4.335	28
	09:48	W1	Top		3.985	44
	10:02	W3	Bottom	22	6.226	34
	10:12	W3	Middle		4.767	38
	10:18	W3	Top		4.744	26
	10:29	W2	Bottom	16	6.326	39
	10:34	W2	Middle		6.051	14
	10:39	W2	Top		4.363	23
	13:03	W7	Bottom	9	10.386	27
	13:09	W7	Middle		5.315	34
	13:13	W7	Top		4.112	25
	13:39	W4	Bottom	14	5.359	29
	13:45	W4	Middle		4.522	24
	13:48	W4	Top		2.982	20
	13:55	W5	Bottom	11	-	25
	13:58	W5	Middle		3.243	25
	14:07	W5	Top		3.713	15
	14:10	W6	Bottom	9	5.613	25
	14:15	W6	Middle		4.315	22
	14:18	W6	Top		4.228	20
10/09/2017	08:11	W8	Bottom	27	5.427	32
Sunday	08:20	W8	Middle		2.866	20
	08:23	W8	Top		1.840	29
	08:36	W1	Bottom	16	12.856	53
	08:47	W1	Middle		9.301	44
	08:51	W1	Top		7.928	40
	08:59	W2	Bottom	18	7.880	21
	09:06	W2	Middle		6.135	25
	09:12	W2	Top		5.782	36
	09:22	W3	Bottom	22	6.706	29
	09:29	W3	Middle		5.662	45
	09:34	W3	Top		5.778	27
	11:13	W7	Bottom	6	8.137	48
	11:18	W7	Middle		3.730	62
	11:25	W7	Top		3.433	29
	11:39	W4	Bottom	14	5.683	33
	11:44	W4	Middle		4.273	32
	11:47	W4	Top		2.796	22

Weekly Progress Report
9 to 15 September 2017



Date	Time (GMT)	Location	Sample Depth	Site Depth [m]	Turbidity [FTU]	SSC [mg/l]
	13:08	W5	Bottom	10	3.337	27
	13:13	W5	Middle		4.266	25
	13:16	W5	Top		2.841	36
	13:24	W6	Bottom	9	4.943	18
	13:27	W6	Middle		3.160	45
	13:32	W6	Top		3.134	16
11/09/2017	08:19	W8	Bottom	27	13.840	62
Monday	08:28	W8	Middle		6.746	39
	08:34	W8	Top		1.942	29
	08:49	W1	Bottom	16	13.912	28
	08:54	W1	Middle		7.801	21
	09:00	W1	Top		4.963	34
	09:11	W2	Bottom	16	9.274	48
	09:17	W2	Middle		6.370	28
	09:23	W2	Top		6.699	21
	09:37	W3	Bottom	22	9.074	46
	09:38	W3	Middle		6.798	53
	09:44	W3	Top		5.359	25
	11:33	W5	Bottom	9	10.185	51
	11:38	W5	Middle		10.440	37
	11:40	W5	Top		9.511	19
	11:49	W6	Bottom	7	4.703	24
11:54	W6	Middle		5.077	25	
11:51	W6	Top		5.042	17	
12/09/2017	08:36	W8	Bottom	27	6.698	24
Tuesday	08:43	W8	Middle		3.015	24
	08:47	W8	Top		1.745	11
	09:04	W1	Bottom	16	9.194	54
	09:12	W1	Middle		7.265	24
	09:14	W1	Top		6.291	38
	11:28	W4	Bottom	14	24.791	29
	11:31	W4	Middle		5.394	34
	12:35	W4	Top		4.223	7
	11:50	DP	Bottom	7	129.570	300
	11:56	DP	Middle		46.751	110
11:58	DP	Top		54.107	190	
13/09/2017	08:16	W8	Bottom	28	3.165	17
Wed	08:24	W8	Middle		2.967	27
	08:31	W8	Top		2.443	17
	08:49	W1	Bottom	17	7.279	24
	08:54	W1	Middle		3.193	25
	08:58	W1	Top		2.272	16
	12:52	W4	Bottom	14	5.410	31
	12:57	W4	Middle		4.600	11
13:00	W4	Top		3.428	4	
14/09/2017	08:20	W8	Bottom	28	3.609	32

Weekly Progress Report
9 to 15 September 2017



Date	Time (GMT)	Location	Sample Depth	Site Depth [m]	Turbidity [FTU]	SSC [mg/l]
Thursday	08:32	W8	Middle		3.797	20
	08:38	W8	Top		2.778	27
	09:05	D1	Bottom	39	1.748	17
	09:08	D1	Middle		1.685	7
	09:12	D1	Top		1.558	13
	11:02	W3	Bottom	23	3.352	22
	11:07	W3	Middle		2.285	9
	11:11	W3	Top		2.262	6
	11:36	W7	Bottom	7	15.332	34
	11:42	W7	Middle		4.167	20
	11:47	W7	Top		4.552	24
15/09/2017	08:48	W8	Bottom	28	3.178	16
Friday	08:52	W8	Middle		2.561	46
	09:00	W8	Top		2.227	16
	10:40	W2	Bottom	16	12.945	33
	10:44	W2	Middle		7.896	36
	10:50	W2	Top		6.633	40
	15:02	W6	Bottom	9	10.019	31
	15:06	W6	Middle		10.506	46
	15:10	W6	Top		7.644	25
Notes:						
SSC = Suspended sediment concentration						
FTU = Formazin turbidity units						
- Denotes data not included in calibration calculation						

Dragados

AHEP

AHEP - Dredge Monitoring Plan for 2018 and 2019 Operations

Report Ref: AHEP 2018 Dredge Surveys Mitigation

Rev A | 17 April 2018

This report takes into account the particular
instructions and requirements of our client

It is not intended for and should not be relied
upon by any third party and no responsibility
is undertaken to any third party

Job number 253300-19

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Appendix A1 Sediment Sample Location

Appendix A2 Suspended Sediment Exceedance Procedures

1 Introduction

This plan has been developed in accordance with the approved Aberdeen Harbour Expansion Project (AHEP) Construction Environmental Management Document (CEMD) and should be read in conjunction with AHEP CEMD Chapter 7 – Dredging and Dredge Spoil Disposal Management and Monitoring Plan.

This plan provides detail on the methodology for suspended sediment monitoring and sediment quality monitoring, adaptive management options and associated reporting requirements for the dredging operations proposed at AHEP for 2018 and 2019.

As part of the 2018 and 2019 dredging operations, Dragados commit to the use of a continuous monitoring system as described in Section 7.6.1 of the AHEP CEMD Dredging and Dredge Spoil Disposal Management Plan.

1.1 Proposed Dredging Operations

Planned dredging operations for 2018 and 2019 at AHEP are:

- Dredging operations commencing as soon as possible after 25th April 2018, subject to all necessary consents being in place;
- A Back Hoe Dredger (BHD) will commence dredging at the end of April 2018 and be serviced by 2 Split Hopper Barges (SHB) to transport material to the disposal site (CR110). Operations for 2018 are due to be completed in November 2018 and restart in Spring 2019, depending on progress in 2018;
- It is planned that a Trailing Suction Hopper Dredger (TSHD) will be dredging mid June to mid July 2018 and then again from the start of September 2018 to end of November 2018. The TSHD will return in 2019 as required, depending on progress in 2018;
- All dredging operations will be carried out within the areas marked in Figure 1: Proposed Dredge Area. Dredging operations will be ongoing 24 hours a day, 7 days a week; and
- Dredged material (except rock), if not used on site, will be disposed of at the offshore disposal site ‘Aberdeen CR110’ as detailed within the AHEP ES and subsequent documents. All rock will be reused.

The vessels undertaking the dredging are similar to those described in the Dredging and Dredge Spoil Disposal Management and Monitoring Plan within the approved AHEP CEMD.



Figure 1: Proposed 2018 and 2019 Dredge Areas

2 Suspended Sediment Monitoring – 2017 Dredging Season

Prior to dredging commencing on September 5th, 2017, Fugro undertook baseline water quality measurements from September 1st to September 4th, 2017. Suspended sediment levels were sampled at eight locations around Nigg Bay and the wider area as pictured in Figure 2.

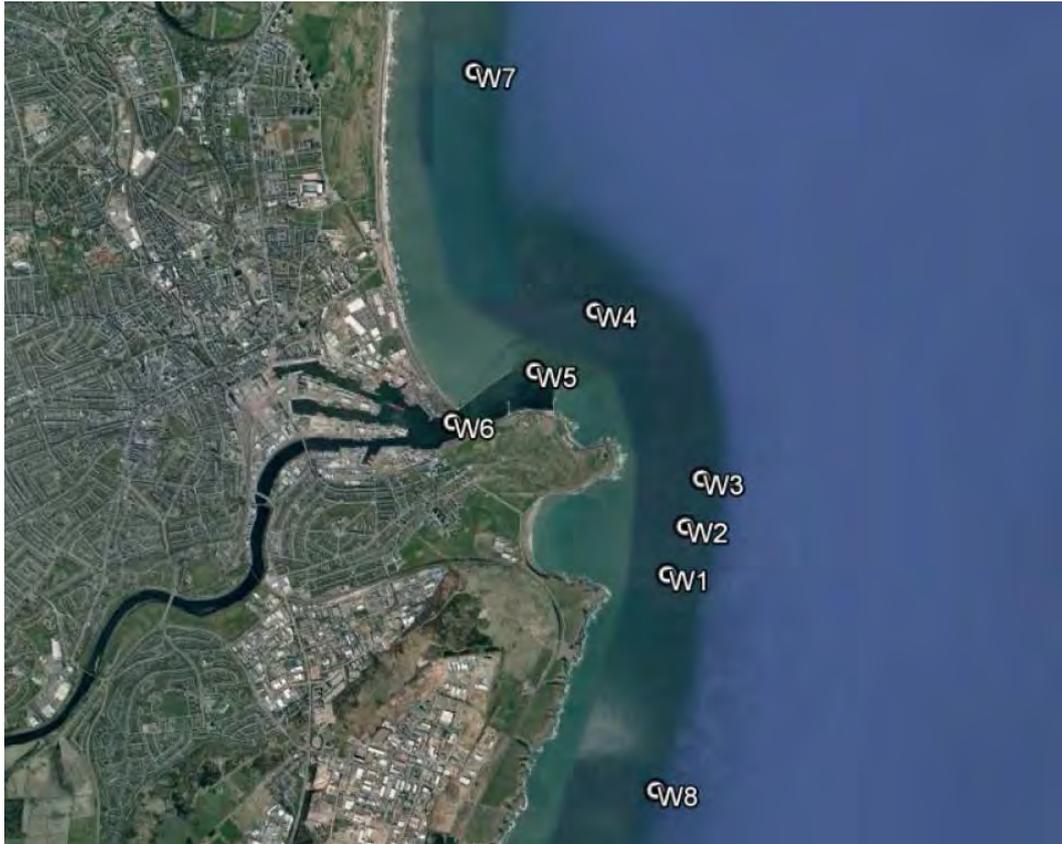


Figure 2: Water quality measurement locations

The baseline water samples were taken at three depths, 2m below surface, 2m above seabed and at a midpoint in the water column. During dredge operations, the suspended sediment concentration were calculated using an average turbidity value from 10 minutes of profiling data at each location.

Dredging operations ceased on September 16th 2017 with no further dredging in 2017. During the dredging campaign, no increase of above 50mg/l was recorded in suspended sediment concentrations, when comparing the baseline measurements at W8 to W1,2,3. Measurements at W5 & 6 were difficult to achieve given the boat traffic coming in and out of the river and found to add little value to the wider recordings given the impact of changing sediment levels in the River Dee It is not proposed that sampling at these locations are continued into 2018 and beyond.

3 Suspended Sediment Monitoring - 2018 & 2019 Dredging Season

For the 2018 and 2019 dredging activities, Dragados will install a continuous suspended sediment monitoring system for monitoring suspended sediment levels at Nigg Bay. Handheld monitoring will be used to measure suspended sediments at the disposal site and as a contingency if the continuous system is unavailable.

3.1 Dredging Monitoring - Buoy Deployment Location

Appendix 7-D of the AHEP Environmental Statement describes the sediment plume modelling for the proposed dredging operations (Intertek Report Ref. - P1974_R3873_Rev2.docx, Issued 27 October 2015). The intention of the suspended sediment monitoring proposed by Dragados is to ensure that suspended sediment levels generated by the AHEP dredging operations do not exceed those predicted in the AHEP ES. The outer buoy will provide a background level and the inner buoy will measure the amount of suspended sediment generated by AHEP activities.

Buoy locations have been selected using the plume model (AHEP ES Appendix 7-D), namely outputs from the TSHD overspill maximum suspended sediment concentration (Figure 3) and the Backhoe overspill area maximum suspended sediment concentrations (Figure 4).

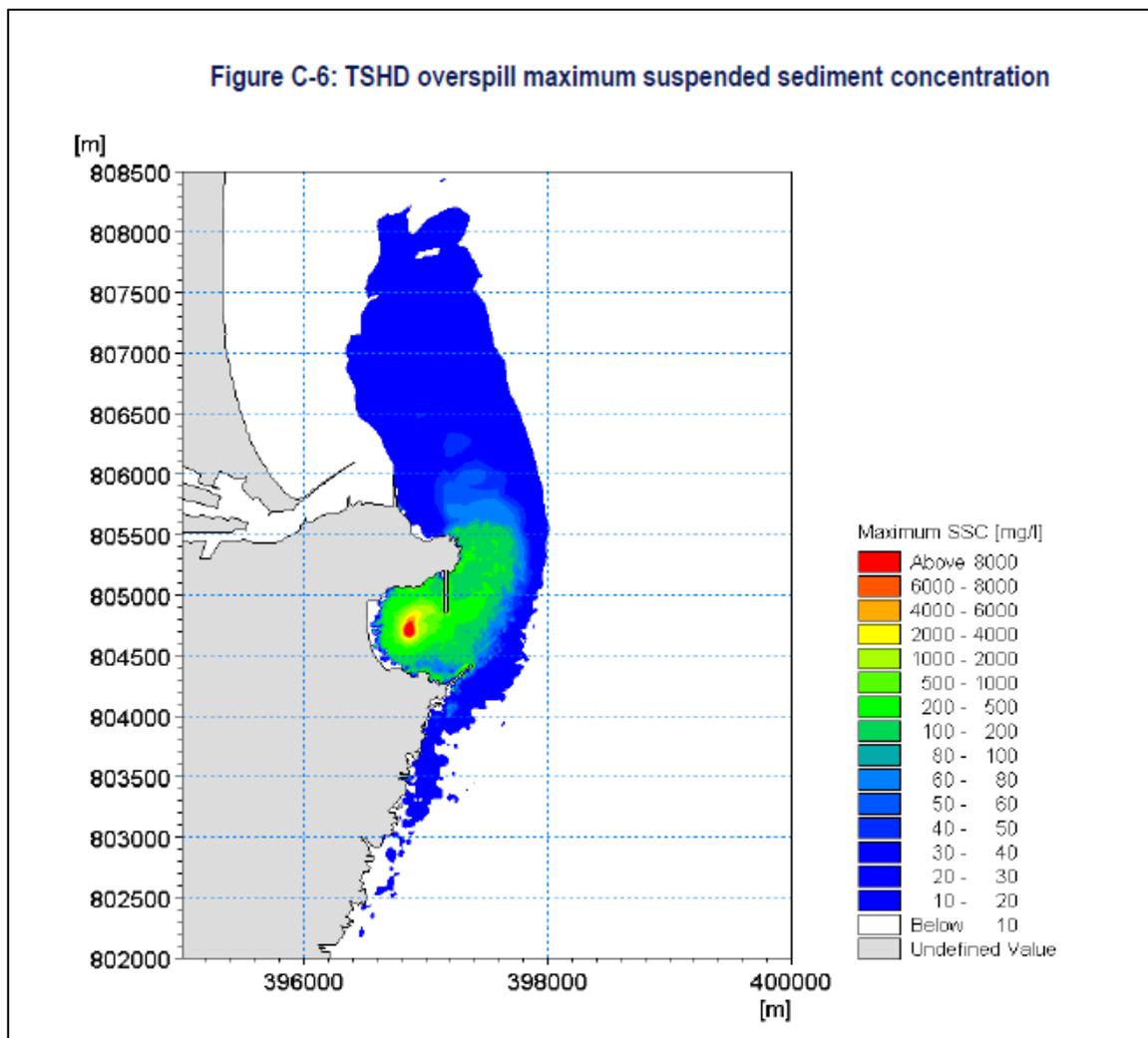


Figure 3: TSHD overspill maximum suspended sediment concentration (From AHEP ES Plume Modelling)

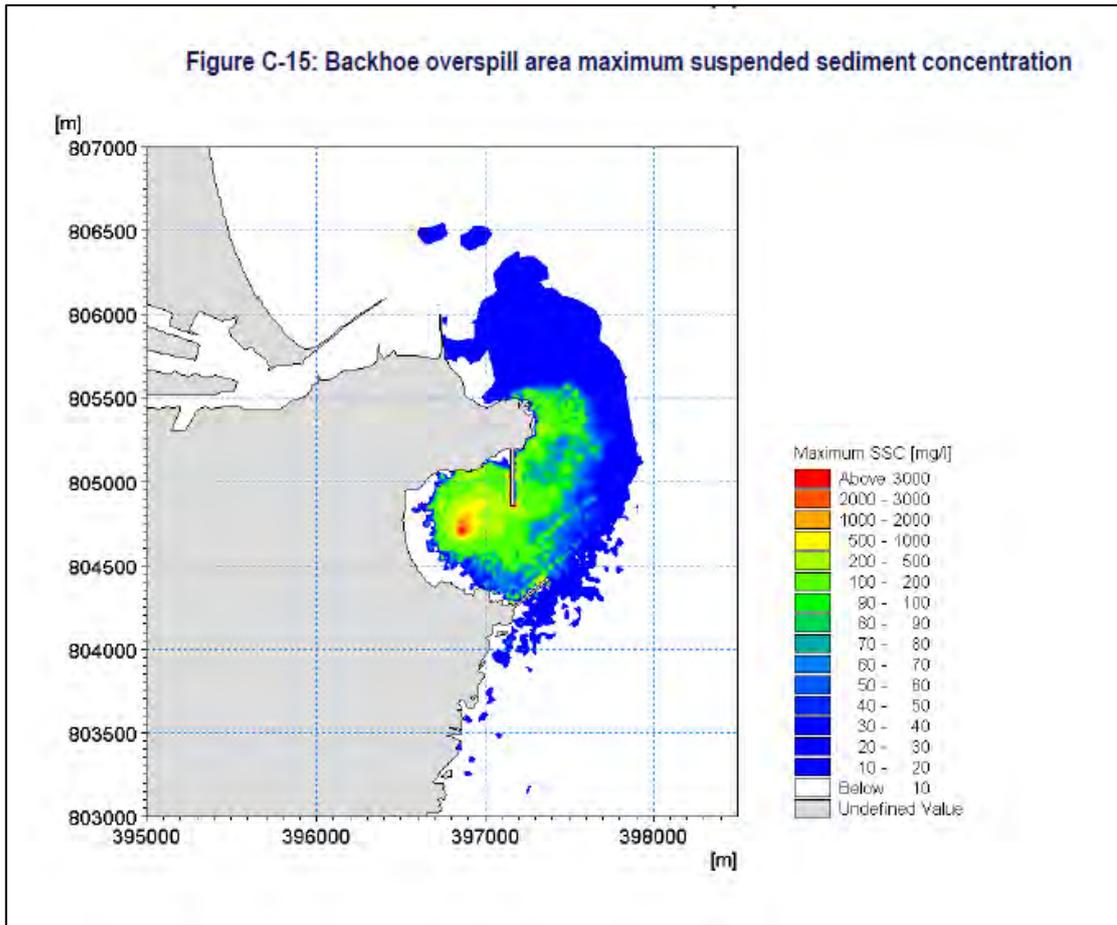


Figure 4: Backhoe overspill area maximum suspended sediment concentrations (From AHEP ES Appendix 7-D)

The locations for buoys have taken into account the location of construction activities ongoing at AHEP and other scientific equipment being placed on the seabed (C-Pods, Waverider etc.). A location, to the north of the site, outside the sediment plume has been selected for the baseline suspended sediment buoy and a location to the north, within the predicted sediment plume, has been selected to record suspended sediment levels within the dredge plume (See Figure 5). These locations are 750m apart. According to the plume model, the maximum suspended sediment concentration at the monitoring buoy location should be less than 200mg/l above the levels of suspended sediment at the baseline buoy.

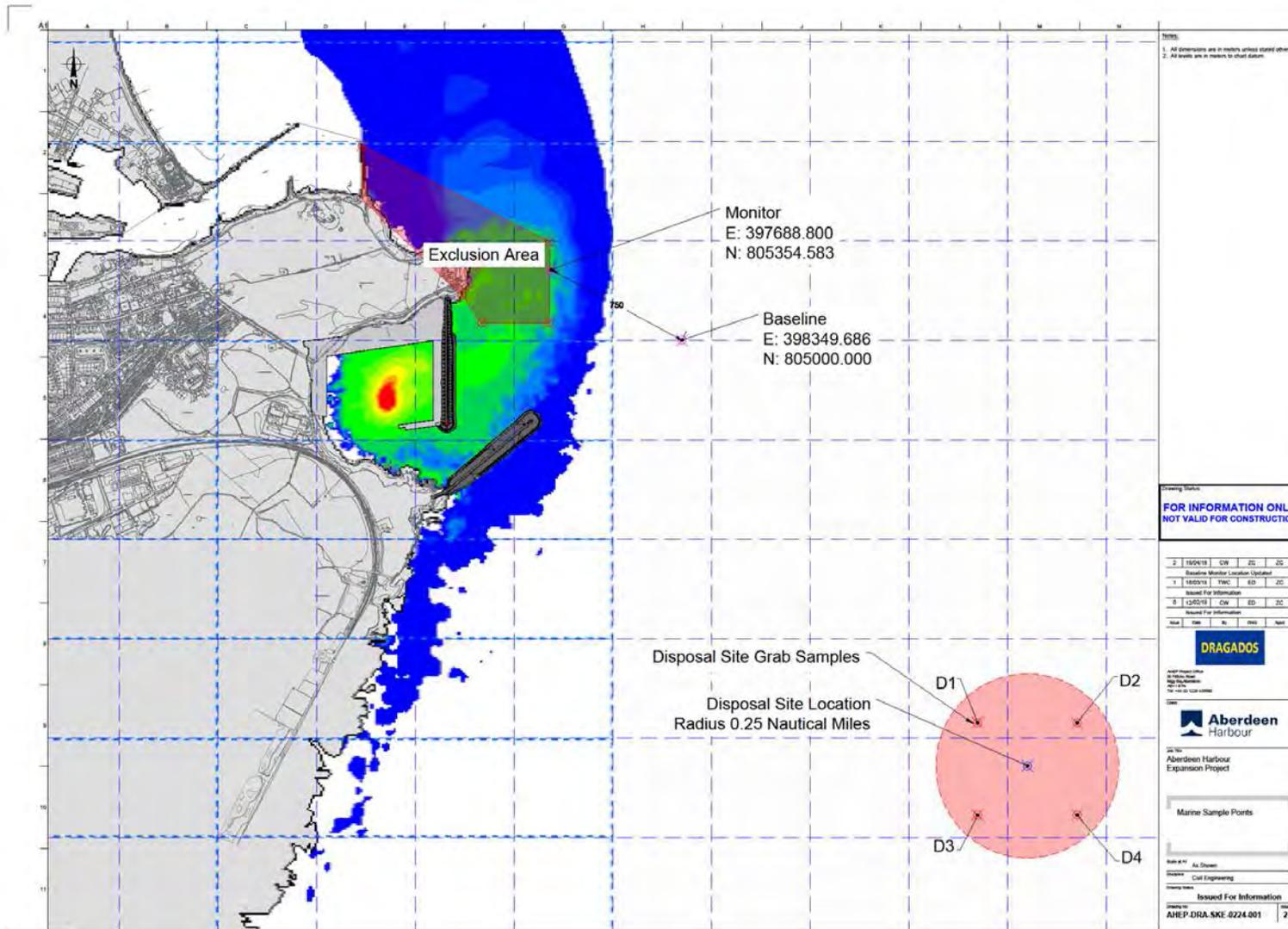


Figure 5: Baseline and Monitoring Buoy Locations

3.2 Dredging Monitoring - Suspended Sediment Monitoring Methodology

The suspended sediment monitoring kit deployed at AHEP will consist of a buoy/marker, weight and turbidity sensor deployed at two locations.

The monitoring equipment will measure the optical quantity, turbidity measured in Formazin turbidity units (FTU), whereas the model provides the physical quantity, the suspended sediment concentration measured in mg/l. As there is no universal relationship between FTU and SSC, turbidity measurements and water samples are collected concurrently to establish a site-specific relationship known as a correlation graph. Water samples within the dredge plume will be taken and analysed in an accredited laboratory for turbidity and suspended sediment concentrations in order to develop this correlation. In-situ turbidity measurements will also be conducted. This correlation graph will then be used to enable real-time monitoring during the dredging activities.

Before the equipment is deployed at AHEP, all instruments will have been tested and calibrated for each specific parameter and purpose. Calibration of the instruments and depth indicators will be performed according to the manufacturer's specification and recorded. Equipment will be cleaned / serviced as per manufacturer's instructions.

The buoys will measure turbidity and transmit the results via GPRS / GSM networks to an internet server every 30 minutes. The levels will be converted from Turbidity to Suspended Sediments. In order to manage peaks and changes due to natural variability, a running average over 12 hours will be taken to work out the elevation above background level. Using the information provided in the AHEP ES (Appendix 7-D), during dredging operations, the Suspended Sediment levels at the inner or monitoring buoy should not exceed 200mg/l above the background level recorded at the baseline or outer buoy.

The results will be displayed near real-time using an online monitoring system. This system allows automatic alerts to project personnel (via SMS or email) if a threshold is breached or if a buoy stops transmitting. If levels are breached, adaptive management measures will be put in place (See Section 4: Adaptive Management).

3.3 Hand Held Suspended Sediment Monitoring

Alongside the continuous monitoring, Dragados will also have in place a service provider to undertake handheld monitoring. This will be as a contingency for when continuous monitoring is not available at the dredging site due to a fault with the equipment and also for measuring turbidity at the disposal site on a monthly basis. Hand held monitoring may also be used at the start of dredging operations whilst the continuous monitor is being set up and calibrated.

Handheld monitoring will be undertaken using the same procedure as that deployed during the 2017 dredging season. A baseline survey will be conducted to establish reference conditions on site by taking samples at the six sites. These baseline condition surveys will establish the correlation curve to be used. Once dredging commences, the suspended sediment monitoring will be undertaken twice daily during dredging operations. A baseline will be established at W7 or W8 and measurements at W1,2,3 and 4 compared against the baseline suspended

sediment levels. As these monitoring points are within different parts of the plume model to where the continuous monitors will be, an exceedance of 50mg/l will trigger further action.

If exceedances are found the adaptive management described in Section 4 will be implemented and Marine Scotland informed.

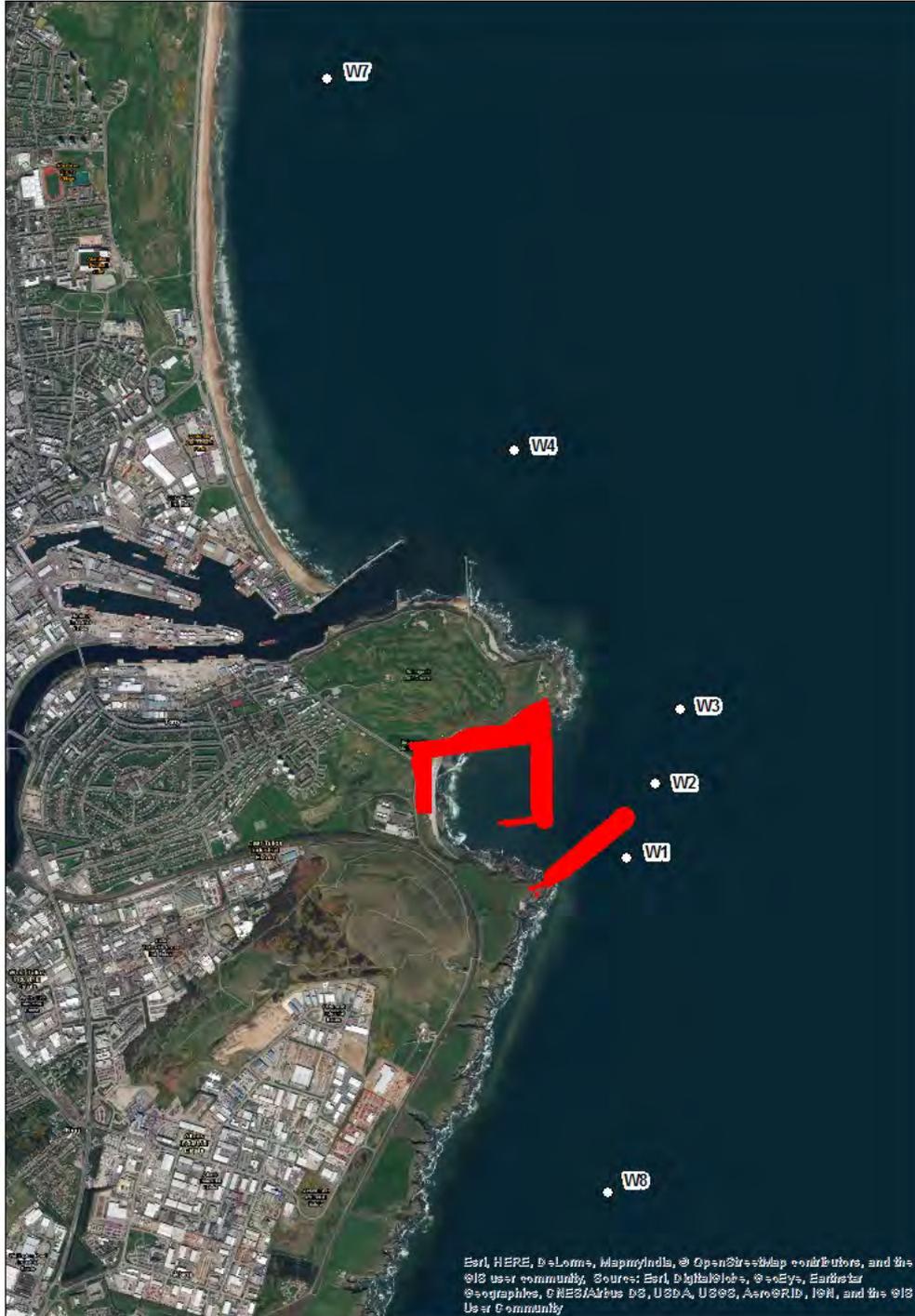


Figure 6: Handheld monitoring sampling points

4 Suspended Sediments - Adaptive Management

Should suspended sediment levels exceed those predicted by the sediment plume modelling an alert will be issued to the Dragados responsible person (EM, ECOW, Marine Manager etc. depending who is on duty) and adaptive management and reporting procedures implemented.

Initially, the Dragados responsible person will review the level of exceedance reported and using the flowcharts provided in Appendix A2, and in conjunction with the dredging contractor, decide upon the mitigation measures to be implemented from the bullet point list provided below.

At the dredging site, the levels of suspended sediment can be controlled by:

- Adjusting the overflow position of the TSHD and/or SHB's;
- Minimise the de-watering process
- Stop dewatering completely
- Reduce dredging production

Dredge at a different location

If suspended sediment levels cannot be reduced using the above, or other mitigation, dredging will be temporarily stopped and other solutions explored such as the use of bubble screens, silt screens or only dredging during certain phases of the tide to reduce the release and/or dispersion of suspended sediment.

If suspended sediment concentrations are exceeded, these will be reported to MS-LOT Major Projects initially by a phone call to a member of the MS-LOT Major Projects Team on:0300 2445046 (within standard working hours) and by a follow up email (within 1 hour of the exceedance being detected) to ms.majorprojects@gov.scot detailing the exceedance and the measures that are being implemented to control suspended sediment levels.

SEPA will also be notified by telephone on SEPA pollution hotline number 0800807060, local SEPA office reception number 01224 266600 if there are potentially any implications for bathing water quality (for instance, a substantial sediment plume which may impact upon the bathing water quality at Aberdeen Pleasure Beach). MS-LOT Major Projects Team will also be asked for advice as to whether SEPA should be contacted, depending on the nature of the suspended sediment level exceedance.

5 Sediment Sampling

In terms of sediment quality and potential contamination, the following monitoring will be undertaken:

5.1 Split Hopper Barge and Trailer Suction Hopper Barge – Hopper Samples

During dredging operations, sampling will be undertaken within the dredge hoppers to verify that mixing material is taking place. In particular, there is a requirement to take samples from where material above AL1 have been found in past sampling campaigns.

To ensure samples are taken from the correct area, Dragados have pinpointed the location and depth at which samples will be taken at approximately 110 points across Nigg Bay. These are provided in Appendix A1. This information will be provided to the dredging contractor with clear instructions to take sufficient material from the hopper for sediment sampling, the first time dredging occurs at this location & dredge depth.

Based on the results of the pre-dredging sampling campaign, the samples will be analysed for Heavy metals (Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc), Tributyltin (TBT), Polychlorinated Biphenyls (PCB's) and Polycyclic Aromatic Hydrocarbons (PAHs) and the results compared to the Marine Scotland Action Levels.

Samples will be stored in a dark, cool environment for transport to the laboratory. At Nigg Bay a freezer will be available to freeze samples as required. The samples will be delivered to the laboratory within 48 hours after sampling. Details of the location where the material was dredged and where the material is disposed will be logged. Reports on the analysis of the given parameters will be provided to the Dragados within 28 days. Reports will be forwarded to MS-LOT on a monthly basis alongside the monthly report.

Duplicate samples will be collected and will be delivered to Marine Scotland, following on from testing for the presence of asbestos.

Table 1: Marine Scotland Action Levels

Contaminant	Revised AL1 mg/kg dry weight (ppm)	Revised AL2 mg/kg dry weight (ppm)
Arsenic (As)	20	70
Cadmium (Cd)	0.4	4
Chromium (Cr)	50	370
Copper (Cu)	30	300
Mercury (Hg)	0.25	1.5
Nickel (Ni)	30	150
Lead (Pb)	50	400
Zinc (Zn)	130	600
Tributyltin	0.1	0.5
Polychlorinated Biphenyls	0.02	0.18
Polyaromatic Hydrocarbons		
Acenaphthene	0.1	
Acenaphthylene	0.1	
Anthracene	0.1	
Fluorene	0.1	
Naphthalene	0.1	
Phenanthrene	0.1	
Benzo[a]anthracene	0.1	
Benzo[b]fluoranthene	0.1	
Benzo[k]fluoranthene	0.1	
Benzo[g]perylene	0.1	
Benzo[a]pyrene	0.1	
Benzo[g,h,i]perylene	0.1	
Dibenzo[a,h]anthracene	0.01	
Chrysene	0.1	
Fluoranthene	0.1	
Pyrene	0.1	
Indeno(1,2,3cd)pyrene	0.1	
Total hydrocarbons	100	
Booster Biocide and Brominated Flame Retardants.*		

In accordance with the requirements of Marine Scotland’s *Pre-disposal Sampling Guidance Version 1 2017*, the laboratory performing the analyses will be ISO17025 accredited for marine sediment analysis and take part in intercomparison exercises such as QUASIMEME. The laboratory will meet the limit of detection (LOD) sensitivity requirements set out in the CSEMP Green Book.

5.2 Disposal Site

Monthly sediment sampling of the disposal site will be undertaken. Four samples will be collected at the disposal site and analysed at an accredited laboratory. The samples will be collected, with a Van Veen or similar day grab, at 4 fixed points within the disposal site. This will allow a comparison of results through time. The disposed material will be spread over a large part of the site, which will be covered by four sampling points:

- Point D1: 57°07’07” N – 02°00’15” W
- Point D2: 57°07’07” N – 01°59’45” W
- Point D3: 57°06’52” N – 02°00’15” W
- Point D4: 57°06’52” N – 01°59’45” W

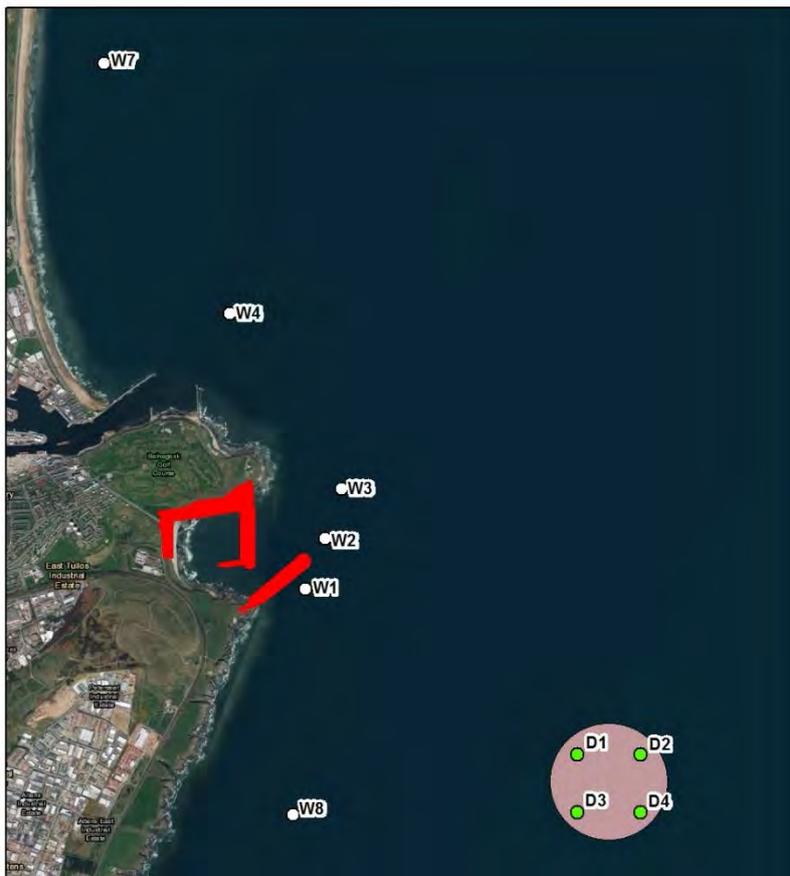


Figure 7: Sediment Sample locations at disposal site (green dots)

Based on the results of the pre-dredging sampling the samples will be analysed for Heavy metals (Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead and Zinc), Tributyltin (TBT), Polychlorinated Biphenyls (PCB’s) and Polycyclic Aromatic Hydrocarbons (PAHs).

5.3 Sediment Sampling Adaptive Management – Material above AL1

The following adaptive management measures will be undertaken in the event that contamination above AL1 is encountered during the hopper monitoring testing.

1. Inform MS-LOT of exceedance of monitored sample by email within 48hrs of receipt of elevated result. Notification will include specific details on the dredge sample location, depth, date and time. Notification will also be made to MS-LOT regarding the disposal location of material where the exceedance occurred.
2. The exceedance will be assessed in line with the contamination assessment⁶ performed by AHB and will assess whether the exceedance would lead to any increased level of risk to the marine environment compared to the baseline contamination assessment, this would be in line with the ERM/ERL assessment. **Error! Bookmark not defined. Error! Bookmark not defined.**
3. In the unlikely event of identifying material greater than AL2 within the hopper samples, adaptive measures 1-2 will be undertaken. Dragados would then take grab samples from the relevant area of the disposal ground for subsequent analysis to enable the potential impact on the disposal site to be appropriately assessed.
4. Following conclusion of an assessment, proposals for mitigating environmental risk will be presented, Dredging activities will cease within any area/depth identified to have elevated levels of contaminants, until the issue is resolved. Changes to processes would be forwarded to and discussed with MS-LOT for agreement.

6 Monthly Reporting

A monthly report will be provided to MS-LOT in which all data from the past month are summarised. The report will include all necessary data to give a complete overview of the results and actions of the past month. This includes:

- Suspended Sediment

A report on the suspended sediment concentrations will be produced and will include:

- Sampling methodology
 - Any difficulties encountered during sampling and changes proposed as a result
 - Suspended Sediment Concentrations at both Baseline and Monitoring Buoys and at the four locations at the disposal site
 - Any instances of exceedances (baseline versus monitoring buoy)
 - Adaptive Management / Actions taken when exceedances have occurred
 - Results of adaptive measures taken
- Sediment Sampling

A report on the sediments sampled will be produced and include:

- Location and depth of samples taken
- Material sampled
- Log of when samples sent to laboratory, asbestos testing complete, duplicate samples sent to MS-LOT and results received
- Details of analyses undertaken and results
- Any further actions undertaken/required (as per Section 5.3)

Appendix A

Sediment Sample Locations & Suspended Sediment Exceedance Procedures

A1 Sediment Sample Locations

Sediment Profile Area BH Number	BH Northing (Approximate locations)	BH Easting (Approximate locations)	VO Dredge Areas	Contaminant action level 2016 Sample Areas	Sample Depth -CD	No of Samples
RC2016-1	804900	396700	9,11, 10a,30	Between AL1 & 2	2,4,6	3
RC2016-5	804800	396700	16	Between AL1 & 2	5,7,8	3
RC2016-14	804600	396700	16	Between AL1 & 2	3,5,7	3
RC2016-17	804500	396700	19	Between AL1 & 2	3,5,7	3
RC2016-2	804900	396800	9, 10a,30	Between AL1 & 2	6	1
VC2016-6	804800	396800	16	Between AL1 & 2	4	1
VC2016-11	804700	396800	16	Between AL1 & 2	5	1
VC2016-3	804900	396900	3,31,32	Between AL1 & 2	4, 6,8	3
VC2016-7	804800	396900	2,16	Between AL1 & 2	4,6,8	3
VC2016-12	804700	396900	16	Between AL1 & 2	6,8	2
VC2016-19	804500	396900	16,18	Between AL1 & 2	5,8	2
VC2016-13	804700	397000	1c 35	Between AL1 & 2	8	1
RC2016-31	804600	397000	1b,35,	Between AL1 & 2	8	1
VC2016-20	804500	397000	1a,17	Between AL1 & 2	6	1
VC2016-19	804500	396900	18	Between AL1 & 2	6	1
VC2016-20	804500	397000	17,1a	Between AL1 & 2	6	1
VC2016-22	804500	397200	13,15	Between AL1 & 2	8	1
VC2016-33	804500	397362	15	Between AL1 & 2	12,14	2
RC2016-14	804600	396700	16	Between AL1 & 2	3	1
RC2016-16	804600	396900	16	Between AL1 & 2	4,6,8	3
RC2016-31	804600	397000	1b	Between AL1 & 2	6,8	2
North Quay	Various Points	Various Points	5a	New Areas	6,8	2

Sediment Profile Area BH Number	BH Northing (Approximate locations)	BH Easting (Approximate locations)	VO Dredge Areas	Contaminant action level 2016 Sample Areas	Sample Depth -CD	No of Samples
North Quay	Various Points	Various Points	6a	New Areas	6,8	2
North Quay	Various Points	Various Points	7a	New Areas	6,10	2
North Quay	Various Points	Various Points	10a	New Areas	4,8	2
North Quay	Various Points	Various Points	12a	New Areas	2,8	2
West Quay	Various Points	Various Points	20	New Areas	2,6,8	3
West Quay	Various Points	Various Points	21	New Areas	2,6,8	3
West Quay	Various Points	Various Points	22	New Areas	2,6,8	3
West Quay	Various Points	Various Points	23	New Areas	2,6,8	3
West Quay	Various Points	Various Points	24	New Areas	2,6,8	3
West Quay	Various Points	Various Points	29	New Areas	2,6,8	3
East Quay	Various Points	Various Points	8	New Areas	6,8, 10	3
East Quay	Various Points	Various Points	25	New Areas	8,10,12	3
East Quay	Various Points	Various Points	26	New Areas	8,10,12	3
East Quay	Various Points	Various Points	27	New Areas	8,10,12	3
Disposal Site CR110	802 859.69	400099.54	4 Grab Samples Per Month			28
					Total	107

A2 Suspended Sediment Exceedance Procedures

Exceedance levels

Monitor buoy; 200 mg/l above baseline buoy
 Hand held monitors; 50 mg/l above baseline buoy

Radio amber warning when reached 40 mg/l above baseline buoy

Contact dredging contractor to warn that we are close to Exceedance levels

Radio red warning when 50 mg/l Exceedance levels reached at monitor buoy

Monitor suspended sediment levels closely

Contact MS-LOT Major Projects to notify of Exceedance levels and proposed mitigation plan
 Telephone MS-LOT Major Projects on 0300 2445046 and email ms.majorprojects@gov.scot within 1 hour of exceedance

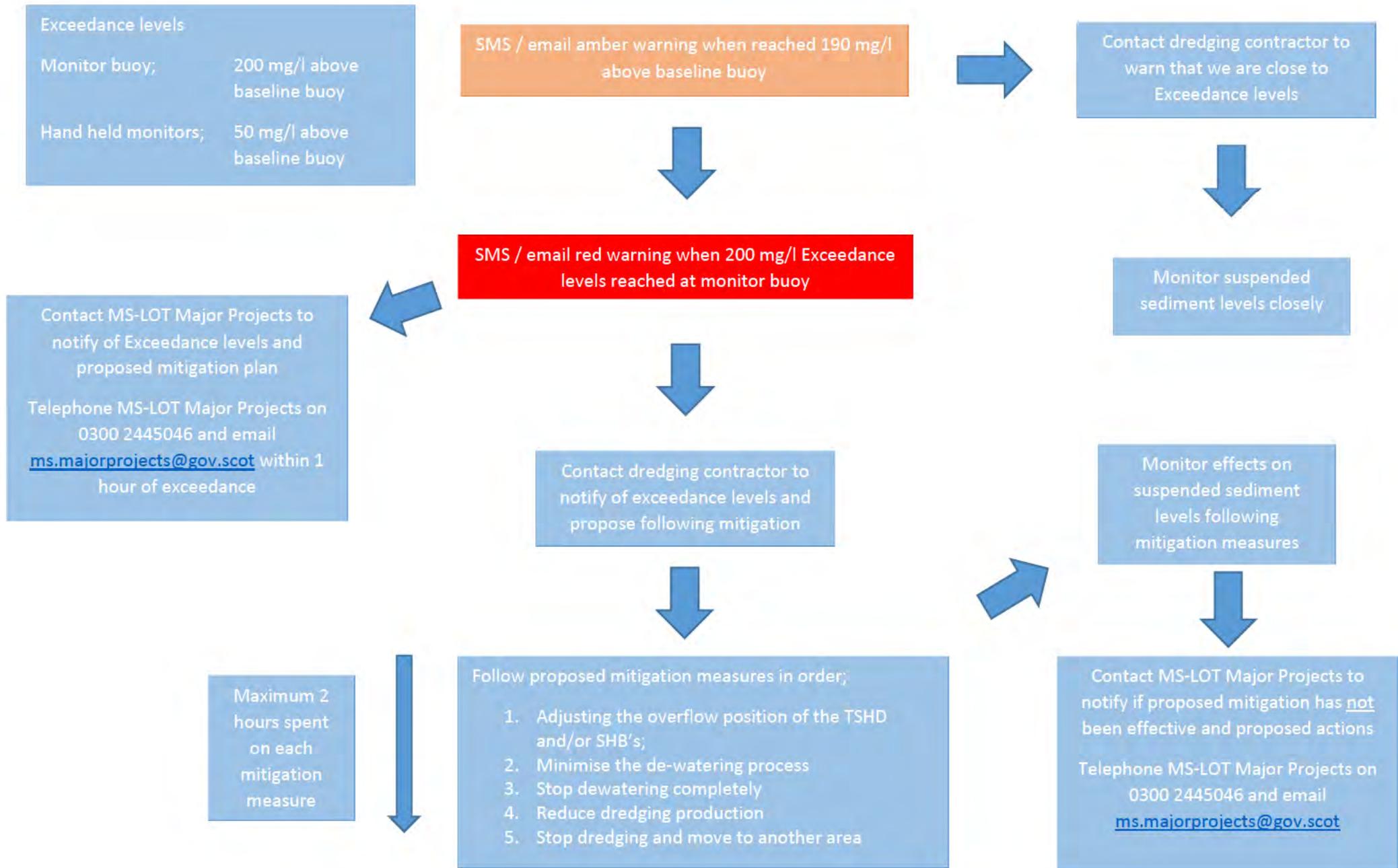
Contact dredging contractor to notify of exceedance levels and propose following mitigation

Monitor effects on suspended sediment levels following mitigation measures

Maximum 2 hours spent on each mitigation measure

- Follow proposed mitigation measures in order;
1. Adjusting the overflow position of the TSHD and/or SHB's;
 2. Minimise the de-watering process
 3. Stop dewatering completely
 4. Reduce dredging production
 5. Stop dredging and move to another area

Contact Marine Scotland to notify if proposed mitigation has not been effective and proposed actions
 Telephone MS-LOT Major Projects Team on 0300 2445046 and email ms.majorprojects@gov.scot



Our ref: PCS/158704
Your ref:

[Redacted]

Marine Scotland
Marine Laboratory
PO Box101
375 Victoria Road
Aberdeen
AB11 9DB

If telephoning ask for:
[Redacted]

26 April 2018

By email only to: ms.majorprojects@gov.scot

Dear [Redacted]

**Marine (Scotland) Act 2010
Amendment to the Dredge Plan to cover the 2018 and 2019 dredging and dredge
spoil deposit activities
Aberdeen harbour**

Thank you for your consultation email which SEPA received on 24 April 2018 and follow up email of 25 April 2018 – confirming our advice is only requested on the last paragraph of Section 4.

1. Advice for the determining authority

- 1.1 Section 4 of the Dredge Monitoring Plan for 2018 and 2019 Operations, dated 17 April 2018, references contacting the MS-LOT Major Projects Team within standard working hours. The last sentence of Section 4 also references requesting advice from MS-LOT Major Projects Team on whether SEPA should be contacted depending on the nature of a suspended sediment level exceedance. We are unclear what out of office hours service the MS-LOT Major Projects Team operate.
- 1.2 In the event of a suspended sediment plume that may impact on the bathing beach we request that SEPA is informed on the Pollution Hotline number regardless of the time. This is to avoid any delay for example if we need to amend the electronic signage as a result during weekend hours etc, which may not be picked up till the next working day by Marine Scotland if reported during office hours only.
- 1.3 As such we request Section 4 is **amended** to meet the requirement that SEPA will be notified on our pollution hotline regardless of the time if there is a potential impact on the bathing water. For the avoidance of doubt we understand from a telephone discussion with Edward Douglas of Dragados they are happy to meet this requirement and as such do not require further consultation on this subject to this amendment being confirmed to Marine Scotland.

1.4 We also **request** details of what criteria will be used to determine whether a plume will impact on the bathing beach. Appendix A2 has two Suspended Sediment Exceedance Procedures flowcharts and we recommend using a similar flowchart to demonstrate this. **Provided** we are provided with details of acceptable criteria for assessing potential impacts to the bathing beach **prior** to 14 May 2018, we have no further concerns with the amendment to the dredge plan.

If you have any queries relating to this letter, please contact me by telephone on [Redacted] email at planning.aberdeen@sepa.org.uk.

Yours sincerely

[Redacted]

Senior Planning Officer
Planning Service

ECopy to: [Redacted]

Disclaimer

This advice is given without prejudice to any decision made on elements of the proposal regulated by us, as such a decision may take into account factors not considered at this time. We prefer all the technical information required for any SEPA consents to be submitted at the same time as the planning or similar application. However, we consider it to be at the applicant's commercial risk if any significant changes required during the regulatory stage necessitate a further planning application or similar application and/or neighbour notification or advertising. We have relied on the accuracy and completeness of the information supplied to us in providing the above advice and can take no responsibility for incorrect data or interpretation, or omissions, in such information. If we have not referred to a particular issue in our response, it should not be assumed that there is no impact associated with that issue. For planning applications, if you did not specifically request advice on flood risk, then advice will not have been provided on this issue. Further information on our consultation arrangements generally can be found on our [website planning pages](#).

[Redacted]

From: [Redacted]
Sent: 27 April 2018 10:29
To: [Redacted]
Cc: [Redacted]
Subject: FW: SEPA Response to Consultation Reference
Attachments: PCS158704Response.doc

[Redacted]

Just as a follow up to your discussion with [Redacted]

In the attached correspondence SEPA have implicitly said that they are happy with the Dredge Plan. Point 1.4 in the attached states that we need to provide a similar Procedure flow chart which we are in the process of doing. Importantly they have stated that if we provide SEPA with acceptable criteria for assessing potential impacts to the bathing beach prior to 14th May, then they have no further concerns. We are in discussions with SEPA on this Criteria and will issue and concluded well in advance of the 14th of May.

Thus we see no issue in approving the Dredge Plan and issuing it today to ensure Dragados can commence Dredging early next week.
Would be grateful if you could give me a call to discuss further.

Regards

[Redacted]

[Redacted]

[Redacted]

AHEP Project Offices| St Fitticks Road | Aberdeen, AB11 8TN (UK)
[Redacted]

Email: [Redacted]

Dragados is An Equal Opportunity Employer

-----Original Message-----

From: planning.aberdeen@sepa.org.uk [mailto:planning.aberdeen@sepa.org.uk]

Sent: 26 April 2018 12:15

To: [Redacted]

planning.aberdeen@sepa.org.uk

Subject: SEPA Response to Consultation Reference n/a

Thank you for consulting SEPA on the above proposal. Please find our response attached.

Where applicable this email has been copied to the agent and/or applicant.

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